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by

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Institut für Weltwirtschaft an der Universität Kiel

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I. Introduction

There have always been fluctuations of production, employment, and prices in economic history. A lot of strenuous work and intellectual efforts have been put into the study of these fluctuations. Huge amounts of time series data have been collected and indicators have been compiled to determine cyclical regularities and to provide information on the cycle (see for example Burns and Mitchell, 1946). And many attempts have been made to explain the forces behind the ups and downs of economic activity (see Zarnowitz, 1985). Whereas originally business cycle research was mainly directed at understanding the fluctuations, research objectives became more practical after the shock of the Great Depression. The experience of the strong and protracted economic downturn enhanced the call for a more active role of the government in supporting economic growth and in maintaining a high level of employment. Keynes' "General Theory" (1936) delivered the theoretical basis for this policy.

In the postwar period, an era of "new dimensions of political economy" (Heller, 1966) seemed to have begun. The new responsibilities of the government were written down in laws like the Employment Act of 1946 in the United States[2] and the Law to Promote Stability and Growth in Germany (1967). Economic research experienced a marked upswing, as the demand for economic forecasts and economic advice increased greatly. Economists were eager to supply those services and, when computer facilities improved, a forecasting industry developed quickly. The profession gained in size and reputation as long as economic policy was quite successful in

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[1] This paper has been presented at the Eighth International Symposium on Forecasting, Amsterdam, June 12-15, 1988.

[2] The law stipulates that "it is the continuing responsibility of the Federal Government to use all practicable means ... to promote maximum employment, production, and purchasing power".

achieving its goals. However, in the seventies, when economic policy began to fail to attain its objectives the disappointment was great and much of the blame for this was put on economists. In view of low growth rates and high unemployment, economics became known again as the "dismal science". The confidence of politicians and of the general public in the accuracy and reliability of macroeconomic forecasts was further reduced by the failure of most forecasters to predict the length and the depth of the recession in the early eighties.

In this paper the performance of macroeconomic forecasts in Germany is analyzed. After discussing the different uses of forecasts, we will have a brief look at the main forecasting institutions in Germany, at the history of economic forecasts, and the forecasting methods used. The main part of this paper consists of an analysis of the forecasts of the most important forecasting institutions. Finally some conclusions will be drawn concerning the practice of macroeconomic forecasting in Germany.

II. The Different Uses of Forecasts

The science of forecasting is based on an understanding of the causal factors that produce fluctuations in economic activity and employment and changes of the price level. Thus, forecasting is applied economic theory. The theoretical model used and the values assumed for the exogenous variables of the model should be clearly spelt out. Given these inputs the forecast should be reproducible in principle. Therefore, the forecast error, i.e. the difference between the predicted and actual value of the variable in question, depends both on whether the underlying model is "true" and on whether the exogenous variables are set correctly. Concerning the model or theory there is no agreement

among economists on the "true" model. Instead, a number of competing hypotheses are used to explain and to predict business fluctuations. This requires a choice for the consumers of economic forecasts, who simply want some information on the most probable course of economic activity in the future. While economic forecasts are used by politicians, businessmen, and investors to make rational decisions for the future, economists use them to discriminate between true and false hypotheses. Milton Friedman (1953, pp. 8, 9) has stressed the methodological importance of forecasts in assessing different theories:

> "..., theory is to be judged by its predictive power for the class of phenomena which it is intended to "explain". Only factual evidence can show whether it is "right" or "wrong" or, better, tentatively "accepted" as valid or "rejected" ... the only relevant test of the validity of a hypothesis is comparison of its predictions with experience."

A good theory is a reliable predictor. The size or the complexity of forecasting models says nothing about the reliability of the results. If several models provide the same accuracy of predictions the one that can supply a certain result with a smaller input of resources should be preferred. Friedman (1953, p. 41) indicates that whether a theory is complex, big or realistic enough "can be settled only by seeing whether it yields predictions that are better than predictions from alternative theories." It is a matter of economic research to use predictions as an instrument to determine a model's ability to explain economic events. Forecasts in this area do not directly aim at supplying information about the future but can be viewed as a kind of investment in macroeconomic knowledge. Macroeconomic forecasts are expected to provide some information on future economic developments. Users of forecasts are primarily interested in the accuracy of the forecasts and not in the structure of the underlying model, its theoretical consis-

tency, and its ability to explain past events. Competition in the forecasting market focuses on forecasting results and not on the way in which they are produced. This allows forecasters with very different approaches to compete in the market. Most forecasts are based on economic models of very different complexity and theoretical orientation (conditional model approach). Some forecasters are using vector autoregressive modeling techniques (VAR) which require no theoretical foundation. VAR-generated forecasts represent a strong challenge to the conditional model approach (McNees, 1986). Other forecasts are derived from polls. Consumers of economic forecasts who are mainly interested in reliable information on the most likely course of economic events in the near future are often frustrated and confused by the wide variety of predictions and the apparent discrepancies among them. However, as in all competitive markets the process of competition will lead to the discovery of models with a superior forecasting performance.

The quality of forecasts is mostly judged by comparing the relative size of the forecasting errors irrespective of whether the approach provides an explanation of economic events or whether the assumptions underlying the forecast were correct. This does not mean that economic theory is irrelevant for macroeconomic forecasts. On the contrary, it is an important input in the production function of any systematic forecast but it is not the final product. In the following we will only deal with macroeconomic forecasts and when analyzing the German experience with macroeconomic forecasts we will do this by measuring the accuracy of the forecasts given by different institutions.

III. The Main Forecasting Institutions in Germany

Important suppliers of macroeconomic forecasts are the economic research institutes. The five biggest institutes are the DIW at Berlin, the HWWA-Institute at Hamburg, the Ifo-Institute at Munich, the Institute of World Economics at Kiel, and the RWI-Institute at Essen. All institutes belong either directly to the public sector, like the institutes at Kiel, Berlin, and Hamburg, or are quasi-public sector institutions mainly financed by the federal and state governments. Each institute normally publishes its own forecast at least twice a year. In addition, in spring and autumn of each year, the institutes prepare a joint economic forecast, the so-called "Gemeinschaftsdiagnose".

Other institutes that produce macroeconomic forecasts are the WSI-Institute at Düsseldorf which is funded by the trade unions, and the IW-Institute at Cologne which is supported by the German business community. Since 1964, the German Council of Economic Experts takes part in the forecasting business and publishes its annual report in November. These domestic forecasts are supplemented by those of international organizations like the OECD and the IMF. Furthermore, all major banks and business associations participate in the forecasting debate and contribute their own business outlook. There are also private forecasting companies like DRI or Chase Econometrics but they play only a minor role in macroeconomic forecasting in Germany. In this respect, the German forecasting market is significantly different from the US market. The main reason probably is that the macroeconomic forecasts offered by the economic research institutes and the Council of Economic Experts are more or less free goods so that private production of these services on a larger scale is not profitable. The dominance of public sector institutions in macroeconomic forecasting is often seen as an advantage because these institutions do not depend on business interests. However, experience has shown

that there is the danger that these institutions are exposed to political pressures or that the forecasts are interpreted politically. In the early eighties, for example, the government heavily criticized the economic research institutes for forecasting a recession on the grounds that this would contribute to the downturn (self-fulfilling prophecy). And in early 1987, before the general election when some institutes forecast a continuation of the upswing, they were blamed for supporting the government coalition by giving "unduly optimistic" forecasts.

IV. Development of Macroeconomic Forecasting in Germany

In the immediate postwar period economic reports and business outlooks were only prepared by the economic research institutes. They mainly dealt with recent economic developments and gave a forecast for the next six months in very vague terms. In 1950 four institutes presented a joint study on "Viability and Full Employment". The purpose of the study was to convey an idea of the magnitude of the task of reconstructing the German economy within a reasonable period of time, presumably the middle of the 1950s. The report is of interest because it documents that the institutes greatly underestimated the strength of the economic revival in Germany.

Since 1950 the institutes have published joint economic forecasts which are prepared for and financed by the Ministry of Economics[1]. Up to 1962, the report contained only an

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[1] The joint economic forecast is prepared by the DIW (Berlin), the HWWA-Institute (Hamburg), the Ifo-Institute (Munich), the Institute of World Economics (Kiel) and the RWI-Institute (Essen). Until spring 1970 the Institute of Agricultural Market Research (Braunschweig-Völkenrode) participated in the forecast.

estimate of the GNP-growth in the next half year and a qualitative forecast of other key variables. In mid-1962, when the establishment of a Council of Economic Experts was decided upon the institutes reacted to increased competition by publishing a detailed forecasting table in their report. Furthermore, the institutes lengthened the forecasting horizon by giving a forecast for the entire next year in the year-end report. Recently, the forecasting horizon for the outlook prepared in spring each year has been lengthened till the end of the following year. In its first report (in November 1964) the Council of Economic Exports published a forecast for the next half year only, but in the following reports a forecast was presented for the next calendar year as a whole. In 1967, the Law to Promote Stability and Growth passed Parliament; it stipulates that the government submits at the beginning of each year its Annual Economic Report including a projection for the next 12 months. All these institutions prepare forecasts only for entire calendar years or for half years; up to now there is no regular forecast on a quarterly basis[1].

The recessions of 1974/75 and of the early eighties as well as the drastic increase in unemployment have intensified the debate on the appropriate economic policy and have increased the demand for and the attention paid to macroeconomic forecasts. Since then, more and more institutions, like banks, the chambers of industry and commerce, associations of industry etc., began to publish economic reports, surveys, and business outlooks and used the opportunity to present their views on economic policy issues.

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[1] Some private suppliers of forecasts, e.g. DRI, produce quarterly predictions.

V. Forecasting Methods in Germany

The different German forecasting institutions rely on different theoretical foundations and forecasting techniques. Most institutions tend to prefer informal approaches. At first, this might seem inferior to the more formal approach of most Anglo-Saxon forecasters. However, the use of a large econometric model is not equivalent to more clarity about the theoretical basis. In fact, in many cases model equations are determined on an ad-hoc basis and do not follow from theory. In addition, models are treated with tender loving care to improve the fit. As a result there are a lot of add-factors and dummies which make it impossible to distill the theoretical content of the model. According to a survey on econometric forecasting models in the United States the judgemental component amounts to approximately 30 percent (McNees, Ries, 1983). The German economic research institutes have an econometric model too, and there is even a joint econometric model which has been developed for the Gemeinschaftsdiagnose. However, these models are rarely used to produce forecasts, they are mainly applied for simulations of various policy alternatives and to check the consistency of the forecast.

As to the theoretical basis there are considerable differences. The DIW has a pronounced Keynesian orientation. The Ifo-Institute combines Keynesian analysis with surveys on business sentiments and on investment plans, while Essen, Hamburg, and Kiel have a neoclassical orientation in common.

Concerning short term economic forecasts, Kiel is known for its straightforward monetarist approach (Trapp, 1976; Langfeldt, 1983). According to the Kiel model changes in real domestic expenditures (real GNP minus exports plus imports) depend on current and lagged changes of narrow money (M1) and of the price index of domestic expenditures. For annual

data the income velocity of narrow money has proven to be stable enough to use this approach for forecasting purposes.

Exports are estimated by means of an export equation (Flemig, 1984). The exogenous variables in the export function are industrial production abroad, the real effective exchange rate, domestic industrial production and a trend variable. The elasticity of exports with respect to industrial production abroad is approximately 1, for the real effective exchange rate the elasticity is -.5 and for domestic industrial production -.33.

It should be noted that the forecasts of the Kiel Institute do not consist of a straightforward application of the two equations. The forecasts given by the models are used as an input and are supplemented by further (informal) considerations including the influence of fiscal policy and of wage policy. In the next chapter we will look at how accurate the Kiel forecasts have been on average and compare the forecast errors with those of other forecasting institutions.

VI. The Track Record of Macroeconomic Forecasts in Germany

Macroeconomic forecasts are mainly used for budgeting purposes and for production and investment plans. Whether such plans or projections can be executed as expected depends partially on the accuracy of the forecast. Therefore, forecast errors are quite important for the users of forecasts. Especially, when the economic reality turns out to be less favorable than was predicted and widely expected, forecasters are often harshly criticised (Krumper, 1988). However, individual forecast errors do not allow a well based judgement on the quality of forecasts.

In the following, the accuracy of forecasts over a sufficiently long period of time is measured by the average dif-

ference between the predicted and the actual value or rate of change of the variable in question. Table 1 shows the accuracy of forecasts made by several German forecasting institutions concerning the most important variables in the National Income Accounts (NIA)[1]. The analysis includes the projections of the Kiel Institute of World Economics (Institut für Weltwirtschaft, IfW), of the joint forecast of the five leading economic research institutes (Gemeinschaftsdiagnose, GD), of the Council of Economic Experts (Sachverständigenrat, SVR) and of the federal government (Jahreswirtschaftsbericht, JWB).[2] The comparison is based on yearly forecasts done at the end of the previous year or, as in the case of the government, in January of the current year. In fact, several of these institutions publish more than one forecast for the next year in the course of time. In the public debate, however, most attention is paid to the forecasts for the next year which are released at the end of the year.

Annual forecast errors were calculated as differences between forecast and actual rates of growth. If the forecasting institution published only a range, the mean value of this range was taken. The Kiel Institute has published quantitative forecasts for the main aggregates of the national accounts on a regular basis only since 1976. Therefore, the period of investigation includes the years 1976 to 1987[3].

For the compilation of forecast errors three different concepts have been used. The average forecast error (AE) is

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[1] A table with all forecasts and the corresponding NIA-data is given in the appendix.

[2] Until 1986 the government projected growth rates of the different components on the expenditure side only in nominal terms. They were therefore excluded from the analysis. Thus, for the JWB there are no forecasting errors for the GNP components in volume terms.

[3] For a similar investigation including 1976-1985 compare Langfeldt, Trapp (1986).

Table 1 - The Accuracy of Macroeconomic Forecasts in the Federal Republic of Germany 1976-1987 - Average Annual Deviation between Predicted and Actual Rates of Growth in Percentage Points -

	First estimate			Revised estimated			Latest estimate (March 1988)		
	AE	AAE	RMSE	AE	AAE	RMSE	AE	AAE	RMSE
Private Consumption[1]									
GD	0.26	1.18	1.42	0.28	1.22	1.44	-0.13	1.05	1.23
SVR	0.43	1.14	1.43	0.45	1.20	1.46	0.03	0.90	1.17
IfW	0.34	1.01	1.14	0.37	1.05	1.17	-0.05	0.75	0.91
Public Consumption[1]									
GD	-0.28	0.93	1.07	-0.26	0.94	1.13	-0.29	0.91	1.17
SVR	-0.15	0.80	0.91	-0.13	0.80	0.96	-0.17	0.78	0.98
IfW	-0.07	0.80	0.92	-0.05	0.82	0.97	-0.08	0.87	1.03
Investment in Machinery and Equipment[1]									
GD	0.28	3.55	3.69	0.18	3.83	3.92	0.21	3.63	3.83
SVR	1.99	3.54	3.95	1.88	3.73	4.09	1.92	3.58	4.24
IfW	-0.38	3.28	3.59	-0.49	3.34	3.84	-0.46	3.08	3.57
Construction Investment[1]									
GD	0.71	1.78	2.51	0.55	1.72	2.33	1.04	1.88	2.29
SVR	1.88	2.31	3.17	1.72	2.25	3.00	2.21	2.53	3.06
IfW	0.58	1.75	2.25	0.43	1.68	2.05	0.92	1.70	2.03
Exports[1]									
GD	0.08	3.31	4.13	0.09	3.24	4.10	0.28	3.22	4.13
SVR	-0.09	3.09	3.83	-0.08	2.91	3.72	0.12	2.80	3.67
IfW	-0.43	3.59	4.52	-0.41	3.66	4.54	-0.22	3.58	4.47
Imports[1]									
GD	-0.34	2.44	2.82	-0.33	2.33	2.87	0.41	1.98	2.77
SVR	0.16	2.26	2.48	0.18	2.13	2.46	0.91	2.13	2.60
IfW	-0.38	2.40	2.83	-0.37	2.38	2.90	0.37	1.93	2.53
Gross National Product[1]									
GD	0.28	1.07	1.35	0.28	1.07	1.35	0.21	1.06	1.38
SVR	0.41	0.75	0.96	0.41	0.77	0.96	0.33	0.84	0.97
IfW	-0.05	0.83	1.11	-0.05	0.83	1.12	-0.13	0.84	1.17
JWB	0.35	0.85	1.19	0.35	0.86	1.19	0.27	0.99	1.23
Deflator of Gross National Product									
GD	0.08	0.30	0.34	0.06	0.29	0.33	0.09	0.31	0.36
SVR	-0.19	0.52	0.62	-0.22	0.53	0.63	-0.18	0.49	0.64
IfW	-0.06	0.36	0.41	-0.08	0.34	0.39	-0.05	0.41	0.47
JWB	-0.19	0.52	0.61	-0.22	0.51	0.60	-0.18	0.55	0.61
Deflator of Private Consumption[2]									
GD	0.17	0.96	1.17	0.18	0.95	1.16	0.19	0.97	1.23
SVR	0.04	0.86	1.09	0.05	0.85	1.08	0.06	0.96	1.17
IfW	0.04	0.84	1.13	0.05	0.83	1.11	0.06	0.84	1.18
JWB	0.04	0.75	0.95	0.05	0.74	0.94	0.06	0.80	1.01
Entrepreneurial and Property Income[2]									
GD	0.49	2.87	3.80	0.55	2.69	3.57	1.00	3.16	3.99
SVR	0.26	3.16	3.65	0.32	2.88	3.41	0.77	3.03	3.82
IfW	-0.19	2.10	3.31	-0.14	2.16	3.16	0.32	2.57	3.41
JWB	0.13	2.67	3.41	0.18	2.42	3.12	0.64	2.89	3.71
Gross Income of Wages and Salaries[2]									
GD	0.35	0.73	0.99	0.30	0.76	1.00	0.06	0.84	1.09
SVR	0.53	0.82	0.98	0.48	0.88	1.02	0.24	0.80	0.93
IfW	0.03	1.03	1.27	-0.02	1.07	1.30	-0.26	1.08	1.32
JWB	0.19	0.75	0.89	0.14	0.80	0.96	-0.11	0.86	1.06

AE: average error. - AAE: average absolute error. - RMSE: root mean square error.
[1]In 1980 prices. - [2]1977-1987.

Source: Arbeitsgemeinschaft deutscher wirtschaftswissenschaftlicher Forschungsinstitute, Die Lage der Weltwirtschaft und der deutschen Wirtschaft. - Jahresgutachten des Sachverständigenrates zur Begutachtung der gesamtwirtschaftlichen Entwicklung. - Institut für Weltwirtschaft, Die Weltwirtschaft. - Jahreswirtschaftsbericht der Bundesregierung. - Own calculations.

used to investigate whether the forecasts show a systematic bias. It provides information on the cumulative forecast error, in the calculation of which positive and negative errors cancel out. However, if one is interested in the short-term forecasting ability the AE is not a useful criterion. For this purpose the average absolute error (AAE), which represents an unweighted average of the absolute forecast errors, is more appropriate. In practice, users of forecasts often want to protect themselves against large individual errors. Therefore the root mean square error (RMSE) which puts greater weight on large errors is also calculated.

The NIA-data are revised several times by the Statistical Office. Sometimes the forecasting error depends crucially on which official estimate is taken as a reference. Therefore, prediction errors are calculated with respect to the first estimate of the Statistical Office (published in January of the following year), to the first revised estimate (published in March of the following year), and to the final data.

A comparison of the forecast errors in table 1 shows that the statistical reference system is important for the size of the forecast error. The relative forecasting record of the different forecasting institutions, however, is hardly changed. In the following analysis we will concentrate on forecast errors calculated by using the official NIA-estimates after the first revision. In March of the following year there seems to be a reasonably reliable data basis of the preceding year. The latest available estimates might include an even broader data basis, however, they also reflect changes resulting from the choice of a new base year. Moreover, since they are published with a considerable lag, they are not a very important yardstick for measuring the forecast error from the user's point of view.

In the public debate the forecasts of the growth rate of real GNP attract the highest attention. With respect to this aggregate the average absolute forecast error is in the order of .8 percentage points. Only the joint forecast of the research institutes shows an error which is slightly higher than 1 percentage point. However, it should be taken into account that the joint forecast is already published in October whereas the individual forecasts are made at the end of the year. Additionally, there were often minority votes in years with large forecast errors (1977, 1980 and 1982) which proved to be much closer to the actual outcome but were not used to calculate the forecast error. In general, users of forecasts should not only look at the consensus forecast. If forecasts are deviating strongly this is a clear indication that forecast risks are high.

Contrary to widespread prejudices, professional GNP forecasts have proved to be quite reliable on average. As compared to naive forecasting techniques they perform quite well. If for example previous year's growth rate had been taken to forecast this year's rate, the average absolute error would have been 2 percentage points, i.e. 2.5 times higher than the forecast error of the Kiel Institute. In the case where the forecast had been strictly oriented at the medium term growth rate the error would have amounted to 1.3 percentage points. Also with respect to time series methods the expert forecasts are superior (see Pflaumer, Swart 1987).

Because the assessment of the future development of economic activity might influence the decisions of the electorate, professional forecasters are often accused of being overly optimistic to enhance the chances of reelection of the government which is financing most of the research activities of the forecast institutions. On the other hand, forecasters are sometimes blamed by politicians of being overly pessimistic. However, there is no evidence for such behavior; the

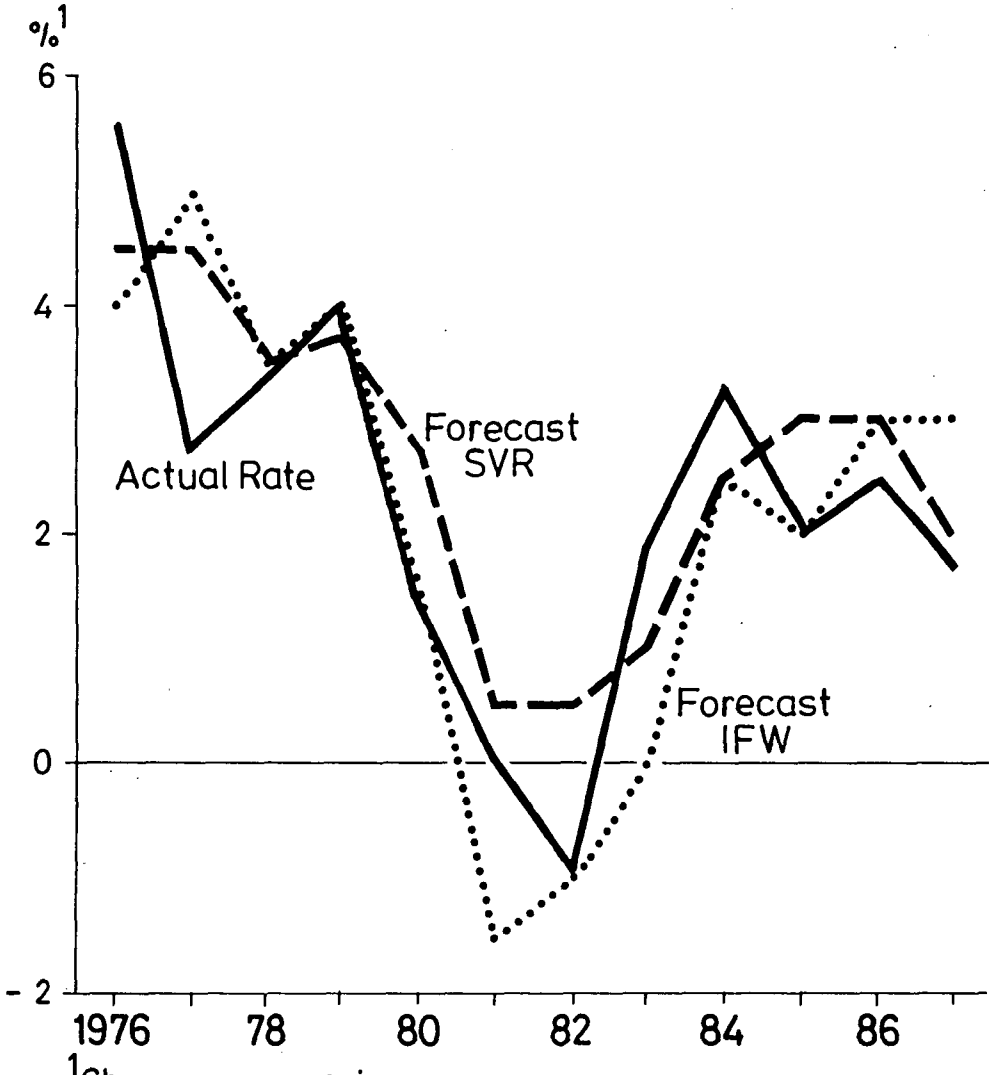
average forecast errors with respect to real GNP hardly show any systematic bias (table 1). The average prediction error is -.05 percentage points for the forecasts of the Kiel Institute and it shows only a slight overprediction in the case of the other forecasters. Even the government, which is probably more inclined to give a rosy forecast, overestimated the annual increase in real GNP by only 0.3 percentage points on average.

The average absolute forecast error gives an impression on the overall reliability of a forecast. However, it is also interesting to investigate whether there are any systematic errors with respect to cyclical fluctuations. Graph 1 shows the actual and projected growth rates of real GNP year by year. It is evident, that the forecasts of the Council of Economic Experts (SVR) are to a certain degree oriented at the growth rate of potential output, they tend to understate the cyclical pattern of the economy. Whereas during the period 1976 to 1987 the actual increase in real GNP stayed between 5.6 p.c. and -1.1 p.c. (standard deviation 1.74) the forecasts by the council only ranged from 4.5 p.c. to 0.5 p.c. (standard deviation 1.34). On the other hand, the forecasts of the Kiel Institute showed a strong cyclical pattern, although staying between 5 p.c. and -1.5 p.c. (standard deviation 1.97) they slightly overstated it.

With respect to the forecast of special components of GNP the Kiel Institute's forecast errors were comparatively small for private consumption, investment and entrepreneurial income. The Council of Economic Experts presented the most reliable projections for foreign trade and public consumption. In the government's forecast deviations between forcast and actual increases in consumer prices were relatively small. The joint forecast of the institutes was superior with respect to forecasts of income from wages and salaries and the GNP-deflator.

Graph 1:

Actual and Predicted Growth Rates of Real GNP in the Federal Republic of Germany 1976 - 87



[1]Change over previous year.

A comparison of the forecasts errors of the different components shows significant differences. While the average absolute error with respect to the GNP-deflator is less than 0.5 percentage points, it is about 4 percentage points for investment in machinery and equipment. However, it should be kept in mind that aggregates like investment or foreign trade exhibit stronger fluctuations during the cycle than private consumption. To evaluate the relative forecasting accuracy concerning different components it is necessary to relate forecast errors to the standard deviation of the aggregates. The results of such a standardization are shown in table 2 for the forecast errors of the Kiel Institute. The standardized forecast errors range between 33 p.c. and 99 p.c. of a standard deviation. With respect to this criterion, the best forecasts were made for the price level while export predictions show the highest error. This is a valuable information as to where future work to improve the overall forecast should be concentrated.

VII. Evaluation of Forecast Errors

By comparing the forecast errors of different forecasting approaches over a sufficiently long period of time it is possible to determine which forecast is on average the more reliable one. While the comparison provides some hints on the relative quality of different forecasts it does not allow any conclusion on whether the forecast with the smallest error is based on a methodologically sound and efficient forecasting approach. Therefore, Neumann and Buscher (1980, 1981) and Kirchgässner (1983) have used the theory of rational expectations and tested whether the forecast of some selected German forecasting institutions are unbiased and efficient. However, in this analysis it is not taken into account that the forecast error may not only originate from systematic mistakes of the forecasting model

Table 2 - The Reliability of the Kiel Institute's Forecasts for Different Aggregates of the National Accounts, 1976-1987

Aggregate	Standard deviation - actual results[1]	Forecast error in percentage points[2]	Forecast error in p.c. of standard deviation
Gross national product	1.82	0.83	45.6
Private consumption	1.99	1.05	52.8
Government consumption	1.14	0.82	71.9
Investment in producer durables and equipment	5.06	3.34	66.0
Construction investment	3.99	1.68	42.1
Exports	3.68	3.66	99.5
Imports	3.32	2.38	71.7
GNP-deflator	1.03	0.34	33.0
Deflator of private consumption	1.94	0.83	42.8
Entrepreneurial and property income	4.31	2.16	50.1
Gross income of wages and salaries	2.11	1.07	50.7

[1]Based on revised data. - [2]Average absolute error based on revised data.

Source: Own calculations.

but also from wrong assumptions on monetary and fiscal policy, on the development of the world economy and on the exchange rate, from distortions of the NIA-data, and from other external factors. In order to improve the forecasts it is necessary to analyze in detail how these factors have contributed to the forecast error in the past. Since quantitative assumptions are only available for the Kiel Institute's forecast we will only refer to this forecast in the following.

The NIA-statistics provide the necessary data for macroeconomic forecasts. However, as table 3 shows the data are subject to considerable revisions. These changes affect the forecasts in two ways: firstly, they change the data-base which was used to prepare the forecast and secondly, they lead to a smaller or larger difference between the original forecast and the outcome. The revisions are made to take account of information which become available only with a time-lag or to use the prices of a more recent base year. With respect to real GNP the revisions amount on average to about half a percentage point. With respect to single aggregates the revisions are sometimes considerably larger. This is especially true for changes in stocks. Since the estimates of real GNP are not published separately for the output and the expenditure side, differences show up at first in the stock variable. When more reliable information becomes available, stockbuilding is revised downwards while the different components of final demand are revised upwards; a behavior of the Statistical Office which is anticipated by forecasters to a certain degree. This might explain why for some aggregates forecast errors with respect to the latest estimates of the Statistical Bureau are lower than with respect to the first or second (compare table 1). Problems concerning data revisions will most likely persist in the future. However, they could be less pronounced if the forecasters had more precise information about the methods the Statistical Office uses for its calculations.

Table 3 - Revision of National Income Accounts Data

	Date of publication					
	January 1985	March 1986	September 1986	March 1987	September 1987	March 1988
GNP						
83	1.3	1.5	1.5	1.8	1.9	
84	2.6	2.7	3.0	3.0	3.3	3.3
85	.	2.5	2.4	2.5	2.0	2.0
Domestic expenditures						
83	2.0	1.9	2.0	2.3	2.3	
84	1.9	1.8	2.0	1.9	2.0	2.0
85	.	1.5	1.4	1.5	1.0	0.9
Private consumption						
83	1.1	1.1	1.2	1.7	1.7	
84	0.8	0.6	0.8	1.5	1.5	1.5
85	.	1.7	1.7	1.8	1.8	1.7
Fixed investment						
83	3.1	3.2	3.2	3.2	3.2	
84	1.3	0.8	0.8	0.8	0.8	0.8
85	.	-0.8	-0.3	-0.3	0.1	0.1
Exports						
83	-1.3	-0.2	-0.2	-0.6	-0.5	
84	7.4	8.0	8.2	8.5	9.0	9.0
85	.	7.2	7.2	7.3	7.2	6.7
Imports						
83	0.5	0.8	1.1	0.8	0.6	
84	5.5	5.5	5.2	5.5	5.3	5.3
85	.	4.6	4.7	4.7	4.7	3.7

In macroeconomic forecasts it is assumed that weather conditions will be normal. However, in recent years the economy was strongly influenced by unfavorable or especially favorable winter weather. Table 4 shows the likely impact of abnormal weather conditions on the annual growth rate of total output. The calculations incorporate only effects of bad weather on production in the construction sector since there are no statistics for other sectors. While this tends to underestimate the effects, it should not be forgotten that output losses in the construction sector due to bad weather during winter can be partly compensated in the rest of the year. To what extent this is possible mainly depends on the extent of unused capacities.

Table 4 - The Influences of Abnormal Weather Conditions on Total Output

	Weather effect on total output[1]	Forecast error real GNP[2]
1976	-0.3	-1.6
1977	+0.1	+2.3
1978	-0.1	+0.2
1979	-0.3	0
1980	+0.2	0
1981	-0.2	-1.5
1982	+0.4	0
1983	+0.1	-1.9
1984	+0.1	-0.8
1985	-0.3	0
1986	+0.2	+0.5
1987	-0.2	+1.3

[1]Based on statistics of a loss of working days in construction (13% share of total output) due to bad weather, change over previous year in percentage points. - [2]Predicted minus actual growth rate.

For these reasons the calculated effects of changes in weather conditions on total output presented in table 4 should be interpreted rather cautiously. They suggest that during the period of investigation the maximum effect of unusual weather conditions did not exceed 0.4 percentage points of real GNP. A comparison with the Kiel Institute's forecast errors for real GNP growth shows that unusual weather conditions can not explain serious prediction errors.

Finally, macroeconomic forecasts are based on assumptions concerning the future development of several important exogenous variables, such as domestic monetary and fiscal policy, wages and salaries, world output, exchange rates and oil prices. The short outline of the methodology of the Kiel Institute's forecast suggests that predictions of the exogenous variables are crucial for the accuracy of the forecast. It seems therefore worthwhile to analyze the accuracy of the underlying assumptions in more detail. Since several assumptions were formulated only in a qualitative way, we have to concentrate on those variables were quantitative assumptions are available. This is the case for the money supply M1, the budget deficit, the exchange rate vis-à-vis the US-Dollar and real GNP of industrial countries.

In general, average forecast errors for the exogenous variables are not very large (table 5). As compared to the standard deviation of the actual results, they amount to 66 p.c. for the money supply M1, 76 p.c. for the budget deficit, 62 p.c. for the exchange rate and 55 p.c. for world output. However, there seem to be some systematic prediction errors. With respect to the exchange rate forecast we used to stick too much to the actual exchange rates; thus there was a systematic overprediction (underprediction) when the DM was appreciating (depreciating). With respect to budget deficits there seems to be a tendency toward overestimation while world output is slightly underestimated.

Table 5 - The Prediction Accuracy of Major Exogenous Variables

	Actual outcome				Prediction errors[2]			
	money supply M1[1]	budget deficit (bill. DM)	exchange rate (DM/$)	real GNP industrial countries[1]	money supply M1[3]	budget deficit (bill. DM)	exchange rate (DM/$)[4]	real GNP industrial countries[3]
1976	10.4	.	2.52	.	+1.6	.	+3.2	.
1977	8.3	.	2.32	3.8	+0.6	.	+3.4	+0.7
1978	13.3	36.0	2.01	3.9	-5.0	-4.8	+14.4	+0.1
1979	7.5	42.3	1.83	3.5	-0.1	-2.3	+3.8	0
1980	2.4	51.4	1.82	1.0	+0.6	-9.4	-5.5	-1.0
1981	1.2	62.4	2.26	1.0	+4.8	+7.6	-26.1	-2.0
1982	3.5	55.3	2.43	-0.3	+2.5	+14.7	-11.5	+0.3
1983	10.4	45.4	2.56	2.6	-4.4	+20.6	-8.6	-2.1
1984	3.2	33.8	2.85	5.0	+3.0	+6.2	-12.3	-2.0
1985	4.3	19.8	2.94	2.9	+1.7	+14.2	-4.1	-0.4
1986	8.6	23.5	2.17	2.7	-3.6	-3.5	+21.7	0
1987	9.0	34.2	1.80	3.1	-1.0	-14.2	+11.1	-0.1
Average	6.8	40.4	2.29	2.7	0.1	2.9	-0.9	-0.6
Average absolute error	-	-	-	-	2.4	9.8	10.5	0.8
Standard deviation	3.65	12.91	0.37	1.46	-	-	-	-

[1]Change over previous year in p.c. - [2]Predicted minus actual value, - indicates underprediction, + indicates overprediction. - [3]In percentage points. - [4]In p.c. of actual value.

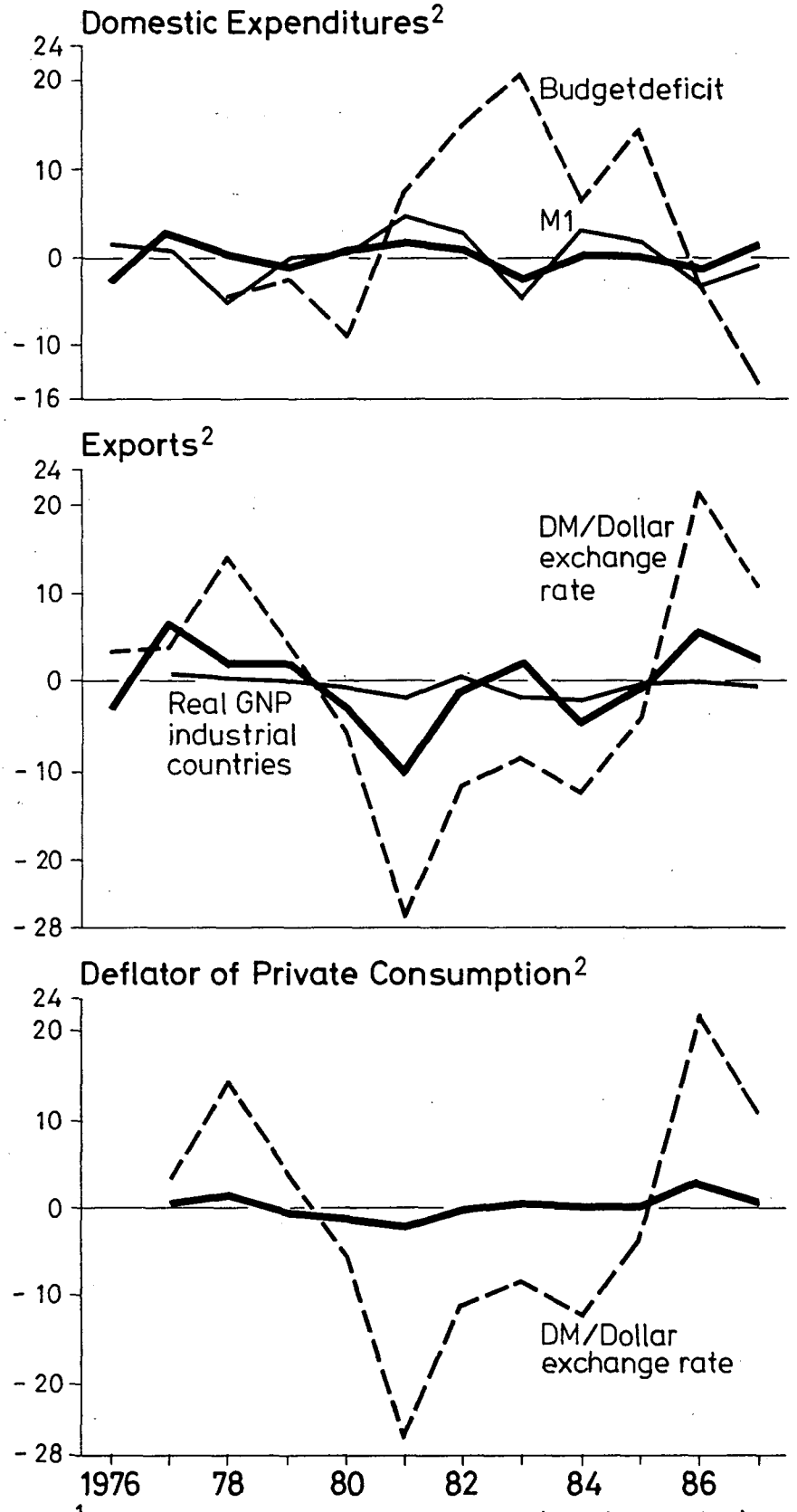
Graph 2 shows how prediction errors for the exogenous variables are related to forecast errors for major variables of the national accounts, i.e. domestic expenditures, exports and inflation. With respect to domestic expenditures the prediction errors can to a considerable degree be explained by wrong assumptions concerning the development of the money supply M1. An overestimation of money growth mostly coincides with an overestimation of domestic demand and vice versa. On the other hand, prediction errors with respect to budget deficits seem to be negatively correlated to forecast errors of domestic demand. This is not surprising because budget deficits incorporate not only the impulse of fiscal policy; they also reflect economic activity. If economic activity is underestimated, tax revenues are also likely to be underestimated and thus budget deficits will turn out to be lower than expected.

Forecast errors for exports can be traced back to wrong assumptions concerning exchange rates and the cyclical development in other industrial countries. Graph 2 clearly indicates that the export predictions were too high when the appreciation of the DM was underestimated like in 1978 and 1986/1987. In 1981 and 1984, the underestimation of real GNP growth in the industrial countries seems to have contributed to the underestimation of exports. The openness of the German economy also shows up with respect to the forecasts of inflation. Because of its strong impact on the development of import prices, an underestimation of the DM/Dollar exchange rate also leads to an underestimation of the inflation rate and vice versa.

This evidence suggests that for an improvement of forecasts it is necessary to pay more attention to the choice of the underlying assumptions. This analysis of forecast errors for the exogenous variables is only the first step. Further steps should be the estimation of reliable policy reaction functions.

Graph 2:

Unexpected Changes of Exogenous Variables and Forecast Errors 1976 - 87[1]



[1]Deviations of assumed or forecast values from actual value in percentage points except budget deficits (Mill. DM) and DM/Dollar exchange rate (p.c.). - [2]Solid line.

VIII. Conclusions

Politicians, businessmen, and financial investors have to plan for the future and try to get some help by using economic forecasts. But the future is as uncertain for the economic forecaster as it is for anybody else. First, he never knows exactly what the "true" model of the economy is. Even if his approach did quite well in the past he can never be certain that it will do so in the future. There may be structural changes or innovations due to technical progress or changes in regulations. As a consequence, the model may become worthless or some adjustments of the relationships or of the data used may be necessary. Second, for any forecast he has to make assumptions about the prospective course of monetary and fiscal policy and about some other exogenous variables. Thus, the forecast is a conditional one and the prediction should only become true if the policy assumptions are correct. If the forecast is correct but the assumptions were wrong the forecaster was just lucky and his model is probably defective. If actual events deviate significantly from the forecast this may be either due to wrong assumptions or to shortcomings of the model. Third, when the forecast is made, there is always some uncertainty about the state of the economy at the time of the forecast. Most data are only published with a lag and are only preliminary. Sometimes the forecaster may prepare an outlook without knowing that the economy has already passed a turning point. Even if he envisages a turning point in the near future the forecast error may be quite large because the change in the direction of economic activity has already occurred. Finally, with respect to past data we are often not on firm ground. Regular revisions of national income accounts data due to new information change the cyclical pattern noticeably and can lead to significant adjustments of the model coefficients.

Given these uncertainties, macroeconomic forecasts should not be considered as something that is based on superior knowledge which is accessible to economists. Economists rather describe one (or some) possible outcome(s) out of a large number of other possible developments. And any forecast user is well advised to check out how the forecast changes if other policy assumptions are used.

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Data Appendix - Forecasts and Results[1]

GD = Forecast of the Gemeinschaftsdiagnose (joint forecast of the five leading German research institutes)

SVR = Forecast of the Sachverständigenrat (council of economic experts)

IfW = Forecast of the Institut für Weltwirtschaft (Kiel Institute of World Economics)

JWB = Forecast published in the Jahreswirtschaftsbericht der Bundesregierung (official government projection)

SB1 = First estimate of the Statistical Office (published in January of the following year)

SB2 = Revised estimate of the Statistical Office (published in March of the following year)

SB2 = Latest estimate of the Statistical Office (March 1988)

Sources: Compare table 1.

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[1] Year-on-year percentage changes.

Private consumption (in constant prices)

	GD	SVR	IFW	JWB	SB1	SB2	SB3
1975	3.00	3.00	N.A.	N.A.	2.20	2.20	3.20
1976	2.00	3.00	3.00	N.A.	3.40	3.40	3.70
1977	4.00	5.00	4.50	N.A.	2.90	2.90	4.30
1978	2.50	3.00	3.50	N.A.	3.80	3.80	3.80
1979	3.50	3.50	3.50	N.A.	2.80	2.80	3.60
1980	2.00	2.00	2.00	N.A.	1.70	1.50	1.20
1981	1.50	2.00	0.50	N.A.	-1.10	-1.10	-0.50
1982	0.50	-0.50	-0.50	N.A.	-2.20	-2.30	-1.30
1983	-0.50	-1.00	-0.50	N.A.	1.00	1.00	1.20
1984	1.00	1.50	1.50	N.A.	0.80	0.60	1.50
1985	1.50	2.50	1.00	N.A.	1.70	1.70	1.70
1986	3.00	3.00	3.00	3.50	4.10	4.20	4.30
1987	4.00	3.00	4.50	3.50	3.00	3.10	3.10
1988	3.00	2.50	3.00	3.00	N.A.	N.A.	N.A.

Government consumption (in constant prices)

	GD	SVR	IFW	JWB	SB1	SB2	SB3
1975	2.50	2.00	N.A.	N.A.	2.80	3.30	3.70
1976	1.50	1.50	2.00	N.A.	2.60	2.90	1.50
1977	2.50	2.50	2.50	N.A.	1.00	0.70	1.40
1978	2.50	3.00	3.00	N.A.	3.10	3.30	3.80
1979	2.50	2.50	2.50	N.A.	3.10	2.80	3.40
1980	2.50	2.00	2.50	N.A.	2.80	2.40	2.60
1981	2.00	2.00	2.00	N.A.	1.90	2.10	1.80
1982	1.00	1.00	1.00	N.A.	0.10	-0.10	-0.80
1983	0.50	0.50	0.50	N.A.	-0.40	-0.20	0.30
1984	0.00	0.50	0.50	N.A.	1.90	2.00	2.40
1985	0.50	1.00	1.00	N.A.	2.20	2.10	2.10
1986	1.50	2.00	1.50	2.00	2.50	2.50	2.40
1987	2.00	2.00	2.50	2.50	1.50	1.60	1.60
1988	1.50	1.50	1.50	1.50	N.A.	N.A.	N.A.

Investment in producer durables and equipment (in constant prices)

	GD	SVR	IFW	JWB	SB1	SB2	SB3
1975	1.00	0.00	N.A.	N.A.	-1.40	-0.30	-0.40
1976	3.00	6.00	7.00	N.A.	6.20	6.70	5.90
1977	8.00	7.50	10.00	N.A.	4.60	4.40	7.80
1978	3.50	4.00	4.50	N.A.	8.20	8.20	8.00
1979	6.00	6.50	6.50	N.A.	9.90	10.00	9.60
1980	6.00	8.50	0.00	N.A.	3.00	2.90	2.60
1981	-0.50	3.00	-4.00	N.A.	-2.40	-3.10	-4.30
1982	-2.00	-2.00	-5.00	N.A.	-8.00	-7.20	-6.70
1983	0.50	3.00	-1.00	N.A.	4.50	5.70	5.60
1984	4.00	5.50	5.00	N.A.	1.00	0.40	-0.50
1985	5.00	10.00	4.00	N.A.	8.80	9.30	9.40
1986	7.00	9.00	6.00	8.50	4.60	4.60	4.10
1987	7.50	7.50	7.00	4.00	4.20	4.00	4.00
1988	3.50	2.00	2.00	2.50	N.A.	N.A.	N.A.

Construction investment (in constant prices)

	GD	SVR	IFW	JWB	SB1	SB2	SB3
1975	-3.50	-3.50	N.A.	N.A.	-9.30	-9.30	-7.60
1976	0.50	4.50	1.00	N.A.	2.50	2.50	2.40
1977	3.00	2.00	3.50	N.A.	1.60	1.60	1.30
1978	3.50	5.50	3.50	N.A.	4.80	4.90	2.80
1979	5.00	5.50	6.50	N.A.	7.20	7.40	5.80
1980	4.50	5.50	4.00	N.A.	4.90	4.40	2.90
1981	-3.00	-3.00	-4.50	N.A.	-3.30	-3.40	-5.10
1982	-5.00	-4.50	-5.00	N.A.	-4.90	-4.50	-4.30
1983	0.50	5.00	0.50	N.A.	0.90	0.90	1.70
1984	4.50	7.00	5.00	N.A.	1.50	1.90	1.60
1985	-0.50	0.00	-2.50	N.A.	-6.70	-6.20	-5.60
1986	2.00	1.00	1.00	3.50	1.90	2.30	2.40
1987	3.50	4.00	4.00	4.00	-0.40	0.10	0.10
1988	1.00	1.00	1.50	1.00	N.A.	N.A.	N.A.

Exports (in constant prices)

	GD	SVR	IFW	JWB	SB1	SB2	SB3
1975	4.50	4.00	N.A.	N.A.	-9.10	-8.90	-6.70
1976	7.50	7.50	7.00	N.A.	12.30	10.90	9.90
1977	11.00	9.00	10.00	N.A.	4.60	4.20	3.30
1978	5.50	5.00	6.00	N.A.	5.00	4.40	4.10
1979	6.00	4.00	6.50	N.A.	5.70	5.00	4.50
1980	4.50	5.00	2.50	N.A.	5.50	5.50	5.30
1981	0.00	0.50	-2.00	N.A.	8.50	8.90	8.20
1982	5.00	6.00	2.00	N.A.	2.70	3.50	3.20
1983	1.00	2.50	1.50	N.A.	-1.50	-0.90	-0.20
1984	3.50	4.00	4.00	N.A.	7.40	7.90	9.00
1985	6.00	6.50	6.00	N.A.	7.20	7.20	6.70
1986	5.00	4.50	5.50	3.50	-0.60	-0.50	-0.20
1987	3.00	1.50	3.00	1.50	0.30	0.80	0.80
1988	3.50	2.50	3.00	2.00	N.A.	N.A.	N.A.

Imports (in constant prices)

	GD	SVR	IFW	JWB	SB1	SB2	SB3
1975	7.00	5.00	N.A.	N.A.	0.30	0.70	-0.60
1976	7.50	9.00	8.00	N.A.	12.60	11.40	10.50
1977	10.50	9.00	10.00	N.A.	5.40	4.20	3.60
1978	6.00	5.00	7.00	N.A.	7.00	6.40	5.50
1979	6.50	6.00	7.50	N.A.	10.00	10.20	10.50
1980	4.00	5.00	3.50	N.A.	5.70	5.90	3.70
1981	-0.50	0.50	-3.00	N.A.	1.80	2.10	-1.20
1982	3.00	3.00	2.50	N.A.	0.50	0.50	-0.10
1983	1.00	2.00	1.00	N.A.	-0.10	0.80	1.10
1984	3.00	4.50	3.50	N.A.	5.50	5.70	5.30
1985	4.00	6.50	4.00	N.A.	4.60	4.70	3.70
1986	5.50	6.00	5.50	6.00	3.10	3.20	3.70
1987	5.50	5.50	6.00	5.50	4.00	4.80	4.80
1988	5.00	4.00	5.00	4.50	N.A.	N.A.	N.A.

Gross national product (in constant prices)

	GD	SVR	IFW	JWB	SB1	SB2	SB3
1975	2.50	2.00	N.A.	2.00	-3.60	-3.40	-1.40
1976	4.00	4.50	4.00	4.50	5.60	5.60	5.60
1977	5.50	4.50	5.00	5.00	2.40	2.40	2.70
1978	3.00	3.50	3.50	3.50	3.40	3.40	3.30
1979	4.00	3.75	4.00	4.00	4.40	4.40	4.00
1980	2.50	2.75	1.50	2.50	1.80	1.80	1.50
1981	0.00	0.50	-1.50	-0.50	-0.30	-0.30	0.00
1982	1.00	0.50	-1.00	1.25	-1.20	-1.10	-1.00
1983	0.00	1.00	0.00	0.00	1.20	1.30	1.90
1984	2.00	2.50	2.50	2.50	2.60	2.60	3.30
1985	2.00	3.00	2.00	2.50	2.50	2.40	2.00
1986	3.00	3.00	3.00	3.00	2.50	2.40	2.50
1987	3.00	2.00	3.00	2.50	1.70	1.70	1.70
1988	2.00	1.50	1.50	1.75	N.A.	N.A.	N.A.

Deflator of Gross national product

	GD	SVR	IFW	JWB	SB1	SB2	SB3
1975	7.00	6.00	N.A.	6.50	8.30	8.20	6.00
1976	4.50	4.00	N.A.	4.00	3.10	3.10	3.70
1977	4.00	4.00	4.00	3.50	3.60	3.70	3.80
1978	4.00	3.50	3.50	3.50	3.90	3.90	4.20
1979	3.50	3.00	3.50	3.50	3.70	3.80	4.00
1980	4.50	4.50	5.00	4.00	5.00	5.00	4.80
1981	4.50	4.00	4.50	4.50	4.10	4.30	4.00
1982	4.50	4.00	4.50	4.00	4.80	4.80	4.40
1983	3.50	3.50	3.50	3.50	3.20	3.20	3.20
1984	2.50	3.00	2.50	3.00	1.90	1.90	1.80
1985	2.50	2.00	2.00	2.00	2.20	2.10	2.10
1986	3.00	2.00	2.50	2.50	3.10	3.10	3.10
1987	2.00	2.00	1.50	1.50	2.10	2.10	2.10
1988	2.00	1.50	2.00	1.50	N.A.	N.A.	N.A.

Deflator of private consumption

	GD	SVR	IFW	JWB	SB1	SB2	SB3
1975	6.50	5.75	N.A.	6.00	6.10	6.10	6.20
1976	5.50	5.00	N.A.	4.75	4.50	4.50	4.10
1977	4.50	4.00	4.00	4.00	3.90	3.90	3.60
1978	4.00	3.50	4.00	3.50	2.60	2.60	2.70
1979	3.50	2.50	3.50	3.00	4.10	4.10	4.00
1980	4.50	4.50	4.50	4.50	5.40	5.40	5.80
1981	4.00	4.00	4.00	4.50	6.00	5.90	6.20
1982	4.50	5.50	4.50	5.00	5.30	5.30	4.80
1983	3.50	4.00	3.50	4.00	3.00	3.00	3.20
1984	3.00	3.00	2.50	3.00	2.60	2.60	2.50
1985	2.00	2.00	2.00	2.00	2.00	2.00	2.00
1986	2.00	1.50	2.00	1.50	-0.40	-0.40	-0.50
1987	1.50	1.00	1.00	0.50	0.60	0.60	0.60
1988	2.00	1.50	2.00	1.00	N.A.	N.A.	N.A.

Employment

	GD	SVR	IFW	JWB	SB1	SB2	SB3
1975	-1.50	-1.50	N.A.	-1.50	-3.20	-3.20	-2.80
1976	-1.50	-1.00	N.A.	-1.00	-1.10	-1.00	-0.80
1977	0.50	0.50	N.A.	0.50	-0.40	-0.40	-0.20
1978	-0.50	0.00	N.A.	0.00	0.20	0.30	0.60
1979	0.50	0.50	N.A.	0.50	1.30	1.30	1.40
1980	0.50	0.50	N.A.	0.50	0.60	0.90	1.10
1981	-1.00	-0.50	N.A.	-1.25	-0.90	-0.60	-0.70
1982	-1.50	-1.50	N.A.	-1.00	-1.90	-1.80	-1.70
1983	-2.00	-1.50	N.A.	-1.75	-1.70	-1.70	-1.50
1984	-0.50	0.00	N.A.	0.00	-0.30	-0.20	0.10
1985	0.00	1.00	N.A.	0.50	0.80	0.70	0.70
1986	1.00	1.00	N.A.	1.00	1.00	1.00	1.00
1987	1.10	1.00	1.50	1.00	0.60	0.70	0.70
1988	0.30	0.50	0.50	0.50	N.A.	N.A.	N.A.

Productivity

	GD	SVR	IFW	JWB	SB1	SB2	SB3
1975	4.50	4.00	N.A.	4.50	-0.40	-0.30	0.90
1976	3.50	4.00	N.A.	4.50	6.50	6.60	6.30
1977	4.50	4.50	N.A.	4.50	3.00	3.00	3.10
1978	3.50	3.50	N.A.	4.00	2.90	2.80	2.20
1979	3.50	3.50	N.A.	4.00	3.10	3.10	2.90
1980	3.00	2.50	N.A.	3.00	1.40	1.00	0.30
1981	2.50	2.50	1.50	2.00	0.90	0.60	0.90
1982	2.50	2.50	1.50	3.00	0.90	0.80	1.10
1983	2.00	2.50	2.00	2.25	2.70	2.70	2.70
1984	2.50	2.50	2.50	2.50	3.00	2.80	2.70
1985	3.00	3.00	3.00	3.00	1.80	1.80	1.40
1986	2.50	2.50	2.50	2.50	1.50	1.50	1.60
1987	2.50	2.00	2.00	2.00	1.00	1.10	1.10
1988	2.00	2.00	1.50	2.25	N.A.	N.A.	N.A.

Entrepreneurial and property income

	GD	SVR	IFW	JWB	SB1	SB2	SB3
1975	13.00	8.00	N.A.	9.00	2.70	3.10	3.10
1976	13.50	13.50	N.A.	13.00	14.10	13.90	15.90
1977	11.00	10.00	11.00	9.50	2.50	3.10	4.60
1978	7.50	8.00	7.50	10.00	10.60	11.00	10.00
1979	9.50	7.50	10.50	10.00	9.40	9.30	7.40
1980	6.00	6.00	4.00	5.00	3.30	2.50	-1.90
1981	4.00	4.50	-1.00	2.50	-1.10	-0.90	0.00
1982	7.50	8.50	4.50	8.00	5.50	6.70	5.50
1983	6.50	7.50	6.50	5.50	11.90	11.20	12.10
1984	7.50	8.00	9.00	8.00	9.50	9.10	10.60
1985	6.00	6.50	6.00	6.50	8.50	8.00	6.50
1986	9.50	7.00	9.50	6.50	9.40	9.50	9.70
1987	4.50	3.50	4.50	4.00	4.60	4.00	4.00
1988	3.50	2.00	3.50	3.25	N.A.	N.A.	N.A.

Gross income of wages and salaries

	GD	SVR	IFW	JWB	SB1	SB2	SB3
1975	8.50	8.00	N.A.	8.00	4.10	4.10	4.30
1976	6.50	7.00	N.A.	7.00	7.20	7.30	7.50
1977	9.50	9.00	9.50	8.50	7.00	7.00	7.10
1978	6.00	7.00	6.50	5.50	6.00	5.90	6.70
1979	7.00	6.50	7.00	6.50	7.20	7.30	7.80
1980	7.00	7.50	6.50	7.00	7.70	7.90	8.60
1981	4.50	4.00	3.00	3.50	4.70	5.00	4.60
1982	3.50	3.00	2.00	4.00	2.40	2.30	2.20
1983	2.00	2.50	1.50	2.00	1.50	1.70	2.00
1984	3.50	4.50	4.00	3.75	3.00	3.00	3.60
1985	3.50	4.50	2.50	4.25	4.00	3.80	3.90
1986	4.50	5.00	4.50	5.00	5.00	5.00	5.10
1987	5.00	4.50	5.50	4.25	3.70	3.80	3.80
1988	4.00	4.00	3.50	3.25	N.A.	N.A.	N.A.