Trends in Short-Term Macroeconomic Forecasting for Demand Management

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INTRODUCTION

The aim of the paper is to provide a summary description of the methods used in the preparation, monitoring and updating of the Department of Finance's[1] macroeconomic forecasts, with particular emphasis on certain techniques employed which are still in an experimental stage. Dr Menton in his 1964 paper (1) described the eclectic method then used for short-term forecasting in the Department. Though greater recourse is now had to econometric techniques as supplementary aids, the basic

133

procedure by which the forecasts are formulated is still essentially of an informal nature.

The first part of our paper is concerned with providing an up-dated description of the short-term economic forecasting process and the second part describes the experimental work to date, aimed at developing a systematic method of reviewing the annual forecasts month by month. The statistical procedure which is used for translating the annual forecasts of certain major expenditure variables into their implicit sub-annual trends is referred to by us as "critical time-path analysis". While bearing in mind the need for more research in this area, the results to date have been of practical help in making early assessments of the likelihood of the forecasts being fulfilled.

PART I

1 *General Background*

The primary reason for the preparation of short-term macroeconomic forecasts in the Department is, of course, to provide policy-makers with a profile of economic activity over the forecast period on certain specified assumptions. Alternative lines of policy can then be considered in the light of the forecasts and appropriate remedial measures devised when these are deemed necessary.

In the past, the Department of Finance has periodically discussed prospective trends with international organisations such as the OECD and the International Monetary Fund. EEC membership has increased our responsibilities in this respect. As members of the EEC, we will be expected to present three times annually[2] successively detailed versions of an Economic Budget for Ireland, setting forth the latest macroeconomic projections combined with details of public authorities expenditure and taxation plans for the year ahead. The Economic Budgets for the various countries are then considered at a meeting of the Short-Term Economic Policy Committee (consisting of representatives from the member countries), who in turn make broad policy recommendations to be considered by the Council of Ministers.

2 *Timing*

Depending on the date of their preparation, the Department's short-term macroeconomic projections extend from about nine months up to twenty months or so ahead. The forecasting process is essentially a continuous exercise throughout the year, but for a number of reasons the starting point may be taken as the set of projections prepared prior to the annual Budget.

Subsequently, towards the end of each month when all of the main

134

monthly economic indicators have become available and have been analysed, a meeting is held between staff members of the forecasting and analysis sections of the Department. In the light of the discussion at the meeting, the current Departmental projections are re-evaluated and, if necessary, reformulated. Furthermore, alterations to the projections may be made at any stage in between the monthly meetings if special circumstances should warrant this.

3 *Some General Remarks on Methodology*

The interrelationships in a modern economy are many and complex and the various lag structures are not easily measurable. Cognisance must also be taken of the fact that political and sociological factors are closely intertwined with economic forces. All these factors magnify the difficulty of formulating a simultaneous econometric model capable of producing accurate forecasts for the short term.

The possible pitfalls in the use of econometric techniques for forecasting are dealth with at length elsewhere (2). Others caution against accepting uncritically the notion that increased technical sophistication is automatically the key to improved forecasting. Worswick (3) has remarked in his introduction to Surrey's book on the NIESR model that "there can be no doubt that the methods currently in use are distinctly more sophisticated than those of ten years ago. There is, nevertheless, room for debate on whether they have resulted in any significant improvement in predictive performance". Worswick (4) goes on to say that "the construction and operation of the econometric model is a part, but not the whole, of the process of economic forecasting. It would probably not be very fruitful to try to estimate just how much the model contributes—whether the major part or the minor part—so long as it is recognised that it is only a part, and that there is an important remainder consisting of processes which cannot, as yet or at all, be reduced to formal public procedure."

We would tend to agree with the remark of another expert in the economic forecasting field when he says: "The econometric model is not . . . a substitute for judgment, but rather serves to focus attention on the factors about which judgement must be exercised." (5).

4 *The General Forecasting Framework*

Research efforts in the Department have been directed towards developing methods of analysing and evaluating the flow of statistical information as an aid to the more traditional forecasting methods, rather than towards seeking to develop an experimental short-term simultaneous model. This is partly due to the lack of a series of quarterly national accounts estimates for Ireland which makes the satisfactory identification of lag structures difficult and reduces the likelihood of producing accurate forecasts by a model of this type. As a result of the research work within the Department, throughout the year a rigorous and systematic analysis of all relevant statistical information is carried out, using deseasonalising methods, regression analysis and relationships derived from input-output tables where appropriate.

The short-term forecasts are drawn up subject to the basic constraint that the projected components of gross national product in value terms from the incomes side must equal those components forecast separately from the expenditure side. The forecasting of national income and national expenditure components proceeds more or less simultaneously in the light of existing information and taking account of specific interrelationships between some of these components. As an additional check, a forecast of sectoral output is also prepared and this is compared with the growth rate arrived at by deflating the forecast value of gross national expenditure at current prices.

The whole forecasting process is, therefore, one of successive approximations or iterations until in the light of a number of cross-checks and interrelationships and taking into account the latest information received from the Central Statistics Office, Departmental and semi-state sources and business organisations, etc., the forecasters adjudge that the projection yields the most likely outturn, given certain important underlying assumptions.

In the initial stages of the procedure, there are some variables which play a key role in that fairly reliable information concerning them is provided at an early stage from outside sources. These are somewhat analogous to the exogenous or predetermined variables in a more formal model. They include non-agricultural employee income and those components where government decisions on expenditure and taxation are involved.

We now proceed with a summary description of the major considerations involved in forecasting the main components of the national accounts.

5 Forecasting the Income Side of National Accounts Non-Agricultural Employee Incomes

Considerable progress has been made towards constructing a system for forecasting the increases in non-agricultural employee incomes arising from the carry-over of wage awards in the preceding year and new agreements within the forecast year. The basic procedure is as follows. Numbers employed in industry are divided into five main categories, viz., the public sector, manufacturing industry, services and distribution, building and construction and a miscellaneous category. Within each of these major categories, a further breakdown exists of numbers employed which is related as far as possible to existing wage levels. The detail available in each case varies from category to category and, as might be expected, the most comprehensive breakdown is for the public sector.

For purposes of forecasting, "typical" wage or salary agreements are selected, or forecast where necessary, for each group in the employment breakdown. The procedure is facilitated somewhat by the fact that overall National Pay Agreements have been concluded in recent years. The selected increases are weighted by the number employed in each particular grouping and also by the phasing of the agreements as between different calendar years. These weighted averages are then aggregated to give an estimate for

the increase in the carry-over and new agreements components of non-agricultural employee income.

The third, and usually the smallest component, of the overall increase, i.e., "drift and increased man-hours worked", is mainly a function of the pressure of demand as reflected in the labour market and the increase in industrial production. This emerges partly from the successive iterations in the overall forecasts and partly from employment forecasts prepared in the light of the general outlook for business, including the contribution to employment of new industries.

The importance of obtaining a reliable estimate of the increase in non-agricultural employee incomes can be seen from the fact that it now constitutes about 60 per cent of total national income and is a major determinant of the level of consumption and the overall pressure of final demand. The initial forecast is kept under review in the light of wage and salary developments throughout the year and of information gleaned from the CSO "Quarterly Industrial Inquiry" and "Quarterly Inquiry on Earnings and Hours Worked in the Building and Construction Industry."

(a) *Agricultural Incomes, Profits and Net Foreign Income*

The forecast of agricultural income is arrived at by predicting the value of agricultural production and making specified adjustments to this total. An analysis of livestock numbers by category, as shown in the latest enumeration, is carried out in order to obtain an assessment of the supply position and, in addition, a survey is made of market prospects and likely agricultural price trends. When a forecast for the value of gross agricultural output, including livestock changes, is arrived at, the deduction of the estimated cost of feed, seed and fertilisers yields a figure for net output and a further deduction for predicted net operating costs and depreciation gives a forecast for total income arising in agriculture. The agricultural employee income element of this is relatively easy to deduce since it increases by a relatively small amount each year.

Throughout the entire forecasting process, informal liaison is maintained with the Department of Agriculture. The major indicators of the trend in agricultural output which become available from the CSO throughout the year are the December and June livestock enumerations, the monthly trade figures for agricultural exports, weekly cattle shipments, weekly cattle, sheep and pig slaughterings, and weekly milk deliveries at creameries. In addition, the CSO publish monthly indicators of cattle and pig prices which serve as a guide to the general trend in the agricultural price index. In national accounts terms, an additional element of a few £ million (with relatively small change from one year to another) for income from forestry and fishing is added to the agricultural incomes total.

Approximately half of the non-agricultural "profits" category relates to trading profits of companies. The remainder consists of professional earnings, interest, and income from land and buildings. Although data constraints and lags in publication of data give rise to difficulties in forecasting profits this category is, generally speaking, positively related to the overall trend in industrial production and the degree of capacity

137

utilisation. The emigrants' remittances and other net foreign income categories, on existing definitions, generally show a relatively small annual increase, except when exceptional factors intervene. The total of these items corresponds to the net factor income category on the expenditure side of the national accounts. Finally, the adjustment for stock appreciation which is made to the above income figures to arrive at National Income represents that portion of the change in the value of non-agricultural stocks attributable to price changes alone.

(b) *Provision for Depreciation and Taxes on Expenditure less Subsidies*

In order to arrive at a forecast estimate of Gross National Product at market prices, two further adjustments, for depreciation and taxes on expenditure less subsidies, are made to total National Income. The increase in the forecast for depreciation has, on average, shown a small but steady annual tendency to rise, so that a trend rate of increase is used to estimate it, with due allowance for the effect of periods of heavy investment.

The main items under the taxes on expenditure heading are value-added tax, customs and excise duties, motor vehicle duties, stamp duties, local authority rates, and some minor charges and fees. Forecasts of the central government taxes are obtained periodically from the Revenue Commissioners who have due regard to such factors as elasticities with respect to income and expenditure in preparing their estimates. The main central government subsidies are the agricultural subsidies, subsidies to CIE, new house grants, and grants to a number of State boards. Expenditure on these in the current year is monitored through monthly control returns. Forecasts of expenditure are obtained from forecast estimates, when these are to hand, or by enquiries from the appropriate sections in the Department of Finance. The main local authority subsidy is the deficit on the local authorities, housing accounts; this is estimated in consultation with the Department of Local Government.

6 *Forecasting Components of Expenditure on Gross National Product*
Personal Consumer Expenditure

Background information on consumption trends is provided by a thorough analysis of movements in the monthly retail sales index in the recent past. In addition, monthly data on new cars registered is a helpful indicator of trends in consumer durable expenditure, and from monthly trade statistics a breakdown of trends in individual categories of consumer goods can be derived.

Once the data on past trends in consumer expenditure have been processed, a general view is formed of how consumer expenditure will proceed during the forecast year ahead. In arriving at this estimate, the forecast increase in incomes is related to the rise in consumer expenditure. None of the experimental econometric relationships which have been tried to date in the Department can be considered fully satisfactory from a forecasting point of view, but they serve as a starting point in the process. Following theoretical and empirical work by Friedman (6) and others, the tendency is to consider consumer durables and non-durables separately.

138

Indeed, as Evans (7) points out, the determinants of purchases of consumer durables are considerably different from those of other consumer goods. In the case of non-durables, habit persistence or irreversibility of consumption patterns is encountered, whereas purchases of consumer durables are sporadic and the level of previous purchases of durables tends to have a negative rather than a positive effect on present purchases.[3]

Evans (8) sees the empirical evidence as favouring Friedman's permanent income hypothesis rather than the relative income (9) or life-cycle hypotheses (10) and he considers that, owing to the severe statistical problems of multicollinearity and serial correlation generally present, it is preferable to formulate the non-durable consumption equation in ratio form and use a weighted average of lagged consumption. Generally, a Koyck transformation is used for simplifying the lag structure of the permanent income formulation.

With existing data limitations, an equation of the general form,

$$C_{nd} = f(Y, C_{nd-i})$$

where C_{nd} = the value of non-durable consumer goods,

Y = Personal Disposable Income, and

C_{nd-i} = lagged consumption, where i is the time-period involved,

probably yields the best results. When personal disposable income is disaggregated into agricultural income, non-agricultural employee income, and profits, in order to take the functional distribution of income into account, there are indications that the short-run marginal propensity to consume out of agricultural income and non-agricultural profits is quite low (11). This accords with the results obtained from the short-term model of the Netherlands Central Plan Bureau (12) where the consumption function is estimated in current, rather than in constant, terms. The most appropriate equation for non-durable consumer goods is likely to include, in addition, a proxy for the existing stock of consumer durables (with a negative sign) and possibly a variable for consumer credit outstanding (with a positive sign).[4]

Gross Domestic Fixed Capital Formation

At present rougly 50 per cent of investment is financed from the public sector,[5] either directly or through the operations of semi-state bodies.

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[3] It is also relevant to note that although it may be considered that consumer durables bear a resemblance to investment goods in a number of respects, the lag which occurs, in the case of investment goods, between the increase in income and their purchase is normally not present for consumer durables.

[4] The EEC Commission are considering the feasibility of carrying out surveys of consumer attitudes a number of times a year in conjunction with the ESRI and, if this should prove feasible, some additional information of help to forecasters may become available.

[5] For example, between 1967 and 1971 total public investment (including capital grants by the IDA and loans, etc. by the ICC and ACC) accounted, on average, for 49·3 per cent of gross domestic fixed capital formation. In individual years within this period, the percentage varied between 47 per cent and 51½ per cent of fixed capital formation.

Also, the grants and loans channelled through these semi-state bodies influence a significant amount of private investment. Once the level of the public capital programme is fixed, therefore, much of the forecasting effort is directed towards ascertaining investment plans in the private sector and taking account of any unusual factors which might inflate or depress the overall investment total in a given year.

Useful prior information on investment by foreign companies and its overall pattern is obtainable from the Industrial Development Authority. In addition, plans for the purchase of costly items of transport equipment are ascertained in advance from Aer Lingus, Irish Shipping and B and I, so that the investment total can be adjusted to take account of any unusually large "bunching" of such investment in a given year. The remainder of business investment is influenced by such factors as the level of capacity utilisation, the previously-existing level of demand, both internal and external, and future prospects for business in general. In this connection, the quarterly CII/ESRI industrial surveys are taken account of in assessing the general trend of business intentions. Further relevant information on the broad trend of capital formation is obtained from the monthly and quarterly statistics on imports of capital goods. Government expenditure plans are also of paramount importance to the level of activity in residential construction. Dwellings account for up to one-fifth of total gross domestic fixed capital formation and approximately half the cost of dwellings (including loans, subsidies, etc.) is financed directly or indirectly by public authorities. A further quarter is financed by building societies and insurance companies (13). The miscellaneous category described as "other building and construction" in table A.12 in the "National Income and Expenditure" booklet accounts for about one-third of capital formation and at least one-third of this is financed by public authorities.

Public Authorities Net Current Expenditure on Goods and Services

Two alternative estimation methods are used. In the first method, an estimate is made of the likely volume increase in total public consumption in view of recent trends and future needs. Remuneration constitutes about 80 per cent of the total and it is assumed to increase at the same rate as forecast general non-agricultural employee remuneration, excluding the allowance for drift in the latter. The remaining non-remuneration component of public consumption is assumed to increase at a rate given by a weighted[6] average of consumer prices and capital goods prices. The second method uses actual data for the central government sector, as prepared prior to the Budget each year and published in the "National Accounts Classification of the Budget", updated by known changes as shown in internal monthly control returns. Consumption expenditure by local authorities is estimated by means of a regression equation linking it with the figure already derived for the central government sector. The results yielded by the two different approaches are then reconciled on the basis of a statistical procedure evolved as a result of previous estimation work in this area.

[*] The weights used are $\frac{2}{3}$ for consumer prices and $\frac{1}{3}$ for capital goods prices.

Changes in Stocks

International experience suggests that stockbuilding (or inventory investment) follows a highly variable pattern which is difficult to predict with any degree of accuracy. The problem is compounded by the fact that statisticians also admit to severe measurement difficulties in this area.

On a theoretical level, the early work of Metzler (14), which represented inventory investment as being a function of the difference between desired and actual stocks, has been extended to include more complex stock adjustment mechanisms. Empirical work suggests that, with appropriate lags, sales levels and existing stocks are useful explanatory variables, but that monetary variables are not. For estimation purposes, disaggregation of industrial stocks between manufacturing and non-manufacturing is desirable from a theoretical point of view. Geary's (16) conclusions from a recent pilot quarterly inquiry into non-agricultural stock statistics point to the feasibility of conducting such inquiries on a regular basis. The variability of annual changes in agricultural stocks can also be quite significant because of the cyclical nature of livestock production.

Imports of Goods and Services

Imports of goods and services constitute a leakage from the circular flow of income in the domestic economy and represent that part of final demand which is not met from home production. Generally speaking, therefore, the level of imports is determined by the size of the principal components of national expenditure, the level of domestic activity, and other factors such as the competitiveness of domestically-produced goods and the degree of capacity utilisation.

An independent forecast of merchandise imports, based on recent trends, is made by sub-dividing imports into their three main components, i.e., consumer goods ready for use, raw materials for further production and capital goods. With regard to consumer imports, as incomes rise there tends to be a demand for a wider variety of consumer goods, some of which are either not produced domestically or not at the desired quality level. The chief explanatory variables which one would expect to be associated with movements in consumer imports are trends in either disposable income or consumer expenditure, relative prices, and variables to take account of any freer trading arrangements or increased obstacles to trade. Imports of capital goods are, of course, closely associated with the level of investment activity in a small economy such as ours and in particular with investment in equipment for manufacturing industry. Imports of raw materials are also closely associated with trends in the level of industrial activity and are also affected by alterations in the various obstacles to trade.

Experimental work (16) using input-output tables to generate the volume of import requirements as a result of changes in the components of real final demand has had only moderate success as a predictive device. Nevertheless, the approach is useful for linking the volume of imports to the overall level of demand during the iterative process, especially since

141

it enables the different import intensities of major items of expenditure to be taken into account.

The following table derived from the 1968 input-output table shows the average import coefficients for the major categories of final demand. It can be seen that the import intensity of investment is by far the highest, with that of exports, personal consumption and government current expenditure following in that order.

TABLE 1
Average import content of final demand*

Import Category	Personal Consumption (including Tourism)	Final Demand Components Exports of Goods and Services (excluding Tourism)	Government Current Expenditure	Final Investment
Competitive	0·1487	0·1424	0·0587	0·2571
Complementary	0·1189	0·1601	0·0432	0·2197
Total (Average) Coefficients	0·2676	0·3025	0·1019	0·4718

*A recent ESRI paper (November, 1972) by E. W. Henry, entitled 'Irish Input-Output Structures 1964 and 1968'', also gives these import content coefficients for the various categories of final demand.

The chief limitations of this approach as a predictive tool are that the structure of the economy may have altered since the imput-output tables were prepared and that the coefficients may change significantly in periods of rapidly rising income and movement towards freer trade.

The forecast of invisible imports gives rise to little difficulty as they tend to increase by a relatively small amount annually, chiefly as a result of additional expenditure abroad on tourism.

Exports

The problems involved in the accurate prediction of export levels stem largely from uncertainty regarding the pattern of demand trends in external markets. These trends in demand are mainly influenced by movements in income levels, though, of course, relative price movements, changes in taste, etc., are also important determinants. Despite the gradual diversification of Irish export markets over the years, approximately 60 per cent of merchandise exports is still exported to the UK with 10 per cent going to the US and 17 per cent to the original six EEC member countries.

At the very least, a disaggregation of exports into broad categories is necessary for forecasting purposes. Merchandise exports are forecast under the broad headings of live cattle and beef, other agricultural products,

Shannon industrial exports, exports of ore and minerals, transport equipment and general industrial exports.

Live cattle and beef exports are taken together as they are alternative means of exporting the same basic product. Under present conditions of world beef shortage and rapidly rising prices, domestic supply conditions constitute the major constraint on the level of cattle and beef exports. The initial forecasts are based on estimates of the stock of exportable cattle at the beginning of the year and the likely movement in cattle prices during the year.

Direct information on prospective industrial exports from Shannon is obtainable periodically from SFADCO. Information on the outlook for exports of ore and minerals and transport equipment is also available directly from the companies concerned. The trend in the "general industrial exports" group, which comprises the bulk of industrial exports, is forecast after an analysis of the recent export performance under each major category.

Following the pioneering work of Rhomberg (17), the OECD (18), and others, recent work[7] in forecasting exports concentrates on taking individual countries' import projections and allocating these as exports from other countries on the basis of a model which contains coefficients showing the manner in which an increase in imports into any country is shared amongst its main suppliers. In this context, it is of interest that Baker (19) found that Irish manufactured exports to the UK were highly dependent on the behaviour of total UK imports of manufactured goods, which are forecast at intervals by the NIESR.

Tourist Earnings and Other Service Exports

Tourist earnings are by far the most important single item in the exports of services category. In preparing a forecast of tourist earnings, recent trends in the number of tourists by country of origin (i.e., broken down as between Britain, North America, Continental Europe, other areas, Northern Ireland day-visitors and visitors for more than one day) are analysed and projected. Account is taken of the repercussions of events such as the political disturbances in Northern Ireland and recent changes in exchange parities. Direct information is obtained from major tourist agencies, airlines and shipping lines on forward bookings and expected passenger numbers. Average expenditure per head, taking account of expected price increases and other factors, is then projected for each category and a total figure for tourist revenue is arrived at. The projections are revised according as information on tourist numbers becomes available throughout the year.

The other significant items under the exports of services category are international freight receipts and earnings from transportation. Changes in receipts under these headings are related to the level of trade and passenger movement.

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[7] The EEC Commission are working on a market-share type model to forecast intra-EEC trade and this should be of some assistance in forecasting exports in future.

Net Factor Income

Under present definitions, net earnings under this category show a small rise each year, except in years when exceptional factors intervene such as exchange parity alterations or larger than normal movements in investment income. In the longer term, the changes in this item are likely to become negative as the inflow of emigrants remittances and pensions may tend to show a relative decline and the outflow of returns to external investment could tend to increase relative to the inflow under the particular headong.

Prices

In projecting the future trend of consumer prices, account is taken of significant price rises known to be in the pipeline, of the impact of past and future increases in indirect taxation, of the level of wage and salary increases taking place, and of the expectations of certain international organisations regarding the future course of prices in other countires, especially agricultural prices in Ireland's main export markets.

In trying to forecast changes in domestic prices, econometricians generally rely on the type of equation in which prices are proportional to variable costs (i.e., the markup equation), modified to take account of the effect of changes in ouput. Generally, these equations include changes in unit wage costs, import prices, and capacity utilisation among the explanatory variables. As part of the Departmental forecasting exercise, a variant of Geary's (20) input-output method of forecasting prices is used to determine whether projected consumer price increases are consistent with the remainder of the marcroeconomic projections. This approach is basically designed to estimate the contribution of changes in the prices of primary inputs to changes in consumer prices. Primary inputs consists of imports, indirect taxes (including local authority rates), subsidies, wages, salaries and pensions, profits and depreciation. The primary input requirement for each category of final household demand is obtained from the matrix of total primary input requirements. The resulting figures are then multiplied by the forecast price increase for the relevant primary input and totalled. Following Geary's methodology, an adjustment to the percentage increases in employee incomes and profits is made by deflating them by indices of the volume changes in sectoral output in order to determine their eventual impact on prices.

As stated earlier, the main object in carrying out the exercise is to provide a consistency check and the results, though useful from a forecasting point of view, cannot be regarded as yielding anything other than approximate estimates. The following table for the years 1969-1971 shows the results yielded by this approach and also the annual average increase in the consumer price index.

The future trends of the deflators for imports and exports of invisibles are projected largely on the basis of past relationship with the consumer price index. This is true to a lesser extent of the initial forecast of the deflator for gross domestic fixed capital formation. Congdon (21) has asserted that in recent years "the strength of investment demand caused

144

TABLE 2

Primary Inputs	Percentage Contribution to Increase in Consumer Prices		
	1969	*1970*	*1971*
1. Imports	1·11	1·83	1·62
2. Indirect Taxation *Less* Subsidies (including local authority rates)	2·07	1·87	1·37
3. Total Wages, Salaries and Pensions ...	2·46	3·88	3·08
4. Profits (Agricultural and non-Agricultural)	1·66	0·01	2·26
5. Depreciation	0·81	0·30	0·55
(a) Total increase per input-output method	8·11	7·89	8·88
(b) Actual Consumer Price Index Increase	7·4	8·2	9·0

capital-goods prices to outpace consumer goods prices, an unparalleled occurrence in recent economic history". Recent international trends of this nature are borne in mind when projecting the trend of the capital goods deflator. Monthly information on trends in the capital formation component of the wholesale price index is available and the forecast is modified, as appropriate, in the light of this. Merchandise import price projections take account of trends in the prices of the major components of international trade as projected by international organisations and certain specialist research institutes. In view of the fact that a substantial proportion of merchandise exports is agricultural in origin, an appraisal is made of the likely evolution of agricultural prices in external markets in arriving at a forecast of the increase in merchandise export prices.

Monetary Policy

In the preparation and subsequent reviews of the forecasts, the implciations for economic activity of the particular credit policy being pursued are analysed. Two main routes through which credit policy impinges on the economy at large are consumer and investment expenditure.

7 Forecasts of the Volume of Sectoral Output

As stated earlier in the paper, a forecast of the increase in the volume of sectoral output is used as a further consistency check on the overall growth projection from the expenditure side. Very briefly, the sectoral forecasts are arrived at as follows:

(a) the forecasts of net output in agriculture at current prices can be transformed into forecasts of sectoral output at constant prices by adjusting for certain costs and subsidies and by using appropriate deflators.

(b) the rise in output in the industrial sector is forecast under a number

145

of main headings[8] which are then weighted and totalled to give the overall industrial contribution to growth.

(c) Output in the services industry, in this country as elsewhere, has given rise to problems of measurement. The best which can be done is to forecast it by means of its statistical relationship with the overall level of economic activity in the past. This forecast is reviewed during the course of the year in the light of the situation in the tourist industry, trends in public employment, etc.

PART II

8 *Monitoring the Projections: Research on a Key Economic Indicators Programme*

A major part of our analytical work is directed towards the continual monitoring of the projections, using relevant monthly and quarterly data relating to key areas of the economy to determine whether the projected annual percentage change estimates are likely to be attained. Towards this end, we have conducted research into the development of a Key Economic Indicators programme which, as the name suggests, involves the use of particular economic series to highlight the trend of activity in the various areas. These indicators refer to the forecast expenditure components as they appear in the projections and provide an indication of the likelihood of the annual forecasts being realised, based on monthly or quarterly data for the current year.

In the selection of key economic indicators, there have been three major considerations. First, since there exist many more monthly and quarterly series relating to the components of expenditure on GNP than to the output or income side, the key economic indicators system has concentrated on growth as seen from the expenditure side. However, trends in other crucial variables such as employment and production are monitored closely to provide cross-checks for the conclusions drawn from the analysis of expenditure data.

Secondly, as regards expenditure on GNP, there are some components for which we have monthly or quarterly equivalent series, such as merchandise trade. However, for many of the components, there are no monthly or quarterly series directly comparable to the national expenditure aggregates. In these instances, certain proxy variables have been selected as key economic indicators. These indicators are selected as a result of tests of past statistical relationships between the variables and the respective national expenditure aggregates; some are inevitably more accurate and,

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[8] The following is the breakdown of industrial activity with approximate weightings:

	Weighting in overall industrial sector
1 Transportable good Industries	0·75
2 Building and Construction	0·10
3 Electricity, Gas and Water	0·07
4 Local authorities and Government Departments etc.	0·06
5 Residual industrial activity	0·02

hence, more reliable predictors of the annual outturn in the particular sector than others.

Thirdly, since we are concerned with monitoring intra-year movements in the relevant series, there is an obvious need for adjustment for seasonal influences. In our own work, we have used a seasonal adjustment programme developed within the US Bureau of the Census, the X-11 variant of Method II[9], based essentially on the ratio-to-moving-average method with important modifications. For forecasting purposes, seasonally adjusted data, in a sense, frees us from the biases implicit in the use of same-month-year-ago analyses; among the most obvious and intractable of these biases is the fact that, while the percentage change from year to year eliminates most seasonal influences, it cannot isolate and factor out irregularities in the base year data. Moreover, for those series where recurrent shifts in seasonal influences are evidenced, the X-11 seasonal adjustment programme estimates the extent of shifts in seasonal influences in the past and incorporates this element into the seasonal factors extrapolated into the current year.

9 Constraints and Criteria

In general, there are several constraints which operate in the formulation of a system of key economic indicators, as well as in the selection of the individual indicators. First, such a system should incorporate a sufficiently large number of indicators to permit a comprehensive portrait of overall economic activity, yet small enough to be easily assimilated. Secondly, while the overall objective of such a system is to develop quantifiable threshold values and permissible ranges of deviation for the various key economic indicators, one must avoid a framework which would appear to be too mechanistic. The general problem here is one common to all systems which attempt to moniter trends in the major economic aggregates, namely, that the system can all too easily be trapped in a rather static dimension if we refer exclusively to point estimates, rather than relating to trends within the forecast year which entail an additional dynamic element. Thirdly, while several of the series which we deal with are reliable and seldom subject to revision, others must be treated with more circumspection; to adopt a rigid approach to the operation of a key economic indicators system would confer a wholly unwarranted aura of accuracy to the data used. For these reasons, while the recommendations provided by the system are taken into account in the making of decisions as regards the projections, action will not automatically follow such indications; the profiles of the components of expenditure produced by reference to the key economic indicators are compared with the respective profiles produced by reference to more conventional methods of analysis.

Beyond these general constraints, there are other criteria that relate to the selection of key indicators to reflect activity in the various areas of expenditure. Several of the more important criteria may be summarised as follows:—

[9] This programme is in fairly widespread use; since July 1972, it has been used by the OECD for all their seasonal adjustment work.

a) *Relevance and Reliability*

Statistical tests, normally in the form of regression analyses, are run to establish the extent to which movements in a key economic indicator series are associated over time with movements in the particular component of expenditure on GNP and to determine the empirical degree of understatement or overstatement involved in such a relationship.

b) *Frequency or Periodicity*

Since the key economic indicators system in its experimental stages has been geared to monitoring the assumptions made in the national accounts projections which are reviewed continually throughout the year, there has been a preference for the use of monthly rather than quarterly data! The monthly data can offer evidence of subtle changes in trend, while quarterly data often disguise the precise timing of cyclical shifts. Since at least two quarters of data are necessary to assess trends, the possible delay in the recognition of a warning signal would considerably reduce its usefulness.

c) *Publication Time Lag*

Frequently, as regards the characteristics of comparable series that could possibly serve as key indicators, there is a trade-off between the requirement for predictive accuracy and the requirement for timeliness in the receipt of the data. In some instances, series which have displayed a high degree of predictive accuracy have been passed over in favour of other series which are available almost immediately after the month to which they refer. There is obviously no fixed rule in deciding on the terms of such a trade-off.

10 *Selected Key Economic Indicators for the Components of Expenditure on GNP*

The actual indicators selected as key economic indicators may be set out as follows:

Personal Consumption Expenditure

The two series which have customarily been used in the past to reflect activity in the area of consumer spending are the retail sales index and the recently terminated turnover tax receipts series.[10] As regards their ability to reflect such activity on an annual basis, there was little difference in the degree of predictive accuracy; the correlation coefficient between the annual percentage change in turnover tax receipts and the annual percentage change in personal consumption expenditure over the period 1964-1971[11] is ·79, while that for the retail sales index relative to consumption over the same period is ·81. In terms of our research in the past, the retail sales index has been a far less erratic series on a month-to-month basis than the turnover tax receipts series; while irregular influences contribute roughly

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[10] The turnover tax receipts series fell out of official usage at the end of 1972 with the introduction of the Valued Added Tax system.

[11] The period 1964-1971 is chosen, since the turnover tax was instituted in November, 1963.

5 per cent to the average month-to-month variation in the former series, they contribute almost 20 per cent to the month-to-month variation in turnover tax receipts.[12] Hence, the monthly turnover tax receipts series had limited usefulness as regards the delineation of intra-year trends and the retail sales index was chosen as the key economic indicator for consumption.

Investment

In our research in the past, the element of expenditure for investment purposes has been broken down into its two main constituents, a) building and construction, and b) machinery and equipment.

a) Building and Construction

Measurement of activity in the building and construction sector has always been problematic. Statistics for the output of building and construction have had numerous deficiencies and are subject to widespread revisions. For example, monthly figures for local authority housing starts and completions, as well as private new houses built under State-aided schemes, become available from the Department of Local Government with a short lag; however, the gestation period of house construction may be from 6 to 12 months and it is difficult to assess the value of work in progress. Secondly, it is often difficult to translate output data into expenditure terms; there has been no fixed relationship over recent years.

The key indicator selected to reflect activity in building and construction is monthly cement sales, details of which are available within one week of the relevant month and are seldom subject to revision. These figures are supplied by the sale manufacturer of cement and actually refer to production consigned to the domestic market. Moreover, since cement cannot be stockpiled for long after it leaves the factory, the monthly figures supplied may be regarded as an adequate measure of current building activity.

As has been cited previously (22), cement sales are subject to a large measure of volatility, due to seasonal, irregular and cyclical influences. However, it is a reasonably accurate predictor of construction activity on a year-to-year basis ($r = \cdot 85$ over the period 1960-1969)[13] and we are able to make allowances for the variations in the pattern of monthly sales through the method to be explained in section 12 of this paper.

b) Machinery and Equipment

In the normal year, machinery and equipment accounts for roughly half of total fixed capital formation. Since imports of machinery and equipment constitute roughly two-thirds of the total for investment in machinery and equipment, it is used as a key indicator for this sector. Details of imports of producers' capital goods are published as part of the detailed trade figures about six weeks after the quarter to which they relate. Additionally, independent estimates for the various categories of imports can be constructed from the aggregate figures available with a

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[12] These estimates are generated as part of the seasonal adjustment of the two series over the period 1964-1971, using the X-11 variant of Method II, referred to earlier.

two-week lag; these estimates have been quite reliable and are used in lieu of CSO data until the actual official estimates become available.

Merchandise Exports and Imports

There are monthly figures available for these categories of expenditure within two weeks of the month to which they refer. The only qualification here is that trade in ships and aircraft is excluded as it tends to introduce serious discontinuities into the monthly data; similarly, Shannon trade is excluded due to the monthly fluctuations stemming from the narrow base of its export markets.

Prices

The three most important price series from the point of view of short-term forecasting in Ireland are the consumer price index, the export unit value index, and the import unit value index; these serve as implicit price deflators for personal consumption expenditure, merchandise exports, and merchandise imports, respectively.

11 Assessment of Trends in the Key Economic Indicators by Reference to Critical Time Paths

Once we are able to predict within reasonable confidence limits the relationship between the components of expenditure on GNP and the corresponding key economic indicators, we can then estimate the percentage changes in the key economic indicators which would be consistent with the respective forecasted annual outturn. The next step is to devise a method of monitoring the trends of the key economic indicators relative to expectations implicit in the national accounts projections on a month-to-month basis.

An obvious choice of methods is the use of same-period-year-ago percentage changes to eliminate most seasonal influences and to highlight shifts in trends over the course of the year. However, as suggested earlier, such a method has the serious deficiency of not being able to separate the influence of shifts in trend in the base year; in instances where the base year was marked by severe disruptions or a disjointed trend of economic activity, the results produced using such a method have little practical significance.

An alternative is to use current year data adjusted for seasonal influences on a quarter-to-quarter basis.[14] Essentially, this procedure involves calculating seasonally-adjusted quarter-to-quarter changes, translating these into annual percentage change equivalents, and then comparing these annual percentage change estimates with the anticipated or threshold values; if two consecutive quarters or two quarters out of three fall below or above relevant threshold values, then a warning signal is produced. Yet, while this method minimises the type of bias produced by reference

[13] The period 1960-1969 is chosen to avoid the distortion caused by the cement strike in 1970 and by the recovery from this strike in 1971.

[14] This system is currently in use in the Commission of the European Economic Community.

150

to base year data, it has not proved to be amenable to our needs. Assuming an average two-month lag in the receipt of the data, one would be forced to wait at least five months (or perhaps eight months) before assessing the extent of the deviation of the trend of the variables from the expected trend; in terms of the national accounts projections where month-to-month assessments are required, such a lag in the receipt of relevant data would constitute a serious handicap.

In the event, we have innovated to some extent, using information on the characteristics of each key indicator series produced by the X-11 seasonal adjustment programme. In addition to extrapolating monthly or quarterly seasonal factors and trading-day factors[15] into the current year, the programme produces estimates of trend-cycle values for all the relevant months or quarters in the period covered. This information can be used to generate expected monthly or quarterly values for the key economic indicators which are consistent with the attainment of the projected annual percentage change in the respective components of expenditure on GNP.

The procedure used to construct a critical time path may be illustrated as follows. Assume that the projections postulate an increase of X per cent in a particular component of expenditure, A; assume further a linear trend of A over the course of the current year.[16] Finally, assume a one-to-one relationship between A and its key indicator, A', hence, an annual increase of X per cent in A' would be consistent with an annual increase of X per cent in A. Given these assumptions, one must establish the precise direction of trend-cycle values (T) of A' over the twelve months of the current year which would be consistent with an annual percentage change of X per cent in A. This reduces down to solving for r in the equation

$$X = \left(\sum_{i=1}^{n} T_{12} (1+ir/12) - \sum_{i=1}^{n} T_i \right) / \sum_{i=1}^{n} T_i \qquad (1)$$

$$n = 1, 2, \ldots . 12$$

where r is the 12-month percentage change in the trend-cycle values of A' and n refers to the individual month (January=1, February=2, etc.).[17] Solving for r in equation (1), we have

$$r = \frac{2 \left(\sum_{i=1}^{n} T_i (1+X) - 12\, T_{12} \right)}{13 T_{12}} \qquad (2)$$

Thus, given an expected annual percentage change in A (i.e., X), one

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[15] An option in the X-11 programme provides for a "trading-day adjustment", based on the actual month-to-month variations in the data. Seven daily weights are estimated by regressing a series of estimated irregular influences upon the number of times each day of the week occurs in each particular month. From these seven weights, monthly factors are constructed and divided into the data to remove trading-day variation.

[16] A linear trend is assumed for the purpose of simplicity of exposition; we have, in our research work, experimented with disjoint and exponential trend lines.

[17] In equations (1) and (2), X and r are expressed as per unit changes rather than percentage changes.

151

can calculate a corresponding 12-month percentage change in the trend-cycle values of A' (i.e., r); given T_{12} (the trend-cycle value of A' in December of the previous year), one can calculate the expected trend-cycle value of A' in December of the current year (i.e., $T_{12}(1+r)$) and derive the expected trend-cycle values of A' for the intervening months by interpolation. Finally, applying the estimated current year seasonal factors and trading-day factors to the estimates for the current year trend-cycle values of A', derived by solving for r, we then have estimates for the actual monthly values of A' which are consistent with an annual increase of X and, by inference, the achievement of an annual increase of X per cent for the component of expenditure on GNP in the national accounts, A. We refer to these monthly estimates, incorporating probable monthly seasonal and trading-day influences and an implicit annual trend line, as monthly critical time path target values.[18] Comparing, then, the actual data to the critical time path monthly values gives an indication of whether or not the particular series (and, by inference, the component of expenditure on GNP) is on target.

Table 3 offers a demonstration of the use of a critical time path in analysing monthly retail sales in 1971. Assuming an annual increase of 11·0 per cent and a 12-month percentage change from the trend-cycle value of December 1970 of 6·2 per cent, the monthly target values of column (4) are generated; these are compared to the actual monthly values of column (5). As a result of the generally linear behaviour of retail sales over the course of 1971, the actual annual increase of 10·7 per cent is closely approximated throughout the year by reference to the monthly target values.

It is also important to emphasise the point that the estimate of annual increase underlying the critical time path is not crucial; within reasonable limits, the percentage deviations of the estimated values from actual values produced by reference to a wide range of annual increase estimates will point to the same general annual outturn in the particular series. Thus, for example, if the estimated underlying growth rate in Table 3 had been, say, 14 per cent rather than 11 per cent, the monthly estimates in column (4) would be higher and the percentage deviations of estimated values from actual values in column (6) would be higher, so that roughly the same estimates of annual percentage change would appear in column (7).

However, even if the postulated seasonal factors and trading-day factors are hypothetically correct and if the projected trend is an accurate assessment of the actual trend to be realised, it is probable that all the actual monthly values will deviate to some extent from the monthly critical time

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[18] The same method can be applied to quarterly data to construct quarterly critical time paths. In this instance,

$$r = \frac{\sum_{i=1}^{n} T_i (1+X) - 4 T_4}{2 \cdot 5 T_4}$$

where r is the 4-quarter percentage change in the trend-cycle values and n refers to the particular quarter (1st quarter = 1, 2nd quarter = 2, etc.).

path estimates as a result of irregular influences. Obviously, a range of feasible deviation is called for. Here again, one can utilise information generated by the X-11 programme since, as a residual output derived from the seasonal adjustment analysis, the programme produces estimates of the degree of irregular influences in each month of each year of the data (irregular in the sense of unexplained by movements in seasonal and

TABLE 3

Critical Time Path Analysis of the Trend of the Monthly Retail Sales Index over the course of 1971

Month	Trend-Cycle Estimate (1)	Seasonal Factor (2)	Trading-day Factor (3)	Critical Time Path Estimate (4)	Actual Value (5)	Deviation of Estimate from Actual (6)	Estimated Annual Percentage Increase (7)
J	130·7	·927	1·010	122·4	122		
J				122·4	122·0	1·003	10·5
F	131·3	·904	·991	117·6	116		
J-F ave.				120·0	119·0	1·008	10·0
M	132·0	·932	·996	122·5	124		
J-M ave.				120·8	120·7	1·001	10·8
A	132·7	·993	1·009	133·0	131		
J-A ave.				123·9	123·3	1·005	10·3
M	133·4	·985	·997	131·0	130		
J-M ave.				125·3	124·6	1·006	10·2
J	134·0	1·013	·994	134·9	136		
J-J ave.				126·6	126·5	1·003	10·5
J	134·7	1·059	1·011	144·2	141		
J-J ave.				129·4	128·6	1·006	10·2
A	135·4	1·000	·992	134·3	133		
J-A ave.				130·0	129·1	1·007	10·1
S	136·0	1·008	·990	135·7	135		
J-S ave.				130·6	129·8	1·007	10·1
O	136·7	·993	1·010	137·1	136		
J-O ave.				131·3	130·4	1·007	10·1
N	137·4	1·004	1·000	137·9	140		
J-N ave.				131·9	131·3	1·005	10·3
D	138·0	1·180	1·005	163·7	168		
J-D ave.				134·5	134·3	1·001	10·8

Underlying Assumptions
> a) X = 11·0 per cent.
> b) r = 6·2 per cent.
> c) Actual annual percentage change = 10·7 per cent.

Derivations and Sources
> Column (1)—Assuming an annual growth rate (X) of 11·0 per cent, the twelve-month percentage change (r) in the trend-cycle values of the retail sales index from December 1970 to December 1971 of 6·2 per cent is derived by reference to equation (2). The intermittent monthly trend-cycle values are derived by linear interpolation between these two values (cf. text).
> Columns (2) and (3)—Generated as part of the seasonal adjustment of the retail sales index over the period 1961-1970.
> Column (4)—Column (1) × column (2) × column (3).
> Column (5)—Central Statistics Office.
> Column (6)—Column (4) ÷ column (5).
> Column (7)—The January-December average estimate of column (4)—i.e., 134·5—is divided by the monthly value in column (6) and the resultant figure is then divided by the average for the base year 1970—i.e., 121·3.

153

trading-day factors and shifts in the trend-cycle series). Separating out the irregularities caused by known major disturbances (e.g., the effects of a strike, a devaluation, the imposition of a tax, etc.), the standard deviation of the irregular series over time is calculated. Using the adjusted standard deviation of the irregular element, we then calculate 95 per cent confidence limits by means of a band of feasible deviation around the critical time path (i.e., the monthly target values ± 1.96 times the standard deviation of the irregular). Thus, if an actual value falls outside the band of feasible deviation, it is judged inconsistent with the hypothesis of an X per cent annual percentage in A'. The magnitude of the band around the critical time path depends on the degree of irregularity witnessed within the series over time. Chart I provides a demonstration of the use of a band of feasible deviation for monthly retail sales in 1971, based on the values presented in Table 3.
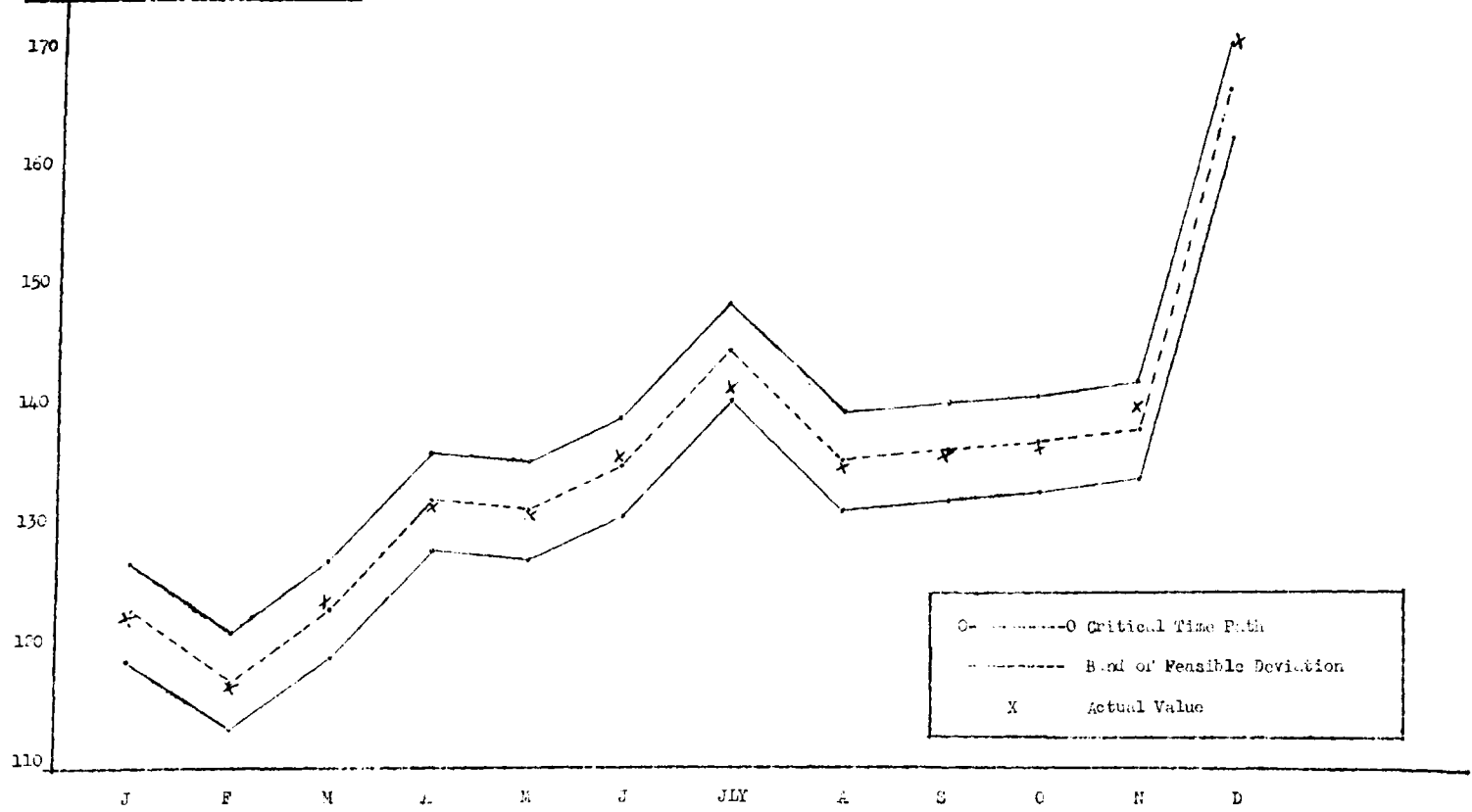
In our experimental work, we have avoided an overly-dirigiste approach towards the assessment of significant deviations from trend. If an actual monthly value falls outside the band of feasible deviation, it can be interpreted as a warning signal that the original forecast value may not be reached; however, in an area as important as the official national accounts projections, we normally await confirmation of this deviant trend in the data of subsequent months. If the series involved has displayed only a small measure of irregularity in the recent past (such as the retail sales index or the external trade price indices), we would adjust our estimates of annual trends on the basis of one or two months data; if, on the other hand, the series involved has displayed a large measure of irregularity in the recent past (such as the monthly figures for cement sales or imports of producers' capital goods), we would only adjust our estimates of annual trends after several months of data. Conversely, it is possible, for example, that several consecutive monthly values could all lie above the critical time path target values, though within the band of feasible deviation, and yet a revision might eventually appear necessary because the trend of monthly values is consistently, though marginally, higher than the original target values.

12. *A Comparison of the Predictive Accuracy of Critical Time Path Analysis relative to the Same-Period-Year-Ago Method*

For the purpose of exposition, we can concentrate on the results produced by reference to critical time paths in three important areas: the retail sales index, merchandise exports, and merchandise imports (the latter two series minus ships and aircraft, minus Shannon). The estimates for annual percentage changes derived by reference to the relationship between actual monthly values and the respective critical time path target values can be compared with those derived by reference to the conventional same-month-year-ago type of analysis.

The first difficulty faced in conducting such a comparison is to establish the criteria for deciding on the most accurate predictive method. At the outset, two such criteria appear as valid: (1) the ability to provide early and consistently close estimates of the final outturn, and (2) the ability

Chart I   Retail Sales Index, 1971

Legend:
O————————O Critical Time Path
——————— Band of Feasible Deviation
X   Actual Value

Y-axis: 110, 120, 130, 140, 150, 160, 170

X-axis: J, F, M, A, M, J, JLY, A, S, O, N, D

to provide a narrow range of deviation of the monthly estimates of annual outturn around the actual annual outturn.

Table 4 offers monthly estimates for the annual outturn in the relevant variables in 1971 provided by the two methods; the same-month-year-ago comparative method generates monthly estimates by summing the available monthly data for 1971 and dividing by the corresponding total for 1970; the critical time path method operates by dividing the projected annual figure by the cumulative percentage deviation of estimate from actual for each month and then dividing by the 1970 total. These two sets of monthly cumulative estimates for each indicator are then compared with the respective actual annual outturn (i.e., the cumulative January-December same-period-year-ago percentage change).

As a measure of a particular method's ability to provide early indications

TABLE 4

Monthly Estimates of the Annual Percentage Change of Merchandise Exports, Merchandise Imports and the Retail Sales Index, Produced by Reference to the Same-Period Year-Ago Method and the Critical Time Path Method, 1971

Period	Imports		Exports		Retail Sales Index	
	Same-Period-Year-Ago	Critical Time Path	Same-Period-Year-Ago	Critical Time Path	Same-Period-Year-Ago	Critical Time Path
January	15·7	11·8	15·7	20·7	13·0	10·5
January-February	15·3	11·2	11·6	17·9	11·2	10·0
January-March	20·7	13·3	15·9	18·3	10·4	10·8
January-April	17·3	11·7	14·4	16·8	9·3	10·3
January-May	17·0	12·3	14·0	17·4	10·5	10·2
January-June	16·3	11·7	17·8	19·3	11·5	10·5
January-July	15·3	11·2	18·1	18·3	11·8	10·2
January-August ...	14·3	11·0	17·7	17·8	11·8	10·1
January-September ...	13·4	10·8	17·1	17·2	11·3	10·1
January-October ...	11·7	10·9	15·3	15·6	10·9	10·1
January-November ...	11·1	10·8	14·9	14·9	10·8	10·3
January-December ...	10·2	10·3	17·1	17·0	10·7	10·8
Average	14·9	11·4	15·8	17·6	11·1	10·3
Actual Annual Percentage Change	10·2%		17·1%		10·7%	
Standard Deviation of Monthly Estimates Relative to Annual Outturn	5·45	1·44	2·20	1·56	0·96	0·45

of the actual annual outturn in a series, one may rather arbitrarily adopt the criterion of two consecutive monthly estimates within 10 per cent of the actual figure for the year. On this basis, Table 4 indicates that in the area of imports, the critical time path technique provides two consecutive estimates within 10 per cent of the actual annual figure by August, while the same-period-year-ago method only fulfils this requirement in December;

in the area of exports, early accurate estimates are provided by the critical time path technique by March, while the same-period-year-ago estimates provide two such values by July; and finally, in the area of the retail sales index, the "early warning" criterion is fulfiled by the critical time path method by February and by the same-period-year-ago method by March.

As regards the second criterion—i.e., the ability to provide a narrow range of deviation of the monthly estimates around the actual annual outturn,—Table 4 suggests that the standard deviation of the monthly estimates from the actual annual outturn produced by the critical time path method is significantly lower for all three series than those produced by the year-on-year comparative method. The difference is striking in the case of imports; the reason for this is that imports rose over the course of 1970 and levelled out at the beginning of and throughout 1971. The year-on-year comparative method would portray relatively high percentage changes in the early months of 1971 and consistently declining percentages over the remainder of the year; the critical time path technique, on the other hand, is not prone to such mis-interpretations.

We can extend our testing to cover the period 1963-1971; Table 5 summarises the results.[19] One observes that, in every case, the critical time path technique produces lower standard deviations of monthly estimates from annual outturn than those produced by reference to the same-period-year-ago method. The reason for this should be made clear. In essence, any piece of data can be broken down into 3 component parts—trend-cycle, seasonal element and irregular element (the latter playing the role, once again, of residual claimant). The change in a particular series from a given month in a given year to the same month in the following year may be explained by reference to one or more of the following influences:

1) a change in the underlying trend-cycle values,
2) a shift of seasonal influences,
3) a shift in the composition or significance of trading days,
4) irregular influences in the data of the base year, or
5) irregular influences in the data of the current year.

The tests for predictive accuracy involve the ability of a particular method to isolate (1). While the same-period-year-ago method produces percentage change figures which incorporate any or all of these elements, it is incapable of isolating them. The critical time path technique, on the other hand, attempts to factor out the influence of (2), (3) and (4); hence, the monthly estimates of prospective annual outturn produced by the latter method are influenced only by (1) and (5). In a series which is statistically "well-behaved" and in a year marked by few irregularities, it will obviously provide a highly accurate assessment of trends and shifts in trends.

[19] The tests as to predictive accuracy in Table 5 are biased to the extent that the critical time paths used are based on the actual annual percentage change for the particular series over the period 1963-1971. Obviously, we cannot assume such prescience in our forecasting towards the beginning of each year. However, regardless of the annual percentage change assumed, the deviations of monthly estimates from the actual values will normally dictate roughly the same annual percentage change.

TABLE 5

Standard Deviations of Monthly Estimates from Annual Outturn in Percentage Changes from Merchandise Exports, Merchandise Imports and the Retail Sales Index, Produced by Reference to the Same-Period-Year-Ago Method and the Critical Time Path Method, 1963-1971

Year				Imports		Exports		Retail Sales Index	
				Same-Period-Year-Ago	Critical Time Path	Same-Period-Year-Ago	Critical Time Path	Same-Period-Year-Ago	Critical Time Path
1963	...	...	...	4·67	3·06	6·67	3·09	1·10	0·69
1964	...	...	...	9·67	2·45	11·37	5·82	0·62	0·35
1965	...	...	...	4·74	2·42	7·71	2·89	3·04	0·94
1966	...	...	...	5·97	4·40	3·40	3·32	1·97	1·15
1967	...	...	...	10·77	2·05	2·80	0·98	1·24	0·38
1968	...	...	...	7·60	2·96	2·51	2·04	1·93	0·55
1969	...	...	...	4·76	2·54	4·18	3·56	1·55	1·15
1970	...	...	...	3·51	1·14	5·69	1·23	2·69	1·07
1971	...	...	...	5·45	1·44	2·20	1·56	0·96	0·45

13. Future Research

It is important to stress the fact that, up to the present, the character of our work on a system of key economic indicators has been purely experimental. For the moment, the primary use of the system is to serve as a means of improving our internal short-term forecasting procedure by helping to alert us to likely deviations from the forecasts at an early stage.

However, from a longer-term perspective, it is possible that the Key Economic Indicators project may be of use in the context of an Early Warning Indicators system, envisaged in the Third Programme for Economic and Social Development (23). There have been several precedents in this area, notably the system developed by the French in their Fifth Plan (1966-1970) and by the Commission of the European Economic Community over the past few years; in addition, the Americans have sought for a long time to make such a system operational. All of these exercises are run on the same general line of establishing threshold values, based on empirically tested relationships in the past, and projecting values consistent with stable growth in the future for the major areas of economic activity.

The conversion from a system of Key Economic Indicators to a system of Early Warning Indicators will involve extensive research and refinements in the future. In particular, the data constraints elaborated in Section 9 of this paper still obtain; these must be overcome before a credible system emerges and is integrated into the policy-making area. Moreover, we would have to extend our analysis to include the output side of GNP growth, as the elements of production and employment could not logically be omitted from such an exercise. However, such a system remains the ultimate goal of our research work in this area.

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DISCUSSION

Mr Thomas O'Connell: I have great pleasure in seconding the vote of thanks to the authors for their interesting paper. I don't think anyone can disagree with the authors' view that there are two sides to short-term forecasting, (1) the informal approach and (2) the set of formal statistical techniques available to the forecaster. It is probably fair to say that the former is more generally used than any formal model, which is better

regarded as a consistency check for the forecasts. This would appear to be specially necessary in the Irish context at the present juncture, when so many new developments with economic repercussions are upon us. Indeed, in a recent paper, Professor Phelps Brown has drawn attention to the fact that many policy makers do not trust the systems fitted by econometricians to establish relations and coefficients on which to base policy. To a certain degree, each year has its own personality and therefore the usefulness of statistical techniques applied to past behaviour may be of limited use. Phelps Brown regards direction observation and sample surveys of economic agents as a more fruitful means of obtaining answers to many of the problems met by forecasters.

There are not a great many points on which one might take issue with the authors. With regard to the first part of the paper, there are a number of observation that I might make. The most important aggregate on the incomes side of the National Accounts is non-agricultural employee incomes. While the forecasting of this item has been faciliated by the National Wage Agreements, there are still quite large gaps to be plugged. We have not found the correlation between increases in non-agricultural employee incomes and those suggested by the wage agreements to be as strong as might be expected. More research into *typical* wage agreements and their linkages with agreements entered into by other workers will be necessary.

On the expenditure side of the Accounts, the authors overemphasise, perhaps, the extent to which Irish exports depend on demand trends in external markets. One has heard it said that the major determinant of growth in Irish industrial exports is the willingness to seek out foreign markets. We are such marginal suppliers that it seems unlikely that small changes in demand conditions abroad are of very great significance for our exports. Given reasonable prices and adequate quality, the market will probably take as much as we supply.

The growth of output by sector poses great difficulties for forecasters. It is for this reason, perhaps, that the authors have treated the output side rather cursorily. Industrial output is best dealt with by keeping one's "ear to the ground" and trying to detect changes in trend. Very little is known about the services sector, which constitutes about half of total output. The simple correlation between the output of industry and that of services is quite low, and some tentative Input-Output calculations do not give a very different picture.

We must be grateful to the authors for the additional forecasting aid that they have constructed from the X-11 seasonal adjustment programme. While the year-on-year change in a raw series is a very crude method of monitoring forecasts, at the same time there is no guarantee that the components of the time-series factored out are the correct ones, and that therefore the procedure proposed by the authors is much superior. Notwithstanding that, however, there can be little doubt that the technique is a significant improvement in the monitoring of forecasts, recognising that there are no one hundred per cent correct methods.

Mr S. Cromien: I would like to join with previous speakers in congratulating Mr Cavanagh and Dr Mooney on their excellent paper. As a colleague of theirs in the Department of Finance, I am aware of the amount of time and thought which they have devoted to the paper over a number of months. Its excellence is a tribute to their industry. Dr Brendan Menton, who had hoped to be present this evening, has unfortunately been called to an urgent meeting in Brussels but he asked me to convey his congratulations also.

It has often struck me that short-term economic forecasting is a peculiar way to earn a living. Forecasting is an unusual, if not unique, career in that one's efforts are inevitably doomed to failure. The simple truth—which we must always bear in mind even in the excitement of preparing neat, carefully balanced rows of figures—is that the future cannot in fact be foretold. One would require the gifts of an Old Testament prophet or a Merlin, or even a Cassandra, to say exactly what the rise in personal consumer expenditure or the deflator for imports of capital goods will be in the year ahead. (As an aside I may say that if we had these gifts we would be more likely to be found in the casino at Monte Carlo than in the Department of Finance.) Being merely ordinary mortals, we must expect our figures to be frequently wrong. It would be a remarkable coincidence, measured in astronomical odds, if more than a handful of the figures turned out to be exactly right when compared with the Central Statistics Office's final outturn.

Why then bother to do projections? The reason is that, while we cannot expect to be exactly right, we always hope that we will not be far wrong. It is not necessary for the projections to be mathematically accurate to be useful for demand management purposes—and we must always bear in mind that it is for these practical purposes they are prepared.

In this connection, Mr Baker's question regarding publishing the Department of Finance forecasts is relevant. If publication were to be decided upon, it would be desirable that the interested public should be clear on the point that the projections claim to be no more than a series of integrated guesses, each subject to an acceptable variation; they can be subject to a margin of error and still be valuable for political decisions. One might say—to vary my earlier remark—they do not have to be right, as long as they are reasonable.

Mr Baker also asked about certain parts of the paper where the lecturers glided rather quickly over their methods. I suspect that the areas he has in mind are those where there is necessarily a strong reliance on the intangible quality of intuition. It is difficult to describe the method by which this important quality is brought to bear in the details of a projection. All that can be said is that it is there and that it is largely responsible for the success or failure of the projection. Perhaps this intuition itself is a sub-form of the prophetic craft of the Merlins and the Cassandras, something which emerges when a person has worked over a period on analysing past and current trends till, as Milton put it,

> ". . . Old experience do attain
> to something of prophetic strain".

161