# CHAPTER 5
# INFLATION AND MONEY SUPPLY

by Roger Tarling and Frank Wilkinson

The view that inflation is quite simply caused by an excessive supply of money, and by this alone, has been widely held through the centuries. For instance, David Hume (1752) wrote:

'It seems a maxim almost self-evident, that the prices of everything depend on the proportion between commodities and money, and that any considerable alteration on either has the same effect, either of heightening or lowering the price.'

More recently, a group of eminent monetary economists (Johnson *et al.*, 1974) have written:

'The more plentiful a commodity, the lower its value [in] terms of other commodities: the greater the abundance of tomatoes, the lower the market value of a tomato. From that rather trite proposition flows our reasoning about inflation, for it is our contention that the same kind of rules must apply to the commodity called money.'

and a popular version of the role of money has been provided by *The Times* (1976):

'The keystone of any stabilization policy must be realism, above all else realism about money based on the absolute insistence that excessive monetary expansion cannot create prosperity and must create inflation.'

This comment followed an article by William Rees-Mogg (Rees-Mogg, 1976), which appeared two months earlier and posited a direct link between excess money supply and prices, whereby price inflation followed necessarily about two years after an excess of the money supply over output.

In these statements about the relationship between money supply and inflation there is no indication of how the process works. It is *implied* that wage bargaining is irrelevant. If this is so, *The Times* in its editorial columns should surely ignore the negotiations about the next phase of incomes policy now beginning, since the rise in prices between 1977 and 1978 would be completely predetermined by a change in the money supply which has already taken place.

In our view, the empirical and institutional foundations for these propositions about the money supply and prices are so weak that it should scarcely be necessary to write this article. However, they have recently received such emphatic and influential support that it has become important to set out the main evidence with some care. We shall show that, in the UK, the money supply and inflation were not correlated except in the early 1970s, and then only as the result of an entirely fortuitous coincidence of separate events.

As is well known

$$MV \equiv PT$$

where $M$ is the supply of money, $V$ the velocity of circulation, $P$ the general price level and $T$ the level of transactions. This equation is of course an identity. If we can assume that the volume of transactions increases fairly steadily, the 'simple' monetarist theory requires that $V$ is approximately constant. Accordingly the 'simple' hypothesis can be tested using the specification

$$\ln\left(\frac{P}{P_{-1}}\right) = a + \sum_{i=0}^{\infty} \omega_i \ln\left(\frac{M}{M_{-1}}\right)$$

For the hypothesis to be supported, $\sum_{i=0}^{\infty} \omega_i$ should be insignificantly different from unity and $a$ should be negative; for equilibrium in steady growth, $\sum_{i=0}^{\infty} \omega_i \, i = 0$ (see Appendix to this chapter).

In Table 5.1, we show the results of regression estimates of this relationship between the change in the money supply and the rate of inflation with a freely estimated but truncated lag structure. Money supply is measured on the official definition of M3 and the rate of inflation is the change in the consumer price

**Table 5·1    Regressions of the rate of inflation on changes in the money supply**

| | Constant | $\ln\dfrac{M}{M_{-1}}$ | $\ln\dfrac{M_{-1}}{M_{-2}}$ | $\ln\dfrac{M_{-2}}{M_{-3}}$ | | | $R^2$ | Standard error of estimate |
|---|---|---|---|---|---|---|---|---|
| 1960/1–70/1 | 0·007(0·5) | 0·185(1·5) | 0·319(2·3) | 0·144(0·9) | | | 0·48 | 0·0146 |
| –71/2 | 0·020(2·0) | 0·058(0·7) | 0·276(1·9) | 0·070(0·5) | | | 0·46 | 0·0149 |
| –72/3 | 0·026(3·5) | 0·064(0·7) | 0·190(1·7) | 0·032(0·2) | | | 0·58 | 0·0146 |
| –73/4 | 0·018(2·4) | −0·053(0·7) | 0·298(2·7) | 0·240(2·0) | | | 0·82 | 0·0162 |
| –74/5 | 0·009(0·9) | −0·036(0·3) | 0·068(0·5) | 0·642(5·7) | | | 0·83 | 0·0237 |

| | Constant | $\ln\dfrac{M}{M_{-1}}$ | $\ln\dfrac{M_{-1}}{M_{-2}}$ | $\ln\dfrac{M_{-2}}{M_{-3}}$ | $\ln\dfrac{M_{-3}}{M_{-4}}$ | $\ln\dfrac{M_{-4}}{M_{-5}}$ | $R^2$ | Standard error of estimate |
|---|---|---|---|---|---|---|---|---|
| 1960/1–70/1 | 0·004(0·3) | 0·127(1·1) | 0·274(2·0) | 0·148(1·1) | 0·182(1·3) | | 0·55 | 0·0147 |
| ,, | 0·003(0·2) | 0·136(0·9) | 0·281(1·8) | 0·152(1·0) | 0·181(1.3) | −0·014(0·1) | 0·55 | 0·0160 |
| 1960/1–74/5 | 0·000(0·0) | −0·008(0·1) | 0·065(0·7) | 0·364(3·6) | 0·446(4·2) | | 0·92 | 0·0167 |
| ,, | −0·004(0·5) | −0·025(0·4) | 0·080(0·9) | 0·319(3·3) | 0·404(4·0) | 0·206(1·7) | 0·93 | 0·0162 |

index. The period over which the proposition is tested is the recent period since 1960.

The first regression in each batch covers the 1960s and successive regressions increase the sample period to add successively further observations from the 1970s, one at a time.

Taking the period 1960-73, the evidence clearly rejects the simple hypothesis, the coefficients on current and lagged ln $\frac{M}{M_{-1}}$ all being insignificantly different from zero. If the period 1973-75 is included the results are more promising. The terms ln $\frac{M}{M_{-1}}$ lagged by two or three years are now significantly above zero.

The constant term, however, is positive and none of the equations come anywhere near satisfying the condition for steady growth in equilibrium, that $\sum_{i=0}^{\infty} \omega_i i = 0$. As the results are significant for the whole fifteen years taken together only when 1973-75 is included, the rest of this article will examine events in those years, to explain the real reasons for the acceleration of inflation which then took place – on which, as we have seen, the correlation entirely depends.

### The transmission mechanism
#### (i) *Money supply and real demand*
To amplify the 'simple' monetarist hypothesis, various transmission mechanisms have been advanced, which depend on the money supply influencing real demand in the first instance. Thus Friedman (1973) writes:

'On the average, a change in the rate of monetary growth produces a change in the rate of growth of nominal income about six to nine months later.'

'The changed rate of growth of nominal income typically shows up first in output and hardly at all in prices . . . If the rate of monetary growth is reduced, for example, then about six to nine months later, the rate of growth of nominal income and also of physical output will decline.'

'On the average, the effect on prices comes some nine to fifteen months after the effect on income and output, so that the total delay between a change in monetary growth and a change in the rate of inflation, averages something like 15 to 24 months.'

Friedman's qualifications about the variability of time lags weaken the hypothesis and make it difficult to test. Nevertheless, we have carried out a number of regressions specified in the form

$$\ln\left(\frac{X}{X_{-1}}\right) = a + \sum_{i=0}^{\infty} \mu_{-i} \ln\left(\frac{EM_{-i}}{EM_{-i-1}}\right)$$

where ln $\frac{X}{X_{-1}}$ represents the year on year percentage growth in real GDP and ln $\frac{EM}{EM_{-1}}$ is the percentage excess of growth in the money supply over the growth in *value* of GDP (see Table 5.2).

Like those of Table 5.1, the results are at best inconclusive. For the period 1960-72 the coefficient on ln $\frac{EM}{EM_{-1}}$ was invariably small and insignificant. If the period 1972-75 is included the coefficients on ln $\frac{EM}{EM_{-1}}$ become significant though they remain extremely small (i.e. it is implied that a 10% excess growth in the money supply raises real output by under 2%). However, even if an effect of the money supply on real demand could be substantiated, it would still be necessary, if inflation is to be explained, to establish a link between real demand and prices. This question is considered in the following section, noting that the hypotheses now to be tested are no longer specifically monetarist at all; demand could be held to influence prices without this implying any particular relationship between money and demand.

#### (ii) *Real demand and inflation*
Table 5.3 gives a comprehensive analysis of the cost composition of annual changes in consumer prices since 1960, together with two indicators of the pressure of demand.

The first column of the table shows estimated annual percentage changes in the total historical normal unit costs entering consumer prices, which are then subdivided in columns (2)-(4) into the contributions of normal unit wage costs, rent and import prices. Column (7) shows the residual between changes in consumer prices (6) and total costs (1) plus (weighted) net indirect taxes (5). The cost series has been obtained by calculating the component series, weighting them, and imposing lags calculated from

**Table 5·2** **Regressions of the growth in real GDP on the excess of growth of money supply over growth of money GDP**

| | Constant | ln$\frac{EM}{EM_{-1}}$ | ln$\frac{EM_{-1}}{EM_{-2}}$ | ln$\frac{EM_{-2}}{EM_{-3}}$ | $R^2$ | Standard error of estimate |
|---|---|---|---|---|---|---|
| 1960/1–70/1 | 0·027(6·0) | −0·052(0·4) | 0·085(0·6) | −0·051(0·4) | 0·07 | 0·0149 |
| −71/2 | 0·027(6·7) | −0·034(0·4) | 0·088(0·7) | −0·056(0·4) | 0·07 | 0·0139 |
| −72/3 | 0·029(7·9) | 0·003(0·0) | 0·188(2·1) | −0·039(0·3) | 0·31 | 0·0137 |
| −73/4 | 0·025(7·5) | 0·074(1·1) | 0·091(1·1) | −0·193(1·8) | 0·35 | 0·0146 |
| −74/5 | 0·025(8·1) | 0·074(1·2) | 0·098(1·5) | −0·202(2·5) | 0·60 | 0·0139 |
| 1960/1–70/1 | 0·027(6·5) | −0·062(0·4) | 0·088(0·6) | | 0·06 | 0·0140 |
| −71/2 | 0·028(7·7) | −0·034(0·4) | 0·094(0·7) | | 0·05 | 0·0132 |
| −72/3 | 0·029(8·9) | 0·002(0·0) | 0·188(2·1) | | 0·31 | 0·0130 |
| −73/4 | 0·026(7·1) | 0·125(1·9) | 0·010(0·1) | | 0·20 | 0·0154 |
| −74/5 | 0·025(6·7) | 0·176(3·0) | 0·046(0·7) | | 0·44 | 0·0158 |

**Table 5·3**   **Inflation and its components 1960-1975** (year on year % changes)

| Period | (1) Normal historical unit costs[a] | Contributions of: | | | (5) Effect of taxes less sub-sidies | (6) Con-sumer prices[b] | (7) Changes in markup and residual =(6)-(1)-(5) | (8) Cyclical variable[c] | (9) Unem-ployment[d] (thousands) |
| | | (2) wages | (3) rent | (4) import prices | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1959–60 | 1·23 | 0·58 | 0·17 | 0·27 | −0·39 | 1·09 | 0·25 | 1·005 | 394 |
| 60–61 | 2·17 | 2·05 | 0·13 | 0·11 | −0·15 | 2·92 | 0·90 | 1·003 | 322 |
| 61–62 | 1·84 | 1·74 | 0·22 | −0·07 | 0·56 | 3·90 | 1·50 | 0·998 | 388 |
| 62–63 | 1·59 | 0·90 | 0·27 | 0·41 | 0·03 | 1·86 | 0·24 | 1·016 | 585 |
| 63–64 | 2·82 | 1·56 | 0·27 | 0·88 | 0·98 | 3·35 | −0·45 | 1·024 | 419 |
| 64–65 | 3·06 | 2·35 | 0·25 | 0·52 | 1·21 | 4·98 | 0·71 | 1·012 | 332 |
| 65–66 | 3·23 | 2·57 | 0·29 | 0·39 | 1·01 | 3·99 | −0·25 | 1·005 | 302 |
| 66–67 | 2·48 | 1·66 | 0·34 | 0·30 | 0·25 | 2·84 | 0·11 | 1·001 | 516 |
| 67–68 | 4·97 | 2·28 | 0·32 | 2·14 | 0·74 | 4·88 | −0·83 | 1·001 | 574 |
| 68–69 | 4·63 | 2·74 | 0·47 | 1·34 | 1·44 | 5·76 | −0·31 | 0·982 | 56? |
| 69–70 | 7·42 | 5·05 | 0·59 | 1·60 | −0·58 | 5·92 | −0·92 | 0·983 | 58? |
| 70–71 | 7·06 | 4·99 | 0·52 | 1·34 | −1·18 | 8·18 | 2·30 | 0·985 | 668 |
| 71–72 | 6·80 | 5·20 | 0·69 | 0·55 | −1·17 | 6·71 | 1·08 | 1·016 | 910 |
| 72–73 | 11·82 | 6·00 | 0·78 | 4·88 | −0·61 | 8·58 | −2·63 | 1·036 | 702 |
| 73–74 | 22·38 | 9·69 | 1·03 | 11·42 | −5·68 | 16·11 | −0·60 | 1·001 | 573 |
| 74–75 | 21·54 | 14·08 | 1·02 | 6·78 | −0·96 | 23·09 | 2·50 | 0·969 | 734 |
| 75–76[e] | 16·33 | 9·45 | 0·74 | 5·83 | 0·80 | 16·25 | −0·88 | 0·949 | 1223 |

Notes:
[a] The individual contributions in columns (2) to (4) do not add to total costs in column (1), because of an aggregation error due to changes in weights.
[b] Measured in terms of the *Blue Book* deflator, i.e. as the ratio of current to constant market price expenditure.
[c] Real consumers expenditure as a ratio to its log trend.
[d] Wholly unemployed UK (excluding school leavers and adult students): seasonally adjusted, first quarter average.
[e] CEPG estimates.

stock/output ratios; thus the 'residual' is not a regression residual but simply the gap between the change in prices and the change in lagged normal costs measured quite independently.[1] It should show the effect of changes in mark-ups on historical normal unit costs, together with errors of statistical measurement.

One hypothesis about how demand influences prices is that it does so in the product market directly, by changing the relationship of prices to costs.

We tested for any effect of demand on consumer prices relative to historical normal costs, using specifications of the pressure of demand both in levels and in changes, The results were

$$\left(\frac{\Delta p}{p}\right)_{-1} = 27·13 + 0·937\left(\frac{\Delta h}{h}\right)_{-1} \underset{(1·5)}{26·56(C/C^*)} \quad R^2 = 0·961$$
$$\underset{(15·1)}{}$$

$$= 0·50 + 0·944\left(\frac{\Delta h}{h}\right)_{-1} 0·225 \ \Delta(C/C^*) \quad R^2 = 0·958$$
$$\underset{(13·5)}{} \underset{(1·0)}{}$$

where $p$ is consumer prices, $h$ is historical normal unit costs plus net indirect taxes and $C/C^*$ is the ratio of real consumption to its log trend.

In each formulation the demand term is insignificant and the negative sign carries the implication that, if anything, mark-ups have moved *anticyclically*. The coefficient on $h$ is, as expected, insignificantly different from unity.

Given that demand has no significant inflationary influence on overall mark-ups, we now have to

[1] This procedure is similar to that used in Nordhaus and Godley (1972) and more fully explained there.

consider the possibility that demand influences prices indirectly, through its effect in factor markets.

So far as wages are concerned, we published our own view of the wage determination process in last year's *Review* (Coutts, Tarling and Wilkinson, 1976). We did not attribute any significant part of the explation of wage increases to excess demand, and we have since encountered no reason to alter this viewpoint. Whether wage bargaining is concerned with price expectations or with compensation for past increases (and we firmly believe that it is the latter), Table 5.3 shows that the acceleration in wages in recent years has been accompanied by exceptionally high levels of unemployment. Moreover, whatever the effect of excess demand on wages, the table shows that it cannot provide anything like the whole, or even the main, explanation of rising wage costs. A number of people (e.g. Coutts, Tarling and Wilkinson (1976), Deaton (1975), Godley (1976, 1977) and Henry, Sawyer and Smith (1976)), have argued that the empirical work purporting to establish that higher unemployment causes wages to decelerate is seriously defective; there has been no answer to these criticisms and we shall therefore not reiterate them here.

The other major component of costs is sterling import prices. Movements in these prices depend on changes in world prices and in the exchange rate. Burns and Budd (1977) have recently argued that excess demand will cause falls in the sterling exchange rate which raise sterling import prices, raising costs both directly and indirectly, through the effect of prices on wages. In Table 5.4 we show changes in

**Table 5·4 Changes in import prices, average earnings and the retail price index, 1972I-1976III**
(percentage increases on a year earlier)

| | | Import prices | Sterling effective exchange rate | Average earnings | Retail price index |
|---|---|---|---|---|---|
| 1972 | I | 4·8 | +0·1 | 10·2 | 8·0 |
| | II | 1·9 | −0·8 | 11·4 | 6·2 |
| | III | 4·7 | −5·8 | 12·2 | 6·5 |
| | IV | 10·2 | −8·9 | 15·8 | 7·7 |
| 1973 | I | 15·1 | −10·4 | 13·9 | 8·0 |
| | II | 23·6 | −10·0 | 14·3 | 9·3 |
| | III | 31·6 | −10·7 | 14·6 | 9·2 |
| | IV | 38·9 | −9·2 | 12·5 | 10·3 |
| 1974 | I | 57·9 | −7·2 | 14·5 | 12·8 |
| | II | 64·3 | −6·1 | 14·0 | 15·8 |
| | III | 53·0 | −0·2 | 19·8 | 17·0 |
| | IV | 43·0 | −1·4 | 25·3 | 18·2 |
| 1975 | I | 23·4 | −5·0 | 27·3 | 20·4 |
| | II | 10·2 | −8·6 | 28·1 | 24·3 |
| | III | 10·1 | −12·1 | 26·5 | 26·6 |
| | IV | 12·4 | −12·5 | 21·8 | 25·3 |
| 1976 | I | 12·3 | −12·1 | 19·7 | 22·4 |
| | II | 21·8 | −18·3 | 18·0 | 16·0 |
| | III | 25·2 | −17·0 | 14·2 | 13·6 |

import prices and the sterling exchange rate since 1971.

The principle of their analysis is acceptable, but it can only account for a small proportion of the acceleration in inflation which has actually occurred. Between the fourth quarter of 1971 and the fourth quarter of 1974, import prices rose by 119%. The fall in the exchange rate over the same period was only 18%, thus contributing only about 1/5 of the total increase in sterling import prices.

World price increases, rather than the fall in the exchange rate, provide the main explanation for the rise in British import prices. The UK had no control whatever over the rise in world prices, which was caused by such factors as the coincidence of expansion in industrial countries raising commodity demand, the Russian intervention in the American wheat market, and the decision by OPEC to quadruple the price of oil.

Price inflation began to increase during 1973, as higher import prices increased costs. This acceleration in prices became very marked during 1974, despite the introduction of food subsidies. Because of the unfortunate threshold scheme, the rise in import prices caused, indeed institutionalised, a response of wages far more rapid and complete than normal; it was almost certainly for this reason that the UK inflation in 1974 and 1975 (and therefore 1976 too) was so much larger than in most other countries.

The threshold agreements, negotiated under stage III of the incomes policy, were first triggered by the April 1974 increases in the Retail Price Index and permitted increases of 40p for each complete percentage increase in the RPI, payable from May 1974 onwards. With retail prices propelled by commodity prices, oil prices and falls in the exchange rate, threshold payments increased rapidly through the year, totalling £4·40 when threshold agreements ended in November 1974. Under normal collective bargaining, *ex post* compensation would be agreed at each wage settlement (e.g. annually), and under a 'normal' incomes policy this compensation would be restricted, although the time lag between price changes and compensating increases in money wages would not be affected. The system of threshold payments guaranteed compensation awards *each month* rather than each year, sharply reducing the time between settlements and eliminating the normal time lag in the response of wages to prices. The impact on average unit wage costs to employers was immediate. The effect on retail prices was an acceleration in the rate of inflation to 25%, helped along by post-threshold increases in nationalised industry prices, which had previously been held back as a deliberate policy.

Thus the acceleration of inflation since 1973 was begun by forces largely outside the UK and maintained by the automatic and immediate compensatory increases in money wages provided through threshold agreements: only a small part, at most, can be attributed to the lax fiscal and monetary policy of the 1971–73 period.

But, as pointed out right at the start, empirical support for the simple monetarist proposition depends entirely on the inclusion of the period 1973–75. This empirical support is exposed as the result of a fortuitous coincidence by the evidence that rising import prices in 1973 and 1974 were predominantly the result of world events, and that real demand does not have any significant effect on costs and prices.

## APPENDIX

Assume that the volume of transactions increases exponentially and that, in equilibrium, the velocity of circulation is constant:

$$\ln T = \beta + at$$
$$\ln V^* = \gamma \text{ (constant)}$$

The equilibrium price level satisfies the identity

$$\ln p^* = \ln V^* + \ln M - \beta - at$$

Let actual prices be a weighted average of previous equilibrium price levels:

$$\ln p = \sum_{i=0}^{\infty} \omega_i \ln p^*, \text{ with } \sum_{i=0}^{\infty} \omega_i = 1$$

Then we can write

$$\ln \frac{P}{P_{-1}} = -a + \sum_{i=0}^{\infty} \omega_i \ln \left. \frac{M}{M_{-1}} \right|_{-i}$$

Note that these assumptions mean that both prices and the velocity of circulation will at any time diverge from equilibrium values by the same amount:

$$\left. \begin{array}{c} \ln \dfrac{P}{P^*} \\[2em] \ln \dfrac{V}{V^*} \end{array} \right\} = \sum_{i=0}^{\infty} \theta_i \left[ \ln M_{-i} - a(t-i) \right]$$

where $\theta_o = \omega_o - 1$,
$\theta_i = \omega_i \ (i > 0)$

and hence $\displaystyle\sum_{i=0}^{\infty} \theta_i = 0$

For equilibrium to be achieved with steady growth of the money supply ($\ln M = \lambda + pt$), it is necessary that

$$\sum_{i=0}^{\infty} \omega_i \ i = 0$$

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