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THE BRITISH EXPERIENCE

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Inflation, Indexation, and the Oil-Price Shock:  
The British Experience

by

David H. Howard <sup>\*/</sup>

During the mid 1970s, there was a dramatic upsurge in British inflation rates, with rates exceeding 25 percent (measured from one year earlier). The acceleration in the growth of prices coincided fairly closely with the oil-and-commodity-price shock of 1973-74, and this coincidence suggests that the acceleration of inflation was attributable at least in part to the sharp increases in oil and commodity prices on world markets. However, a few years prior to the acceleration of inflation, there was an increase in the growth rates of the reported monetary aggregates, which suggests that the course of inflation in the United Kingdom during the mid 1970s was attributable at least in part to monetary causes as well.

In this paper the U.K.'s inflation experience in the mid 1970s is examined. In section I, the behavior of major macroeconomic variables is described and British economic policy is summarized. The two features of the British macroeconomic experience which are of particular interest to this study are the monetary disturbance that preceded the oil-price shock and the fact that in the year following the oil-price shock, real wages in the United Kingdom rose substantially. This increase in real wages -- in part attributable to the wage-indexation policy adopted in response to the earlier monetary shock -- inhibited the U.K.'s adjustment to the lower real wage consistent with the new relative price of oil. Section II analyzes the behavior of the money stock and concludes that a monetary disturbance did occur prior to the acceleration in inflation in the mid 1970s and prior to the oil-price shock of 1973. In section III the interaction between the oil-price shock and the wage-indexation policy adopted in response to the preceding monetary shock is examined. It is

shown how the indexation policy amplified the effects of the oil-price shock on real economic activity and inhibited the adjustment process. Section IV presents a summary of the paper and a policy conclusion concerning wage indexation: British experience during the oil-price shock of 1973-74 seems to confirm the conclusion of the theoretical literature that indexation exacerbates the real effects of real shocks and therefore that indexation is not a perfect substitute for monetary stability.

## I. Macroeconomic Developments in the 1970s

Interpretation of British macroeconomic developments in the 1970s is complicated somewhat by the fact that for some economic indicators data based on either 1970 or 1975 prices are available for analysis. The choice of indexes is potentially important in this case because of the substantial increase in the relative price of energy during the years between 1970 and 1975 and the subsequent increase in U.K. production of oil. In Table 1, GDP data based on 1970 and 1975 prices are presented. Real GDP advanced rather steadily during the first four years of the 1970s, with inflation steady but at a relatively high rate. (In the late 1960s inflation was about half that of the early 1970s.) In 1974 -- the year following the oil-price shock -- output growth declined sharply and was even negative according to the measure based on 1975 prices. At the same time the rate of inflation more than doubled. In the following year, real growth remained weak while inflation again accelerated strongly -- this time to a rate of about 25 percent. After 1975, inflation abated dramatically (until 1979) and output recovered somewhat.

The course of the GDP deflator over time indicates an acceleration of inflation in 1974. The behavior of other measures of inflation conform to this pattern, although there are indications that the acceleration of inflation was already underway in 1973. Table 2 presents data on retail and wholesale price indexes as well as real wages. As can be seen, after increasing a few percentage points in 1973, inflation in retail prices accelerated strongly in 1974, peaked in 1975, and decelerated markedly after that (until 1979). Wholesale-price inflation also accelerated somewhat in 1973, but peaked in the following year and then decelerated more gradually than did consumer-price inflation.

TABLE 1  
Expenditure on GDP at Market Prices  
(percentage change from fourth quarter of previous year)

<u>Quarter 4 of:</u>	<u>Real GDP</u>		<u>Deflator</u>	
	<u>1970 Prices</u>	<u>1975 Prices</u>	<u>1970 Prices</u>	<u>1975 Prices</u>
1970	2.2	2.3	9.3	8.9
1971	3.6	2.6	8.5	9.1
1972	3.2	3.1	7.9	8.2
1973	4.0	3.8	8.3	8.0
1974	1.0	-0.4	17.5	19.6
1975	-2.7	0.7	29.0	24.7
1976	4.6	5.0	11.6	12.3
1977	-0.4	1.6	14.5	12.9
1978	n.a.	1.7	n.a.	10.9
1979	n.a.	1.1	n.a.	18.2

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Source: Economic Trends.

TABLE 2

Prices and Wages  
(percentage change from fourth quarter of previous year)

<u>Quarter 4 of:</u>	<u>Retail Price Index</u>	<u>Wholesale Price Index</u>	<u>Real Wages</u>
1970	7.7	9.4	5.4
1971	9.2	7.1	0.3
1972	7.7	6.5	7.2
1973	10.4	9.4	1.9
1974	18.1	25.9	6.1
1975	25.3	20.1	-3.0
1976	15.0	18.4	-2.3
1977	13.0	16.5	-2.6
1978	8.1	7.9	6.7
1979	17.2	15.6	0.7

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Source: Economic Trends.

Note: The real wages variable equals the average earnings index (older series) divided by the retail price index.

Real wages followed a rather erratic course in the 1970s. Real wages actually rose sharply in 1974 when real GDP growth fell sharply and only in subsequent years (1975-77) did real wage growth show the effects of the oil-price shock on British living standards. The 1974 increase in real wages is attributable in large part to the wage-indexation policy in force during most of the year and is discussed in more detail later in this paper.<sup>1/</sup> The sharp increase in real wages in the face of no growth in real GDP was accomplished in part by a shift in the distribution of income between wages and profits-- between the fourth quarters of 1973 and 1974 the share of income from employment in GDP (at factor cost) went from 69 percent to 74 percent while the share of gross profits or surpluses of companies, public corporations, and government enterprises went from 20 percent to 17 percent.<sup>2/</sup> It should be pointed out that the rise in real wages overstates its effect on personal disposable income because the wage index used is not net of taxes, which rose considerably in 1974 because of legislated rate increases as well as inflation-induced fiscal drag.<sup>3/</sup>

The world price of oil rose sharply in late 1973 and early 1974 and the rise came as part of a general increase in world-commodity prices -- between the fourth quarter of 1972 and the fourth quarter of 1973 world-commodity prices in sterling terms rose over 60 percent and increased another 48 percent in the following year.<sup>4/</sup> The U.K.'s terms of trade fell 15 percent during 1973 and dropped an additional 5-10 percent (depending on the index used) during 1974.<sup>5/</sup> The weighted-average exchange rate fell 8 percent in 1973 but the bilateral dollar/sterling rate was essentially unchanged, and in 1974 neither measure of the exchange

rate changed very much.<sup>6/</sup> Thus the 1973-74 increase in sterling commodity prices was almost entirely attributable to the increase in world prices rather than a decline in sterling's external value.

The timing of the oil and commodity price increases suggests that these increases may have been the cause of the 1974-75 acceleration of inflation in the United Kingdom. However, as indicated in Table 3, an increase in recorded monetary growth rates (particularly for sterling M3) preceded the increase in inflation rates. The 1971 change in the U.K.'s financial structure (see Bank of England) complicates the interpretation of these data, which is deferred until section II of this paper. Nevertheless, the monetary data are consistent with a monetary explanation of the 1974-75 acceleration of inflation in the United Kingdom. Thus, despite the coincidence of the oil-price shock and the acceleration in U.K. inflation rates, it is not at all clear that the acceleration of inflation was entirely or even primarily caused by the world-price shocks of 1973-74.

The final element to be discussed in this overview of the U.K. macro-economy is the external account. Selected trade and balance-of-payments data are presented in Table 4. The current account moved into deficit in 1973 and recorded a substantial deficit -- over 4 percent of nominal GDP -- in 1974, despite a marked fall in import volumes. The swing into current-account deficit was largely the result of the adverse shift in the U.K.'s terms of trade.

In many respects, the adjustment to the price shocks of 1973 and 1974 may have been complete by 1977. Inflation, although higher than what it had been before the shocks, was considerably below its 1974-75 peaks, and

TABLE 3

Monetary Aggregates  
(percentage change from end of previous year)

<u>End of:</u>	<u>M1</u>	<u>£M3</u>
1970	9.4	9.5
1971	10.9	13.9
1972	13.6	24.5
1973	5.1	26.3
1974	10.7	10.2
1975	13.1	6.6
1976	11.3	9.5
1977	21.5	10.0
1978	16.4	15.0
1979	9.1	12.7

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Source: Bank of England and Bank of England Quarterly Bulletin.

Note: All data are adjusted by the Bank of England for breaks in the series.

TABLE 4

External Data

Year or Quarter 4 of:	Current Account <sup>*/</sup>		1970=100 <sup>**/</sup>			1975=100 <sup>**/</sup>		
	£ million	As Percentage of Nominal GDP	Volume		Terms of Trade	Volume		Terms of Trade
			Exports	Imports		Exports	Imports	
1970	779	1.5	6.0	11.8	3.9	5.9	9.7	5.2
1971	1,076	1.9	1.4	0.9	1.2	0.6	2.5	1.4
1972	189	0.3	12.4	21.7	-4.2	12.2	20.4	-3.5
1973	-1,056	-1.4	4.7	8.8	-14.9	4.0	8.5	-15.5
1974	-3,380	-4.1	2.7	-4.7	-9.6	1.8	-4.9	-4.9
1975	-1,674	-1.6	0.2	-4.7	6.1	1.6	-8.6	5.9
1976	-1,060	-0.9	8.7	8.4	-1.7	8.8	9.8	-3.1
1977	- 206	-0.1	4.6	1.2	7.2	3.1	-4.3	4.9
1978	776	0.5	n.a.	n.a.	n.a.	5.9	10.1	4.9
1979	-1,425	-0.8	n.a.	n.a.	n.a.	5.4	12.7	-3.1

Source: Economic Trends.

Notes: <sup>\*/</sup> Annual Data.

<sup>\*\*/</sup> Percentage change from fourth quarter of previous year.

real output had resumed growing. Real wages, after their initial surge in 1974, fell for three straight years and then began growing again in 1978. Finally, the current-account balance was close to zero in 1977, just as it had been in 1972.<sup>7/</sup> Since the 1977 terms of trade were considerably less favorable to the United Kingdom than those prevailing in 1972, the current-account outcome was achieved in large part by an increase in real exports and no growth in real imports (see Table 4).

Prior to the increases in world-oil prices which took place at the end of 1973 and the beginning of 1974, the British authorities instituted three major policy measures that had potentially important implications for subsequent events. First, in September 1971, new financial arrangements -- usually referred to as "competition and credit control" (CCC) -- were put into effect.<sup>8/</sup> For present purposes the most important changes were that quantitative limits on bank lending and restrictions on interest rate movements as methods of monetary control were abandoned, and that new reserve requirements were adopted.<sup>9/</sup> The former appears to have led to reintermediation of credit flows through the banking system and an increase in the stock of money. The new reserve requirements were less stringent than the old requirements for one important group of banks -- the London clearing banks which account for about half of the U.K. banking system's sterling deposits -- and it is argued in this paper that they were less stringent for the banking system as a whole as well. Furthermore, because the authorities did not act to reduce bank reserves in order to offset the effects of the lower reserve requirements, the new reserve requirements appear to have led to increased monetary growth.

The second major policy measure was embodied in the 1972 Budget announced in March 1972. The 1972 Budget was a response to rising unemployment and continued wage and price inflation. The Budget itself aimed at stimulating the economy -- through personal tax cuts -- sufficiently to achieve a 5 percent rate of growth in output (1-1/2 percent above what was forecast without new fiscal measures) and in so doing reduce unemployment. At the same time, discussions on wage-and-price controls -- to combat inflation -- were initiated. (A wage-and-price freeze was implemented in November 1972.) The stimulus administered to the economy appears to have been quite large and effective at raising real GDP growth.<sup>10/</sup> In addition, it is likely that the fiscal and monetary measures taken to stimulate real activity also were responsible at least in part for the subsequent acceleration of inflation.

By Autumn 1973 there appeared to be general agreement that as part of any incomes policy, wage increases should be linked to increases in prices, and in November, as part of Stage III of the incomes policy adopted a year earlier, an index-link between prices and wages was introduced. Under Stage III -- which was to last for 12 months -- certain aspects of wage agreements were stipulated and a "threshold" provision calling for pay increases of 40p per week for each percentage point over 7 percent that the retail price index increased during Stage III was adopted.<sup>11/</sup> In 1974 inflation exceeded 7 percent by a wide margin and indexed wages were increased by means of the indexation formula by a total of £4.40 per week. These index-linked increases in nominal wages had a major role in the increase in real wages in 1974 reported above, and thus probably made the subsequent downward adjustment in real wages larger than it otherwise would have had to have been. Indexation was abandoned as a component of incomes policy when Stage III expired in November 1974.<sup>12/</sup>

These three policy measures -- the change in financial structure, the expansionary macroeconomic policies of 1972, and the indexation of wages -- are essential parts of the U.K.'s economic experience in the 1970s. Each of these policy actions as well as the tripling of the world-oil price at the end of 1973 and the beginning of 1974 had a role in the British economic experience in the mid 1970s. This paper examines the role of each and the interactions among them.

Policy measures following the expiration of the wage-indexation scheme in November 1974 are not of interest to the present paper. For most of the rest of the decade, the United Kingdom had various types of incomes policies, but indexation was conspicuously absent from these policies. Largely owing to an exchange-rate crisis in 1976, British macroeconomic policy tightened, and, in December 1976, agreement on a standby arrangement with the IMF, which included some restrictive conditions on fiscal and monetary policy, was reached.

## II. The Behavior of the Money Stock

In Table 5, data on the money stock and the monetary base for the period 1963-1979 are presented.<sup>13/</sup> As one can readily see, the growth rates of the two monetary aggregates -- M1 and sterling M3 -- fluctuate quite markedly. For example, the monetary deceleration in 1966 was followed by a sharp acceleration which in turn was followed by a deceleration during the next two years, 1968-1969; in 1970 there was another sharp acceleration. During the 1970s monetary growth rates continued to fluctuate but the striking characteristic of the period is the divergent behavior of the two measures of the money supply. The period 1971-1974 is particularly noteworthy. The growth rate of sterling M3 nearly doubled during 1972 -- to over 24 percent -- while that of M1 increased by only 2-1/2 percentage points -- to 13-1/2 percent. In the following year, the growth rate of sterling M3 remained essentially unchanged while that of M1 fell dramatically -- to about 5 percent; in 1974 M1 growth rebounded strongly while sterling M3 growth declined very sharply -- from 26 percent in 1973 to 10 percent in 1974. Note that between 1972 and 1979, with one minor exception, whenever the rate of growth of M1 increased (decreased), the growth rate for sterling M3 decreased (increased); the one exception was in 1977 when M1 increased strongly and sterling M3 increased slightly.

In general the path of the measure of the monetary base reported in Table 5 was smoother than that of the money stock but appears to have coincided broadly with movements of the money stock. The coincidence in the monetary base and the money-stock series is particularly apparent in the case of M1, as is evidenced by the fact that the M1 money multiplier (i.e., M1 divided by the monetary base) -- reported in Table 6 -- was nearly constant during the period studied here.

TABLE 5

The Money Stock and the Monetary Base  
(percentage change from end of previous year)

<u>End of:</u>	<u>M1</u>	<u>LM3</u>	<u>Monetary Base</u>
1964	3.0	5.6	7.9
1965	3.7	7.6	5.3
1966	-0.2	3.4	3.6
1967	8.7	9.5	4.1
1968	4.2	6.9	4.6
1969	0.1	2.4	3.3
1970	9.4	9.5	5.0
1971	10.9	13.9	8.8
1972	13.6	24.5	12.4
1973	5.1	26.3	8.9
1974	10.7	10.2	15.6
1975	13.1	6.6	11.6
1976	11.3	9.5	11.1
1977	21.5	10.0	17.1
1978	16.4	15.0	13.2
1979	9.1	12.7	9.7

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Source: Bank of England, Bank of England Quarterly Bulletin, and Bank of England Statistical Abstract.

Note: The money stock data are adjusted by the Bank of England for breaks in the series. For the definition of the monetary base, see the Appendix to this paper.

TABLE 6

Money Multipliers and Other Ratios

<u>End of:</u>	<u>M1/B</u>	<u>£M3/B</u>	Percent				
			<u>PC/D</u>	<u>BN/D</u>	<u>DD/D</u>	<u>R/D</u>	<u>(PD+ROA)/D</u>
1963	2.6	3.8	22.8	1.4	61.1	9.2	0.9
1964	2.5	3.7	23.2	1.3	58.9	9.6	1.0
1965	2.4	3.8	22.8	1.2	56.1	9.1	1.0
1966	2.3	3.8	22.9	1.2	53.3	9.0	1.1
1967	2.4	4.0	21.6	1.2	53.3	8.4	1.1
1968	2.4	4.0	20.9	1.1	51.7	8.2	1.1
1969	2.4	4.0	21.1	1.2	49.9	8.3	1.1
1970	2.5	4.2	20.9	1.2	49.9	7.1	1.2
1971	2.5	4.4	19.4	1.1	48.7	6.1	2.0
1972	2.5	4.8	17.8	1.0	43.5	5.5	1.3
1973	2.4	5.6	14.9	0.9	34.7	4.5	1.2
1974	2.3	5.4	15.9	0.9	34.4	4.8	1.2
1975	2.4	5.1	17.0	1.0	36.9	4.7	1.4
1976	2.4	5.0	17.9	1.0	37.4	4.3	1.4
1977	2.5	4.7	19.0	1.1	42.6	4.7	1.6
1978	2.5	4.8	19.1	1.1	43.4	4.3	1.6
1979	2.5	4.9	18.8	1.0	41.5	4.0	1.5

Source: Bank of England, Bank of England Quarterly Bulletin, and Bank of England Statistical Abstract.

Note: The money stock data are adjusted by the Bank of England for breaks in the series. For definitions of the variables, see the Appendix to this paper.

As explained in the Appendix to this paper, in the United Kingdom the M1 multiplier (h1) and the sterling M3 multiplier (h3) are, respectively:

$$h1 \equiv \left( \frac{\frac{PC}{D} + \frac{BN}{D} + \frac{DD}{D}}{\frac{PC}{D} + \frac{R}{D} + \frac{PD}{D} + \frac{ROA}{D}} \right) ,$$

$$h3 \equiv \left( \frac{\frac{PC}{D} + \frac{BN}{D} + 1}{\frac{PC}{D} + \frac{R}{D} + \frac{PD}{D} + \frac{ROA}{D}} \right) .$$

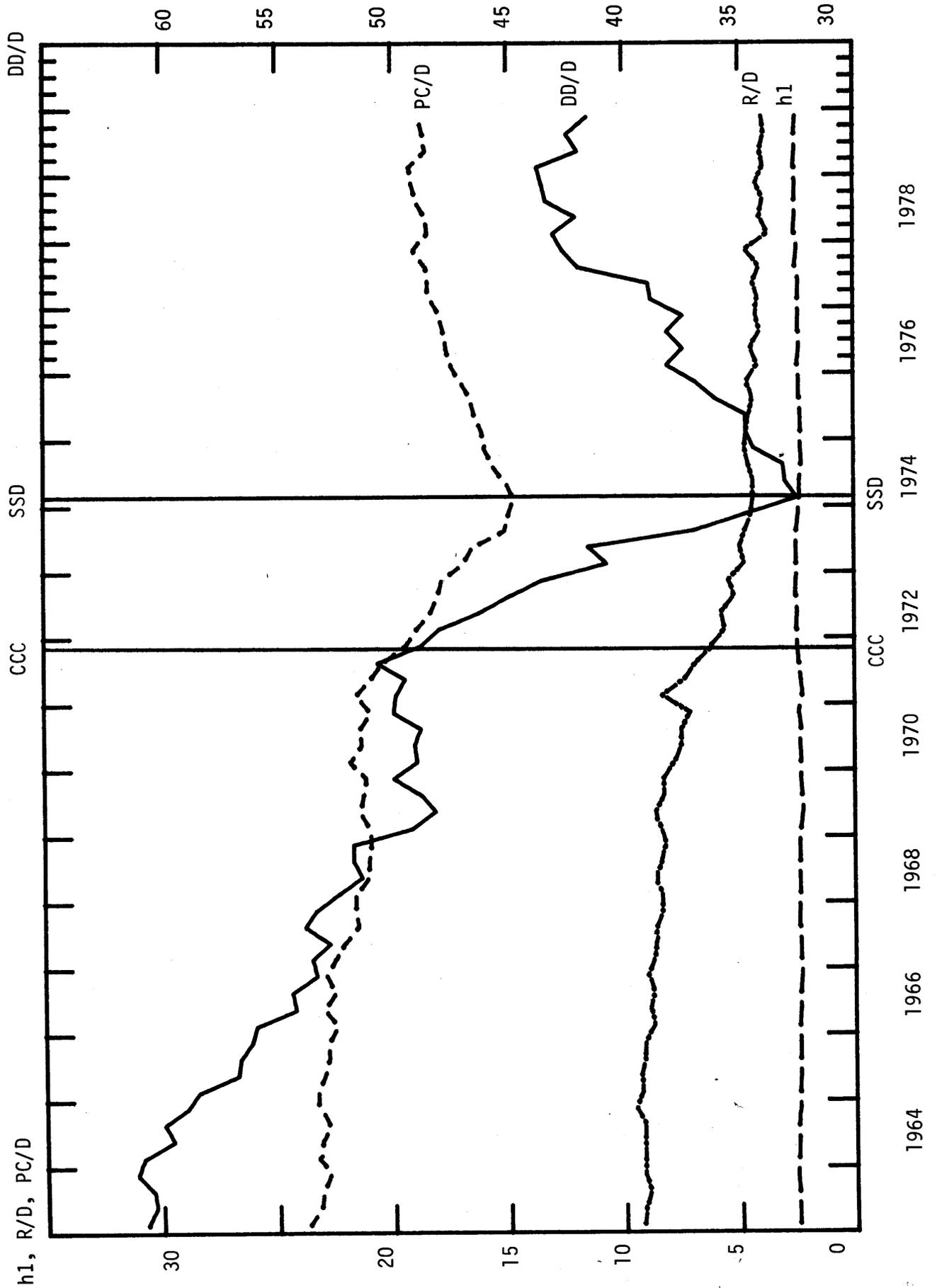
(See the Appendix for the definitions of the variables.) The near constancy of the M1 multiplier reported in Table 6 is largely the result of two offsetting, but not unrelated, circumstances. The change in reserve requirements toward the end of 1971 mentioned in the preceding section reduced the banks' cash-reserve ratio (R/D in Table 6) in 1971 and subsequent years -- required cash reserves as a percentage of deposits went from 5.8 percent at the end of 1970 to 1.0 percent at the end of 1971. This change in R/D and the contemporaneous fall in the private nonbanks' cash ratio (PC/D) were translated into an increase in the sterling M3 multiplier but not in the M1 multiplier because of an offsetting change in the demand-deposit ratio (DD/D) -- note that DD/D does not appear in the expression for h3 -- which occurred at about the same time. The changes in the three ratios are all results of the 1971 financial reforms, which lowered cash-reserve requirements and removed quantitative restrictions on both bank lending and deposit interest

rates. The latter change meant that any increases in the money stock most likely would be in the form of increases in interest-bearing bank deposits rather than either DD or PC.

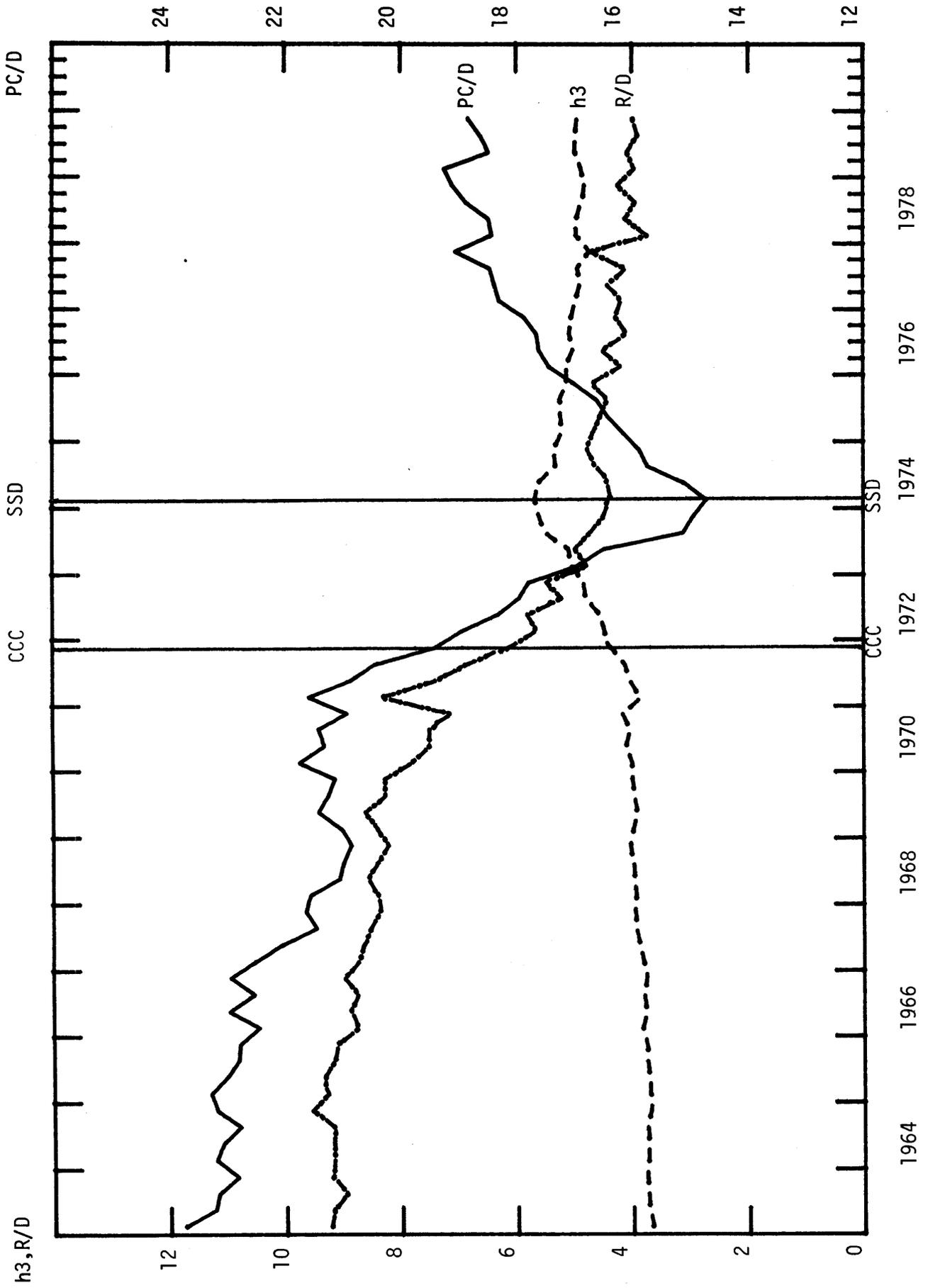
In Charts 1 and 2, quarterly data on the two money multipliers are plotted along with the PC/D ratio and the R/D ratio. In Chart 1, in which the M1 multiplier is plotted, the DD/D ratio is plotted as well. (The relatively small BN/D and  $(PD + ROA)/D$  ratios are ignored for the sake of visual simplicity.) The remarkable stability over time of the M1 multiplier ( $h_1$ ) is clearly shown in Chart 1, although it is important to note that its stability relative to the behavior of  $h_3$  over time is exaggerated by the scales used in the two charts. In contrast with the path of  $h_1$ , the sterling M3 multiplier -- see Chart 2 -- began to move sharply upward at the end of 1971 and appears to have stabilized at a level about 25 percent higher than that prevailing in the 1960s. The behavior of  $h_3$  is, of course, primarily a reflection of the declines in the R/D and PC/D ratios shown in the chart.

The acceleration of monetary growth in the early 1970s, reported in Table 5, and the sharp increase in the sterling M3 multiplier at the same time, shown on Chart 2, merit further discussion. Following the 1971 changes in the financial system (CCC), the course of M1 growth was somewhat erratic, with some acceleration in 1972, a sharp deceleration in 1973, and then further acceleration. On the other hand, the path of sterling M3 shows a substantial acceleration of growth commencing in the fourth quarter of 1971, i.e., immediately after the financial reform, which is not reversed until 1974. The different behavior of M1 and  $\pounds$ M3 implies that monetary growth consisted largely of increases in interest-bearing bank deposits. Two of the factors responsible for the divergent behavior

CHART 1  
M1 Multiplier



LM3 Multiplier



of the narrow and broad monetary aggregates were the removal of quantitative controls on bank lending and interest rates on bank deposits and the manner in which the banks reacted to a shortage of liquid-asset reserves starting in late 1972. The former allowed the banks to expand their lending by increasing their interest-bearing liabilities; thus the removal of controls enabled the banks to adjust their balance sheets and the adjustment itself implied a rate of growth of interest-bearing deposits exceeding that of non-interest-bearing deposits. The second factor became operative toward the end of 1972 when the banks reacted to a shortage of liquid-asset reserves by purchasing the needed liquid-asset reserves (e.g., U.K. Treasury bills) with funds obtained by expanding their interest-bearing liabilities (e.g., certificates of deposit) rather than by reducing their other assets. Thus growth in the interest-bearing component of money was increased relative to the growth of the non-interest-bearing component of money.<sup>14/</sup>

The 1971 changes in the financial system lowered the amount of cash reserves that had to be held by the banking system to meet "legal" requirements, removed quantitative limits on bank lending, and encouraged the use of interest rates to bid for deposits. The banks' use of interest rates to bid for deposits increased the attractiveness of interest-bearing deposits relative to currency (and demand deposits) to the nonbanks. Thus the financial changes of 1971 would be predicted to lead to a decrease in the bank and nonbank cash-to-deposits ratios, an increase in the money multiplier, and, unless the base were contracted sufficiently, the money supply as well. As has been pointed out in the preceding discussion, it is the case that R/D and PC/D declined dramatically, and h3 increased sharply after September 1971; h1, on the other hand, did not, because

of the offsetting decrease in the ratio of demand deposits to total deposits. (The decline in the DD/D ratio was to be expected just as was the decline in PC/D, but its fully offsetting effect was not to be expected.)

As the data in Table 5 indicate, the monetary base was not contracted in order to offset the changes in the banks' reserve ratio and the nonbank public's currency ratio and the resulting change in the sterling M3 multiplier.<sup>15/</sup> On the contrary, between December 1970 and December 1972 (1973), the monetary base increased some 22 (33) percent while the sterling M3 money multiplier increased about 14 (33) percent; the broad money supply increased about 42 (79) percent. The increases in narrow money during these periods were somewhat less -- 26 and 32 percent, respectively -- as explained earlier in this section.

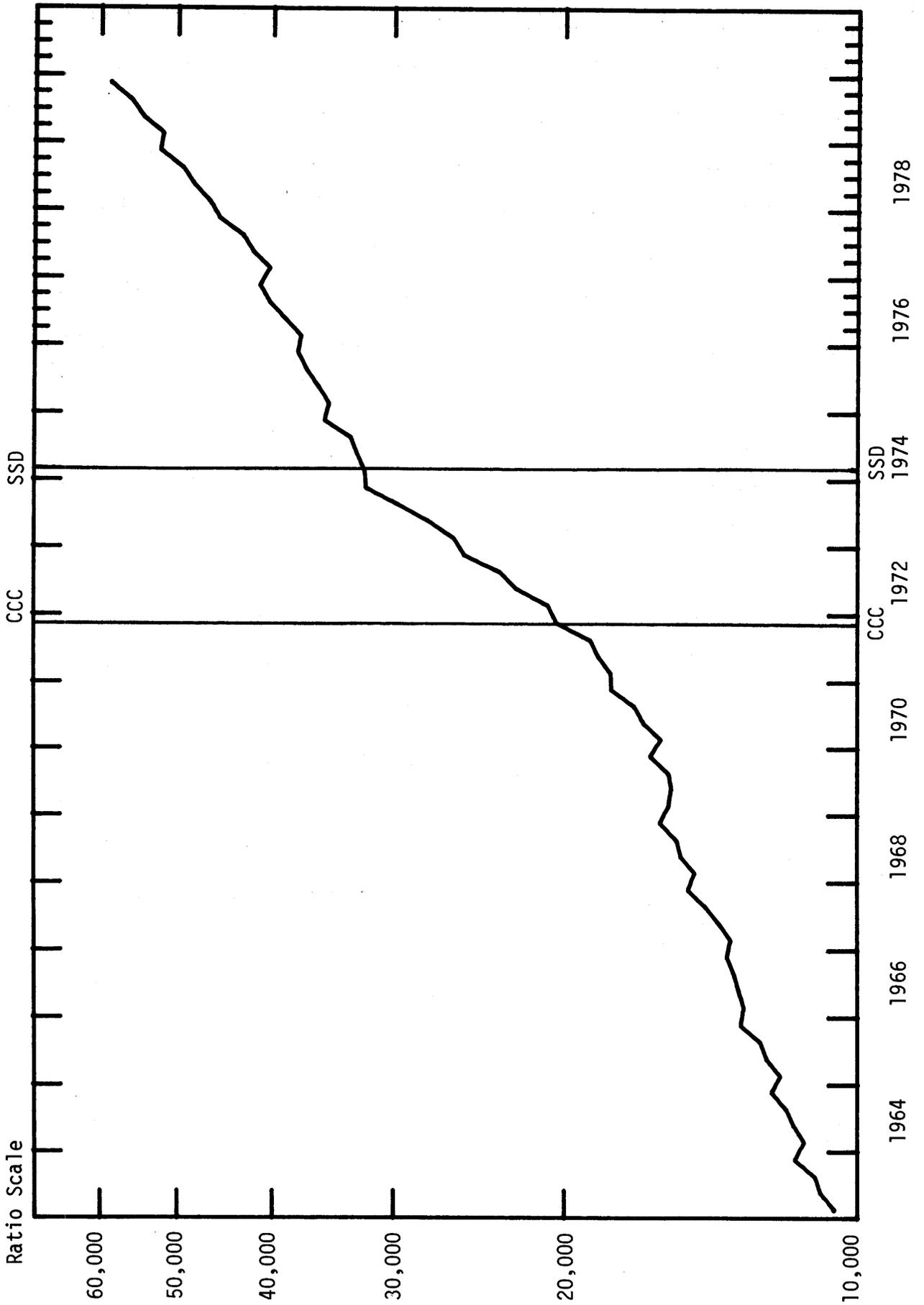
The impact of the CCC system on the sterling M3 money multiplier can be seen clearly in Chart 2. The CCC reforms were implemented on September 16, 1971 and the first observation on the chart completely under the new regime is that of December 1971, which is marked by the vertical line labeled "CCC". Prior to CCC, the sterling M3 multiplier had been fairly stable near a value of 4 with a slight upward trend. Towards the end of 1971 the behavior of the multiplier changed dramatically and it moved sharply upward until the institution of the supplementary-special-deposits (SSD) scheme -- quantitative limits on the expansion of interest-bearing bank liabilities -- on December 17, 1973 seems to have brought its climb to a halt. The first observation on the chart under the SSD regime is that of March 1974, which is marked by the vertical line labeled "SSD". After December 1973, the money multiplier fell somewhat and then stabilized at a value of approximately 5. Note also that after September 1971 -- i.e., the introduction of CCC -- the values of the banks' reserve and nonbank currency ratios shift downward; none of the R/D values after September 1971 exceeds any of

the R/D values before that date and the same is true for the PC/D series as well. The shift in the banks' reserve ratio is particularly striking and appears to have been permanent; the initial decline in the nonbank currency ratio -- while even more dramatic than that of the banks' reserve ratio -- was not sustained, perhaps because of the effects of the SSD scheme on the competition among banks for deposits.

The evidence presented in Chart 2 is not conclusive. In particular, the downward trend in R/D prior to CCC and the partial reversal of the decline in PC/D raise the possibility that the change in the money multiplier after September 1971 was caused by factors other than those associated with CCC. Examples of such factors are the changing structure of the banking system over time -- only the London clearing banks were subject to the cash-reserve requirement -- and transitory interest-rate movements. In addition, expectations of a financial reform may have influenced the behavior of the ratios prior to the actual implementation of CCC -- a consultative document was issued in May 1971. A complete model of the determinants of the money multiplier is beyond the scope of this paper. For present purposes it is assumed that the decline in R/D was mostly attributable to the lowering of cash-reserve requirements under CCC but that most of the movement in PC/D was caused by transitory interest-rate movements.<sup>16/</sup> Thus, the effect of CCC on the money multiplier is estimated conservatively to have been to increase the multiplier from 4 to 5, rather than the value of nearly 6 which it reached just prior to the implementation of the SSD scheme.

Another way of presenting the impact of CCC on the money stock is to plot sterling M3 on a ratio scale and mark off the CCC and SSD periods as in Charts 1 and 2. The result -- see Chart 3 -- shows quite clearly that

CHART 3  
EM3 (Em)



the rate of growth of sterling M3 accelerated after the CCC reforms and decelerated when the SSD scheme was imposed. The period between the CCC and SSD lines in Chart 3 can be viewed roughly as the period during which the money multiplier adjusted to the new monetary regime; the chart indicates that this adjustment involved an acceleration in monetary growth.

The conclusion to be drawn from the preceding discussion is that the U.K. economy in the early 1970s was subjected to a substantial monetary shock attributable in large part to the "competition and credit control" system introduced in 1971 and the implicit decision not to offset the effects on the money supply of the 1971 measures. It is estimated here that CCC increased the broad money supply by roughly 25 percent by raising the sterling M3 money multiplier from approximately 4 to about 5.<sup>17/</sup> It is not clear what impact the rapid growth of sterling M3 in 1972-73 had on subsequent price inflation. The much slower growth of M1 presents a problem to a monetary explanation of the inflation performance. However, as explained earlier in this section, the changes put into effect in the CCC regime would have tended to channel monetary growth into interest-bearing deposits during the period in which the banks adjusted their portfolios. Thus it is probably the case that during this period the behavior of the sterling M3 aggregate was the more appropriate measure of underlying monetary growth.

For the purposes of this paper, it is sufficient to state that both the monetary shock discussed in this section and the world-oil-price shock probably contributed importantly to the sharp increase in U.K. inflation rates in 1974-75. An attempt to quantify each contribution is beyond the scope of the present paper. Nevertheless, the timing of events seems to suggest that the CCC reforms and the deliberately expansionary macroeconomic policies of

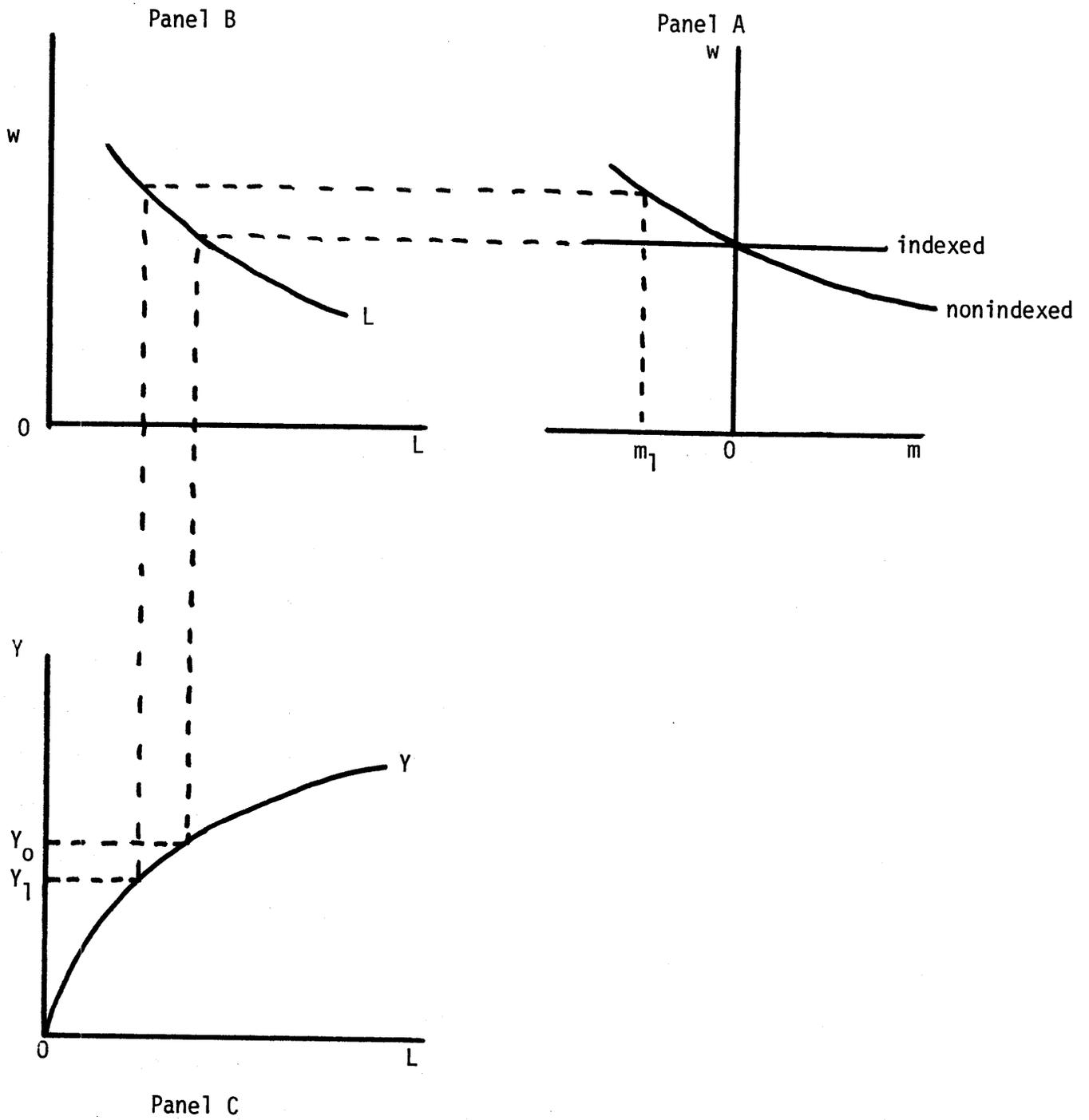
1972 put significant upward pressure on inflation rates prior to the oil-price shock -- recall that the U.K. government instituted a wage-and-price freeze in November 1972 -- and that the upward pressure on the price level caused by the oil-price increases was accommodated by the earlier monetary expansion.<sup>18/</sup>

### III. Macroeconomic Shocks and Indexation

As concluded in the preceding discussion, the U.K. economy in the early 1970s experienced an upsurge in monetary growth followed by a substantial deterioration in its terms of trade attributable largely to the dramatic increase in the world price of oil which took place in 1973-74. Of particular interest to this paper is the policy toward wage indexation adopted by the British authorities in response to the monetary shock, and the way in which the wage-indexation policy interacted with the subsequent real shock.

Papers by Jo Anna Gray and Stanley Fischer examine wage indexation as a policy response to macroeconomic disturbances and show that indexation prevents monetary shocks from affecting real output, but that the effects of real disturbances will tend to be exacerbated when wages are indexed.<sup>19/</sup> This proposition is best demonstrated by means of two diagrams presented by Gray. In panel A of Figure 1, the dependence of the real wage ( $w$ ) on unanticipated changes in the money supply ( $m$ ) -- given a contractually fixed nominal wage -- is represented assuming in turn a nonindexed wage and a fully indexed wage. In the former case the monetary shock's effect on the price level affects the real wage, but in the latter case the nominal wage simply adjusts in order to keep the real wage constant. Panels B and C of Figure 1 depict, respectively, a demand for labor ( $L$ ) function and a production function. ( $Y$  denotes real output.) As is readily seen, a monetary disturbance will affect output in the nonindexed case because of its effect on the real wage. However, indexation, by preventing the monetary shock from affecting the real wage, insulates real output from monetary disturbances.

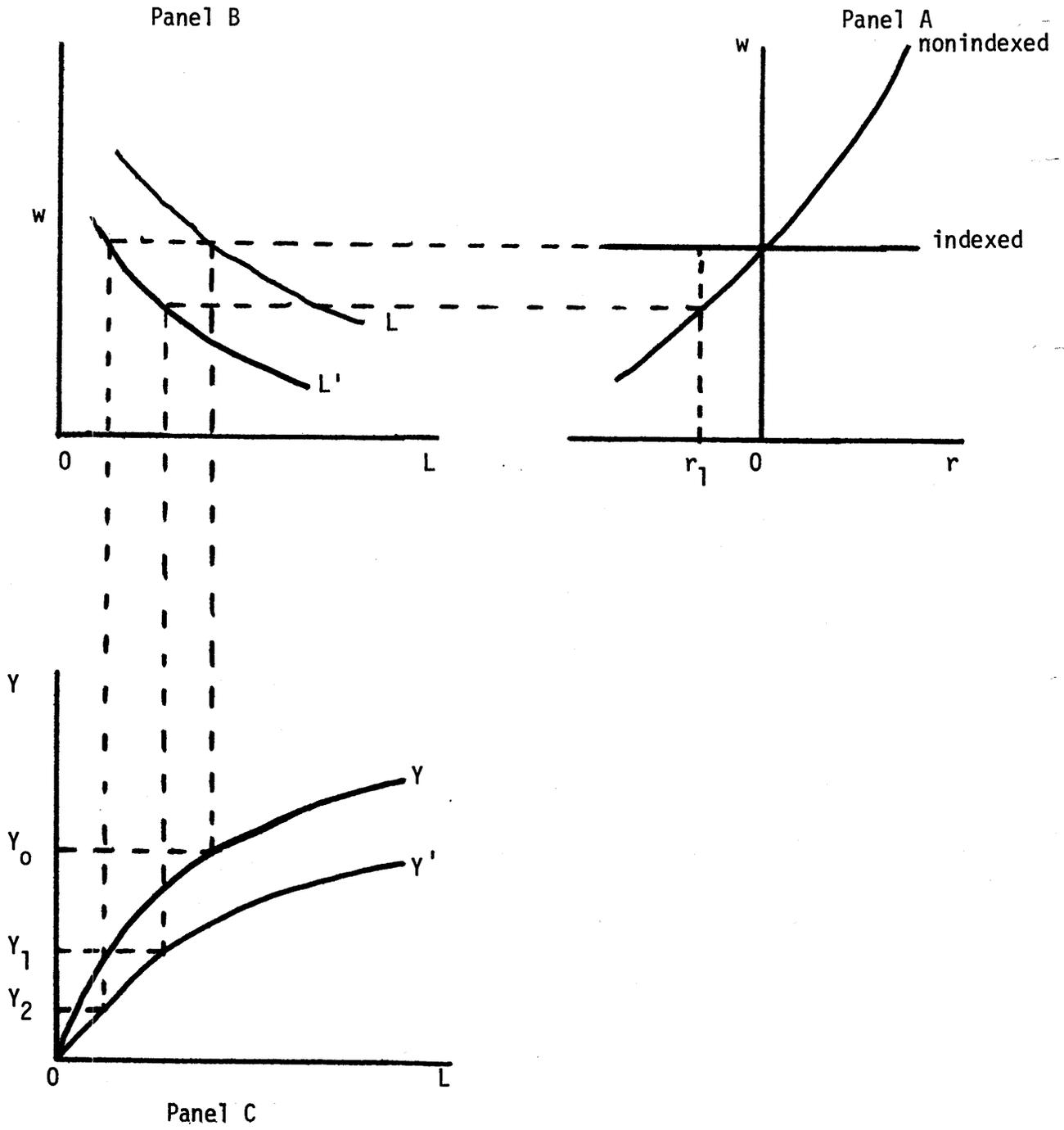
FIGURE 1



Gray models a real shock as a change in labor productivity ( $r$ ) which, with a given money supply, implies changes in the real or the nominal wage. In the absence of indexation the nominal wage is fixed and therefore the real wage adjusts. On the other hand, when wages are indexed the real wage is fixed and the nominal wage adjusts. These two cases are drawn in panel A of Figure 2. In panels B and C of the figure, the demand-for-labor function and the production function are presented. However, unlike in Figure 1, in Figure 2 the postulated shocks affect the curves in panels B and C. Specifically, an increase, for example, in labor productivity shifts the demand for labor outward and the production function upward. In Figure 2, a negative real shock is depicted by the curves  $L'$  and  $Y'$ .

The diagrams in Figures 1 and 2 can be used to demonstrate clearly the Gray and Fischer conclusion. A negative monetary shock ( $m_1$ ) results in a decrease in output (from  $Y_0$  to  $Y_1$ ) in a nonindexed economy but has no effect on real output in an indexed economy. A negative real shock ( $r_1$ ), on the other hand, results in a lower real output in either case, but the output loss in an indexed economy ( $Y_0 - Y_2$ ) is greater than that in a nonindexed economy ( $Y_0 - Y_1$ ). Thus the conclusion is that indexation insulates real output from the effects of monetary disturbances but amplifies the effects of real disturbances.<sup>20/</sup> Another way of stating the Gray-Fischer result is that if a monetary disturbance affects output by altering the real wage, then indexation, by holding the real wage constant in the short run, insulates output from the effects of monetary shocks. In the case of a real shock, if the disturbance alters the equilibrium real wage, indexation, by precluding real-wage adjustment in the short run, inhibits the adjustment process and increases the real shock's effects on output.

FIGURE 2



Marcus Miller has pointed out that a change in a country's terms of trade affects labor productivity.<sup>21/</sup> Thus, in Gray's framework, the oil-price shock can be analyzed as a negative real shock,  $r_1$ .<sup>22/</sup> The implication of the analysis is that the effect of the oil-price shock, other things remaining the same, is a decrease in output which would be ameliorated, but not eliminated, if the real wage fell.<sup>23/</sup>

Towards the end of 1973 the British authorities adopted a policy of wage indexation as part of their anti-inflation policy. The objective was to lower nominal wage demands by, in effect, insuring the workers against inflation-rate outcomes above a certain threshold amount. Presumably what the authorities had in mind can be represented by Figure 1: in order to avoid raising the real wage and thereby lowering real output during a period of monetary restraint (a negative  $m$  in Figure 1), wages were indexed. Unfortunately, just as the wage-indexation policy was being instituted, the world price of oil was raised sharply.<sup>24/</sup> The implied adverse change in the U.K.'s terms of trade meant that the British real wage had to fall in order to minimize the implied loss in domestic real output (see Figure 2), but the indexation scheme prevented the necessary wage change from occurring. The index-link between prices and wages adopted in late 1973 was intended to ease the transition to the lower inflation rate implied by a policy of monetary restraint by ensuring proportional changes in wages and prices. However, as it turned out, the U.K. economy experienced a real shock to which the appropriate response was nonproportional changes in wages and prices in order to effect a change in the real wage. By inhibiting this change, the indexation policy probably lengthened the adjustment period and increased the costs of adjustment in terms of lost output. Thus, in this particular

period of British economic history, a policy of indexation which had been intended to ameliorate the effects of one kind of macroeconomic shock (monetary) actually ended up exacerbating the effects of another kind of shock (real).<sup>25/</sup> Gray argues that there is an optimum degree of indexation which depends on the stochastic structure of the economy. It would be interesting to know how far from the optimum the U.K.'s wage indexation scheme was during 1973-74, but this question is well beyond the scope of the present paper.<sup>26/</sup>

#### IV. Conclusion

Between the fourth quarter of 1971 and the fourth quarter of 1973, the broad measure of the British money supply grew at an annual rate of about 25 percent, roughly twice the rate that had prevailed in the immediately preceding two-year period. It has been argued in this paper that this monetary expansion is attributable to two main causes: the 1971 financial reform measures, which had the perhaps unintended result of creating a substantial amount of excess monetary base, and the deliberately expansionary macro-economic policies pursued by the U.K. government. The subsequent inflationary pressures eventually led the U.K. authorities to adopt an anti-inflation policy in which wage indexation had an important role. As the wage-indexation scheme was being implemented, world-oil prices increased substantially, the U.K.'s terms of trade deteriorated sharply, and inflation rates rose dramatically. The index link between prices and wages inhibited the reduction in the real wage called for by the deterioration in the terms of trade. Indeed, real wages in 1974 actually rose some 6 percent. Therefore, indexation probably prolonged the U.K.'s period of adjustment to the new world-oil price and caused a greater loss in real output than otherwise would have occurred if real wages had been able to fall (or rise by less than they actually did) immediately after the oil-price shock. After wage indexation was abandoned at the end of 1974, real wages began falling (see Table 2) and eventually some semblance of adjustment to the oil-price shock was attained.

The U.K.'s experience in the mid 1970s seems to confirm the policy implications of the Gray and Fischer papers. That is, economies are subject to both monetary and real disturbances and although indexation can insulate real output from monetary shocks it actually amplifies the real effects of real shocks. Gray concludes that partial indexation is the optimum policy

and, since monetary shocks therefore will affect real output even under optimum conditions, she concludes that indexation is not a perfect substitute for monetary stability. Although the oil-price shock may well be much larger than the "average" real disturbance, it serves well as an illustration, albeit perhaps an exaggerated one, of what can go wrong in an indexed economy, why indexation should be partial only, and, thus, why it is not a perfect substitute for monetary stability.

Appendix: Monetary Data

A. The Bank of England Balance Sheet and the British Money Multiplier

In this study, the monetary base is defined to be the monetary liabilities of the monetary authorities. Therefore, in the United Kingdom the monetary base consists of the monetary liabilities of the Bank of England, coin (issued by the Royal Mint), and a very small amount (about £5 million) of the bank notes issued by the Scottish clearing banks and the Northern Ireland banks. The third item can be thought of as a liability of the monetary authorities if one considers the banks involved to be agents of the Bank of England charged with issuing and maintaining a fixed amount of the outstanding stock of fiat currency. (The Scottish clearing banks and the Northern Ireland banks are authorized to issue approximately £5 million in bank notes that are not backed by reserves; the remainder of their bank notes must be covered entirely by holdings of Bank of England notes.)

Bank of England liabilities constitute the most important part of the British monetary base, and, in fact, the other two items mentioned above can be consolidated into the Bank of England's accounts very easily. In Figure A1, the balance sheet of the Bank of England, in which the Issue and Banking departments are combined, on December 12, 1979 is presented. The notes entry refers to Bank of England notes in circulation. Public deposits (PD) are balances held by the U.K. government at the Bank. Special deposits are required, interest-bearing, and non-transferable deposits amounting to a certain percentage of banks' liabilities; the percentage can vary from month to month and is determined by the Bank of England. (Supplementary special deposits are included in special deposits.) Bankers deposits (BD) are balances held by the banks and the discount houses at the Bank. Reserves and other accounts (ROA) include deposit liabilities to foreign central banks, the

FIGURE A1

Balance Sheet of the Bank of England, December 12, 1979  
(£ million)

<u>Liabilities</u>		<u>Assets</u>	
Notes	10,089	Government Securities	10,097
Public Deposits (PD)	20	Other Securities	1,465
Special Deposits	806	Advances and Other Accounts	161
Bankers Deposits (BD)	462	Coin	1
Reserves and Other Accounts (ROA)	697	Premises, Equipment, and Other Securities	365
Capital	15		

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Source: Bank of England Quarterly Bulletin.

Notes: The Bank's Issue and Banking departments are combined in this balance sheet. See the Bank of England Quarterly Bulletin for detailed notes on the balance-sheet entries.

accounts of local authorities and public corporations, and some private sector accounts. The Bank's capital is held by the U.K. Treasury. The Bank's assets listed in Figure A1 need no explanation.

The two components of the British monetary base other than the Bank of England's monetary liabilities -- that is, coin and the fiduciary part of the bank-note issue -- can be consolidated into the Bank's balance sheet simply by adding them to Bank of England notes, denoting the resulting aggregate as N, and by making appropriate revisions in the asset totals to reflect the assets purchased with the coin and the uncovered bank notes. In this paper, coin and the uncovered bank notes issued by the Scottish clearing banks and the Northern Ireland banks are treated as if they were liabilities of the Bank of England.

The monetary base (B) in the United Kingdom is defined to be the sum of the Bank of England's liabilities exclusive of special deposits and capital -- neither of which is a monetary liability -- but inclusive of coin and uncovered bank notes.<sup>27/</sup> That is,

$$(1) \quad B \equiv N + PD + BD + ROA.$$

N is composed of notes and coin held by nonbanks (PC) and banks (VC), and the banks' cash reserves (R) consist of VC and BD. Thus equation (1) can be written as:

$$(2) \quad B \equiv PC + R + PD + ROA.$$

The two most commonly reported and discussed measures of the stock of money in the United Kingdom are M1, which consists of notes and coin in circulation with the public plus sterling sight deposits held by the U.K.

private sector (DD), and sterling-denominated M3 (LM3), which consists of notes and coin in circulation with the public plus all sterling bank deposits -- including certificates of deposit -- held by the U.K. private and public sectors (D). Thus,

$$(3) \quad M1 \equiv PC + BN + DD,$$

$$(4) \quad LM3 \equiv PC + BN + DD + TD,$$

where BN denotes the nonbank public's holdings of bank notes issued by the Scottish clearing banks and the Northern Ireland banks and covered by Bank of England notes, and  $TD \equiv D - DD$ .

Manipulation of equations (2) - (4) yields:

$$(5) \quad M1 \equiv \left( \frac{\frac{PC}{D} + \frac{BN}{D} + \frac{DD}{D}}{\frac{PC}{D} + \frac{R}{D} + \frac{PD}{D} + \frac{ROA}{D}} \right) B,$$

$$(6) \quad LM3 \equiv \left( \frac{\frac{PC}{D} + \frac{BN}{D} + 1}{\frac{PC}{D} + \frac{R}{D} + \frac{PD}{D} + \frac{ROA}{D}} \right) B.$$

The bracketed expressions in equations (5) and (6) are the M1 multiplier (h1) and the sterling M3 multiplier (h3), respectively. The behavior of the money multipliers depends on the behavior of the ratios of which they are composed.

## B. British Monetary Data

The Bank of England publishes both quarterly and monthly data on the U.K. monetary aggregates. The monthly data are available only for the period commencing June 1971 for sterling M3 and October 1971 for M1. Thus in a study covering the 1960s as well as the 1970s it is necessary to use the Bank's quarterly series, which are available for the period commencing the end of the first quarter of 1963. Unfortunately, the quarterly money-stock data are end-of-quarter figures while most of the rest of the U.K. monetary data that are used in this study are mid-month figures for the last month of the quarter.<sup>28/</sup> Thus a discrepancy of some two weeks in the timing of the variables must be introduced.

Data on the Bank of England's balance sheet are available for mid-month dates. In the March 1981 issue of the Quarterly Bulletin, the Bank published a time series of monthly data on the components of the monetary base. In this time series, holdings of Bank of England notes, coin, and the £5 million fiduciary note issue of the Scottish and Northern Ireland banks are allocated between U.K. banks and nonbanks; nonbanks are treated as if they held the Bank of England notes that are actually held by the Scottish and Northern Ireland banks as backing for their own notes. In this paper the Bank of England data are adjusted to reflect actual holdings of currency. Thus BN is subtracted from the Bank's data on nonbank holdings of cash and added to the Bank's data on vault cash.

An estimate of the value of BN in the middle of the last month of the quarter can be obtained by adding mid-month data on the notes outstanding of Scottish clearing banks and data on those of Northern Ireland banks (mid-month from the second quarter of 1975 and end-of-quarter before that date)

and subtracting the £5 million that is being treated as part of the monetary base in this study. (This method of estimation assumes that all of the note issue of the Scottish and Northern Irish banks is held by nonbanks, which, of course, is not necessarily the case.)

Finally, it is possible to decompose the cash reserves (VC plus BD) of the U.K. banking system into "required" reserves (RR) and "excess" reserves (XR). Although the U.K.'s reserve requirements on the banks during the period studied in this paper were not statutory and were not binding on any particular day, but rather were those agreed upon by the banks and the Bank of England and referred to a vaguely defined average over time, they are treated in this paper as if they were legal requirements. Thus, prior to the reform of the monetary system in 1971, the London clearing banks are treated as if they were obliged to hold cash reserves -- i.e., vault cash plus bankers deposits at the Bank of England -- amounting to 8 percent of their gross deposit liabilities in the previous month; after the reform the London clearing banks are treated as if they were obliged to hold bankers deposits at the Bank amounting to 1-1/2 percent of their eligible liabilities in the previous month.<sup>29/</sup> Banks other than London clearing banks had no cash-reserve requirement during the period 1963-1979 other than the requirement that all but £5 million of the bank notes issued by backed fully by Bank of England notes; these holdings are not treated as required reserves in this study.

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FOOTNOTES

- \*/ International Finance Division, Federal Reserve Board. This paper represents the views of the author and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System or other members of its staff. I would like to thank Gerard Caprio, Peter Clark, Richard Freeman, Karen Johnson, and Raymond Lubitz for their comments on an earlier draft of this paper.
- 1/ Even in the absence of indexation, it is possible that labor's resistance to declines in real wages might have impaired adjustment to the oil-price shock. In this regard, it is also possible that the U.K. government's various incomes policies during the period of falling real wages helped to overcome this real wage resistance and bring about the necessary adjustment to the increase in oil prices.
- 2/ In addition, the share of other income (including income from rent and self-employment) and the residual declined and stock appreciation as a percentage of GDP increased. These data are from Economic Trends.
- 3/ Between the fourth quarters of 1973 and 1974, nominal employment income rose about 30 percent while nominal income tax payments plus national insurance contributions increased nearly 50 percent. While income taxes are not the same as taxes on wage income, they are sufficiently similar that one can readily conclude that the increase in the after-tax real wage was somewhat less than the 6.1 percent increase in real wages reported on Table 2. During the period between 1973:Q4 and 1974:Q4 nominal personal disposable income rose 22 percent -- which implies an increase of some 1.7 percent at 1975 prices. The effect of the increase in real wages on consumption expenditures was further attenuated by a

rise in the personal saving rate: between the fourth quarters of 1973 and 1974 real personal consumption expenditures (at 1975 prices) actually fell slightly. These data are from Economic Trends.

- 4/ The index of world-commodity prices in sterling terms is from Economic Trends.
- 5/ See Table 4.
- 6/ The changes are measured as fourth quarter to fourth quarter; the data are from Economic Trends.
- 7/ This is not to say that either a zero balance or the 1972 balance was an equilibrium level; the point is simply that the substantial current-account deficits of the mid 1970s had passed, at least temporarily.
- 8/ See Bank of England and Brian Griffiths.
- 9/ The reserve requirements were not statutory. Rather, the requirements were agreed upon by the banks and the Bank of England; nevertheless, they are treated as if they were legal requirements in this paper.
- 10/ By the end of 1972, some policy measures that were intended to be restrictive had been taken.
- 11/ The 40p figure was roughly equal to 1 percent of the average wage. The indexation feature was not mandatory; nearly one half of the employed labor force ended up with indexed wages.
- 12/ For general accounts of U.K. policy during this period see F. Blackaby, the OECD Economic Surveys, and the National Institute Economic Review.
- 13/ See David Howard for empirical evidence that the standard definition of monetary base is applicable in the United Kingdom.
- 14/ See U.K. Treasury and Bank of England, pp. 18-19. The supplementary-special-deposits scheme introduced in December 1973 was aimed at restricting the growth of interest-bearing bank liabilities.

- 15/ During this period, the Bank of England was concerned primarily with influencing short-term interest rates; the Bank did not attempt to control the monetary base. (See M. Foot, C. Goodhart, and A. Hotson.)
- 16/ Although CCC may well have been responsible for changes in relative interest rates, and thus for the movements in the PC/D ratio as well, it might be argued that most of these changes in interest rates would not be sustained. Three reasons for the termination or reversal of the initial movements in relative interest rates are: the completion of the banks' portfolio-adjustment process, the implementation of the SSD scheme and its restraining effect on the competition for interest-bearing bank deposits, and the limit on the rate of interest paid on time deposits which was in effect from September 1973 through the end of February 1975 and which also dampened competition among banks for interest-bearing deposits. Note that when the SSD scheme was not in effect, e.g., from March 1975 through October 1976, and after the ceiling on time deposit rates was removed, the PC/D ratio continued to increase, which seems to imply that any reversal of relative interest-rate movements was not attributable to the imposition of the SSD scheme and the interest-rate limit alone. (However the SSD scheme and the interest-rate ceiling almost certainly determined the timing of such a reversal.)
- 17/ In this section of the paper, the monetary base and the money multiplier in the United Kingdom have been discussed and the data necessary for analyzing their behavior during the period 1963-1979 have been examined. The discussion in this section of the paper indicates that the monetary-base or money-multiplier approach to monetary analysis appears to be potentially useful for the understanding of British monetary developments. In particular, the sharp increases in monetary growth rates experienced

during the early 1970s seem to be readily explained in terms of predictable changes in various behavioral ratios in response to policy measures taken during that period. Thus further research into the determination of the ratios appearing in the money-multiplier expressions would appear to be useful. Such research would involve the construction of theoretical models of each component of the money multiplier, econometric estimation of the resulting equations, and an empirical investigation into the properties of the estimated equation. A first step in this research program has been reported elsewhere (see Howard), in which the banking system's demand-for-cash-reserves function during the period 1973-1978 is investigated econometrically. However, further econometric work is beyond the scope of the present study. In fact, the major structural changes that have taken place in the British monetary system since 1963 would seem to make it extremely difficult, and perhaps impossible, to model the necessary functions for the entire period 1963-1979. The analyst must either model carefully each structural change or simply analyze sub-periods in which there was no major structural change (as was done in Howard). Recent policy actions such as the termination of exchange controls seem to imply that the analyst interested in studying the current U.K. monetary system must attempt to model the changes or wait several years for sufficient data to be generated under the new policy regime. (Other major structural changes appear to be in the offing; see, for example, U.K. Treasury and Bank of England.) It is to be hoped that further research on the determinants of the British money multiplier will be undertaken, given that the evidence reported in this paper and in the earlier paper (Howard) indicate that it may well be a promising area for research in British monetary economics and that such research may prove to be useful to British policymakers.

- 18/ David Laidler contends that British inflation in the 1970s was a monetary phenomenon and notes that CCC, by creating excess cash reserves, had a role in the monetary expansion during this period.
- 19/ Alex Cukierman has shown that some of the Gray-Fischer results depend on the assumptions made about how the actual quantity of labor employed is determined. Gray and Fischer use models in which employment is demand determined. Cukierman shows that if employment is not demand determined, wage indexation may attenuate rather than amplify the effects of a real shock. Cukierman's results are important qualifications to the Gray-Fischer analyses but, as is argued in footnote 23, for the particular real shock discussed in this paper, the Gray-Fischer results probably are valid.
- 20/ Gray investigates the optimum degree of indexation and concludes that it is somewhere between no indexation and full indexation.
- 21/ Miller's proof rests on the proposition that the relevant marginal product of labor in an open economy must be in value-added terms, that is, net of import requirements. Thus, if  $NY \equiv P_F F - P_Z Z$ , where  $NY$  is nominal income,  $F$  is real final sales,  $Z$  is real imports, and  $P_F$  and  $P_Z$  are the prices of  $F$  and  $Z$ , respectively, then real national income can be defined as:  $Y \equiv NY/P_F = F - (P_Z/P_F)Z$ . (It is implicitly assumed that export prices, which are in  $P_F$ , do not differ in behavior from prices on domestic expenditure.) Denoting the terms-of-trade expression  $(P_Z/P_F)$  as  $T$ , the marginal product of labor in an open economy is  $\partial Y/\partial L = (\partial F/\partial L) - T(\partial Z/\partial L)$ , which depends on the terms of trade ( $T$ ). As Miller (p. 511) states, although "a deterioration in the terms of trade will not affect the physical productivity of labor, it will adversely affect the value-added by labor,..." (Miller explicitly assumes that  $\partial Z/\partial L > 0$  by making  $Z$  a positive function of  $F$ .) Therefore the change in the terms of trade represented by the oil-price shock can be modeled as a shift in the (relevant) marginal product of labor.

- 22/ Using a more elaborate production technology and an explicit model of a profit-maximizing firm, Karen Johnson shows that the demand-for-labor and production functions will shift as they do in Gray's analysis of a negative real shock if the increase in oil price is sufficiently large.
- 23/ As mentioned in footnote 19, Cukierman has raised questions about the determination of employment in the Gray and Fischer models. The relevance of these questions for the analysis in the present paper must be addressed. Assuming that there are no involuntary transactions, the actual amount of employment at a given wage is determined by the minimum of quantity demanded and quantity supplied at that wage. A negative real shock produces a leftward shift in the demand for labor but no change in the supply of labor. Therefore, at the old wage there is excess supply of labor and employment is demand determined. Thus the Gray-Fischer results hold if the real shock is negative and there are no involuntary transactions. (Cukierman also reports this result, see pp. 159-60.) In the case of an oil-price increase the real shock is negative. Furthermore the principle of no involuntary transactions seems to be a reasonable assumption to make. Therefore for the situation analyzed in this paper, the Gray-Fischer results probably are valid -- that is, indexation exacerbates the real-output effects of real shocks. Note that for positive real shocks the principle of no involuntary transactions implies that the effect of a shock is confined to that operating through the shift in the production function. (Note also the implication that output is always less under a regime of wage indexation than it would be under a regime of wage flexibility and market clearing, regardless of the sign of the real shock.)
- 24/ It is interesting to note that the U.K. government foresaw the possibility that an increase in import prices would increase wages by way of the indexation arrangement. The government's view was that "in the interests of fairness," such a risk was acceptable. (See U.K. Treasury, p. 12.) Presumably the government did not have in mind an increase in import prices of the size that actually occurred.

- 25/ For another discussion of the way in which the policy of wage indexation prevented the real wage from falling after the price of oil rose, see Miller.
- 26/ It is, in fact, conceivable that the degree of wage indexation in force was close to the optimum, particularly if the oil-price shock was an extreme outlier.
- 27/ Special deposits are omitted from the definition of B because they are not transferable and therefore are not used to settle accounts and for clearing purposes. Even though special deposits are a liability of the central bank, they are not a monetary liability. For a further discussion of this point, see Howard, in which it is argued that it is not very important analytically whether special deposits are included in B. (For the present study, however, it is important -- for expository reasons -- that special deposits not be included in B.)
- 28/ Most British monetary data are reported for a Wednesday near the middle of the month; this date is referred to in this study as "mid-month."
- 29/ Eligible liabilities essentially are sterling deposit liabilities (see Bank of England for the exact definition).