ECONSTOR
Make Your Publications Visible.

A Service of
ZBW
Leibniz-Informationszentrum Wirtschaft
Leibniz Information Centre for Economics

Langfeldt, Enno; Trapp, Peter

Working Paper — Digitized Version

The relationship between money, economic activity, and prices in Norway

Kiel Working Paper, No. 140

Provided in Cooperation with:
Kiel Institute for the World Economy – Leibniz Center for Research on Global Economic Challenges

Suggested Citation: Langfeldt, Enno; Trapp, Peter (1982) : The relationship between money, economic activity, and prices in Norway, Kiel Working Paper, No. 140, Kiel Institute of World Economics (IfW), Kiel

This Version is available at:
https://hdl.handle.net/10419/52657

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

WWW.ECONSTOR.EU

Mitglied der Leibniz-Gemeinschaft

Kieler Arbeitspapiere
Kiel Working Papers

Arbeitspapier No. 14o

The Relationship between Money, Economic Activity, and Prices in Norway

by Enno Langfeldt and Peter Trapp

Institut für Weltwirtschaft an der Universität Kiel

The Relationship between Money, Economic Activity, and Prices in Norway+

1. The acceleration of inflation in the seventies has led to a renaissance of the quantity theory of money. Central banks in many industrial countries have adopted quantitative targets for monetary aggregates (see OECD, 1979). This emphasis on the growth rate of the money stock reflects the growing perception that output and employment can only be maintained at a high level when inflation is brought under control and that this can only be achieved by reducing the expansion of the money supply (BIS, 1981, p. 3).

   Also in Norway, more attention has been paid to the growth rate of the money stock in recent years (Isachsen, Klovland, 1980). However, this did not go along with a fundamental reorientation of monetary policy. In general, the behaviour of monetary aggregates in Norway is still more or less the outcome of "a number of ad hoc decisions where interest is mainly focussed on solving sectoral problems" rather than the result of a policy which is deliberately based on macroeconomic considerations (Skånlund, 1980, p 272).

The Role of Monetary Policy in Norway

2. The reluctance against the use of money stock targets is deeply rooted in the inflation theory prevailing in Norway. According to the so-called "Scandinavian inflation model", price and wage trends in a small economy with a large ex-

---

+This paper has been initiated and supported by Den norske Creditbank. Thanks are due to the participants of a seminar at Den norske Creditbank for a number of helpful comments.

ternal sector are determined by price trends in the world market, existing exchange rates, and productivity trends in the sheltered and the exposed sector (Aukrust, 1977, p. 107-166). With inflation being more or less determined by external factors, the prime objective of domestic policies is to achieve full employment. Thus the role of monetary policy is to promote investment by providing funds at relatively low interest rates and to accommodate the demand for money resulting from nominal income changes in order to avoid unfavorable impacts on overall demand. Abstinence from money-stock targets seems also warranted given the policy of pegging the exchange rate vis-à-vis a basket of currencies[1]. Under such circumstances monetary control is often ineffective because of the inflow or outflow of short-term capital from or to abroad.

3. In accordance with this conception, monetary policy in Norway has focused on providing credit for investment purposes. This policy is institutionalized in the form of the credit budget which is a constituent element of the national budget (see Forsbak, 1979, pp. 137). The plan includes all domestic sources of the credit supply (commercial and savings bank lending, state bank lending, loan issues on the domestic bond market, and lending by other domestic financial institutions) plus borrowing from abroad (including capital inflow from abroad). Through the state banks the authorities grant a substantial amount of investment credits at relatively low interest rates for sectoral and regional purposes (see Eide, Holli, 1980, p. 30).

---

[1] The Norwegian Krone is pegged to a currency composite. (See IMF, 1981, p. 11).

All other sources of credit and foreign capital transactions are subject to comprehensive regulations. In spite of that, in general, substantial revisions of the credit budget have taken place in the course of the year because some items in the credit budget are only rough estimates, e.g. domestic share issues or borrowing abroad by the shipping and the oil sectors (Forsbak, 1979, p. 138).

4. Notwithstanding strict regulations, the domestic sources of the credit supply and - consequently - monetary aggregates have usually expanded much more strongly than seemed to be consistent with the intended policy stance (Graph 1). This has induced the central bank to use new instruments (introduction of short-term money market papers, a new system of borrowing facilities with the central bank, swap transactions in the exchange market) and to adopt a more flexible interest rate policy in order to deal with short-run fluctuations in bank liquidity (OECD, 1981, pp 32-42).

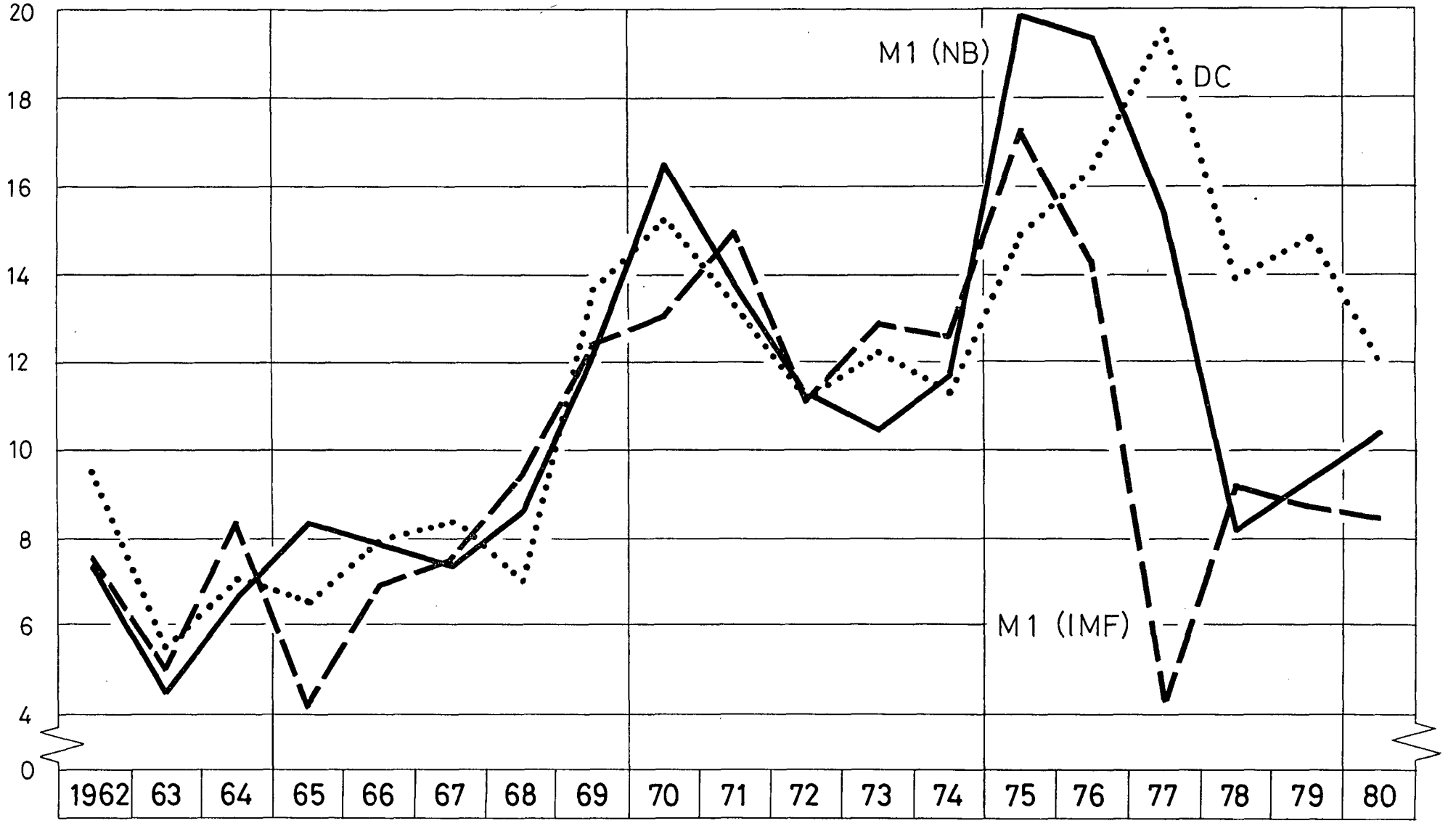
While this indicates that in recent years more attention has been paid to the growth rate of the money stock, there is still widespread resistance against employing monetary policy as a primary instrument against inflation[2]. It is mainly the psychological effect of monetary restraint which is considered to be helpful in reducing inflationary tendencies: "... control of the money supply is an essential and useful part of an economic policy aimed at containing inflation. A tightening of liquidity will gradually foster an economic basis and an economic climate conducive to greater realism and moderation in fiscal policy as well as

---

[2] "In this country greater emphasis is put on the objective of full employment than in most other countries. Therefore it would hardly be conceivable to limit the growth of money in order to slow down the rate of inflation if the immediate consequence had to be a substantial increase in unemployment." (Forsbak 1979, p. 142).

Graph 1

Money (M 1) and Domestic Credit in Norway[a]



[a] *Year-on-year rates of change.*

in the labour market and among consumers and enterprises. Control of the money supply is thus necessary, but not sufficient in itself" (Wold, 1981, p. 11). The key element of an anti-inflation policy is seen in measures which aim directly at moderating income and cost increases. Therefore wage and price controls have always been regarded as adequate and effective instruments for fighting inflation[3].

5. However, in view of the persistence of inflation some doubts have been expressed concerning the merits of the traditional policy mix in Norway (Dammann, 1973; Martin, 1980; Isachsen, Klovland, 1980). The criticisms have mainly to do with the combination of monetary and fiscal policy and the absolute priority given to the maintenance of full employment as well as to the emphasis on certain sectoral and regional developments.

These questions, however, touch a fundamental problem of economic policy. Since every policy instrument will - at least temporarily - affect several target variables, the authorities are inclined to use the instruments in such a way as to promote those targets which have priority. In general, this coordination of means and ends prevents each policy instrument from being directed primarily towards the one variable on which it has the relatively strongest effect (Sohmen, 1969). As long as there seems to be a trade-off between inflation and unemployment a less efficiant use of policy instruments can be justified by the preference given to the employment target. Thus, in accordance with the utility function underlying economic policy in Norway, a higher rate of inflation is simply accepted as the price for full employment.

[3] In view of the pronounced accelerations of inflation since the end of 1979 the authorities have introduced a new comprehensive wage and price stop in mid-1981. The freeze was terminated at the end of 1981.

6. However, according to the natural-rate hypothesis there is no permanent trade-off between unemployment and inflation (Friedmann,1968). On the contrary inflation has proven costly and unjust. In an inflationary environment there is always confusion as to whether a price increase is a change of absolute or relative prices (Lucas, 1975) and whether an increase in the rate of inflation is permanent or temporary (Brunner, Cukierman, Meltzer, 198o). This creates uncertainty which increases information costs and leads to a misallocation of resources. In addition, with inflation the cost of holding money rises and more resources will be invested in financial management services. Finally, inflation normally increases the fiscal drag (through progressive income tax rates on nominal income), and leads to disincentives to work, and channels more income into those uses which are taxfree or tax-favored.

   Thus, the stimulating effect of inflation goes along with a less efficient allocation of resources. And what is more important, as soon as inflation is anticipated in wage contracts and in interest rates the stimulating effect on demand will subside and output will decline again.

7. Since there is no permanent trade off between inflation and unemployment, policy instruments and economic targets should be paired in the most efficient way. A solution to the assignment problem which fits the quantity-theoretical approach is one (Fels et al., 1971), where
   - monetary policy is in charge of achieving price level stability,
   - wage policy is responsible for securing a high level of employment,
   - fiscal policy has the task of providing proper conditions for the working of market forces,
     and
   - external balance is secured by a flexible exchange rate.

   It remains true that under this division of responsibilities, the target variables remain mutually dependent and a change in monetary policy will not only affect the price level but

other target variables as well. But what is important is that the effect on other target variables is only transitory whereas the price level consequences of changes in the growth rate of the money supply will be permanent.

These effects on output and prices of changes in the growth rate of the money supply will be examined empirically in this paper.

Previous Studies of the Relationship Between Money and Income

8. One important element in the relationship between money, output and prices is the demand-for-money function. Studies on money demand in Norway in the postwar period have been published by Syring (1966), Teigen (1971), Isachsen (1975), and Isachsen, Klovland (1980). These investigations show that the demand for real money balances is a stable function of real income and of the yields on other financial assets. As to the proper definition of money and the appropriate set of explanatory variables, the authors came to different conclusions. Furthermore, in all studies it proved to be difficult to show a significant influence of changes of the rate of interest (or another proxy for the opportunity costs of holding money) on money balances. This, however,

is not surprising given the policy of keeping the interest rates on most assets by regulations relatively low and stable over most of the period covered by the investigations. All in all, Teigen's conclusion that, "while the demand elasticity with respect to income and the lag structure has been changing gradually over time, there is no evidence that the demand for money in Norway is unstable; that is, in spite of these changes, it appears to be possible to predict the response of the demand for money to an income disturbance both in direction and (at least approximately) in magnitude" (Teigen, 1971, p. 97) seems to hold for all studies mentioned. In addition Isachsen's investigation showed that the expected rate of inflation had a significant negative effect upon the demand for money (Isachsen, 1975, p. 45).

9. The existence of a demand-for-money function is mainly based on micro-economic considerations: income, price level and interest rates (or changes of these variables) are determined by the market and economic agents decide how much money they want to hold under these circumstances. However, when these micro-relationships are aggregated the direction of causation which is implied in the demand-for-money function is reversed. Now money is more or less exogenously fixed (depending on the exchange-rate regime, either by the national central bank or by external reserve movements) while income, the price level, and interest rates are the (endogenous) result of interdependent actions of economic agents (Kavanagh, Walters, 1966). For macroeconomic policy considerations it is therefore important to test how changes of the money supply have influenced the path followed by income.

This kind of relationship has been tested by Teigen applying the Almon distributed lag technique (Almon, 1965) to quarterly data from 1964II to 1970IV (Teigen, 1975, pp. 149-164). In this study a number of regressions of changes in gross national product on changes in the money stock and changes in government

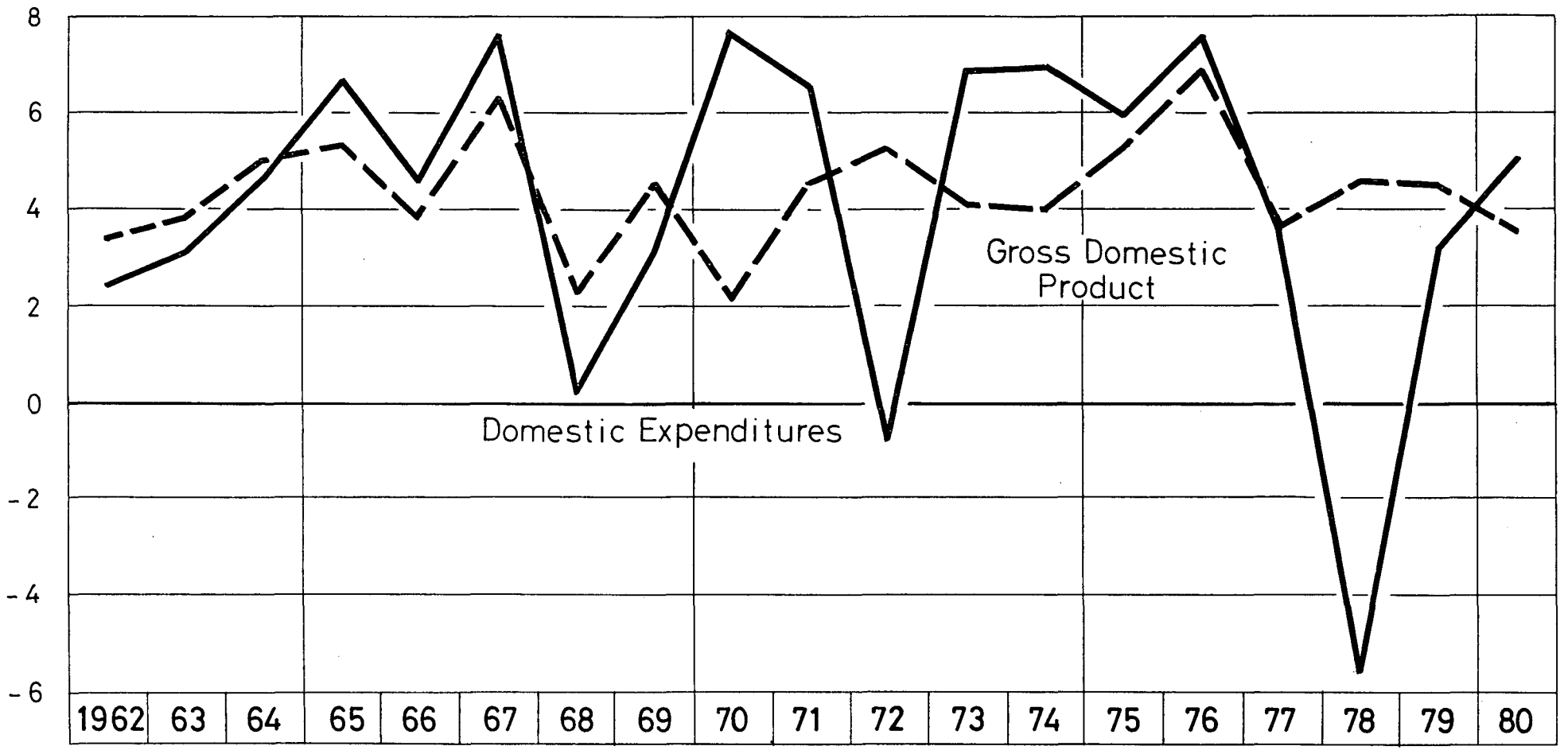
spending or surplus were made. As to changes in the money stock, the effects appeared to be quite weak in all cases, with relatively small beta coefficients and very low levels of significance (Teigen, 1975, p. 162). This result seems to be somewhat surprising given the close relationship between income and money which was a main feature of all demand-for-money studies. There may, however, be a simple reason for the different outcome of the test: In the demand-for-money function, income is a proxy for the transactions volume. Any mismatch between the demand for money for transaction purposes and actual money balances leads to interest rate changes. While the interest rate effect of changes in the growth rate of the money supply influences domestic economic activity in the medium run, it immediately affects the demand for money because it is equivalent to a change in the opportunity costs of holding money. In Teigen's study the hypothesis is tested that changes in the money supply have a dominating effect on economic activity represented by changes in gross domestic product. However, the gross domestic product in Norway is - particularly in the short run - strongly influenced by external developments (Graph 2) and is therefore not a good indicator for the effects of monetary policy. A further handicap of the study is that, due to the institutional setup in Norway there is a close relationship between monetary and fiscal policy. Thus, it is often difficult to distinguish between monetary and fiscal measures, so that the effects of each policy cannot be identified properly.

Some Further Test of the Relationship Between Money, Income and Prices

10. Although there is a broad consensus among economists that money matters, there is much uncertainty about the strength of the effect of changes in the money stock and how the effect is distributed on output and prices. In this paper, we want

Graph 2

Gross Domestic Product and Domestic Expenditures at 1975 prices[a]



[a] *Year-on-year rates of change.*

to investigate the strength of these effects as well as their distribution in time in Norway. In order to avoid the identification problem, and for the sake of simplicity, it is assumed that changes in economic activity and price increase are determined by changes in the money supply only:

(1) $\Delta Y = f(\Delta M)$

(2) $\Delta P = f(\Delta M)$

The purpose of this investigation is not to test any particular model describing the transmission of monetary impulses. The aim is rather to find out whether there are systematic relationships between changes in those variables. For the analysis it does not matter that monetary policy in Norway has not aimed at controlling the money supply in the past. Even if the growth path of the money stock was the "unintended" result of the interaction of fiscal policy, exchange rate policy, and interest rate policy, information about empirical regularities between changes in money, output, and prices may be helpful in formulating policy and in forecasting, e.g. in predicting tax receipts or in assessing the scope for wage increases.

11. There is no general answer to the question concerning which definition of money is crucial for monetary policy purposes. A priori, a narrow definition of money seems to be more appropriate, since in that case money is comprised only of non-interest-bearing assets (currency in circulation and demand deposits). A broader definition of money consists of interest-bearing deposits as well as of non-interest-bearing deposits. In the latter case, an increase in interest rates due to a restrictive monetary policy leads to a strong expansion of time deposits since households and firms try to economize their holding of (non-interest-bearing) demand depostits and eschew investment in bonds because capital losses are likely to occur as long as there is no clear indication that a decrease of interest rates is imminent.

Due to this effect the broader definitions of money may in the short run even show a perverse reaction to a change of the policy stance. However, the substitutability and the extent to

which time deposits may be considered as part of money holdings for transaction purposes may vary from country to country because of institutional differences. In empirical tests, some authors obtained better results with a broader definition of money than for M_1 or a similar aggregate (Friedman, Meiselman, 1963). Thus it appears advisable to use different definitions of money for the investigation of the relationship between changes in money, output and prices.

12. For Norway, the menu of definitions of money is particularly broad because of the existence of unused overdrafts. Whether or not such credit facilities should be considered as money depends on how sensitively this component reacts to changes in the stance of monetary policy; e.g. how close the elasticity of substitution between money and unused overdrafts is. In general, only actual holdings of money are relevant for economic analysis because this is the quantity of money demanded under a given set of values for the variables determining the demand for money. Any large-scale effort to increase the money balances by utilizing unused overdrafts would push up interest rates and thus affect one of the factors determining the overall demand for money.

However, when the demand for unused overdrafts is a relatively stable function of the variables which determine the demand for money there would be good reason to include this component in the money definition. Therefore we have experimented with M1 and M2 excluding as well as including unused overdrafts.

There are further differences depending on whether demand deposits are compiled to include public demand deposits (Norges Bank) or to exclude public demand deposits (IMF), or whether M2 includes foreign currency time deposits (IMF) or not (Norges Bank)[5].

---

[5] For a complete list of the definitions of money used, see the annex.

Bibliothek des Instituts
für Weltwirtschaft Kiel

13. A first approximation of the timing relationship between changes in money and in economic activity can be obtained by calculating coefficients of correlation for money and economic activity assuming different leads and lags in the effect of monetary policy. Since the rate of growth of overall output in Norway is strongly influenced by external demand, we have used real domestic expenditures (GNP plus imports minus exports) instead of gross national product as a measure of domestic activity. Alternatively we have adjusted real domestic expenditures for investment in the oil sector and in the ship building industry since such investment is much more influenced by world market conditions than by domestic developments. Control calculations showed in all tests that domestic expenditures performed better than changes in gross domestic product. The time series of money and of domestic expenditures display a strong trend. In order to avoid the coefficients of correlation being dominated by the trend, first differences of the logarithms of the variable were used in the calculations.

The coefficients of correlation between percentage changes of different monetary aggregates and percentage changes in real domestic expenditures are shown in Graph 3. The graph contains only the coefficients of correlation calculated with IMF data. Correlations with the money data compiled by Norges Bank yielded similar results. Since revised and updated quarterly national income account data were available only for the period from 1968 to 1978, the most recent years are not included in the calculations. Due to systematic changes in the national account data, it was not possible to enlarge the sample by linking this series to previously published data.[6]

---

[6] In a preliminary version of this paper previously published data were used and yielded similar results.

14. Graph 3 shows that M1 and M1U are positively correlated with real domestic expenditures when a lead in the change of the money stock (which is equivalent to a lag in the effect of changes in the money stock) is assumed. When monetary changes are lagging behind income changes (as the reverse causation argument implies) the coefficients of correlation become negative. This phenomenon can only be observed for the broad definition of money: for a lag in the change of the money stock M2 or M2U there is a positive correlation with domestic expenditures. The results for domestic credit are more or less in the middle of these extremes. The longest lead (= lag in effect) exists for M1U (4 quarters); for M1 the lead is between 1 and 3 quarters.

All in all, the timing relationship between monetary and real variables is similar to that observed in other industrial countries, namely that a change in the growth rate of the narrow money supply is f o l l o w e d by a change in domestic activity.

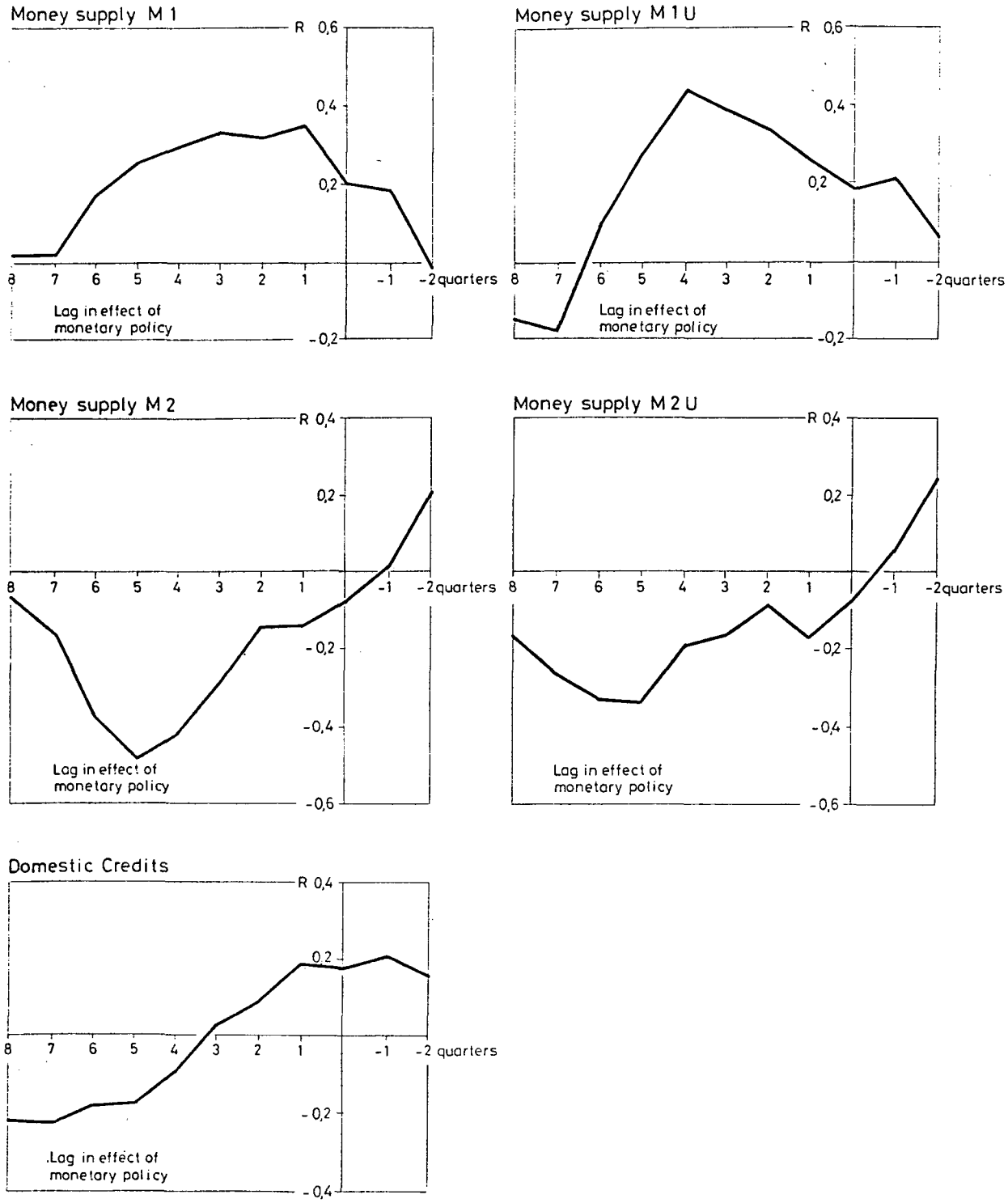
15. To investigate the adjustment process more properly we assume that changes in prices and domestic expenditures - real as well as nominal - are a function of current and lagged changes of the money supply. A distributed lag in the effect of monetary policy can be explained by the uncertainty as to whether changes in the growth rate of the money supply are permanent or only transitory (Brunner, Cukierman, Meltzer 1980) and by the existence of information and adjustment costs. The investigated function is of the following type:

$$(3) \qquad Z_t = \sum_{j=o}^{n} \mu_{-j}^{(Z,M)} \cdot \Delta M_{t-j} + V_t ,$$

Where Z_t alternatively represents real domestic expenditures (Δa), nominal domestic expenditures (ΔA) and the deflator

Graph 3

Correlation between changes in monetary aggregates and changes in real total domestic expenditures 1968/III - 1978/II [a]



[a] *Percentage changes over preceding period calculated from quarterly data smoothed by a 3-quarters' moving average.*

of domestic expenditures (ΔP). Because the endogenous variables are connected ($\Delta A=\Delta a+\Delta P$) the length of the adjustment process has been constrained to be the same for all three variables. To estimate the adjustment coefficients we used the Almon lag procedure (see Almon, 1965) without constraining the endpoints. As to the degree of the polynominal used for the determination of the coefficients $\mu_{-j}^{(Z,M)}$ ($j=0...,n$) and the length of the adjustment process, different combinations were tried. In order to avoid multicollinearity, the seasonally adjusted data were transformed to first differences. Since quarter to quarter changes show a great deal of variation, the series was smoothed by a 3-quarter-moving average. The best results, using quarterly data from 1970 to 1978, are reported in Table 1.

16. As in the case of the cross correllogrammes, economically plausible results were only obtained for M1. When broader monetary aggregates such as M2 (M1 including time deposits) or domestic credits were used, strongly negative coefficients for the monetary variable were obtained for lags up to 7 quarters regardless of whether economic activity or prices were the dependent variable. For M1, the best results - measured by their statistical significance - were obtained when a third-degree polynomial and an adjustment period of 3 years were assumed.

According to the results in Table 1, the coefficients of money for real domestic expenditures are positive up to a lag of 8 quarters and then turn negative. As to prices a change in the money supply M1 has an almost immediate impact. However, for a lag of 2 to 5 quarters the coefficients are close to zero and only for a lag of six quarters and more can further significant positive impacts of money on prices be observed. Thus an increase in the growth rate of the money supply seems to have a short-run effect on the rate of inflation;

TABLE 1: Monetary coefficients with respect to inflation and domestic expenditures, using quarterly data from 1968 to 1978[1]

Lag	Δreal domestic expenditures	Δdeflator of domestic expenditures	Δnominal domestic expenditures
j=0	0.183 (0.193)	0.179 (0.095)+	0.369 (0.214)+
j=1	0.131 (0.079)	0.069 (0.039)+	0.204 (0.087)+
j=2	0.113 (0.084)	0.011 (0.041)	0.127 (0.093)
j=3	0.117 (0.097)	0.005 (0.048)	0.113 (0.108)
j=4	0.132 (0.088)	0.007 (0.043)	0.141 (0.097)
j=5	0.145 (0.073)+	0.037 (0.036)	0.184 (0.081)+
j=6	0.144 (0.079)+	0.073 (0.039)+	0.221 (0.088)++
j=7	0.119 (0.099)	0.105 (0.048)+	0.226 (0.109)+
j=8	0.055 (0.105)	0.120 (0.051)+	0.177 (0.116)
j=9	-0.057 (0.083)	0.107 (0.041)++	0.049 (0.092)
j=10	-0.23 (0.078)++	0.055 (0.038)	-0.187 (0.086)+
j=11	-0.47 (0.212)+	-0.046 (0.105)	-0.537 (0.225)+
$\sum_{j=0}^{11} \mu_j$	0.374 (0.090)	0.716 (0.044)	1.098 (0.099)
R^2	0.314	0.060	0.346
$\bar{R}^2$	0.253	-0.022	0.288
F3,34	5.18	0.72	5.99
DW	1.98	0.93	1.58

+significant at a 5 p.c. level

++significant at a 1 p.c. level

[1] Standard errors are in parentheses behind the coefficients.

both monetary expansion and the price increase stimulate real domestic demand; but when demand pressures intensify, inflation picks up again and has a dampening effect on economic activity.

Apparently the immediate price effect is interpreted by firms as an increase in the relative price of their products and leads to improved sales expectations, higher output, and more employment. But in the course of the process when it becomes evident that input prices rise as well and that price level increases are more and more anticipated in wages and interest rates the effect of inflation on output becomes increasingly negative.

After the total adjustment has taken place nominal domestic expenditures are increased by about the same rate as the money supply M1; the sum of the coefficients for nominal domestic expanditures is not significantly different from 1. All in all, the results confirm the view that an increase in the growth rate of the money supply M1 mainly affets the price level; contrary to theoretical expectations there still remains a small positive effect on economic activity. However, these results should be interpreted cautiously, since the overall explanatory power of the price equation is rather low. Furthermore it is not certain that the adjustment process is completed after 12 quarters.

17. The explanatory content of the equations estimated with quarterly data is relatively low and the equation proved to be quite sensitive to changes of the test period. But the quality of the results is not as bad as it may appear considering that first differences of quarterly data have been used which show a great deal of variability due to non-systematic short-run influences on monetary and real data (e.g. weather, changes in taxation, calendar effects).

Nevertheless, these equations do not provide much help for short-term forecasting.

One reason for the unsatisfactory results may be a relatively high degree of variability of the lag in the effect of monetary policy. This factor could be partly eliminated by using annual data. The general form of the test equation is as follows:

$$(4) \quad \Delta \ln a = c + \sum_{i=0}^{n} \alpha \Delta \ln M_{t-i} + \sum_{i=0}^{n} \beta \Delta \ln P_{t-i},$$

where a is real domestic expenditures, M is the money supply, and P is the deflator of domestic expenditures. Δln indicates that the annual data were transformed to logarithms and that the tests were run with first differences. Since the estimation of distributed lag functions has shown that the adjustment of income and prices to changes in money takes place over a period of approximately 3 years, lags up to t-2 were tested. The most interesting results of these regressions are shown in Table 2.

18. The best results - measured in terms of the standard error - were obtained with a lag of two years in length[7]. Surprisingly, for real domestic expenditures as the dependent variable M2 yields a better fit than M1 regardless whether the data compiled by Norges Bank or those of the IMF are used. In these equations the coefficient of the current change of the money supply is positive and rather high, probably reflecting the fact that M2 reacts comparatively slowly to changes in the stance of monetary policy with the result that M2 and real domestic expenditures move more or less simultaneously. The standard error is in all cases quite high and most coefficients are not significant at the 5 p.c. level. The low reliability of the coefficients is underlined by the fact that the estimate of the intercept which theoretically should be about as high as the average rate of growth of domestic expenditures is - particularly in equations with M2 - implausibly high.

[7] The best equation could be regarded as a dynamic version of the simple quantity-theoretical approach. In this case one would expect coefficients of the same size (and opposite signs) for M and P for each lag. This result can be achieved by rearranging and extending the equation in the following way (equation 5):

$$\Delta \ln a = 0.051 - 0.5\, \Delta \ln \frac{M_t}{P_t} + 0.8\, \Delta \ln \frac{M_{t-1}}{P_{t-1}} - 0.5\, \Delta \ln \frac{M_{t-2}}{P_{t-2}} + 1.5\, \Delta \ln \frac{P_{t-1}}{P_{t-2}}$$

Thus changes in real domestic expenditures are determined by changes of real monetary balances and by a price expectation term.

Table 2: Results of OLSQ-Estimations between Money, Economic Activity and Prices in Norway (annual data 1963-1980)[1]

No.	observation period	dependent variable	independent variables	constant	estimated coefficients M_t	M_{t-1}	M_{t-2}	P_t	P_{t-1}	P_{t-2}	D 1	SEE	$\bar{R}^2$	F	DW
	Real Economic Activity														
1	65 - 80	a	M1IMF, P_a	0.058*	-0.500°	0.785**	-0.547*	0.410	0.774°	-1.089		0.0277	0.4099	2.74	1.91
2	65 - 80	a	M2IMF, P_a	0.092*	0.627	-1.613**	0.372	0.424°	0.029	-0.126		0.0272	0.4327	2.91	2.39
3	65 - 80	a	M1 NB, P_a	0.061	0.247	-0.100	-0.683°	0.059	0.470	0.034		0.0332	0.1537	1.45	2.75
4	65 - 80	a	M2 NB, P_a	0.097*	0.907°	-1.89**	0.071	0.372	0.250	0.027		0.0265	0.4593	3.12	2.18
5	65 - 79	a_c	M1 MF, P_a, D1	0.051**	-0.309	0.485*	-0.518*	0.663*	-0.015	-0.274	0.054**	0.0189	0.5553	3.49	2.11
	Prices														
6	63 - 80	P_a	M1IMF	-0.014	0.181	0.269°	0.389**					0.0203	0.555	8.08	1.66
7	63 - 80	P_a	DC	-0.001	0.500**	0.378°	-0.290					0.0221	0.476	6.15	1.10
8	63 - 80	P_a	M1 NB	-0.007	0.572**	0.036	0.073					0.0204	0.553	8.03	1.67

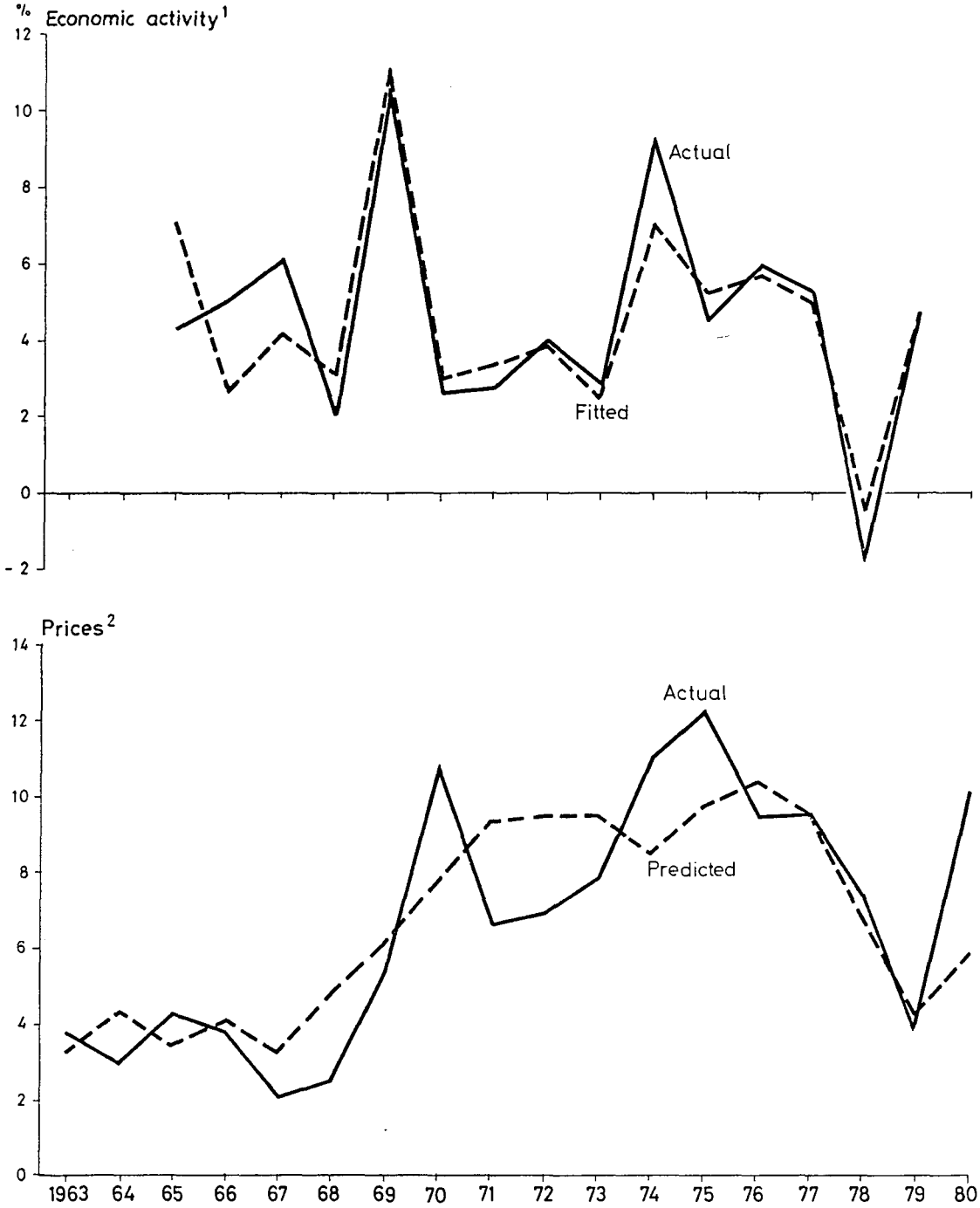
[1] For a list of variables see Appendix. All variables are expressed as first differences of their logarithmic values. The coefficients market with° (*, **) are significant on a 10 (5,1) % level.

The low explanatory content of the equations may partly result from large fluctuations of investment in ships and in the oil sector which are caused by changes in world market condition and not by changes of the growth rate of the domestic money supply.
We have therefore adjusted real domestic expenditures for these investments. In addition, a relatively high deviation between theoretical and actual values was observed for 1969/70. This seems to be due to the pronounced increase in the VAT rates effective as of January 1st 1970. The tax increase has presumably induced advanced purchases.
When a dummy is introduced for this event and when real domestic expenditures are adjusted for investment in ships and in the oil sector, the result turns out to be somewhat better. The upper part of Graph 4 shows the actual and the theoretical rates of change calculated with equation 5 in Table 2. While the equation missed the actual values in the first two years noticeably, the swings in the growth rate of real domestic expenditures corrected for oil and ship investment are reasonably well tracked. In particular the turning points are pinned down quite acurately.

19. As to prices, the results display an adjustment pattern similar to that which was obtained with quarterly data. The equations with M_1 (both Norges Bank and IMF definition) have the lowest standard error and the best fit. The constant term has a negative sign in all test equations, indicating that without an expansion of the money supply there would have been a decline of the overall price level because the demand for real money balances rise in line with the growth of real income. In the lower part of Graph 4 the actual and the theoretical (calculated with equation 6 in Table 2) rates

Graph 4

Actual and predicted changes in economic activity and prices in Norway 1963 - 1980



[1] *Real domestic expenditures minus investment in the oil and shipping sector, calculated with equation 5.*
[2] *Deflator of domestic expeditures, calculated with equation 6.*

of change of the domestic expenditures deflator are presented. All in all, the equation captures the general movement of the rate of inflation quite well.

20. While these calculations indicate that there is a systematic relationship between changes in money and those in output and prices, we were not able to find a relationship which is stable enough so that it could be used for forecasting purposes. This failure may be due to the simplicity of the approach and it might be more fruitful to analyse monetary impulses in a broader context, e.g. by taking into consideration external and fiscal influences as well.

A more fundamental handicap to any econometric inquiry on Norwegian data is the relatively high degree of government intervention in nearly all markets. Government action tends to blur economic relationships in the short run because it adds significantly to nonsystematic variations of the data. Furthermore, widespread regulations are likely to increase activity in shadow markets, the unrecorded part of the economy.

Although the calculations did not yield a precise picture of the adjustment process, the distributed lag function illustrate quite well how an acceleration of monetary expansion leads to an increase in real domestic expenditures and in prices. Furthermore, the tests show that the attempt to promote employment by means of an easy monetary policy has inflationary consequences which eventually tend to reduce the growth of output and employment. In view of these results it seems appropriate to put more emphasis on the control of the money supply. First steps in this direction have been made by introducing new monetary instruments and by adopting a more flexible interest rate policy.

Appendix

List of variables and sources:

M1NB = Notes and coins plus sight deposits

M1UNB = M1NB plus unutilized overdrafts and building loans

M2NB = M1NB plus time deposits

M2UNB = M2NB plus unutilized overdrafts and building loans

Source: Norges Bank, Publikums Likviditet

M1IMF = Money (currency outside banks plus private sector demand deposits)

M2IMF = Quasi-Money (M1 plus time, savings, and foreign currency deposits)

DC = Domestic credits

Source: International Monetary Fund, International Financial Statistics

a = Domestic expenditures at 1975 prices

A = Domestic expenditures at current prices

a_c = Domestic expenditures minus investment in the oil and shipping sector at 1975 prices

A_c = Domestic expenditures minus investment in the oil and shipping sector at current prices

P_a = Deflator of domestic expenditures

Source: Central Bureau of Statistics, Monthly Bulletin of Statistics

D1 = Dummy variable for advanced purchases due to the increase in VAT effective from 1970 - D1 takes the value 1 in 1969 and -1 in 1970 and 0 in the other years

Quarterly data have been seasonally adjusted with the program "X-11 Variant of the Census Method II - Seasonal Adjustment Program" version used by the Deutsche Bundesbank.

All computations were done with the program TSP, version October 1979, in the computing center of the University of Kiel.

References:

Almon, Shirley, The Distributed Lag between Capital Appropriations and Ependitures. Econometrica, New Haven, Conn., Vol. 33 (1965), pp. 178-196.

Aukrust, Odd, Inflation in the Open Economy: A Norwegian Model. Worldwide Inflation ed. by Lawrence B. Krause and Walter S. Salant, Washington D.C. 1977, pp. 107-166. IMF, International Financial Statistics, Washington DC. 1981.

BIS, Annual Report 1980/81, Basle 1981.

Brunner, Karl, Alex Cukierman and Alan H. Meltzer, Stagflation, Persistent Unemployment and the Permanence of Economic Shocks. Journal of Monetary Economics, Vol. 6 (198o), pp. 467-492.

Dammann, Axel, Monetary Policy in Norway. Monetary Policy in Twelve Industrial Countries, ed. by Karel Holbig, Boston 1973, pp. 329-374.

Eide, Leif and Knut Holli, The Norwegian Monetary and Credit System. Norges Banks Skriftserie No. 9, Oslo 1980.

Fels, Gerhard, Herbert Giersch, Hubertus Müller-Groeling, Klaus-Dieter Schmidt, Neue Rollenverteilung in der Konjunkturpolitik. Die Weltwirtschaft Tübingen 1971, Heft 1, pp. 5-8.

Forsbak, Einar, Experiences and Attitudes vis-à-vis Monetary Targets in Norway. New Approaches in Monetary Policy ed. by John E. Wadsworth and Francois L. De Juvigny. Alphen aan den Rijn 1979, pp. 137-142.

Friedman, Milton and David Meiselman, The Relative Stability of Monetary Velocity and the Investment Multiplier in the United States, 1897-1958. Commission on Money and Credit, Stabilization Policies, Englewood Cliffs, 1963, pp. 165-268.

Friedman, Milton, The Role of Monetary Policy. The American Economic Review, Vol. LVXIII, March 1968, pp. 1-17.

IMF, International Financial Statistics, Dec. 1981, Washington, D.C.

Isachsen, Arne J., Four Essays on Capital Markets, Inflation and Labor in Norway, Ann Arber 1977.

Isachsen, Arne J. and Jan T. Klovland, Pengemengde og inflasjon. Sosialøkonomen, Vol. 34, 2, Oslo 1980, pp. 13-23.

Kavanagh, N.J. and A.A. Walters, The Demand for Money in the U.K., 1877-1961: Some Preliminary Findings. Money and Banking ed. by A.A. Walters, Bungay 1973, pp. 170-200.

Lucas, Robert E., An Equilibrium Model of the Business Cycle, Journal of Political Economy, Vol. 83 (1975) pp. 1113-1144.

Martin, Sarah, Will Norway face up to being rich? Euromoney Nov. 1980, pp. 42-52.

OECD, Monetary Targets and Inflation Control. Monetary Studies Series, Paris 1979.

OECD, Economic Surveys, Norway July 1981, Paris.

Skånland, Hermod, The Role of the Central Bank. Norges Bank. Economic Bulletin, 1980/4, pp. 264-273.

Sohmen, Egon, The Assignment Problem, Monetary Problems of the International Economy, Chicago and London 1969, pp. 183-197.

Syring, Edward M., The Demand for Money in Norway, Oslo 1966.

Teigen, Ronald L., The Demand for Money in Norway 1959-1969, Statsøkonomisk Tidsskrift, Oslo 1971, pp. 65-99.

--- Monetary and Fiscal Influences on Economic Activity: Evidence from Denmark, Finland, and Norway. The Swedish Journal of Economics. Stockholm Vol. 77 (1975), pp. 149-164.

Wold, Knut G., The Economic Situation, Address at the meeting of the supervisory Council of Norges Bank. Norges Bank, Economic Bulletin 1981/1, Oslo 1981, pp. 3-17.