INFLATION AND MONETARY GROWTH: EXPERIENCE IN FOURTEEN COUNTRIES OF EUROPE AND NORTH AMERICA SINCE 1958

*Richard T. Selden**

INTRODUCTION

The idea that inflation is strongly influenced by monetary growth—once actively debated within the economics profession—is readily accepted by a large majority of economists today, especially with respect to the United States. While disagreements persist over such issues as the precise manner in which monetary growth fosters inflation, the length of lags between changes in the money supply and related changes in the price level, the importance of non-monetary causes of inflation, and the optimal strategy for reducing inflation, there is an impressive body of empirical evidence supporting the linkage between money and U. S. inflation throughout its history.

Outside the United States there is less agreement on the sources of inflation. No other country has been subjected to as much empirical analysis by so many independent researchers as the United States, so there is more room for differences of opinion. Moreover, in most of the leading industrial nations there are reasons for thinking that various nonmonetary factors have distorted the relationship between monetary growth and inflation. For example, these countries are far less self-sufficient than the United States, and most of them have relied more aggressively on price-wage controls. In addition, several European countries have revamped their tax systems during the last decade or two in ways that may have affected the standard inflation measures.

This article examines the impact of monetary growth on inflation in fourteen industrial economies. The countries studied and their rates of inflation since 1958 are displayed in Table I and in Chart 1. We begin by developing a simple model of inflation in Section I. Then in Section II we present regression results for all countries, employing as nearly as possible a common model specification. In this way we hope to gain insights into similarities and differences across countries with respect to the role of monetary growth in recent inflations. Section III subjects the general findings to further analysis in an attempt to extract some broader implications from the results. The major conclusions are summarized in Section IV. An appendix contains detailed regression equations for individual countries.

Obviously, a study of this sort is subject to various hazards and limitations. By attempting to examine a large number of countries we are necessarily superficial in our treatment of any single country. Countries differ greatly in institutional frameworks and macro-policies, and these are unlikely to get the attention they deserve. Further, by applying a common model to all countries we run the risk of ig-

Table I

MEAN RATES OF INFLATION, 1958 to 1977, SELECTED COUNTRIES OF EUROPE AND NORTH AMERICA

Country	Mean Inflation Rate* (percent)	Standard Deviations
Austria	4.43	5.02
Belgium	4.50	3.84
Britain	6.86	7.09
Canada	4.22	3.44
Denmark	6.59	5.49
France	6.19	4.82
Germany	3.47	3.03
Italy	6.71	6.51
Netherlands	4.95	5.46
Norway	5.61	4.92
Sweden	5.07	4.28
Switzerland	3.77	3.51
United States	3.94	2.50
Yugoslavia	11.46	12.28

* Except for the U. S., where the GNP implicit deflator is used, inflation is measured by the annualized quarter-to-quarter percent change in the consumer price index.

* Carter Glass Professor of Economics, University of Virginia and Visiting Scholar, Federal Reserve Bank of Richmond. This paper was presented at a Research Department seminar at the Federal Reserve Bank of Richmond, July 30, 1981.

noring factors that may be pertinent to a particular country. We recognize these trade-offs, but we leave to others the task of building more elegant theoretical models and more precise empirical formulations.

I.
A FRAMEWORK OF ANALYSIS

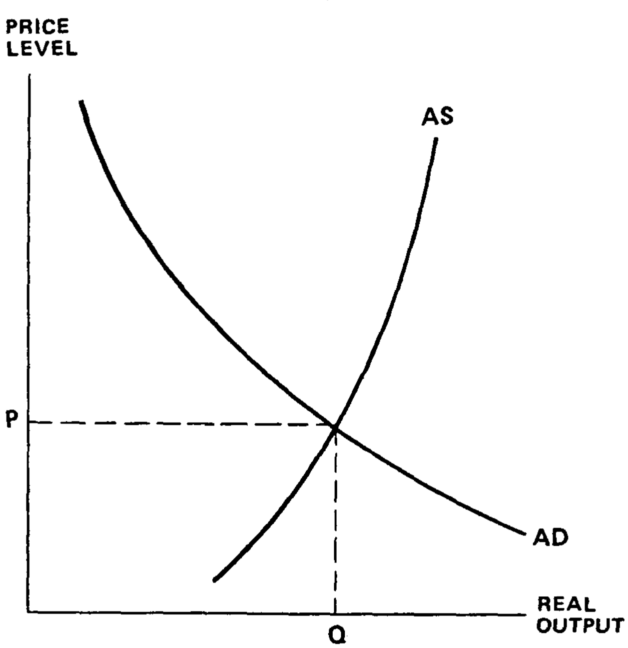
Money and Inflation It will be helpful at the outset to provide a general analytic framework that encompasses both monetary and nonmonetary sources of inflation. Figure 1 shows hypothetical demand and supply curves for total output for an entire economy. The curve labeled AD is referred to by economists as an "aggregate demand" curve. Its downward slope indicates that the quantity of output demanded will be greater at a lower level of prices than at a higher level. Similarly, the upward slope of the AS curve (i.e., "aggregate supply") assumes that producers will provide more goods and services at higher prices than at lower prices. In equilibrium, the price level (P) and the level of output (Q) are established by the intersection of AD and AS.

For present purposes there is little point in striving for greater rigor in our formulations of AD and AS.[1] The important point to recognize is that P may rise —i.e., inflation may occur—either because of a rightward shift in AD or because of a leftward shift in AS. The precise shapes of the curves and the exact nature of the forces that may bring about inflationary shifts are secondary issues as far as this article is concerned.

Economists hold that monetary growth influences inflation by affecting the position of the AD curve. Ordinarily a rise in the volume of money, M, will increase the nation's demand for goods and services; hence AD will move to the right and, under stable supply conditions, P will rise. There is less than unanimity among economists about the relative importance of changes in M and various other disturbances that might conceivably produce shifts in AD in the real world. For example, those who continue to view the world in terms of "Keynesian" models are apt to emphasize the importance of fiscal policies (quite apart from the monetary implications of these policies) as determinants of AD.[2] But even the Keynesians concede that monetary growth usually will result in inflation, unless it is matched by an equally rapid increase in AS.

Of course, inflation can come about because of nonmonetary disturbances. Supply conditions change from time to time, and the inflationary consequences need not be negligible. During the 1970s, in fact, there were some notable "supply shocks" relating to energy and food. Thus as Alfred Marshall reminded us nearly a century ago, there are two blades to the scissors. Failure to take account of the supply "blade" may well result in biased estimates of the role played by monetary growth and other demand disturbances.

Figure 1



An Empirical Model of Inflation One approach to an investigation of real-world inflations would be to develop full-blown aggregate demand and supply functions along the lines of the figure and to solve them simultaneously to determine both the inflation rate and the rate of growth of output. We do not adopt this "structural model" approach. Instead we work with a single-equation model that represents a modified version of the ancient Equation of Exchange, $MV = PQ$, where V is the velocity or turnover rate of money and the other symbols are as previously defined. For our purposes it is convenient to rearrange terms, add time subscripts, and convert from *levels* to *rates of change* by taking logarithmic first differences:

$$p_t = v_t - q_t + m_t. \quad (1)$$

[1] See, for example, Dornbusch and Fischer [4], chaps. 11 and 12.

[2] An example may be found in Blinder [2].

Obviously, both forms of the equation of exchange are identities. In order to transform equation (1) into a theory of inflation we must impose constraints on the behavior of one or more of the variables on the right-hand side. One very simple constraint would be to assume that the sum of the growth rates of velocity and output, v_t and q_t, is equal to a constant:

$$v_t - q_t = k. \tag{2}$$

This assumption allows the levels of V and Q, and their growth rates, to vary over time. By substituting (2) into (1), we obtain (3), which is not an identity:

$$p_t = k + bm_t. \tag{3}$$

Note that the coefficient b which we have inserted into (3) is necessarily equal to unity in this simple model.

Equation (3) is not yet a promising hypothesis for empirical testing since it takes no account of monetary lags. A large amount of earlier work has established that changes in monetary growth rates do not have immediate effects, either on real economic activity or on prices.[3] In the case of prices, most U. S. studies have found average lags ranging between one and a half and three years. While the reasons for such long lags are not entirely understood, neither are they wholly surprising, given the prevalence of government-imposed price constraints in contemporary economies. Examples include the prices of goods and services that are provided directly by governments (e.g., postal rates and bus fares), as well as prices of private firms that are set by regulatory bodies (e.g., electricity and telephone rates).

We allow for monetary lags by substituting a lag expression for m_t:

$$p_t = k + \sum_{i=o}^{n} w_i m_{t-i}. \tag{4}$$

There is little basis in theory for preferring a particular pattern for the weighting coefficients, w_i. All of the results reported in this article were obtained from polynomial distributed lag functions ("Almon" lags) using third degree polynomials, a specification that is compatible with a wide variety of weight configurations.

A second problem with (3), and with (4) as well, is that it ignores supply shocks. A related omission in these models is that they ignore the impact of price-wage controls. When effective, such controls may result in disequilibrium situations—i.e., combinations of P and Q at points other than intersections of AD and AS. Still another type of occasional shock arises when countries engage in major revampings of their tax systems, the most relevant example being the introduction of broad-based value-added taxes (VATs), usually as substitutes for other types of expenditure taxes, in several European countries during the 1960s and 1970s. There is no reason to think that either AD or AS will be affected permanently by such a shift; the only significant lasting effects would appear to be changes in the relative price structure. In the short run, however, the transition to VAT might well cause an inflationary spurt, especially if inflation is measured by a price index whose scope is rather narrow. Prices of newly taxed items would rise while prices of items that are now taxed less heavily than before might be slow to fall. Moreover, there might be a temporary surge of demand for durable goods immediately prior to the tax change, to be followed later by a fall-off in demand. It also is not unlikely that the central bank would attempt to accommodate the implied short-run rise in velocity (and in interest rates) by a "one-time" rise in M. In this latter case, of course, AD would shift to the right and there would be a permanent rise in P—and a transitory increase in the rate of inflation. But even if the central bank does *not* adopt an accommodative policy, one would expect a transitory jump in the inflation rate.

A simple but effective way of dealing with these "shocks" is to introduce dummy variables with values of 1 in the quarters when the shocks occur, and values of 0 in all other quarters. Thus we have:

$$p_t = k + \sum_{i=o}^{n} w_i m_{t-i} + \alpha_j D_j \quad (j = 1, \ldots m) \tag{5}$$

where there are m separate shock dummies, D_j, and the α_j are their estimated regression coefficients. In some instances it is possible to adopt the more sophisticated procedure of constructing time series to measure the intensity of shocks. This can be done for energy by introducing the rate of change in relative energy prices as an explanatory variable. Similarly, rather than rely on a crude VAT dummy equal to 1 in the initial quarter of the tax and 0 in all other quarters, it seems preferable to substitute a time series of changes in actual VAT rates. This enables us to take account of the impact on inflation (if any) resulting from subsequent rate manipulations, which have been substantial in some countries. Incorporating these latter modifications, we obtain:

[3] A useful recent discussion of the rates of monetary growth and inflation may be found in Carlson [3]. See also Berman [1] and Karnosky [5].

$$p_t = k + \sum_{i=o}^{n} w_i m_{t-i} + \alpha_j D_j + \Upsilon p_E + \sigma T \quad (6)$$

where p_E is the relative price of energy and T is the change in the standard tax rate under VAT.

The empirical results presented in Section II are derived from equations (5) and (6). There are additional problems, however, in formulations such as (3) which, though not addressed directly in the work reported in Section II, must be mentioned briefly at this point. These problems relate to the treatment of inflation expectations, the nature and importance of international transmission mechanisms, and the possibility of "reverse causality" running from inflation to monetary growth.

It has become common in recent studies of inflation to work with models that make the current rate of inflation p a function of expected inflation, p*, plus other variables such as the size of the gap between actual and potential real GNP. In such a model, monetary growth influences p largely through its effect on p*. Since p* is considered to depend primarily on the *trend* rate of monetary growth, transitory deviations of monetary growth from its trend are expected to have little impact on inflation. At the same time, factors other than the trend rate of monetary growth—e.g., the inflation rate in countries that are important trade partners—are held by some economists to play a role in determining p*. We shall return to this topic in Section III.

Even casual inspection of the chart on pages 24 and 25 suggests that inflation rates are highly correlated across countries.[4] Nevertheless, despite a literature on the international transmission of inflation which has grown rapidly both in size and complexity in recent years, there is considerable disagreement over the nature of the transmission mechanism. One simple hypothesis, which of course is compatible with equations (5) and (6), is that a country's rate of monetary growth is influenced by the rate of inflation in other countries. This is a plausible hypothesis under a regime of fixed exchange rates such as existed for most of our study period up to the winter of 1973, and it is also relevant to a situation in which central banks engage in "dirty floating" to moderate the swings in nominally flexible exchange rates.

According to this view, a country that was able to insulate its monetary growth rate from such external influences would be able to "go its own way" with respect to inflation. An alternative (though not mutually exclusive) hypothesis argues that inflation can be transmitted from one country to another independently of any immediate effect on the recipient country's monetary growth rate through a process known as "goods arbitrage." Thus a rise in the price of (say) automobiles in country A will soon result in higher auto prices in country B as traders switch orders from the high-price suppliers to those with lower prices. The rise in auto prices in B, according to this hypothesis, will be followed by more rapid monetary growth in B as its central bank acquires foreign exchange and expands bank reserves. In both hypotheses about the transmission mechanism, it should be noted, there will be a rise in monetary growth associated with an increase in inflation. However, the causal roles played by monetary growth under these alternative scenarios are entirely different.

This leads, finally, to the closely related issue of reverse causality. In our discussion of equations (5) and (6) we assumed implicitly that the rate of monetary growth is determined in each country by the policies of its own central bank. This is not to deny the existence of various feedback mechanisms whereby monetary growth can be influenced by the behavior of banks and their customers; it simply assumes that such feedbacks can be neutralized by the central bank's policies. We have already noted that under a regime of fixed exchange rates a central bank will be obliged to establish whatever monetary growth rate is compatible with maintaining the official exchange rate. Even in a closed economy, however, one can imagine situations (e.g., adherence through thick and through thin to an interest-rate or unemployment objective) in which the monetary growth rate would not be the focal point of policy deliberations. By and large we shall ignore such issues, just as we ignore any consideration of formal money-supply models. Undoubtedly this topic will receive attention from other researchers.

II.
THE MAIN EMPIRICAL FINDINGS

The basic regression results for all fourteen countries are summarized in Table II. More detailed results may be found in the appendix. For eleven countries the estimations were based on two complete decades of quarterly data, extending from 1958 I through 1977 IV. Shorter periods were used in the cases of Britain and Norway because of data limitations; in the case of Germany, because the long-period results were unsatisfactory.

[4] See Table V for a matrix of simple correlation coefficients of inflation rates.

Except for the United States, the dependent variable is the annualized percent change in consumer prices. U. S. regressions were run with both the CPI and the GNP implicit deflator; while the results were very similar, those with GNP prices had slightly higher R^2s, and they alone are reported here. Monetary growth rates were calculated from narrow measures of money in most instances. One exception is Yugoslavia, where currency was used. Another is Norway, where we found a much stronger effect of monetary growth on inflation when money was defined broadly. Britain provides a similar exception: British M1 produces much poorer results than the broad M3 measure, which includes even non-sterling deposits held by residents in British banks. In the United States, as well as most other countries, on the other hand, narrow money is more closely related to inflation rates than broad money is. Since we have no preconceptions about which money measure to use, we have selected whichever measure provides the best statistical fit. Discussion of various other data problems is left to the appendix.

The first and most important point to be noted in Table II is that in every country there is a statistically significant relationship between monetary growth and inflation. In two instances—Denmark and France—the summed monetary coefficients just barely passed the five percent significance test; the remaining countries' monetary coefficients were significant at the one percent level. The monetary

Table II

SUMMARY OF BASIC INFLATION REGRESSIONS

Country	Regression Number	Period	Money Measure Used	Sum of Monetary Coefficients (t statistics)	Mean Monetary Lag (t statistics)	$\bar{R}^2$	Standard Error of Regression	Durbin-Watson Statistic	Other Variables Included in Regression
Austria	1.2	58I-77IV	M1	.939 (3.38)	7.0 (2.56)	.393	3.93	2.29	C,S,PCRELPEN$_{-1\text{ to }-2}$
Belgium	2.2	58I-77IV	M1	1.278 (7.82)	7.5 (4.10)	.672	2.21	2.03*	C,PCRELPEN$_{0\text{ to }-5}$
Britain	3.4	63I-77IV	M3	.927 (6.79)	8.9 (5.08)	.735	3.79	1.79	C,S,PCRELPEN$_{0\text{ to }-5}$, WPCON
Canada	4.2	58I-77IV	M1	.612 (5.50)	4.7 (2.62)	.681	1.93	1.90	C,PCRELPEN$_{0\text{ to }-5}$
Denmark	5.3	58I-77IV	M1	.565 (2.07)	10.1 (2.35)	.531	3.72	2.06*	C,S,PCRELPEN$_{0\text{ to }-5}$, VATCHNGE
France**	6.1	58I-77IV	M1	.431 (2.08)	6.0 (1.76)	.311	3.32	1.98*	C,S
Germany	7.3	64I-77IV	M1	.805 (2.91)	5.8 (1.55)	.742	1.53	1.97*	C,S,PCRELPEN$_{0\text{ to }-5}$, VATCHNGE
Italy	8.2	58I-77IV	M1	1.290 (4.14)	11.1 (4.45)	.695	3.64	2.14*	C,PCRELPEN$_{0\text{ to }-3}$, WPCON
Netherlands	9.2	58I-77IV	M1	1.148 (5.90)	9.4 (5.07)	.626	3.36	2.42	C,S,PCRELPEN$_{0\text{ to }-3}$, WPCON,VATCHNGE
Norway	10.2	64I-77IV	M2	.816 (5.01)	13.2 (3.44)	.616	3.04	1.99	C,S,WPCON, VATCHNG
Sweden	11.2	58I-77IV	M1	1.693 (5.40)	9.7 (5.50)	.550	2.88	2.08*	C,WPCON,DECON,OIL
Switzerland	12.2	58I-77IV	M1	.598 (4.67)	10.6 (5.11)	.516	2.46	1.58	C,S,PCRELPEN$_{0\text{ to }-5}$
United States	13.4	58I-77IV	M1B	.801 (10.65)	7.1 (3.93)	.797	1.13	1.74	C,PCRELPEN$_{-1\text{ to }-4}$, WPCON
Yugoslavia	14.2	58I-77IV	Currency	1.580 (2.78)	8.5 (3.02)	.628	7.52	2.06*	C,S,REFORM

* Cochrane-Orcutt Procedure was applied.

** In the case of France, the Almon Lag Procedure was applied to the current and 15 lagged quarterly monetary growth rates.

Glossary: C, constant; DECON, dummy variable = 1 in quarter following suspension of wage-price controls; OIL, dummy variable = 1 in 73IV to 74II; PCRELPEN, percent change in ratio of energy prices to all consumer prices; REFORM, dummy variable = 1 in 65III; S, seasonal dummy variables; VATCHNGE, quarter-to-quarter change in standard value-added tax rate; WPCON, dummy variable = 1 in quarters of comprehensive (and binding) wage-price controls.

CHART 1

QUARTERLY INFLATION RATES OF SELECTED WESTERN COUNTRIES
1958 – 1980

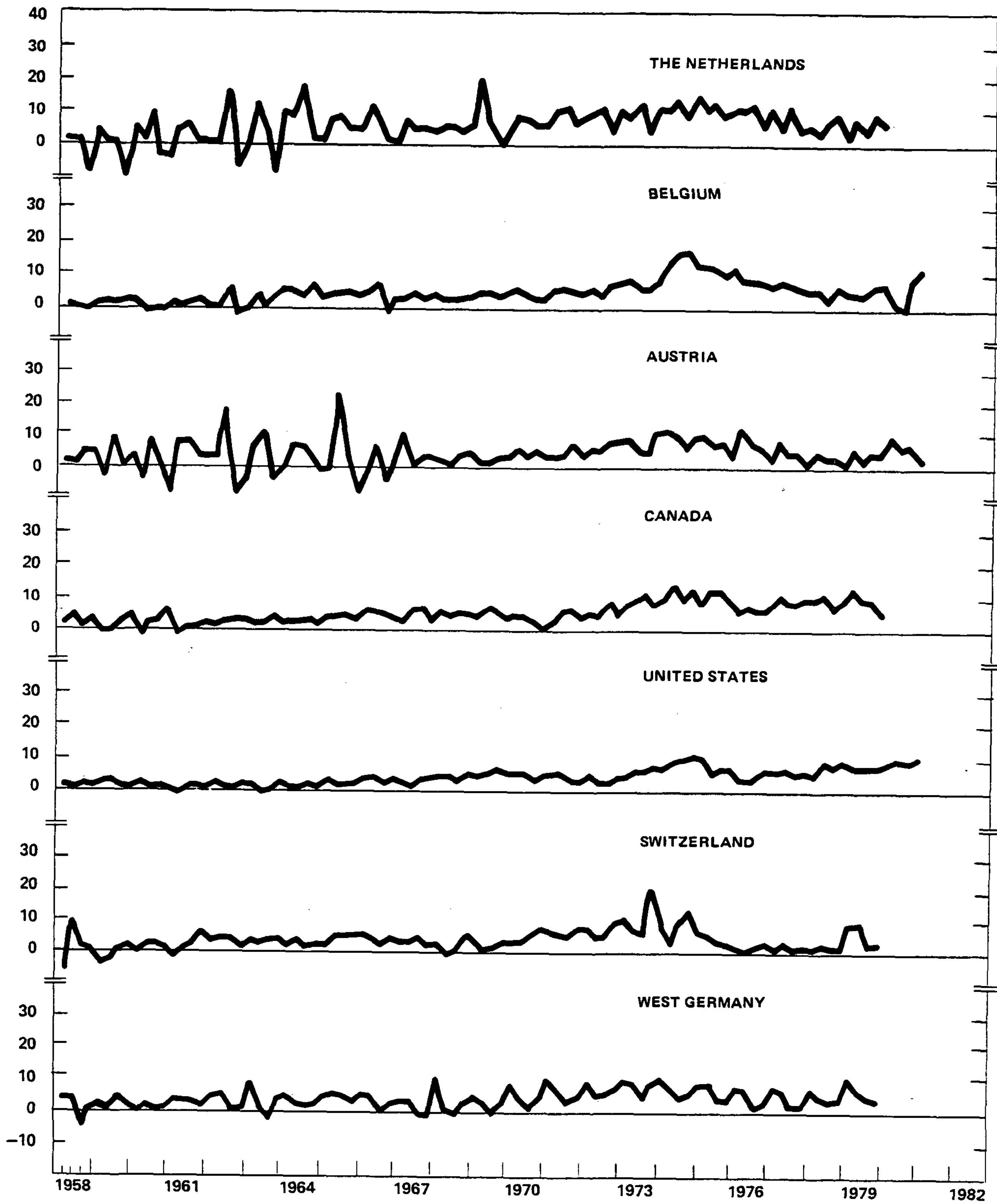
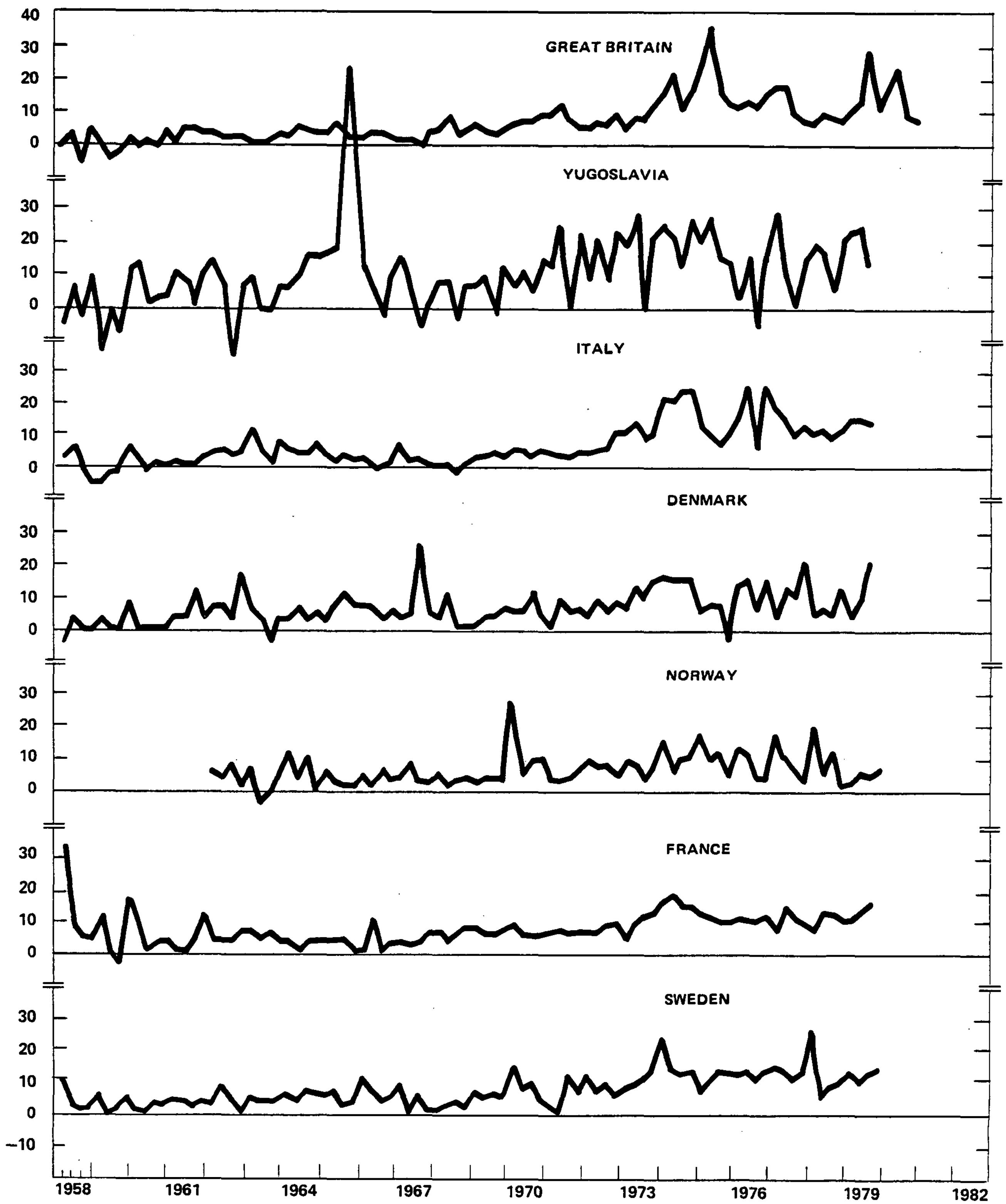


CHART 1 (Cont'd)

QUARTERLY INFLATION RATES OF SELECTED WESTERN COUNTRIES 1958 – 1980



coefficients vary from country to country, ranging between a low of .431 in France and a high of 1.693 in Sweden.

A second interesting aspect of Table II is the evidence that monetary growth affects inflation with long lags. Mean monetary lags range from a little over one year in Canada (4.7 quarters) to more than three years (13.2 quarters) in Norway. The estimates of mean monetary lags were significant at the five percent level in every country except France and Germany.

Except for France, all of the regression equations summarized in Table II includes variables other than lagged monetary growth rates. The most common additional variable is PCRELPEN, the quarter-to-quarter percent change in the relative price of energy.[5] We were interested to find that energy prices did not have a statistically significant effect on the inflation rate in five countries: Austria, France, the Netherlands, Norway, and Yugoslavia. However, in the Austrian equation the t-ratio on PCRELPEN narrowly missed the five percent significance level, and the French equation for 1968 I to 1977 IV (6.2) shows high significance levels for this variable. Thus in all but a couple of countries it appears that the relative price of energy played an important role in the inflations of 1958-77.

We obtained mixed results with regard to the impact of changes in value-added tax rates. Four countries—Canada, Switzerland, the United States, and Yugoslavia—have not adopted this form of taxation. In the case of Sweden, the rate of inflation is calculated net of changes in VAT rates. Among the remaining nine countries, we failed to find significant coefficients on VATCHNGE (the quarter-to-quarter change in the standard tax rate) in Austria, Belgium, Britain, France, and Italy. This may reflect the relatively low tax rates in some countries, the narrow scope of items that are taxed at the standard rate, or the fact that VAT may have replaced earlier excises on consumer goods. However, in countries such as Denmark, Germany, the Netherlands, and Norway it is clear that changes in VAT have had major (but transitory) effects on the rate of inflation. Denmark has relied heavily on frequent changes in VAT rates as a tool of macro-stabilization.

Finally, every country except Germany and Switzerland experimented with direct wage-price controls during 1958-77. Our attempts to use dummy variables to gauge the impacts of these controls on the behavior of inflation rates were only partially successful. Controls dummies ("WPCON") had significant negative coefficients in just four countries: Britain (65III-67II and 76I-76IV), Italy (73III-73IV), Sweden (70IV-71II), and the United States (71III-72IV). A plausible explanation of our failures in other countries is that many controls programs are not severely binding, due either to loose administration or to explicit loopholes. Another problem is that controls typically are dismantled piecemeal, which forces the researcher to make an arbitrary decision about the effective time span of WPCON. In countries such as Austria, France, and the Netherlands there is a further difficulty: interventionist policies are applied so continuously in these countries that one is hard-pressed to identify periods that are free of controls.

In summary, the regression results displayed in Table II provide strong evidence of a link between monetary growth and inflation in Canada, Yugoslavia, and most of the industrialized democracies of Western and Central Europe quite similar to the linkage that is known to exist in the United States. Given the wide differences among these countries in institutional settings and policy strategies, these findings suggest that the linkage between monetary growth and inflation is indeed robust.

III.
SOME FURTHER RESULTS

The empirical results in Table II are of considerable interest as they stand. There are, however, a number of unanswered questions that demand additional investigation. For example, has the inflation-monetary growth linkage been stable over time? In particular, is there any indication that lags have become shorter in recent years? Then there is the complicated issue of reverse causality which was mentioned in Section I. Still another important issue relates to the international transmission of inflation. We cannot provide definitive answers to any of these questions in the space that is available. Nevertheless we do have some pertinent evidence to present.

Stability Over Time A major impediment to the development of economic science is the tendency for human behavior to change over time. This may result from alterations in the basic institutional setting. Even in a stable setting, however, people discover new ways of attaining goals, and even their goals shift. Indeed, it has often been noted that economics tends to be self-invalidating, in the sense that the

[5] We were unable to calculate this variable for Sweden and Yugoslavia. For Sweden we relied instead on an OIL dummy (equal to one in 73IV and 74I) with good results.

discovery and publication of information about a regularity in economic behavior tends to cause changes in behavior as individuals begin to utilize the information for personal gain.

The economics of inflation is not exempt from this hazard. As inflation persists over time, individuals are likely to become more sophisticated in protecting themselves from its consequences. One result might well be a shortening of the lag between monetary growth and inflation. Thus regression equations based on one period's data may fit poorly a different set of observations. In fact, this could occur even without behavior changes if the basic institutional setting undergoes major transformations. An example might be the transition from pegged to flexible exchange rates early in 1973. Clearly, therefore, we need to investigate the temporal stability of the linkage between monetary growth and inflation.

The stability issue can be investigated in three ways. First, we can see how closely these inflation equations, which were derived from data through 1977, fit post-sample observations for 1978-80. Second, we can compare parameter estimates obtained within subperiods of the overall data set. Third, we can examine estimates of the mean monetary lags in earlier and more recent periods to see whether they appear to have changed. Since it would be extremely tedious to review all of the available evidence under each of these headings, we will limit ourselves to a few summary statements.

1. The weight of evidence supports the conclusion that money-based inflation equations of the sort presented in this article have been rather unstable since 1958. We do not know how these equations compare with alternative inflation equations in this respect.

2. With one or two exceptions (e.g., Germany and Denmark), the money-based equations did not do notably well in "predicting" inflation rates in 1978-80. This is hardly surprising, given the economic turbulence of the period and the poor track record of alternative models.

3. Separate regressions for 1958-67 and 1968-77 sometimes produced widely differing monetary growth coefficients. An extreme example is Italy, whose sum of monetary growth coefficients was .792 in a 1958-67 estimation compared with 2.180 in a similar specification for 1968-77. On the other hand, in Switzerland the estimates were virtually identical over the same periods (.614 vs. .596). It should be noted, of course, that short-period regressions involving cycle-sensitive variables would be expected to display considerable instability.

4. There is no convincing evidence in these regressions of a general shortening (or lengthening, for that matter) of lags between changes in monetary growth rates and inflation rates. Table III compares mean lag estimates calculated from 1958-67 and 1968-77 regressions for the six countries in which statistically significant estimates were obtained in both periods. In Britain, Switzerland, and the United States lags were shorter in the more recent period; in Belgium, Italy, and the Netherlands the opposite was true.

Reverse Causality As was noted briefly in Section I, the existence of a close historical relationship between monetary growth and inflation—such as we have found in all fourteen countries—can be interpreted in various ways, as far as causality is concerned. We have suggested that the main line of causality runs from monetary growth to inflation rather than the other way around. The fact that long lags were found between monetary growth and inflation does not "prove" that our interpretation is correct. However, it does represent a challenge to the proponents of reverse causality to formulate a hypothesis that is capable of explaining how changes in the rate of inflation can bring about *prior* changes in monetary growth—a nontrivial task.

On a more elementary level, it must be conceded that the results presented in Table II and the appendix do not really address the possibility that monetary growth rates are determined at least partially by prior movements in the rate of inflation. We have regressed the inflation rate only on current and past monetary growth rates. Conceivably there is also a statistically significant relationship between inflation and future monetary growth.

Table III

COMPARISON OF MEAN MONETARY LAGS, 1958-67 vs. 1968-77, SELECTED COUNTRIES

Country	1958-67 Regressions (quarters)	1968-77 Regressions (quarters)
Belgium	6.6*	10.1*
Britain	10.9*	9.0**
Italy	7.6*	12.9**
Netherlands	7.1**	10.7**
Switzerland	13.0**	10.8*
United States	10.0**	6.4**

* Significant at the 5 percent level.

** Significant at the 1 percent level.

Table IV presents some preliminary evidence on this possibility. For each country we selected a representative equation and added monetary growth in periods t + 1 through t + 4 as explanatory variables. The numbers in the table are "t" statistics on the regression coefficients for these leading monetary growth terms. It can readily be seen that not a single coefficient was statistically significant at the five percent level in the first three future quarters. In period t + 4 only three of the 14 countries had significant coefficients, and one of them had a significant *negative* coefficient. Altogether there were 15 negative coefficients among the 56 estimates. Negative coefficients, of course, contradict the hypothesis that central banks tend to validate inflations that originate from nonmonetary disturbances by promoting accelerated monetary growth.

Not surprisingly, the significant negative coefficient appeared in the United States regression. In fact, all four U. S. coefficients were negative. This result suggests that the Federal Reserve's policy reaction function is quite sensitive to inflation developments. A speed-up in U. S. inflation tends to be followed by monetary tightness (i.e., slower monetary growth). In Canada and Sweden, on the other hand, this evidence suggests a considerably more accommodationist stance by their central banks.

International Transmission of Inflation The inflation equations presented in this article do not pay explicit attention to international transmission mechanisms. This does not mean that we think that inflations cannot be imported. Obviously, the inflation rates in all of the countries studied here are sensitive in some degree to inflation elsewhere; this is suggested quite strongly by the chart, which shows broadly similar trends across countries. Rather, our model can be interpreted as assuming that the main way in which inflation is transmitted from one country to another is via external influences on monetary growth.

Table IV

T-STATISTICS ON LEADING RATES OF MONETARY GROWTH

	Eqn. No.	t+1	t+2	t+3	t+4
Austria	1.2	.79	.37	.29	−.21
Belgium	2.2	.75	1.29	1.65	1.76
Britain	3.3	−1.59	−1.55	.55	1.48
Canada	4.4	.40	1.06	1.58	2.11*
Denmark	5.3	.03	.74	1.00	1.16
France	6.1	.16	1.47	.51	.39
Germany	7.3	−1.15	.60	.06	−1.09
Italy	8.2	.07	1.17	1.74	.49
Netherlands	9.2	1.70	.85	.78	1.69
Norway	10.2	.38	−.91	.44	−1.33
Sweden	11.2	−.18	.70	.98	2.43*
Switzerland	12.3	.73	.39	1.52	.22
United States	13.4	−1.77	−1.29	−1.17	−2.37*
Yugoslavia	14.3	−.43	−1.46	−1.00	.45

* Significant at the 5 percent level.

To shed further light on the international transmission issue, we carried out three supplemental empirical exercises. First, we ran simple correlation matrices for inflation rates and for monetary growth rates for all countries. Second, we ran further regressions for the United States with lagged values of the trade-weighted value of the dollar as added variables. Third, for all thirteen countries other than the United States we ran further regressions with the U. S. M1B growth rate as an additional explanatory variable. These results and their implications are discussed briefly below.

1. *The Correlation Matrices.* Pairwise simple correlation coefficients among the quarterly inflation rates for all fourteen countries are displayed in Table V. Table VI contains a similar display for monetary growth rates, except that Norway has been excluded from the table.

The most striking feature of these tables is the contrast between them. Even though we made no allowance for possible lagged relationships between countries, all of the inflation correlation coefficients are positive and 72 (of 84) are significantly different from zero. On the other hand, 23 (of 78) money-growth correlations are negative, and 47 of them are not significantly different from zero. Clearly, inflation is much more strongly correlated across countries than monetary growth is.

The case of the United States is especially worth noting. Except for the correlations with Belgium and Britain (.32 and .37 respectively), U. S. monetary growth was correlated either very weakly or, in the case of Switzerland, negatively with monetary growth elsewhere during 1958-77. Despite this, the correlations between inflation rates in the United States and the other thirteen countries were consistently significant, ranging upward from .26 for Austria to .76 for Belgium.

2. *Exchange Depreciation and U. S. Inflation.* It is often asserted that exchange depreciation provides an important mechanism whereby a country may import inflation from its trade partners. According to this argument, if it takes more U. S. dollars (say) to buy a French franc, then dollar prices

Table V

MATRIX OF SIMPLE CORRELATION COEFFICIENTS: QUARTERLY INFLATION RATES, 1958-77

	Austria	Belgium	Britain	Canada	Denmark	France	Germany	Italy	Netherlands	Norway	Sweden	Switzerland	United States
Belgium	.45												
Britain	.40	.72											
Canada	.26	.75	.65										
Denmark	.24	.41	.33	.47									
France	.11	.44	.41	.42	.19								
Germany	.43	.52	.55	.36	.18	.25							
Italy	.33	.73	.63	.63	.57	.49	.45						
Netherlands	.54	.55	.59	.35	.35	.19	.60	.45					
Norway	.27	.44	.41	.38	.18	.22	.51	.48	.25				
Sweden	.39	.67	.49	.60	.40	.52	.40	.68	.39	.53			
Switzerland	.31	.38	.28	.31	.33	.01	.41	.31	.33	.28	.20		
United States	.26	.76	.61	.70	.43	.44	.40	.60	.42	.39	.52	.40	
Yugoslavia	.21	.38	.40	.26	.28	.04	.43	.36	.41	.17	.15	.39	.27

Note: Coefficients that exceed .22 are significantly different from zero at the 5 percent level of significance.

of French imports into the United States are bound to be higher, thus exerting upward pressure on the U. S. inflation rate. Despite an appealing surface plausibility, this argument suffers from the difficulty that most instances of exchange depreciation can be linked to either actual or expected inflation at rates exceeding those elsewhere. Thus we have another case in which the direction of causality is under question.

We have tested this hypothesis in crude fashion for the United States by regressing the 1958-79 inflation rate on M1B growth and the trade-weighted average value of the dollar against major foreign currencies. The latter variable was entered four

Table VI

MATRIX OF SIMPLE CORRELATION COEFFICIENTS: QUARTERLY MONETARY GROWTH RATES, 1958-77

	Austria	Belgium	Britain	Canada	Denmark	France	Germany	Italy	Netherlands	Sweden	Switzerland	United States
Belgium	.10											
Britain	−.04	.09										
Canada	.07	.10	.38									
Denmark	.48	.16	−.18	.10								
France	.45	.05	−.01	−.01	.61							
Germany	.66	−.04	−.11	.02	.53	.67						
Italy	.28	−.11	.02	.07	.45	.73	.66					
Netherlands	.03	.16	−.07	−.06	.13	.11	.13	.01				
Sweden	−.73	.12	.22	.11	−.31	−.39	−.66	−.29	.04			
Switzerland	.20	−.11	−.25	−.13	.28	.33	.45	.50	.12	−.23		
United States	.06	.32	.37	.08	.08	.02	.02	.02	.21	.06	−.05	
Yugoslavia	.59	−.06	−.03	.13	.51	.58	.68	.63	−.04	−.53	.38	.02

Note: Coefficients that exceed .22 (in absolute value) are significantly different from zero at the 5 percent level of significance.

times, with lags of one to four quarters. None of these four lagged terms were significant: their respective "t" statistics were —.14, —.45, .37, and —1.12. Perhaps more thorough testing would produce evidence of an important impact of exchange depreciation on U. S. inflation. However, these preliminary results offer no support to this particular version of the imported-inflation hypothesis.

3. U. S. Monetary Growth and Foreign Inflation. As a final empirical exercise we decided to explore the consequences of substituting U. S. monetary growth for own-country monetary growth for each of the thirteen foreign countries included in this study. The main features of these results are listed in Table VII.

In every country, U. S. monetary growth proved to be a significant explanatory variable—a surprising result in view of the absence of correlation between monetary growth in the United States and elsewhere. U. S. monetary growth, in fact, attained higher "t" statistics than domestic monetary growth in the cases of Britain, Denmark, Sweden, and Yugoslavia. However, the mean lag estimates in the right-hand columns show better significance levels—and greater plausibility—when each country's own monetary growth rates are used. Thus, despite the unexpectedly close relationship between monetary growth in the United States and inflation elsewhere, it still appears that in most instances one obtains more satisfactory results with own-country money growth.

Table VII

COMPARISON OF REGRESSION RESULTS WITH UNITED STATES AND OWN MONETARY GROWTH RATES

		t-statistics on ΣPCM		Mean Monetary Lag	
	Eqn. No.	Own PCM	U. S. PCM	Own PCM	U. S. PCM
Austria	1.2	3.38	2.97	7.4**	10.0*
Belgium	2.2	7.82	5.50	7.5**	7.5*
Britain	3.3	8.10	8.12	9.2**	15.8**
Canada	4.2	5.50	3.95	4.7*	4.3
Denmark	5.3	2.07	2.60	10.1*	17.9*
France	6.2	6.50	2.99	6.9**	9.5**
Germany	7.3	2.91	2.36	5.8	6.7
Italy	8.2	4.14	2.09	11.1**	13.3
Netherlands	9.4	4.90	4.60	10.4**	10.2**
Norway	10.2	5.01	2.26	13.2**	16.2**
Sweden	11.2	5.40	5.64	9.7**	12.6**
Switzerland	12.2	4.67	3.84	10.6**	—.4
Yugoslavia	14.3	2.54	3.37	8.6**	6.4

* Significant at 5 percent level.

** Significant at 1 percent level.

4. Tentative Conclusions on the Transmission Mechanism. Admittedly, we have not probed very deeply into the question of how inflation gets transmitted from one country to another. Nevertheless, we believe that these preliminary findings point toward cross-country influences on monetary growth rates as an important element in the transmission mechanism.

Our main results, summarized in Section II, show that each country's monetary growth rate has played a strong but delayed role in its inflation experience during 1958-77. Our pairwise simple correlation coefficients indicate that monetary growth rates are not closely correlated across countries. Yet we have found a surprisingly close relationship between U. S. monetary growth and foreign inflation.

The key to understanding this paradoxical set of results lies in the lag estimates reported in Table VII. Note that eight of the thirteen regressions with U. S. monetary growth substituted for own monetary growth produced statistically significant monetary coefficients. In six of these eight cases, lags were longer—sometimes substantially longer—when U. S. monetary growth was used. In a seventh case (Belgium) the lag estimates for U. S. and own monetary growth were identical, and in the eighth case (the Netherlands) the estimates were virtually identical. There is a strong suggestion, therefore, that U. S. monetary growth influences foreign inflation primarily through a delayed impact on foreign monetary growth. Because the correlation coefficients of U. S. monetary growth and monetary growth in the thirteen other countries take no account of lags, they turn out to be weak, but this does not mean that they are not in fact closely related.

It should be recalled that during most of our study period the world was operating under the Bretton Woods system of pegged exchange rates. The rules of this system required each central bank to maintain the external value of its currency within a narrow band around a stated par value. Thus a tendency for a country's currency to (say) appreciate vis-à-vis the dollar would require its central bank to buy dollars on the foreign exchange market. Ordinarily such purchases would result in a more rapid growth in the country's monetary base, and ultimately in its money supply. If we assume (as is plausible) that the original disturbance in the foreign exchange market reflected a speed-up in U. S. monetary growth, then we have a situation in which more rapid monetary growth in the United States leads, with a lag, to more rapid monetary growth in other countries.

This does not deny the possibility of other sorts of international transmission mechanisms, including even direct expectational links between a country's inflation rate and that of its principal trade partners. The strong correlation coefficients of inflation rates across countries are consistent with this type of link.

Clearly, many puzzles remain with respect to the transmission question. We expect to extend the work reported here by examining the lag structures among monetary growth rates for the various countries. We also intend to compare results for the Bretton Woods portion of our period, 1958-72, with more recent results under floating exchange rates.

IV.
CONCLUDING REMARKS

In this article we have developed a simple model that attempts to explain inflation primarily as the result of current and past monetary growth rates. In addition, our model allows for energy-price shocks, the effects of wage-price controls, and the impact on inflation rates from changes in value-added tax rates.

For the period 1958-77, and for various subperiods, we have developed quarterly inflation equations for the United States, Canada, and twelve European countries. In each country we found statistically significant regression coefficients on the sum of the current and nineteen lagged monetary growth rates. We also found in each country that the estimated mean lag between monetary growth and inflation was very long—it ranged from a minimum of one year to over three years at the maximum. On the other hand, other explanatory factors—the relative prices of energy, changes in value-added tax rates, and the use of wage-price controls—were important in some countries, unimportant in others. They did not exhibit the same degree of consistency in their contributions to inflation as monetary growth did.

As far as the United States is concerned, the findings reported here are consistent with previously published studies. The main novelty of the present work is its extension of the U. S. results to other countries, employing as nearly as possible a common format for all countries. Despite the obvious potential pitfalls in this approach, we believe that this exercise in cross-country comparisons has provided a useful perspective which suggests a substantial similarity across countries with respect to the nature of the inflation problem. Everywhere the main difficulty has been excessive monetary growth. A return to reasonably stable prices will require much slower monetary growth in the future than during the past quarter of a century.

References

1. Berman, Peter I. *Inflation and the Money Supply in the United States, 1956-1977.* Lexington: D. C. Heath and Co., 1978.
2. Blinder, Alan S. *Economic Policy and the Great Stagflation.* New York: Academic Press, 1979.
3. Carlson, Keith M. "The Lag from Money to Prices." *Review,* Federal Reserve Bank of St. Louis 62 (October 1980): 3-10.
4. Dornbusch, Rudiger, and Fischer, Stanley. *Macroeconomcis.* 2d ed. New York: McGraw Hill Book Co., 1981.
5. Karnosky, Denis S. "The Link Between Money and Prices." *Review,* Federal Reserve Bank of St. Louis 58 (June 1976): 17-23.

APPENDIX

Table A1

AUSTRIA

	1.1	1.2	1.3
Item/Period	58-77		68-77
ΣPCM1 (20 qtrs)	1.010 (3.60)	.939 (3.38)	.864 (5.34)
Mean Lag (qtrs)	7.4 (2.88)	7.0 (2.56)	6.6 (3.37)
PCRELPEN$_{-1}$		.003 (.11)	.014 (.80)
PCRELPEN$_{-2}$		.062 (1.99)	.035 (1.99)
SA1	.946 (.48)	1.023 (.53)	
SA2	8.393 (5.08)	8.120 (4.96)	
SA3	−1.837 (1.12)	−1.756 (1.08)	
SB1	5.332 (2.58)	5.523 (2.71)	3.548 (2.77)
SB2	1.552 (1.02)	1.385 (.92)	−.136 (.14)
SB3	2.404 (1.50)	2.267 (1.43)	.349 (.34)
C	−6.618 (2.47)	−5.949 (2.24)	−3.587 (2.11)
N	80	80	40
Mean Rate of Inflation	4.43	4.43	5.76
$\bar{R}^2$	.371	.393	.516
Standard Error of Regression	4.00	3.93	2.05
Durbin-Watson Statistic	2.25	2.29	2.02
Rho	—	—	—
F	5.7	5.3	5.6

Table A2

BELGIUM

	2.1	2.2	2.3	2.4
Item/Period	58-77		58-67	68-77
ΣPCMI (20 qtrs)	1.275 (6.91)	1.278 (7.82)	.637 (4.12)	1.456 (2.88)
Mean Lag (qtrs)	9.0 (4.68)	7.5 (4.10)	6.6 (2.55)	10.1 (2.71)
ΣPCRELPEN (6 qtrs)		.129 (2.10)		
Mean Lag (qtrs)		2.2 (.85)		
C	−3.581 (2.84)	−3.711 (3.32)	−1.002 (1.24)	−4.319 (1.05)
N	79	79	39	39
Mean Rate of Inflation	4.55	4.55	2.29	6.87
$\bar{R}^2$	.667	.672	.352	.767
Standard Error of Regression	2.23	2.21	1.96	1.79
Durbin-Watson Statistic	2.06	2.03	2.18	1.55
Rho	.39	.31	−.32	.69
F	40.0	21.0	6.2	32.3

Table A3

BRITAIN

	3.1	3.2	3.3	3.4	3.5
Item/Period		58-77		63-77	68-77
ΣPCM3 (20 qtrs)	1.016 (10.69)	1.025 (11.12)	.875 (8.10)	.927 (6.79)	.865 (3.45)
Mean Lag (qtrs)	10.2 (8.20)	10.3 (8.59)	9.2 (5.58)	8.9 (5.08)	9.0 (2.85)
WPCON		−3.075 (2.42)	−3.355 (2.72)	−2.885 (2.07)	−2.665 (.70)
ΣPCRELPEN (6 qtrs)			.343 (2.53)	.475 (2.49)	
Mean Lag (qtrs)			2.5 (4.06)	2.4 (4.52)	
PCRELPEN					.082 (.95)
PCRELPEN$_{-1}$					−.009 (.12)
PCRELPEN$_{-2}$					.171 (2.17)
PCRELPEN$_{-3}$					.115 (1.35)
S1	.602 (.49)	.561 (.47)	.465 (.40)	1.018 (.70)	2.129 (.94)
S2	3.371 (2.76)	3.352 (2.84)	3.302 (2.81)	4.642 (3.09)	5.409 (2.43)
S3	−3.844 (3.15)	−3.853 (3.26)	−3.590 (3.06)	−3.096 (2.04)	−2.924 (1.29)
C	−.674 (.60)	−.264 (.24)	1.199 (.94)	−.141 (.08)	.160 (.05)
N	80	80	80	56	40
Mean Rate of Inflation	6.86	6.86	6.86	8.90	10.98
$\bar{R}^2$	.708	.726	.746	.735	.646
Standard Error of Regression	3.86	3.73	3.60	3.79	4.52
Durbin-Watson Statistic	1.57	1.69	1.83	1.79	1.80
Rho	—	—	—	—	—
F	28.4	27.2	20.3	13.7	6.9

Table A4

CANADA

	4.1	4.2	4.3	4.4
Item/Period	58-77		58-67	68-77
ΣPCM1 (20 qtrs)	.822 (10.28)	.675 (7.12)	1.081 (2.93)	.617 (3.40)
Mean Lag (qtrs)	5.2 (3.70)	4.9 (2.94)	10.4 (2.50)	4.0 (1.34)
PCRELPEN$_{-1}$		.055 (1.70)	.097 (1.16)	.040 (1.03)
PCRELPEN$_{-2}$		.047 (1.44)	−.006 (.07)	.052 (1.27)
C	−1.191 (2.19)	.093 (.13)	−1.695 (1.22)	.264 (.18)
N	80	80	40	40
Mean Rate of Inflation	4.22	4.22	2.04	6.40
$\bar{R}^2$	.632	.655	.101	.549
Standard Error of Regression	2.10	1.93	1.91	2.18
Durbin-Watson Statistic	1.88	2.03	2.26	1.74
Rho	—	—	—	—
F	34.9	26.0	1.7	8.9

Table A5

DENMARK

	5.1	5.2	5.3
Item/Period		58-77	
ΣPCM1 (20 qtrs)	.644 (2.53)	.366 (.93)	.565 (2.07)
Mean Lag (qtrs)	10.2 (2.84)	7.0 (.81)	10.1 (2.35)
ΣPCRELPEN (6 qtrs)			.139 (3.36)
Mean Lag			1.8 (1.23)
VATCHNGE		2.136 (8.12)	2.097 (7.69)
S1	−3.447 (1.87)	−2.264 (1.81)	−2.135 (1.66)
S2	.399 (.24)	−.876 (.78)	−.830 (.69)
S3	−1.653 (.92)	−2.272 (1.93)	−1.997 (1.65)
C	1.742 (.61)	4.120 (1.01)	2.031 (.70)
N	80	79	79
Mean Rate of Inflation	6.72	6.72	6.72
$\bar{R}^2$	.093	.490	.531
Standard Error of Regression	5.26	3.88	3.72
Durbin-Watson Statistic	1.56	2.25	2.06
Rho	—	.50	.29
F		10.4	8.4

Table A6

FRANCE

	6.1	6.2
Item/Period	58-77	68-77
ΣPCM1 (16 qtrs)	.431 (2.08)	.689 (6.50)
Mean Lag (qtrs)	6.0 (1.76)	6.9 (4.98)
PCRELPEN		.060 (3.28)
PCRELPEN_{-1}		.038 (1.93)
PCRELPEN_{-2}		.051 (2.61)
PCRELPEN_{-3}		.026 (1.41)
SA1	−1.180 (.74)	
SA2	−3.893 (2.57)	
SA3	−3.046 (1.96)	
SB1	2.456 (1.37)	
SB2	1.755 (1.27)	
SB3	1.745 (1.18)	
C	1.571 (.68)	1.090 (1.14)
N	79	39
Mean Rate of Inflation	5.88	7.98
$\bar{R}^2$	.311	.709
Standard Error of Regression	3.32	1.71
Durbin-Watson *Statistic*	1.98	2.09
Rho	.26	—
F	4.5	12.9

Table A7

GERMANY

	7.1	7.2	7.3	7.4
Item/Period		64-77		68-77
ΣPCM1 (20 qtrs)	.961 (3.59)	1.055 (2.95)	.805 (2.91)	.716 (1.84)
Mean Lag	7.8 (2.66)	8.5 (2.43)	5.8 (1.55)	10.7 (2.16)
ΣPCRELPEN (6 qtrs)			.035 (2.33)	
Mean Lag			2.5 (.22)	
VATCHNGE		.775 (5.31)	.782 (4.93)	1.036 (3.51)
S1	5.478 (4.46)	3.661 (3.21)	3.677 (3.33)	3.596 (2.82)
S2	2.413 (2.46)	1.655 (1.96)	1.730 (2.03)	1.248 (1.29)
S3	−.737 (.94)	−1.279 (2.02)	−1.145 (1.76)	−1.986 (2.75)
C	−5.665 (2.43)	−5.849 (1.92)	−4.139 (1.74)	−1.946 (.55)
N	55	55	55	39
Mean Rate of Inflation	4.05	4.05	4.05	4.55
$\bar{R}^2$	.616	.739	.742	.751
Standard Error of Regression	1.87	1.54	1.53	1.46
Durbin-Watson Statistic	2.05	2.06	1.97	2.10
Rho	.25	.56	.36	.56
F	13.4	20.1	13.9	15.3

Table A8

ITALY

	8.1	8.2	8.3	8.4	8.5
Item/Period	58-77		58-67	68-77	
ΣPCM1 (20 qtrs)	1.547 (5.27)	1.290 (4.14)	.792 (2.67)	2.180 (5.18)	1.997 (5.96)
Mean Lag (qtrs)	11.4 (5.79)	11.1 (4.45)	7.6 (2.29)	12.9 (6.78)	12.5 (7.49)
WPCON		−6.430 (2.01)			−7.316 (2.36)
PCRELPEN		.076 (3.00)			.074 (2.48)
PCRELPEN_{-1}		−.021 (.84)			.035 (1.09)
PCRELPEN_{-2}		.065 (2.65)			.052 (1.72)
PCRELPEN_{-3}		.036 (1.45)			.057 (2.06)
C	−15.524 (3.53)	−11.718 (2.55)	−6.365 (1.68)	−26.043 (3.67)	−23.530 (4.30)
N	79	79	39	39	39
Mean Rate of Inflation	6.74	6.74	3.47	10.17	10.17
$\bar{R}^2$	.619	.695	.286	.604	.758
Standard Error of Regression	4.07	3.64	2.88	4.60	3.60
Durbin-Watson Statistic	2.16	2.14	1.84	1.99	1.85
Rho	.46	.49	.16	.12	−.03
F	32.7	20.7	4.8	15.5	14.2

Table A9

NETHERLANDS

	9.1	9.2	9.3	9.4
Item/Period	58-77		58-67	68-77
ΣPCM1 (20 qtrs)	1.124	1.148	1.112	.898
	(5.37)	(5.90)	(2.73)	(4.90)
Mean Lag (qtrs)	9.1	9.4	7.1	10.4
	(4.50)	(5.07)	(2.02)	(4.29)
WPCON		−1.245		−1.304
		(.83)		(1.35)
VATCHNGE		1.060		1.116
		(3.61)		(5.75)
PCRELPEN				.010
				(.52)
$PCRELPEN_{-1}$				−.013
				(.68)
$PCRELPEN_{-2}$				.033
				(1.76)
$PCRELPEN_{-3}$				.020
				(1.03)
SA1	2.965	3.091	3.587	
	(1.90)	(2.14)	(1.80)	
SA2	5.155	5.296	5.193	
	(3.31)	(3.67)	(2.61)	
SA3	−5.920	−5.804	−4.801	
	(3.83)	(4.05)	(2.42)	
SB1	1.715	.375		−.520
	(1.21)	(.27)		(.52)
SB2	2.089	2.330		2.456
	(1.47)	(1.75)		(2.69)
SB3	−2.788	−2.697		−3.675
	(1.97)	(2.06)		(3.87)
C	−4.739	−4.972	−5.632	−1.874
	(2.44)	(2.74)	(1.78)	(.78)
N	80	80	40	40
Mean Rate of Inflation	4.95	4.95	2.59	7.30
$\bar{R}^2$	.561	.626	.460	.731
Standard Error of Regression	3.64	3.36	4.42	1.91
Durbin-Watson Statistic	2.38	2.42	2.64	2.26
Rho	—	—	—	—
F	11.1	12.0	5.7	9.1

Table A10

NORWAY

	10.1	10.2	10.3
Item/Period	64-77		68-77
ΣPCM2 (20 qtrs)	.764	.816	1.091
	(3.46)	(5.01)	(5.00)
Mean Lag (qtrs)	13.5	13.2	10.5
	(2.48)	(3.44)	(3.94)
WPCON		−4.337	−3.189
		(1.88)	(1.62)
VATCHNGE		.994	1.222
		(6.08)	(7.75)
S1	5.940	5.428	5.439
	(3.32)	(4.04)	(4.34)
S2	.872	2.159	4.558
	(.45)	(1.49)	(3.03)
S3	1.207	2.106	3.727
	(.61)	(1.44)	(2.64)
C	−1.751	−2.838	−7.060
	(.71)	(1.55)	(2.66)
N	56	56	40
Mean Rate of Inflation	6.74	6.74	7.62
$\bar{R}^2$	.293	.616	.752
Standard Error of Regression	4.12	3.04	2.54
Durbin-Watson Statistic	1.98	1.99	1.88
Rho	—	—	—
F	4.3	10.8	14.1

Table A11

SWEDEN

	11.1	11.2
Item/Period	58-77	
ΣPCM1 (20 qtrs)	1.921	1.693
	(4.40)	(5.40)
Mean Lag (qtrs)	8.3	9.7
	(3.86)	(5.50)
WPCON		−6.522
		(3.06)
DECON		4.563
		(1.54)
OIL		9.950
		(4.20)
C	−11.016	−9.059
	(3.01)	(3.44)
N	79	79
Mean Rate of Inflation	5.01	5.01
$\bar{R}^2$	.390	.550
Standard Error of Regression	3.36	2.88
Durbin-Watson Statistic	2.09	2.08
Rho	.34	.21
F	13.5	14.6

Table A12

SWITZERLAND

	12.1	12.2	12.3	12.4
Item/Period	58-77		58-67	68-77
ΣPCM1 (20 qtrs)	.558	.598	.614	.596
	(3.93)	(4.67)	(2.30)	(5.46)
Mean Lag (qtrs)	13.2	10.6	13.0	10.8
	(5.45)	(5.11)	(2.79)	(6.04)
ΣPCRELPEN (6 qtrs)		.254	−.04	.133
		(3.90)	(.19)	(2.56)
Mean Lag (qtrs)		2.5	−24.9	1.9
		(5.40)	(.19)	(1.00)
S1	−2.557	−2.262	.120	−.894
	(2.74)	(2.57)	(.09)	(1.01)
S2	−1.974	−1.120	−.514	−2.411
	(2.14)	(1.40)	(.40)	(2.93)
S3	−1.900	−1.256	−.155	−2.076
	(1.97)	(1.42)	(.13)	(2.45)
C	1.263	.518	−1.335	1.772
	(1.05)	(.48)	(.56)	(1.87)
N	80	80	40	40
Mean Rate of Inflation	3.77	3.77	2.74	4.80
$\bar{R}^2$	.390	.516	.433	.823
Standard Error of Regression	2.76	2.46	2.09	1.65
Durbin-Watson Statistic	1.55	1.58	1.94	2.14
Rho	—	—	—	—
F	8.2	8.7	3.7	17.4

Table A13

UNITED STATES

	13.1	13.2	13.3	13.4	13.5	13.6
Item/Period			58-77		58-70	68-77
PCM1B (20 qtrs)	1.038 (6.96)	1.077 (7.78)	.798 (10.13)	.801 (10.65)	.765 (7.66)	
PCM1B (12 qtrs)						.690 (2.24)
Mean Lag (qtrs)	7.9 (3.38)	8.5 (3.99)	6.7 (3.40)	7.1 (3.93)	12.4 (2.99)	6.4 (3.04)
WPCON		−1.601 (1.87)	−1.344 (2.50)	−1.351 (2.55)		−1.432 (2.74)
PCRELPEN (6 qtrs)			.134 (5.98)		−.116 (1.01)	.116 (5.33)
Mean Lag			2.5 (2.83)		1.6 (.14)	2.5 (1.98)
$PCRELPEN_{-1}$				.036 (2.54)		
$PCRELPEN_{-2}$				.050 (3.10)		
$PCRELPEN_{-3}$				.005 (.29)		
$PCRELPEN_{-4}$				.039 (2.72)		
C	−.050 (.07)	−.041 (.06)	.616 (1.85)	.631 (1.96)	.796 (2.12)	1.534 (.90)
N	79	79	80	80	52	40
Mean Rate of Inflation	3.97	3.97	3.97	3.94	2.73	5.83
$\bar{R}^2$	.712	.720	.791	.797	.547	.732
Standard Error of Regression	1.35	1.33	1.15	1.13	1.13	1.04
Durbin-Watson Statistic	2.11	2.12	1.85	1.74	1.89	2.48
Rho	.46	.42	—	—	—	—
F	49.1	41.2	34.2	35.5	8.69	12.85

Table A14

YUGOSLAVIA

	14.1	14.2	14.3
Item/Period		58-77	
ΣPCC (20 qtrs)	1.956 (2.43)	1.580 (2.78)	1.451 (2.54)
Mean Lag (qtrs)	8.4 (2.55)	8.5 (3.02)	8.6 (2.81)
REFORM		66.031 (8.76)	66.396 (8.76)
OIL			5.392 (1.00)
S1	−4.948 (.98)	−2.847 (.81)	−2.614 (.74)
S2	−2.061 (.49)	−1.351 (.46)	−1.220 (.42)
S3	−9.605 (2.67)	−12.392 (4.93)	−12.046 (4.72)
C	−24.376 (1.44)	−17.355 (1.46)	−15.082 (1.27)
N	79	79	79
Mean Rate of Inflation	11.46	11.46	11.46
$\bar{R}^2$	.231	.628	.622
Standard Error of Regression	10.81	7.52	7.52
Durbin-Watson Statistic	2.01	2.06	2.05
Rho	.26	.27	.26
F	4.3	17.4	15.6