

FORECASTING INDUSTRIAL PERFORMANCE

The first issue of the Fraser of Allander Institute's Quarterly Economic Commentary (July 1975) contained a special article which outlined the problems likely to beset any attempt to construct a forecasting model of the Scottish economy. The intention of this article is to review recent progress in the development of such a model and to comment on some of the most recent results which could be used to generate forecasts of industrial output.

The initial article on regional forecasting pointed out that there are both theoretical and empirical difficulties in the construction of a regional econometric model. At the theoretical level one must decide to what extent the model is to operate as a 'satellite' to a larger, national system. Further, one has to determine which national income identity (if any) one should use as the basis for the model. Typically, national models in the Keynesian tradition are based on an expenditure identity, where components of expenditure such as consumption investment etc. are determined by a set of behavioural relationships.

At the empirical level, it was argued that relevant regional data series tend to be either completely unavailable or too short and too infrequent. This leads to difficulties in both model specification and estimation and to overdue reliance on the use of 'proxy' variables. However, there have been a number of advances recently in the provision of statistics on the Scottish economy which can substantially assist in the resolution of the theoretical problems mentioned above.

Firstly, the Development of Employment recently (DOE Gazette August 1976) published continuous estimates of employees in employment over the period 1965-1975. Before these became available, there were a number of discontinuities in the employment series such as the changeover in 1969 to the 1968 SIC classification and the change in 1971 from the National Insurance card count to the annual censuses of employment.

Secondly, the Scottish Economic Planning Department have compiled an index of industrial production for Scotland. This gives a detailed breakdown on a quarterly basis of movements in the volume of output in different industries. Further, this index, which begins in 1970, has been linked to the old index which was discontinued in 1971 (Scottish Economic Bulletin, Summer 1977) to provide annual indices which go back, for most industries, to 1948

Thirdly, the Fraser of Allander Institute, along with Scottish Council Research Institute and IBM United Kingdom Scientific Centre, has just completed the Scottish Input-Output Project which gives a detailed breakdown, for the first time, of linkages within Scottish industry and of trade between Scotland and the rest of world. (Fraser of Allander Institute Quarterly Economic Commentary, July 1977).

These data have substantially increased our knowledge of the Scottish economy. Further, since data availability is always a binding constraint on the building of statistical models, these additions to our knowledge strongly suggest that any econometric modelling of the Scottish economy should be output based rather than, say, expenditure based. This, in itself, may be no bad thing. What British economic experience over the last twenty years above all, suggests, is that short-term manipulation of the components of aggregate expenditure is not, in itself, a sufficient policy to establish a faster rate of growth, lower unemployment, lower inflation etc. - indeed, it may not even be necessary. Concomitant with the attention which has been accorded to the categories of expenditure has been the relative neglect of the study of movements of sectoral outputs. The costs of this neglect may have been high.

Thus, in answer to one of the problems raised in the second paragraph, it would seem that there is an argument to be made for an output, rather than an expenditure based model. Having accepted this, the next question to be answered is to what extent are the outputs of Scottish industries determined by external factors and how far can these be identified. In later paragraphs the results of some crude attempts to identify these influences are reported, but first let us examine one theory of output determination which has gained some credence, at least in France.

The argument runs as follows: Scotland has a small open economy where external events play a major role in determining key economic variables. In fact, the economy can be considered, following Courbis*, to be a 'competitioned' economy. The essence of the theory of the 'competitioned' economy is that there are three main sectors in the economy - the exposed sector, the sheltered sector and the administered sector. The exposed sector is regulated by strong external competition and generally will compete in the domestic and international markets at prices determined externally. The sheltered sector, operating mainly

* see Liggins, National Economic Planning in France

in domestic markets where imports are fixed or negligible, will have some control over price, and in the administered sector, prices and/or output are determined by the authorities. In the exposed sector, because producers are price takers, shortfalls in the domestic market between demand and supply are met by increases in imports. As a result, it can be shown, policies which seek to manipulate the level of demand are relatively ineffective in the exposed sector. In contrast, policies designed to stimulate supply have a greater chance of success in the exposed sector rather than the sheltered sector.

It is clear that a complete dichotomy between sheltered and exposed sectors will not be empirically tenable. Rather, one must imagine firms lying at some point on a spectrum which extends from the completely sheltered sectors to the completely exposed sectors. Any test to determine a particular sector's position on this spectrum will, of course, depend on adequate data on price and output behaviour. Unfortunately, there are, of course, no sectoral price data in Scotland. However, there are earnings data which may provide at least a very indirect view on the 'competitioning' hypothesis.

Let us suppose that the competitioning hypothesis holds: then one might argue:-

- (1) industries which are exposed to external competition may be subject to more violent output fluctuations than sheltered industries because they have no control over price and may operate in relatively large markets.
- (2) employers in exposed industries will have more incentive to restrict wage increases than their counterparts in sheltered industries because of their more limited ability to influence price.

Now let us consider the data on Scottish wages and output in the light of these arguments. In particular, consider the period 1970-76, for which period both the new index of industrial production and the New Earning Survey are available.

The chemicals, coal and petroleum products sector and electrical engineering, on heuristic evidence alone, might well be felt to fall into the exposed sector. However, there is some concrete evidence for placing them in this category. The Scottish Input-Output Survey indicates that both these industries have a high level of imports and exports relative to domestic output suggesting that they operate in markets where there is fairly strong international competition. Secondly, in accordance with

TABLE 1

MALES MANUAL

Scot/UK Relative

Industry	1970	1970r	1976	1976r	REL 70	REL 76
All Industries	25.7		66.2		95.9	101.7
Mining	25.3	12	78.6	1	96.6	103.2
Food, Drink & Tobacco	26.5	8	63.2	12	99.3	94.6
Chemicals	28.5	5	68.3	10	98.3	100.1
Metal Manu- facture	29.4	3	73.8	3	98.7	101.2
Mechanical Engineering	30.5	1	73.1	4	105.9	109.3
Electrical Engineering	30.0	2	67.1	11	108.7	103.7
Shipbuilding	28.8	4	76.7	2	99.0	100.9
Textiles	21.5	13	59.4	14	86.7	97.5
Bricks, Pottery & Glass	27.4	6	68.7	9	99.3	100.7
Paper, Printing	27.0	7	70.2	6	85.7	99.6
Construction	26.5	8	70.1	7	88.6	108.5
Gas, Electricity & Water	25.5	11	72.1	5	98.1	103.1
Transport	26.0	10	70.1	7	91.2	99.0
Distribution	20.5	16	52.7	16	90.3	97.8
Professional & Scientific	21.1	14	60.7	13	94.2	105.9
Miscellaneous Services	19.8	17	49.5	17	90.4	97.1
Public Admin- istration	20.8	15	56.6	15	97.2	99.6

(1), the index of industrial production shows that these industries have outpaced all other industries in terms of the rapidity of their output growth in the period 1970-1976. Lastly, as argued in (2), these industries have experienced fairly low rates of wage inflation. In fact, the logarithmic trend growth rate of wages in electrical engineering for male manual workers was 14.2%, in chemicals, coal and petroleum products 14.3%. These were lower rates of wage growth than those recorded in all other sectors. Note that this finding - of rapidly growing output but relatively slow growth in wages conflicts with classical economic theory (given that there has been no large increase in employment) but does not conflict with the theory of the 'competitioned' economy as outlined above.

Further evidence in favour of the 'competitioning' hypothesis can be gained from an examination of the rankings of earnings of male manual workers in various sectors in 1970 and 1976. (See Table 1). Almost without exception, the industries which have improved their earnings ranking between 1970 and 1976 appear to lie, on heuristic evidence, in the sheltered, or administered sectors.

The most obvious empirical approach to testing the relationship between industrial output in Scotland and external factors, is to investigate the link between the Scottish index of industrial production and that of the UK as a whole. One approach to this might be to use the input-output table to determine the weights when regressing a weighted sum of UK final demand categories against Scottish output. However, as a first step we have adopted the fairly crude approach of establishing the relationship between industrial output in Scotland and the output of the corresponding industry in the UK. Using the revised Scottish index of industrial production this relationship was estimated for the period 1955-1965 and 1966-1976. The results are set out in Table 2. The sample period was sub-divided because it was felt that the improvement in the performance of Scottish industry vis-a-vis the UK, which has been occurring since the late sixties would not be properly accounted for by a model which assumed that the relationship between Scotland and the UK was invariant over the entire period 1955-1976.

Most of the results show that there has been a strong relationship between fluctuations in the level of output in Scotland and the level of output in the UK. (Values of R^2 (in cols. 2 and 4) close to one indicate that a large proportion of the variation in Scottish output is explained by variations in UK output). Only in the metal manufacture and timber and furniture sectors is the relationship weak during the period 1955-65. Between 1966 and 1976, however, the relationships weakened in a number of sectors, notably mining and quarrying, bricks, pottery, glass and cement,

TABLE 2

Industry	(1)	(2)	(3)	(4)	(5) (6)	
	Regression Coefficient 55-65	R ²	Regression Coefficient 66-76	R ²	1977 1978 Forecast (annual % rate of change)	
Mining & Quarrying	1.99	0.93	0.58	0.63	- 2	- 2
Food, Drink & Tobacco	1.84	0.98	1.80	0.97	4	5
Metal Manufacture	0.77	0.46	1.22	0.85	1	4
Bricks, Pottery & Glass	0.68	0.83	0.18	0.17	1	0
Timber & Furniture	0.39	0.40	1.91	0.66	-9	6
Paper, Printing & Publishing	1.03	0.95	0.59	0.19	2	1
Other Manufacturing	0.66	0.95	1.02	0.83	6	3
Construction	1.04	0.98	0.56	0.22	-3	2
Gas, Electricity & Water	1.08	0.98	1.23	0.98	4	4
All Industries	0.93	0.98	1.31	0.92	3	4
Electrical Engineering ¹	2.28	0.94	2,28	0.98	9	11
Metal Goods n.e.s. ¹	0.99	0.90	1,63	0.64	9	6

¹ For Electrical Engineering and Metal Goods not elsewhere specified separate figures are not available before 1958

² The effect of North Sea oil production on the output index of mining and quarrying differs between Scotland and the UK as a whole, rendering comparison between these indices impossible (see Leading Indicators p8)

printing, paper and publishing and construction. Consequently, after 1966 variations in all the industrial index in Scotland is marginally less well explained by variations in the UK index, which suggests, if the figures are accurate, that the Scottish economy has become less responsive in recent years to changes in the level of output in the rest of the UK. This effect may go some small way to explain the narrowing of the unemployment differential between Scotland and the rest of the UK since employment fluctuations are likely to be less pronounced if Scotland is less dependent on external demand. Our earlier argument regarding 'competition' would suggest, *ceteris paribus*, that decreased dependence on the 'exposed' sector and increased dependence on the 'sheltered' sector might lead to a relatively faster growth in prices and wages. Whether this phenomenon can explain recent relative growth in Scottish wages may be an appealing hypothesis on the current evidence. However, more substantial data will need to be made available before this theory can be accepted or rejected.

At the industry level, over the period 1966-1976, it can be seen that most Scottish industries grew more quickly than their UK counterparts. For example, in column 3 the coefficient of 1.84 on food, drink and tobacco indicates that for every 1% rise in the UK output of this industry there was a 1.84% rise in output in the corresponding industry in Scotland. The highest relative growth rate occurred in electrical engineering where output in Scotland grew, in both the period 1955-65 and 1966-76, at a rate more than twice as fast as that in the UK as a whole. In contrast, the bricks, pottery, glass and cement sector has performed very poorly in Scotland, relative to the rest of the UK.

On the assumption that the trend over recent years will continue, one can form crude forecasts of likely movements in Scottish output for 1977 and 1978, given a set of forecasts for output growth in the UK. The National Institute publishes a set of forecasts based on its UK model and these have been utilised to generate the forecasts shown in column 5 of Table 2. These indicate continued slow growth in aggregate output through 1977 and 1978. The construction and timber sectors are expected to perform badly in 1977 with a modest recovery in 1978. However, using arguments previously outlined, since Scottish output of timber and furniture is not highly correlated with that of the UK, the forecasts for this sector are subject to a much larger degree of error than that for, say, gas, electricity and water. It must be emphasised that these forecasts are undoubtedly crude. However, they do represent a meaningful first step, and in the future it is hoped to increase the degree of sophistication of the forecasts and to extend their range. Further analysis will also, of course, give us additional insights into the response of the Scottish economy to changing external economic circumstances.

NOTESTRENDS IN GROSS DOMESTIC PRODUCT

An estimate of Scottish GDP at factor cost in 1975 was published in July in the Scottish Economic Bulletin (No 12 Summer 1977) and Economic Trends (June 1977). The estimate refers to GDP at current prices, and as on previous occasions we have converted this to constant (1970) prices by means of the implicit price index for UK GDP, obtained from the series of current and constant price GDP estimates published in Economic Trends. As pointed out in previous issues, while this is not a satisfactory procedure for estimating Scottish GDP at constant prices for any one year, unless there is a persistent bias in price movements over time between Scotland and the UK, it can be used to depict the trend of GDP over time with reasonable confidence.

Table 1 Estimates of Real Non-Oil Gross Domestic Product, Scotland 1970-1977

Year	GDP at current Factor Cost	GDP at constant (1970) prices	Annual percent change in Real Non-Oil GDP
	£ million	£ million	%
1970	3,736	3,736	-
1971	4,197	3,805	+1.8
1972	4,742	3,901	+2.5
1973	5,550	4,199	+7.6
1974	6,446	4,214	+0.4
1975	8,248	4,179	-0.8
1976*		4,254	+1.8
1977*		4,369	+2.7

* Forecast, excluding oil

Sources for Column 1: *Scottish Economic Bulletin, Summer 1977*
Economic Trends, June 1977

The figures given above must be treated with some caution as a guide to the overall performance of the Scottish economy. The official series of current GDP statistics on which they are based was itself revised within the last year, and will probably be revised again. The estimates for 1976 and 1977 represent the Institute's own forecasts, in the absence of any official data for these years. In our last GDP forecast (Quarterly Economic Commentary, July 1976) we estimated real GDP for 1975 at £4,017

million, representing a fall of 1.4% on the 1974 level. The official figures released in June 1977 suggests the fall in 1975 to have been only 0.8%.

With these reservations in mind, it may be suggested that, so far in the present recession, the Scottish economy has fared less badly than the UK economy as a whole. The year on year changes in real GDP for the UK from 1973 to 1976 were -0.4, -2.3% and +1.4%, while the comparable Scottish figures from Table 1 are +0.4%, -0.8% and +1.8% respectively.

Our forecast for 1977, if broadly correct, would imply a further improvement in Scottish GDP relative to the UK. In view of the disappointing trends in the contemporary Scottish economy discerned elsewhere in the Commentary, this implies a very poor performance by the UK economy in 1977. This view is borne out by the statistics of industrial production for the first eight months of the year.

We have not included in the figures shown in Table 1, any estimate of the value of the oil produced from the North Sea. To do so would be to obscure the performance of the rest of the Scottish economy. Instead, we show separately in Table 2 our estimate of the contribution of oil production to GDP. But first it is worth drawing attention to a novel feature of official UK estimates of regional accounts, which arises from the recently announced method of treating income generated by offshore oil and gas exploration and production.

It will be recalled that the contribution of any firm or industry to GDP at factor cost comprises its value added, which can be broken down into income from employment, income from self-employment, gross trading profits and surpluses, (with an adjustment for stock appreciation), and rent. In the construction of regional accounts, there are often difficulties in allocating elements of value added to particular regions. The problem is particularly acute in the case of profits, where the reporting units are companies whose head offices and producing units may be distributed throughout several regions of the UK.

The principal means of resolving this problem is to allocate "national" profits to regions in proportion to the regional distribution of employment in each industry. In practice, of course, profitability can (and does) vary considerably between firms in the same industry, and the results of the exercise are strongly affected by the definition of "industry" used for the calculation. For example, Scotland contains over 50% of UK

employment in MLH 104 (Petroleum and Natural Gas), but only about 10% of UK employment in SIC Order II (Mining and Quarrying) of which MLH 104 is a part. Thus the industry groupings used for allocating profits on a regional basis have an important and arbitrary effect on the results, particularly where there are large differences in profitability between industries.

To avoid either allocating Scotland a very substantial increment to GDP in the form of North Sea Oil profits, or of distributing North Sea oil profits amongst all other regions, the CSO have chosen to create a new "region", the UK Continental Shelf, to which all profits of offshore oil and gas production will be allocated. Income from employment in offshore activities however, will not be allocated to this new region, but to the appropriate "onshore" region (mainly Scotland). Consequently, Scottish GDP will include that part of value added in offshore production attributed to employment, but not that part attributable to profits. The apparent purpose of this rather unusual treatment is to avoid possible distortions to the Scottish GDP series caused by the magnitude of North Sea oil profits, though similar "distortions" caused by the exploitation of natural resources are visible in the national accounts of many other countries. Moreover, the different elements of factor incomes in the Scottish GDP accounts are now no longer defined on the same basis. A more satisfactory treatment would have been to allocate profits from the Scottish section of the UK Continental Shelf to Scotland, but record the data separately from other gross trading profits. The distorting effect of oil on the GDP series could then be identified exactly, and could be excluded or included according to the nature and purpose of particular analyses.

The Contribution of Oil Production to Real GDP

Prior to 1976, the value of oil produced was of slight importance, but in that year we estimated the value of net output at current prices to be of the order of £800 million or about £130 million in 1970 prices. (Quarterly Economic Commentary, July 1976). This estimate is close to that which appeared in the official publication Trade and Industry, 19 August 1977. The same article anticipates that the contribution to GNP arising from oil production in 1977 will be "£1 billion to £1½ billion" in 1976 prices. This would suggest that the contribution to GDP would be of the order of £1,850 million in 1976 prices, or £300 million in 1970 prices. The gap between the latter two figures reflects the increase in crude oil prices between 1970 and 1976. It should be borne in mind that a time series of gross domestic product estimates is an attempt to measure the change in the volume of the aggregate output of goods and services in the economy. It cannot reflect appropriately the benefit which economic activity in one sector, such as oil, confers on the economy as a whole.

Table 2 Estimated Changes in Real Gross Domestic Product, Scotland 1975-1977

	(Change on Previous Year)			
	Non-Oil (£ million at 1970 prices)	Oil	Total	Total (Percent)
1975	- 35	-	- 35	- 0.8
1976	+ 75	+ 130	+205	+ 4.9
1977	+115	+ 300	+415	+ 9.8

The last column of Table 2 shows the growth in the aggregate volume of output when oil production is taken into account. Had the same calculation been carried out in prices of 1974, or a later year, very much higher growth rates would have resulted.