Short-term Forecasting: A review of recent experience*

J. DURKAN and R. KELLEHER

S INCE September 1968 The Economic and Social Research Institute has published detailed forecasts on a quarterly basis of Gross National Product and its components in both value and volume terms. It is hoped in this paper that by examining relationships between forecasts and the outcomes, one may be able to get some insights into the adequacy of forecasting methods employed in this country. We will also attempt to take cognisance of qualitative statements contained in the various publications containing forecasts.

Some objections may be raised to the method we have employed in this paper to test the forecasting record. In particular, it could be argued that by merely taking the figures out of the various commentaries without paying any attention to the numerous reservations and qualifications that were expressed about those figures in the accompanying texts we have not done full justice to the forecasters' views of trends in the economy. Several points need to be made in this regard. First, the figures do, in fact, represent what on balance the forecasters felt was likely to occur. It is the figures, and not the qualifications, which received publicity and, thus, these figures embody whatever influence on decisions such commentaries possess. Therefore a test of the accuracy of the figures forms the essential context within which any judgment of the forecasts must be made. Second, we feel our analysis implies that more emphasis should be placed on textual and qualitative analysis of trends in the economy rather than the precise quantification of future events. At best the present degree of accuracy of forecasting methods is that statements such as "that growth is likely to be above (or below) average" can be made. Thus, the fact that the absolute levels of past forecasts have in some cases diverged quite a lot from the eventual outcomes does not imply that the commentaries themselves have not been valuable in the

*This article was first submitted in May 1974.

167

understanding of current trends in the economy. Unrealistic expectations have been generated about the accuracy of the forecasts and it is important that the large confidence intervals attached to the forecasts be stressed.

Divergences between forecasts and eventual outcomes do not necessarily reflect faults in the forecasting process. Any set of forecasts are based on certain assumptions and to the extent that these assumptions are unrealised, forecasts can be expected to differ from outcomes. Indeed, in some cases the forecasts themselves could result in changes in some of the assumptions on which they were originally based. If sluggish growth in the economy were forecast on the basis of unchanged fiscal and monetary policies, the effect of such a forecast could well be that the authorities would take a considerably more expansionary stance on these issues which would thus revise upwards the expected outturn of economic activity in that year.

Apart from these "policy" assumptions many others have to be made in relation to exogenous influences on the economy which will largely be determined by political and other non-economic factors in which the forecaster has no particular expertise. Present forecasts have to make some assumptions concerning the likely future development of oil prices. To the extent that eventual divergences between forecasts and outcomes can be accounted for by the failure of these assumptions to be realised no blame can be attached to the forecasting process.

The Forecasting Record

These reservations aside, a systematic divergence between forecasts and outcomes may be due to inadequacy in forecasting procedures. With the possible exception of the "policy" assumptions the effect of the non-fulfilment of initial expectations concerning other exogenous influences should not bias the forecasts in any particular direction all the time. It is possible that both fiscal and monetary policy has tended to be rather more expansionary usually than was originally assumed, so that some downward bias in the forecasts would be expected. To some extent, however, this problem can be overcome by looking at post-budget forecasts to see to what extent they differ from previous ones. It is our contention that a systematic underestimation has occurred in the forecasts. This trend seems to be considerably stronger in value forecasts than those relating to volume suggesting that the increase in price deflators has been subject to considerable underestimation.

Principal conclusions appear obvious from inspection of Tables 1 to 3 which present the various forecasts made for each year together with three different estimates of the eventual outcomes for those years. In these Tables five forecasts are given for each year. The first of these is normally made in the autumn of the previous year with further forecasts coming in the following winter, spring, summer and autumn. All forecasts relate to expenditure on Gross National Product and no attempt has been made to assess forecasts made on the incomes and output sides.

It is clear from Table 1 that considerable underestimation has occurred in

TABLE I: *Current Values (per cent change)*

	QEC 1st Forecast	QEC 2nd Forecast	QEC 3rd Forecast	QEC 4th Forecast	QEC 5th Forecast	First Official Estimate	CSO 1st Estimate	CSO Latest Estimate
1969	September 1968	January 1969	May 1969	September 1969	December 1969			
C	11·5	7·5	10·3	12·5	12·0	11·5	12·0	13·5
G	8·5	8·5	10·4	10·5	11·0	13·0	16·25	16·1
I	17·0	15·5	20·8	22·0	22·0	27·0	31·0	29·0
X	5·0	6·0	8·6	10·0	10·0	12·0	9·5	11·0
M	12·0	8·0	15·0	18·5	17·5	18·0	18·0	18·2
GNP	9·8	8·5	10·5	11·5	10·5	12·0	12·25	14·5
1970	September 1969	December 1969	March 1970	June 1970	September 1970			
C	9·0	11·0	11·0	11·5	10·5	9·75	10·75	10·75
G	10·0	12·0	13·0	13·0	12·5	18·75	20·5	20·5
I	11·0	14·5	15·0	13·0	12·5	7·25	7·0	8·1
X	11·5	12·0	12·0	12·0	12·0	13·75	12·5	11·7
M	10·5	11·5	12·5	9·5	9·0	10·25	10·25	9·5
GNP	11·0	11·5	11·5	12·0	11·5	11·25	11·5	11·7
1971	September 1970	December 1970	March 1971	June 1971	Autumn 1971			
C	9·0	9·5	10·0	11·0	12·0	11·25	12·5	10·9
G	12·0	10·5	10·5	11·5	13·5	17·25	17·5	22·3
I	15·0	14·0	14·0	17·0	15·0	17·5	21·0	19·8
X	11·5	12·0	12·0	12·5	12·0	11·5	12·5	12·6
M	14·5	13·5	13·0	14·5	13·0	10·25	10·5	10·3
GNP	9·5	10·0	10·5	11·0	11·75	12·75	14·0	13·3
1972	Autumn 1971	Winter 1971/72	July 1972	October 1972	January 1973			
C	10·5	7·75	11·0	11·25	12·0	12·75	13·9	13·9
G	12·5	14·0	14·0	16·5	17·0	22·5	25·4	25·4
I	9·0	5·5	8·5	8·5	8·5	11·5	12·5	12·5
X	12·5	8·0	9·0	9·5	14·5	15·5	14·25	14·25
M	11·5	7·5	7·5	7·0	10·5	11·25	11·25	11·25
GNP	11·0	9·0	11·5	12·5	13·5	16·5	18·0	18·0
1973	October 1972	January 1973	April 1973	August 1973	December 1973			
C	10·5	11·5	13·0	15·75	18·75	18·4		
G	14·5	15·0	17·0	20·0	21·0	20·7		
I	17·0	17·0	19·0	24·0	27·0	27·6		
X	15·0	20·5	22·5	28·0	31·25	31·4		
M	14·0	17·0	21·5	29·5	34·0	34·2		
GNP	13·25	14·0	12·0	18·0	20·75	19·5		

N.B.: For definitions of abbreviations see Appendix.

forecasts relating to current values. In all the years considered the growth in the value of GNP has been greater than suggested by the forecasts. This divergence has become greater in the last two years.For 1972 the first forecast was for a rise of 11 per cent in the value of Gross National Product while the latest estimate is for an 18 per cent rise. The first forecast for 1973 was for a 13 per cent rise while the fifth forecast was over 20 per cent. This pattern is true for practically all of the components of GNP. However, most surprisingly, the greatest error made, both in forecasting and estimating, was in the growth of government expenditure. In all years the latest estimate for the percentage increase in this item is approximately twice the original forecast. Furthermore, this cannot be explained by fiscal policy being more expansionary than was originally assumed for even the final forecasts for each year considerably underestimate the true growth in public expenditure. Of course, in 1973 the greatest error was in relation to the growth of both exports and imports. The final forecasts for that year were for a 31·25 per cent and 34 per cent increase respectively while the first forecasts were 15 per cent and 14 per cent.

No such clearcut conclusions emerge from Table 2 which presents volume forecasts for GNP and its components. Probably the most important forecast made is that for the growth in the volume of GNP. This indicator is best accepted as showing the degree of under-utilisation or inflationary pressure which exists in the economy. Unfortunately, the record of forecasting these growth rates is not altogether too impressive. The picture clearly emerging from examination of the forecasts is that they have tended to cluster around a mean range of 3–5 per cent. Thus, in years of reasonably average growth, such as 1971 and 1972, the forecasts have been fairly accurate. However, when the growth rate has diverged from the average the forecasts have been unable to detect the extent of this divergence. 1968 and 1973 were years of very much above average growth. The estimated growth rate (on expenditure data) for 1968 is now 8·5 per cent while the corresponding preliminary estimate for 1973 is 6·9 per cent. The initial forecast for 1968 was 3·6 per cent while the first post-budget forecast in May of that year was 3·9 per cent. The initial forecast for 1973 was 5·25 per cent with an immediate post-budget expectation of 5·75 per cent. On the other hand, 1970 was a year of sluggish growth with GNP rising in volume terms by 2·7 per cent. The first prediction was for an increase of 5 per cent which represented a higher growth than at the time was estimated for 1969. Little can be said about the value of forecasts in this year since major distortions were introduced by particularly bad industrial relations. The general conclusion is that the forecasts have not been successful in identifying the extent to which the economy sometimes diverges from its average growth path. At best all that the forecasts are likely to be able to say is either that growth will be above, below or about average in the coming year or perhaps above or below the previous year's level. It is important that quantitative forecasts presented should be interpreted in this way.

Table 2 again brings out the failure of the forecasts to deal with the growth in government expenditure. Even in years such as 1971 and 1972 when the forecasts were reasonably accurate for GNP and most of its other components, they hope-

TABLE 2: *Constant Values (per cent change)*

	QEC 1st Forecast	QEC 2nd Forecast	QEC 3rd Forecast	QEC 4th Forecast	QEC 5th Forecast	First Official Estimate	CSO 1st Estimate	CSO Latest Estimate
1969								
C	5·3	2·9	3·6	4·5	4·0	4·0	4·5	5·4
G	2·4	2·4	2·6	2·5	3·0	4·0	8·5	6·9
I	10·5	8·9	13·0	13·0	13·0	17·5	23·25	19·7
X	3·5	4·4	6·0	6·0	5·5	6·0	3·5	4·7
M	8·8	4·6	11·7	13·0	12·0	11·5	13·0	13·5
GNP	4·2	4·0	3·8	4·0	4·0	3·75	4·25	5·3
1970								
C	3·5	5·0	5·0	3·0	2·5	1·5	2·75	2·1
G	3·0	2·5	3·0	3·0	3·0	3·75	7·0	6·3
I	9·5	6·0	6·5	3·5	3·5	—1·25	—1·25	—
X	8·0	8·0	8·5	8·0	4·5	6·0	5·25	4·7
M	7·0	8·5	9·0	6·0	2·0	3·5	3·25	2·5
GNP	5·0	4·5	4·5	3·0	2·5	1·5	2·75	2·5
1971								
C	3·0	2·5	2·5	3·0	3·0	2·0	3·25	2·1
G	3·5	2·0	2·0	2·0	3·0	6·25	3·25	11·25
I	8·0	6·0	8·0	9·5	7·5	8·0	9·0	9·25
X	6·0	6·0	6·0	5·5	5·0	3·5	5·0	5·0
M	9·0	7·0	7·5	8·0	6·0	3·0	4·0	4·0
GNP	3·5	2·75	3·0	3·0	3·0	3·0	3·0	2·9
1972								
C	3·5	0·5	2·75	2·5	3·0	4·0	5·4	5·4
G	3·0	4·5	4·5	5·0	5·5	8·75	10·4	10·4
I	2·5	—0·5	2·0	2·0	2·0	2·0	2·5	2·5
X	6·0	2·5	2·5	2·0	2·25	3·5	2·0	2·0
M	6·0	1·5	2·5	2·0	5·0	7·25	7·9	7·7
GNP	3·75	1·5	3·0	2·75	2·75	3·0	3·7	4·2
1973								
C	3·5	3·5	4·25	5·0	7·0	6·3		
G	5·0	5·0	6·0	8·0	8·0	7·4		
I	10·0	10·0	10·0	12·5	15·0	12·9		
X	8·0	12·0	14·0	15·75	16·75	10·6		
M	8·5	11·0	14·0	19·5	22·25	13·5		
GNP	5·25	5·25	5·0	5·75	7·0	6·6		

See note Table 1.

lessly underestimated the growth in the volume of current government consumption expenditure. In 1971 the expectation was for a 3 per cent growth while the actual turned out to be over 11 per cent. A similar error occurred in 1972.

As for the other components many of the comments made in relation to GNP are again applicable. In years of above average growth (1968 and 1973) the forecasts underestimated the expansion in both the external sector and in capital formation although a considerable underestimation of consumer expenditure also occurred in 1973. In 1970, a year of very sluggish growth, considerable overestimation in the growth of all components of GNP occurred.

These characteristics of the forecasts are unlikely to depend on the institution making the forecasts. Rather, they reflect the general state of the art of forecasting in the country in general or perhaps even the world wide state of the art. Forecasts* were made for years earlier than 1969 i.e. before the "Quarterly Economic Commentary" Series commenced. In 1965 and 1966 the Department of Finance forecasts were unable to pick up the extent of the downturn of the economy in those years. In 1965 their expectation was 4 per cent growth, while the outcome turned out to be 2·75 per cent. In 1966 their "pessimistic" outlook was for a 3·7 per cent growth rate with the outcome eventually being 1·25 per cent. Again in 1967 the NIEC were unable to identify the extent of the recovery in the economy. In recent years the ESRI has been the only body to publish detailed forecasts and they continue, as has been discussed, to have similar characteristics. It must be assumed that these characteristics have also continued to be part of the forecasts of other Institutions.

Table 3 gives the various forecasts for the increase in the price deflators of GNP and its components. The underestimation which occurred in the value forecasts was mainly due to a very significant underestimation of the increase in price levels. Except for import prices in 1972 the implicit price deflators of GNP and its components have been underestimated in every year since 1969. The result has been that even in some cases where volume increases were considerably overestimated the underestimation of the price increase resulted in the overall underestimation of value forecasts, (e.g. exports in 1972).

The price forecast on which most interest centres is that for consumer prices. Again, we have clearly been unable to grasp the extent to which consumer prices were increasing in any year until the final part of the year. Thus, in every year the forecast was continually revised upwards from commentary to commentary. For example, the initial expectation for 1973 was a rise of 7 per cent—an expectation continually revised upwards to the final figure of 11·4 per cent. Possibly, the forecasts represented a hope (rather than a belief) that successful anti-inflationary policies were being introduced. Furthermore, it is possible that forecasts of very

*The authors can make available to interested people a copy of a table which covers the period 1962 to 1968 inclusively. It includes ERI papers 6, 15, 21, 27, 33, 39, and subsequent papers by Baker *et al.* In addition it covers CSO latest estimates and forecasts by the Department of Finance and NIEC.

TABLE 3: *Price Deflators (per cent change)*

	QEC 1st Forecast	QEC 2nd Forecast	QEC 3rd Forecast	QEC 4th Forecast	QEC 5th Forecast	1st Official Estimate	CSO 1st Estimate	CSO 1st Estimate
1969								
C	6·0	4·5	6·5	7·5	7·5	7·25	7·25	8·0
G	6·0	6·0	7·5	7·5	7·5	8·75	7·25	8·5
I	6·0	6·0	7·0	8·0	8·0	8·0	6·25	7·75
X	1·5	1·5	2·5	4·0	4·0	5·75	5·75	6·0
M	4·75	8·0	3·0	5·0	5·0	5·75	4·5	4·1
GNP	5·5	4·3	6·5	7·0	7·0	8·0	7·75	8·7
1970								
C	5·5	5·5	6·0	8·5	8·0	8·0	7·75	8·5
G	7·0	9·0	10·0	10·0	9·0	9·5	12·5	13·5
I	7·0	8·0	8·0	9·5	8·5	8·5	8·5	8·0
X	3·0	3·5	3·5	4·0	7·0	8·0	7·0	6·75
M	3·0	3·0	3·0	3·5	6·5	7·5	6·75	6·75
GNP	6·0	6·5	6·5	9·0	8·5	8·5	8·5	9·0
1971								
C	6·0	7·0	7·0	8·0	8·5	9·0	8·5	8·5
G	8·0	8·5	8·5	9·0	10·0	10·5	13·75	10·0
I	6·5	7·5	6·0	7·0	7·0	8·75	11·0	9·5
X	5·0	6·0	6·0	6·5	6·5	7·75	7·0	7·5
M	5·0	6·0	5·0	6·0	6·5	7·0	6·25	6·20
GNP	6·0	7·5	7·5	8·0	8·25	9·5	10·75	10·1
1972								
C	7·0	7·25	8·0	8·5	8·5	8·5	8·1	8·1
G	9·0	9·0	9·0	11·0	11·0	12·5	13·6	13·6
I	6·0	6·0	6·5	6·5	6·5	9·25	9·8	9·8
X	6·0	5·5	6·5	7·5	12·0	11·5	12·0	12·0
M	5·5	6·0	5·0	5·0	5·0	6·5	3·2	3·2
GNP	7·25	7·25	8·25	9·25	10·5	13·0	13·6	13·2
1973								
C	7·0	7·5	8·5	10·25	11·0			
G	9·0	9·5	10·0	11·0	11·75			
I	6·5	6·5	8·0	10·0	10·5			
X	6·5	7·5	8·0	10·75	12·25			
M	5·0	5·5	6·5	8·75	9·5			
GNP	7·5	8·5	9·5	11·5	12·75			

See note Table 1.

rapid growth of consumer prices could in themselves have inflationary effects—
a situation which the Institute would be anxious to avoid. Hopefully, our present
forecast of a rise of 15 per cent for 1974 in consumer prices is not subject to
similar large errors as in the past!

Government expenditure in Table 3 reflects again the findings of Tables 1 and
2 in that it seems quite often to have the largest margin of error. The other
components have similar trends as that for consumer prices—an initial under-
estimation which is continually revised upwards throughout the year.

The statistical significance of the divergences discussed above was tested by
regressing the outcomes on the forecasts. Ideally, one would wish to do this for
each component of GNP. However, since observations on both forecasts and
outcomes exist for only four years this was clearly ruled out. Instead, all forecasts
for current values were considered as one variable and, similarly, for constant
values and price deflators. This resulted in 24 observations on each variable when
forecasts were paired with first official estimates (FO) or CSO first estimates and
18 observations when paired with CSO 1972 observations. However, any results
obtained must be related to a group of forecasts and no inferences can be drawn
for the individual components of GNP.

Since practically all the equations had a constant term not significantly different
from zero they were re-estimated through the origin. If the resulting coefficient
was significantly different from unity we concluded that the forecasts were
significantly different from the outcomes.

The results for current and constant values are given in Tables 4 and 5 respec-
tively. This confirms that systematic underestimation occurs as practically all of the
coefficients are significantly greater than unity. Furthermore, the coefficients
decline, as one moves from first forecasts to final forecasts, confirming our belief
of a constant upward revision throughout the year. In general, the degree of
underestimation appears to be greater in relation to the CSO estimate than to the
FO estimates, reflecting that these latter estimates also tended towards under-
statement.

Table 5 again seems to confirm our expectations. On average, forecasts of
volume changes in the economy have not been significantly different from the
outcomes. However, the regression analysis does not bring out the extent to
which the forecasts have failed whenever the economy diverges from average
values. Interestingly, final forecasts again tend to understate significantly the
CSO estimates but not FO estimates. The overall effect is to re-emphasise the
understatement of the increase in general price levels.

Problems of Data

Several explanations can be offered for this. This paper examines one explanation
which relates to the basic data and has two dimensions. First, a lengthening time-
lag exists between events and the availability of data describing them. At the end
of the first quarter of 1974, detailed trade figures are only available for the first
seven months of 1973, export and import unit value figures for the first six months

TABLE 4: *Results: Current Values*

Observations 1969–1972 (inclusive)	$t(B = 1)$	DW	R
$FO = 1.25 F_1$ (18.3)	3.68**	1.79	.53
$FO = 8.41 + .54F_2$ (2.45) (1.67)	†	1.97	.34
$FO = 1.18 F_3$ (19.17)	2.88**	1.82	.58
$FO = 1.11F_4$ (21.93)	2.18*	1.86	.70
$FO = 1.11F_5$ (28.75)	2.84**	2.43	.83
$CSI = 1.33F_1$ (16.89)	4.21**	1.76	.59
$CSI = 1.38F_2$ (13.79)	3.83**	1.27	.23
$CSI = 1.25F_3$ (17.79)	3.59**	1.65	.64
$CSI = 1.18F_4$ (20.36)	3.17**	1.70	.73
$CSI = 1.18F_5$ (23.77)	3.62**	2.11	.81
$CSI = 1.07D.F.$ (56.1)	3.48**	1.78	.97

Observations 1969–1971 (inclusive)	$t(B = 1)$	DW	R
$CSL = 1.32F_1$ (13.7)	3.29**	1.59	.52
$CSL = 9.47 + .47F_2$ (1.66) (.93)	†	1.85	.23
$CSL = 1.19F_3$ (14.12)	2.26*	1.81	.56
$CSL = 1.13F_4$ (16.16)	1.85	2.23	.68
$CSL = 1.67F_5$ (18.55)	2.65*	2.22	.77
$CSL = 1.08D.F.$ (13.36)	3.13**	1.59	.96
$CSL = 1.01CSI$ (38.43)	.38	2.46	.95

See note Table 1.

†A test on the coefficients where a constant term occurs will not indicate whether a systematic bias exists in the equation as the constant term may nullify any under or over-statement in the coefficient.

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TABLE 5: *Constant Values: Results*

Observations 1969–1972 (inclusive)	$t(B=1)$	DW	R
$FO = \cdot 85F$ (6·92)	—1·18	1·53	·37
$FO = 2\cdot 80 + \cdot 5F_2$ (1·91) (1·62)	†	1·67	·33
$FO = \cdot 89F_3$ (8·45)	—1·04	1·46	·59
$FO = \cdot 95F_4$ (10·38)	—·51	1·52	·73
$FO = 1\cdot 10F_5$ (14·75)	1·37	1·91	·86
$CSI = 1\cdot 00F_1$ (6·28)	0·0	1·63	·32
$CSI = 3\cdot 18 + \cdot 61F_2$ (1·71) (1·56)	†	1·87	·32
$CSI = 1\cdot 05F_3$ (7·76)	·40	1·58	·57
$CSI = 1\cdot 13F_4$ (9·22)	1·04	1·56	·69
$CSI = 1\cdot 31F_5$ (12·76)	3·04	1·83	·84
$CSI = 1\cdot 18D.F.$ (19·89)	2·98**	1·87	·93
$CSL = \cdot 98F_1$ (5·7)	—·12	1·47	·29
$CSL = 2\cdot 8 + \cdot 5F_2$ (1·91)(1·62)	†	1·69	·33
$CSL = 1\cdot 97F_3$ (6·57)	—·23	1·55	·50
$CSL = 1\cdot 04F_4$ (8·04)	·32	1·80	·67
$CSL = 1\cdot 25F_5$ (10·92)	2·17*	2·12	·82
$CSL = 1\cdot 17F$ (19·68)	2·91**	1·87	·94
$CSL = \cdot 94CSI$ (13·98)	—·90	·00	·89

See note Table 1.

†See note Table 4.

(and these have only recently become available), industrial production figures up to the third quarter (and again the third quarter figure has only recently become available), no data at all on wholesale prices and no data on agricultural output except for the livestock enumeration. These delays mean that commentators very often have to "forecast" the past before making projections into the future. Clearly, forecasts will reflect the cumulative errors of such a procedure. Until these delays are greatly reduced the accuracy of forecasts is not likely to be radically improved.

The second dimension is that data available to forecasters is preliminary and sometimes subject to drastic revisions. Two consequences follow. First, it distorts one's view of the past relationship between variables in the economy. Whenever econometric methods are being used the coefficients of estimated equations will be distorted depending on the extent to which preliminary rather than final data was used in their estimation. Denton and Kuiper [1] estimated simple macro-models for several countries using preliminary, mixed and final data. They found the resulting coefficients highly sensitive to the type of data used in estimation and much less sensitive to different methods of estimation. This also holds when non-econometric methods (such as mere inspection) are being used.

Second, data revisions also distort one's view of current trends in the economy. It will be argued that such a distortion was in large part responsible for the considerable underestimation of the growth in the economy in 1973. Denton and Oksanen [2] examined preliminary and final data for fourteen countries and found that, in general, preliminary data is later subject to upward revision. They then estimated a simple macro-model for each country using only final data, (i.e. ignoring the first problem of data revisions). Ex-post forecasts were generated feeding both preliminary and final data into the models. Forecasts generated by the preliminary data (which itself was an underestimation of the final data), yielded forecasts significantly lower than those generated by final data. Clearly, this tendency holds also for forecast based on Irish preliminary data.

Irish forecasters most frequently have to use the first official estimates. Table 6 gives these together with the CSO 1972 estimates. Tables 7 and 8 clearly show that underestimation has been a feature of these estimates. Table 7 presents the revisions of percentage changes from first official estimates to CSO latest estimates. Table 8 presents the regressions of the estimates on one another constraining the constant term to zero. One can test whether the coefficients are significantly different from unity. For current values the average revision over the period has been upwards for all components of GNP except exports. In current values growth has been revised on average upwards by 1·15 percentage points, with the poorest estimate again government expenditure at 2·06 percentage points. It is not clear why this is so. It seems a priori to be one of the easier areas on which to collect data. In every year the revision was upwards except in 1966. The average absolute value of the revision is 2·51. In 1971 it was 5·0 per cent while in 1972 it was subject to an upward revision of 3 percentage points in the first estimate of the CSO. In Table 8 growth in the value of GNP has been significantly underestimated

TABLE 6: *First Official Estimates (FO) and CSO Latest Estimates (CSL)*

	1964		1965		1966		1967		1968		1969		1970		1971		1972	
	FO	CSL	FO	CSL	FO	CSL	FO	CSL	FO	CSL	FO	CSL	FO	CSL	FO	CSL	FO	CSL
Percentage in value of																		
C	10·6	11·4	6·9	5·4	3·4	5·9	5·7	6·8	10·0	13·9	11·5	13·5	9·8	10·7	11·2	10·9	12·8	13·9
G	17·2	19·5	5·0	8·9	6·9	5·1	5·9	6·7	12·3	13·8	13·0	16·1	18·8	20·5	17·3	22·3	22·5	25·4
I	20·0	17·3	12·5	14·1	−1·1	0·0	9·3	10·5	18·6	17·0	27·0	29·0	7·3	7·9	17·6	19·8	11·4	12·5
X	12·1	13·5	3·9	2·8	10·1	12·7	13·8	11·1	16·2	16·0	12·1	11·0	.13·8	11·7	11·4	12·6	15·6	14·2
M	14·0	14·4	6·9	7·3	1·0	3·8	5·3	3·5	23·9	24·8	17·9	18·3	10·3	9·5	10·2	10·3	11·2	11·2
GNP	13·6	13·3	7·2	7·2	4·6	6·4	8·0	9·3	10·3	13·4	12·1	14·5	11·3	11·7	12·8	13·3	16·4	18·0
Percentage in volume of																		
C	3·7	4·5	1·9	0·9	0.3	1·8	2·4	3·8	5·2	8·4	3·9	5·4	1·5	2·1	2·1	2·1	4·0	5·4
G	4·8	2·7	2·3	4·0	1·2	1·0	2·3	4·6	3·3	5·7	4·0	6·9	3·8	6·3	6·3	11·2	8·7	10·4
I	12·7	10·6	9·7	10·2	−5·1	−3·1	5·8	6·7	13·9	12·9	17·6	19·7	−1·3	0·0	7·9	7·9	2·1	2·5
X	5·0	8·2	0·6	1·0	8·9	10·6	12·7	10·3	8·7	8·9	6·1	4·7	6·0	4·7	3·6	4·9	3·4	2·0
M	10·5	13·0	4·5	4·7	0·0	3·5	5·9	3·8	14·4	15·6	11·4	13·5	3·5	2·5	2·9	4·1	7·2	7·7
GNP	4·2	3·7	2·5	2·8	1·1	1·0	4·1	5·6	5·4	8·5	3·8	5·3	1·5	2·5·	3·0	2·9	2·9	4·2
Percentage in Price Deflator of																		
C	6·7	6·6	4·9	4·5	3·1	4·0	3·2	2·9	4·6	5·1	7·3	7·7	8·2	8·4	8·9	8·6	8·5	8·1
G	11·8	16·4	2·6	4·7	5·6	4·1	3·5	2·0	8·7	7·7	8·7	8·6	14·5	13·4	10·3	10·0	12·7	13·6
I	6·5	6·1	2·6	3·5	4·2	3·2	3·3	3·6	4·1	3·6	8·0	7·8	8·7	7·9	9·0	11·0	9·1	9·8
X	6·8	4·9	3·3	1·8	1·1	1·9	1·0	0·7	6·9	6·5	5·7	6·0	7·4	6·7	7·5	7·3	11·8	12·0
M	3·2	1·2	2·3	2·5	1·0	0·3	−0·6	−0·3	8·3	8·0	5·8	4·2	6·6	6·8	7·1	6·0	3·7	3·2
GNP	9·0	9·3	4·6	4·3	3·5	5·3	3·7	3·5	4·6	4·5	8·0	8·7	9·7	9·0	9·5	10·1	13·1	13·2

See note Table 1.

TABLE 7: *Difference between the CSO latest estimates (CSL) of percentage changes and first official estimates (FO)*

	C	G	I	X	M	GNP
			Current Values			
1964	0·8	2·3	—2·7	1·4	0·4	—0·3
1965	1·5	3·9	1·6	—1·1	0·4	0·0
1966	2·5	—1·8	1·1	2·6	2·8	1·8
1967	1·1	0·8	1·2	—2·7	—1·8	1·3
1968	3·9	—1·5	—0·6	—0·2	0·9	3·1
1969	2·0	3·1	2·0	—1·1	0·4	2·4
1970	0·9	1·7	0·6	—2·1	—1·8	0·4
1971	—0·3	5·0	2·2	1·2	0·1	0·5
Average	1·18	2·06	0·53	—·25	0·2	1·15
/Average/*	1·63	2·51	1·5	1·6	1·1	1·22
			Constant Values			
1964	1·2	—2·1	—2·1	3·2	2·5	—0·5
1965	—1·0	1·7	0·5	0·4	0·2	0·3
1966	1·5	—0·2	2·0	1·7	3·5	—0·1
1967	1·4	2·3	0·9	—2·4	—2·1	1·5
1968	3·2	2·5	—1·0	0·2	1·2	3·1
1969	1·5	2·9	2·1	—1·4	2·1	1·5
1970	0·6	2·5	1·3	—1·3	—1·0	1·0
1971	0·0	4·9	0·0	1·3	1·2	—0·1
Average	1·05	1·81	·53	·21	·95	·84
/Average/*	1·49	2·39	1·41	1·49	1·73	1·01
			Price Deflators			
1964	—0·1	4·7	—0·4	—1·9	—2·0	0·3
1965	—0·4	2·1	0·9	—1·5	0·2	—0·3
1966	0·9	—1·5	—1·0	0·8	—0·7	1·8
1967	—0·3	—1·5	0·3	—0·3	0·3	—0·2
1968	0·5	—1·0	—0·5	—0·4	—0·3	—0·1
1969	—0·4	—1·0	—0·2	0·3	—1·6	0·7
1970	0·2	—1·1	—0·8	—0·7	0·2	—0·7
1971	0·3	—0·3	—2·0	0·2	—1·1	0·6
Average	0·1	0·1	·46	—·48	—·63	·26
/Average/*	0·4	1·7	·76	·76	·80	·60

See note Table 1.
*Average of the absolute changes.

TABLE 8: *Regression of First Official Estimates (FO) on CSO Latest Estimates (CSL)—*
(1964-1971)

		Current Values	$t(B = 1)$
All variables:		FO = ·91 CSL	—4·04
C		FO = ·87 CSL	—2·52
G		FO = ·98 CSL	—1·32
I		FO = ·97 CSL	— ·81
X		FO = 1·01 CSL	·09
M		FO = ·97 CSL	— ·72
GNP		FO = ·90 CSL	—2·77
		Constant Values	
All variables:		FO = ·88 CSL	—3·90
C		FO = ·68 CSL	—5·30
G		FO = ·60 CSL	—5·44
I		FO = ·99 CSL	—0·24
X		FO = ·96 CSL	—0·4
M		FO = ·86 CSL	—2·18
GNP		FO = ·74 CSL	—4·4
		Price Deflators	
All variables:		FO = ·98 CSL	— ·89
C		FO = ·98 CSL	— ·60
G		FO = ·93 CSL	— ·91
I		FO = ·97 CSL	— ·62
X		FO = 1·08 CSL	1·34
M		FO = 1·10 CSL	1·27
GNP		FO = ·96 CSL	— ·98

See note Table 1.

mainly due to the underestimation of private and government consumption expenditure. Thus, the quality of data and forecasts are inextricably related.

This tendency towards underestimation is also present in the estimates of volume growth, particularly for consumer expenditure, public authority current expenditure, and gross national product. In six out of nine years the growth in GNP has been considerably underestimated. For 1967 the FO estimate was 4·1 per cent while the actual turned out to be 5·6 per cent and so was partly responsible for the underestimation of growth in 1968. In 1968 the greatest underestimation occurred with the first estimate of the growth rate being 5·4 per cent while the latest estimate is 8·5 per cent. This, in turn, led to underestimation of the rate of expansion in 1969. Table 8 shows that the volume of GNP has been significantly underestimated with again the underestimation of consumption expenditure, both public and private, being the main cause although the volume of imports has also been subject to quite large upward revisions.

In general, one feels that part of the underestimation evidenced in the forecasts was due to preliminary data understating the final outcomes. However, the fact that the greatest underestimation occurred in forecasts of price deflators cannot be explained in this way. Table 7 shows that, in general, revisions of price deflators have been small and to a large extent appear to be random. This is borne out by Table 8 where more of the coefficients for price deflators are significantly different from unity—no matter whether all variables are taken together or individual components are tested separately.

The Forecasts for 1973

Apart from these general observations each year has its own peculiarities. It is worthwhile to look at some of the reasons for the changes made in the forecasts during 1973. The forecasts of the Institute are built up primarily around an expenditure table for GNP in current prices, with a supporting table for National Income which acts as an input into the derivation of the expenditure table and provides a consistency test of the orders of magnitude involved in that table.

The growth rate, in real terms, derives, given the GNP figure, from the price indices applied to the components of the expenditure table. Changes in the forecast growth rate result both from changes in value and in the price indices used. To date the Institute has published five forecasts for the year 1973. Even at this stage it would be very difficult to go much beyond the statement made in the first forecast in October 1972 that 1973 would be a year of very rapid growth.

It is possible, however, to pad out the picture, on the expenditure side with figures in current prices for private consumption, the external sector, and to a much lesser degree government consumption, and investment. The forecast in value terms in the December commentary is more than likely reasonably correct—requiring revision in the light of the figures in NIE (1972). In value terms GNP is likely to have risen by about 21 per cent over 1972, compared with the first forecast of 13·25 per cent in October 1972. The table below indicates the change in the pattern of the forecast in the five issues of the commentary concerned with 1973:

Percentage change over 1972

Commentary	October 1972	January 1973	April 1973	August 1973	December 1973
GNP current prices	13·25	14	15	18	20·75
GNP constant prices	5·25	5·25	5	5·75	7
GNP deflator	7·50	8·50	9·50	11·50	12·75

Strictly speaking the first two forecasts are not comparable with the remainder as subsidies received through the EEC were included in exports in the former, but not in the latter group. The growth rate of 5 given in the April commentary

is roughly equivalent to the earlier forecasts when allowance is made for this. While the table is summary in nature it does reveal a failure to forecast adequately both price and volume in 1973.

At this time (May 1974) we would be reluctant to say what the growth rate for the year was. This reluctance stems primarily from lack of data on prices in general so that the appropriate price indices cannot be applied to the components of GNP presented in the December commentary. This lack is felt most strongly in the external sector where import and export prices for the first half of 1973 have only just, within the past month, become available, at a time when we could reasonably expect the annual figures. In an appendix to the Quarterly of January 1973 it was pointed out that it is only the annual figure that has a meaning and the forecasts have to be based not on monthly figures but on the expected annual figure. In times of very rapidly rising (or falling) trade prices the monthly trend tends to overestimate the annual change. While the price figures for the first six months are staggering, particularly those for exports, the resultant growth rate does not differ very significantly from the 7 per cent given in the December QEC. We had clearly underestimated, in export prices, the price of manufactured goods due to a failure to take proper account of the effect of devaluation. Given the price rise in the export of manufactures compared with the price rise in the non-food items of the CPI it seems that exporters took foreign prices as given, in foreign currency units, and applied different pricing for goods for domestic sale.

If this is the correct interpretation then the growth, in volume terms, of manufactured exports was very much less than we had thought. Of course, the failure to forecast adequately export prices was only part of a general failure on export values. The October 1972 figure of £711 million was replaced by the December 1973 figure of £870 million for merchandise exports. Even within the broad categories, Industrial and Agricultural, the forecasts were incorrect. A substantial expected rise in the volume of exports of cattle and beef, turned into an actual 8 per cent fall in such exports. Why the forecast was wrong was explored in the August Commentary, and again in the December Commentary—the latter being a slightly better attempt to explain the failure.

It was not only, of course, the external sector that bore the brunt of under-forecasting. Private consumer expenditure was forecast rising by 10·5 per cent, 11·5 per cent, 13 per cent, 15·75 per cent and 18·75 per cent through successive issues of QEC. In large part this was due to the assumption that the Second National Wage Agreement would involve few divergences from the basic terms, proving invalid. This was not obvious until November when in the Quarterly Industrial Production figures it became clear that the agreement was being used as a basis for further negotiation. Thus, it was estimated that average wages, etc. would increase by 11 per cent in 1973 in the October 1972 QEC. By the December 1973 issue this had been revised to 15·75 per cent. The rise, in both value and volume, of retail sales in the first few months of 1973 was seen as temporary, given that average earnings were expected to rise by 11 per cent. A

correct view of the movement in earnings would have placed the growth in retail sales in a different light, and would have led to a different August issue of QEC. By that issue we were having severe difficulties with the disposition of industrial production between exports and home sales. Looked at with hindsight it seems industrial production was indeed growing by 13 per cent or so, manufactured exports increasing in volume terms very much less than we thought, but domestic consumption very much more—the latter made possible by the rapid growth in incomes. There was a further failure on consumer prices, due to an expectation that agricultural prices would not rise so rapidly in 1973, and that the operation of the Second National Pay Agreement would lead to a reduction in the rate of increase of the non-food component of CPI.

It is possible to go through the components of GNP and identify particular changes and reasons for particular changes in these components. This would obscure the general feature of the earlier forecasts—a tendency to be excessively optimistic about prices, and assumptions with regard to earnings, exports, etc. proving invalid over time. The forecasting exercise for 1973 was made more difficult given that the first forecast was prepared in 1972 at a time when it was not clear what the outcome for 1972 was likely to be. *Now* it is possible to identify the turning point in mid-1972. In October 1972 data was not available to indicate much more than the glimmering of such an upturn, and such data did not become available until well into 1973. Of course, this problem of identifying turning points is terribly important for 1974. Although on average 1973 was a year of very rapid growth it now seems clear that activity in the second half of the year showed no increase over the first. Little of the growth in 1973 can thus expect to be carried into 1974.

There is also a natural tendency towards conservatism, given the wide ranging publicity Institute forecasts receive. By the April QEC it seemed almost inevitable that the CPI would rise by a *minimum* of 9·5 per cent. Yet a forecast of that order would simply not have been believed.

Over and above these points we are now of the opinion that too great a contact with others in the field—albeit informally—militates against a truly independent forecast. It is idle to pretend that we are not influenced by contact, and this tends to give a certain uniformity to forecasts made by different bodies.

Conclusions

Finally, some reflections on the state of the art of short-term forecasting: it should be stated that forecasting errors of the type and magnitude experienced in this country are also common in other countries (see [Polonyi, 3], [Nelson, 4] for examples in the British and American economies). These occur when the level of sophistication in terms of technique and the inputs of human labour is so much greater than is the case in Ireland.

Some may feel that the logical way to improve the forecasts would be the greater use of econometrics and, in particular, the building of macro-econometric models of the economy. However, examining the experience of such models

abroad [e.g. Walsh, 5], it is not obvious that the returns to such exercises would be necessarily very large. Problems in such exercises are particularly acute in Ireland given its openness to exogenous influences and the fact that the quality and availability of data is so much inferior than in countries such as the United Kingdom and the United States. Rather, we feel that further research in the effectiveness of other forms of forecasting methods is needed before any large investment of money is undertaken. In particular, we feel the possible extension of survey methods should be considered. More important perhaps, what is needed is a change in the role performed by short-term forecasting and a much keener awareness of the degree of accuracy possible from the forecasts.

Its present role can be understood in the following terms. Assume there are n target variables in the economy $(X_1 \ldots X_n)$, n instrument variables $(Y_1, \ldots, Y_n)$, and n exogenous variables $(Z_1 \ldots, Z_n)$.

Let them be related in the following manner:

$$X = AY + BZ$$

where X, Y and Z are vectors of the various variables and A and B are vectors of reduced form coefficients. The appropriate levels of the instrument variables are then obtained from the equation

$$X^\star = AY + BZ_f$$

where Z_f is the forecasts of the levels of the exogenous variables and $X^\star$ is the desired level of the target variables. The actual level of these latter variables however will be given by

$$X_a = AY + BZ_a$$

where X_a and Z_a are the actual levels of the target and exogenous variables. Therefore

$$X_a = X^\star - BZ_f + BZ_a$$
$$\text{i.e.} \quad (X_a - X^\star) = B(Z_a - Z_f)$$

Thus, the realised values of the target variables will differ from the desired values if forecasts of exogenous variables differ from actual outcomes. It is clear that in some situations if the forecasts are sufficiently inaccurate no change in policy would yield actual values of the target variables nearer their desired levels than adjusting policy to misguided forecasts.

In Ireland the main target variable is the degree of utilisation of capacity in the economy although the general price level and the balance of payments deficit are also important. The main indicator of capacity utilisation is the forecast

growth rate in GNP. Rates of growth of between 3-5 per cent are considered as representing the long-term average growth rate of the economy. Rates outside this range, however, reflect an economy which is operating at a sluggish level of activity, or is growing at a rate which is unmaintainable over any significant period of time. Clearly, the policy implications of being on opposite sides of this average range are very different. The error in the first estimates of the growth rate have been as great as 2 and 3 per cent. The margin of error in the forecasts must, at times, be even greater than this. Considerable errors were certainly present in 1968, 1970 and 1973. It is, obviously, possible that if the economy was operating on one side of the average range, forecasts, because of errors, could conceivably reflect it operating on the other side. In such circumstances forecasting is operating in a destabilising manner. In particular, it is obvious that the forecasts in the past have reflected the economy growing at an near average rate when, in fact, actual trends in the economy were well above (or well below) average growth.

Even if perfect forecasts were available proper short-term "fine tuning" of the economy could not take place. For this to occur proper techniques for relating changes in truly instrument variables, such as tax-rates, to the level of overall economic activity in the country would have to exist, i.e. the elements of the A and B vectors would have to be known. Few or none such techniques exist in Ireland (or perhaps anywhere else). The implication of this analysis appears to be that medium-term policies should take precedence over the short-term.

The implication for short-term commentaries on the economy seems to be that less emphasis should be placed on precise quantification of future trends in the economy, though, of course, tables must be prepared to ensure consistency in this type of analysis. It should be stressed that the forecasts can, at least, indicate the general order of magnitude of movements in the economy and that reasonably wide confidence intervals should be attached to any figures produced. In these circumstances less attention should be paid to mechanical manipulation of figures and more emphasis placed on qualitative analysis of trends in the economy.

The Economic and Social Research Institute,
Dublin.

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ABBREVIATIONS USED

QEC	Quarterly Economic Commentary	$t(B=1)$	Computed t values under the hypothesis $B = 1$
C	Consumption	I	Investment
G	Government expenditure	M	Imports
X	Exports	F_j	jth estimate in QEC
FO	First official estimate (1)	DF	Department of Finance
CSI	CSO first estimate (2)	DW	Durban Watson statistic
CSL	CSO latest estimate (3)	**	Significant at 1 per cent level
R	Multiple regression statistic	*	Significant at 5 per cent level

(1) Taken from the annual "Review and Outlook"—prepared mainly by the Department of Finance.

(2) Taken from the first published "National Income and Expenditure" for each year.

(3) Taken from "National Income and Expenditure 1972", adjusted to conform with earlier definitions.