The CBI 'Industrial Trends Survey' as a Measure of Current Manufacturing Output

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Introduction

'The ideal situation would be one in which all the data were bang up to date, completely reliable and mutually consistent. We should then be able to say with confidence what had been happening and where we were. Unfortunately this is hardly ever possible. The first thing we have to forecast is the past.'[1]

A major difficulty familiar to those engaged in practical economic forecasting is the lack of up-to-date and reliable information on the trends of the present and the immediate past; the forecasting of the future then requires as an essential preliminary some 'forecasting' of developments which have already taken place but whose nature and size are still unclear because of delays and uncertainties in data-compilation. Even in the case of such leading indicators of current output trends as the indices of production in industry and manufacturing, the first figures are not available until around seven weeks after the end of the month to which they refer. These are, moreover, in provisional form only, and subject to frequent and sometimes substantial later revision; the *Monthly Digest of Statistics*, March 1970, for example, incorporates revisions to the index of manufacturing production for eight of the ten months from December back to March 1969. With the publication of firm official figures thus lagging substantially behind the economic events which they measure, any information which can be used to anticipate them may make a highly significant contribution to forecasting.

In its 'Industrial Trends Survey' the CBI seeks to give up-to-the-minute information both on current levels and trends and also on expectations for the immediate future for a variety of important economic categories, including output, employment, new orders, stocks, the utilisation of capacity, the authorisation of capital expenditure, the general business situation, and exports. The Survey is compiled three times a year, most of its reports relating to the four-monthly period just ending and anticipations to the four months to come. The results are processed and published within a fortnight of the completion of replies, and are therefore available substantially before even the provisional figures for the index of manufacturing production, and in addition are supported by reports of anticipations for the following four months.

The CBI, however, formulates its survey questions in non-quantitative terms. The 2,000 firms in the circulated sample, of whom on average 70 per cent will reply, are asked simply to indicate past and future trends as 'up', 'down', or 'the same' and not as percentage changes. The individual replies are then weighted and aggregated, the results being expressed in percentage form as the proportions replying 'up', 'down', or 'the same'.[2] In this summary form the Survey gives a useful impression of current and expected trends as seen by the business community; but for purposes of short-term macro-economic forecasting the value of the information presented would be substantially enhanced if it could be related systematically and quantitatively to the representation of economic reality given by the official statistical series.

The Survey asks several questions highly relevant to the assessment of trends in output. Most directly it asks '*Excluding seasonal variations* what has been the trend over the past four months, and what are the expected trends for the next four months, with regard to the value of output?' The same question is also posed in respect of new orders, and firms are further asked whether or not they are operating with excess capacity. The questions have been subject to minimal alteration since the first Survey, published in February 1958, so that the full series of results is available without adjustment. The results are reported below for the (relatively successful) attempt to use the replies to 'forecast' the index of manufacturing production up to several months before a smoothed series can be derived from the official figures.

From the 36 Surveys compiled up to October 1969, 31 observations are used in the analysis, the first two Surveys being reserved to allow the use of one- and two-period lags on the information given in the replies, and the three Surveys of 1969 to give a test of the parameters on observations not included in their estimation. Since the Surveys, published towards the middle of February, June, and October, are completed by the firms about a fortnight earlier, the data given are referred to the ends of January, May, and September respectively. The official series used is the monthly index of manufacturing production, seasonally adjusted and smoothed by a four-monthly moving

[1] A. K. Cairncross, *Economic Forecasting*, Presidential Address to the Royal Economic Society, 1969.

[2] Before 1964 the sample of firms questioned was chosen to be representative, in terms of size and industry and composition of manufacturing industry as a whole, and the replies were aggregated directly. Since 1964 an explicit weighting procedure has been used to take these factors into account.

This article was prepared by Mrs M. Gregory of the National Institute.

Table 1. Results of regression equations based on reported output trends only

Z denotes the change in the official index of manufacturing production, with Z_1 as the change over the preceding four monthly period and Z_3 as the change over the corresponding period a year (i.e. three Surveys) earlier : B denotes the balance or diffusion index of replies on the reported trend, and U, D, and S the percentages reporting ' up ', ' down ', and ' same ' respectively, with t as a time subscript and the subscripts −1, −2, etc., referring to the Surveys one, two, etc. before the latest. The coefficient of determination (R^2) and the standard error of the residuals (SE) are shown on the right of the table. Standard errors of individual coefficients are shown in brackets.

	Constant term	Regression coefficients of independent variables									R^2	SE
		B_t	B_{t-1}	B_{t-2}	D_t	D_{t-1}	D_{t-2}	S_t	S_{t-1}	S_{t-2}		
(1) Z_{1t} =	+0.427	+0.134 (0.017)	−0.087 (0.017)	..	..	..	..	..	..	..	0.665	1.16
(2) Z_{3t} =	−0.268	+0.200 (0.026)	+0.067 (0.036)	−0.056 (0.025)	..	..	..	..	..	..	0.891	1.53
		U_t	U_{t-1}	U_{t-2}								
(3) Z_{1t} =	−37.096	+0.698 (0.326)	−0.271 (0.422)	..	+0.418 (0.325)	−0.091 (0.399)	..	+0.576 (0.323)	−0.193 (0.411)	..	0.660	1.17
(4) Z_{3t} =	−70.036	+0.326 (0.477)	+0.537 (0.613)	+0.101 (0.552)	−0.027 (0.475)	+0.397 (0.579)	+0.196 (0.517)	−0.082 (0.471)	+0.448 (0.602)	+0.106 (0.545)	0.866	1.65
		B_t	B_{t-1}	B_{t-2}								
(5) Z_{1t} =	+0.253	+0.141 (0.022)	−0.095 (0.021)	..	..	..	..	+0.035 (0.054)	−0.031 (0.051)	..	0.647	1.19
(6) Z_{3t} =	+2.870	+0.198 (0.031)	+0.065 (0.044)	−0.060 (0.030)	..	..	..	−0.012 (0.073)	−0.006 (0.081)	−0.052 (0.069)	0.882	1.59
(7) Z_{1t} =	+4.918	..	..	..	−0.273 (0.044)	+0.186 (0.042)	..	−0.106 (0.046)	+0.059 (0.047)	..	0.626	1.23
(8) Z_{3t} =	+22.639	..	..	..	−0.405 (0.062)	−0.120 (0.085)	+0.122 (0.059)	−0.200 (0.064)	−0.076 (0.070)	+0.007 (0.065)	0.877	1.62

average which retains its reference to the end of the month. The Survey information is applied to ' explain ' the change recorded in this smoothed index over the relevant period.

The direct approach

The most direct approach is that adopted in the earlier studies by Shepherd and the Board of Trade of the CBI data, and by Blyth of an almost identical survey for Australia.[1] This focuses on the replies to the question on the trend in output over the preceding period, summarising them through the ' balance ' of the percentage reporting ' up ' over the percentage reporting ' down ' or equivalently, through a ' diffusion index ' of responses, where the percentages replying ' up ', ' down ', and ' the same ' are aggregated with weights of +1, −1, and 0 respectively. This balance or diffusion index of reported output trends is then applied to explaining the change in the official index either over the preceding four months (as the most usual interpretation of the question asked) or over the corresponding period a year (i.e. three Survey periods) earlier (on the hypothesis that many firms will use this as a base of reference for assessing trends and, in particular, for eliminating seasonal variations).

Equations (1) and (2) (table 1) can be regarded as relating the change in the official index either to the reported trends for the current and preceding period(s) or to the weighted representation of the level and change in the reported trends.[2] Neither, however, gives entirely satisfactory statistical results. In equation (1), although the standard errors of the individual coefficients are low, the overall coefficient of determination (R^2) is not high ; the introduction of further lagged terms, such as B_{t-2}, actually reduces it. Equation (2) on the other hand, yields a substantially

[1] C. A. Blyth, ' The ACMA—Bank of NSW industrial trends survey : its use in estimating changes in statistical series ', *The Economic Record*, December 1967 ; Board of Trade, ' Some of the results of the industrial surveys of the FBI compared with official statistics ', *Economic Trends*, September 1965 ; J. R. Shepherd, ' The FBI industrial trends inquiry ', *National Institute Economic Review* no. 26, November 1963.

[2] The algebraic proof of this is given in Shepherd (*op. cit.*, Appendix 1). Using only the first 15 of the observations included above Shepherd obtained a closely similar result for equation (1) :

$$Z_{1t} = .26 + .113\ B_t - .064\ B_{t-1} \qquad R^2 = .65 \quad SE = 1.12$$
$$(.025) \quad (.024)$$

improved value of R^2, but the high standard errors on the coefficients of B_{t-1} and B_{t-2} (both scarcely significantly different from zero) reduce its suitability for forecasting.

It should be noted that, although the standard error of the residuals (SE) takes a larger absolute value in equation (2), this is relative to a mean value of 4.0 for the dependent variable (the change in the official index over one year) against a mean of 1.5 for Z_{1t} (the change over four months) in equation (1).

However, since any individual figure for ' balance ' can result from a large number of combinations of values for ' up ' and ' down ', while the numbers reporting ' same ' are not explicitly represented, the use of the diffusion index formulation apparently fails to make the maximum use of the information contained in the replies. In equation (3), therefore, ' balance ' is replaced by the percentages reporting ' up ', ' down ', and ' same ' individually. The overall quality of fit as measured by R^2 and the standard error of the residual is fractionally inferior to that on the diffusion index formulation. Much more importantly, however, the majority of the individual U, D, and S coefficients have unacceptably high standard errors, the consequence of the almost exact linear relationship U + D + S = 100 per cent.

Pair-wise correlations among these variables reveal the closest correlation to be between the percentages reporting ' up ' and ' down ', with substantially lower correlations between these and the numbers reporting ' same '. ' Same ' also has the lowest degree of correlation with its own lagged values (table 2). For the statistical objective, therefore, of minimising multicollinearity among the explanatory variables ' same ' appears potentially the most effective among the variables individually. (It is also, incidentally, the largest category, by a small margin, with a mean value over the Surveys used of 42 per cent, against 38 per cent of ' ups ' and 15 per cent of ' downs '.)

Table 2. Correlations between individual terms

	r
Correlation between :	
U, D	−0.878
U, S	−0.691
D, S	0.267
B, S	0.526
	R^2
Regression of :	
B_t on B_{t-1}	0.559
U_t on U_{t-1}	0.496
D_t on D_{t-1}	0.575
S_t on S_{t-1}	0.202

But the use of ' balance ' and ' same ' as explanatory variables (equations (5) and (6)) gives results fractionally inferior to the use of ' balance ' alone (equations (1) and (2)), with ' same ' and its lagged values failing to make a significant contribution to the explanation. Similarly in equations (7) and (8) the use of ' down ' and ' same ', the values which are least correlated, also gives results which are systematically inferior to the use of ' balance ' alone. In spite, therefore, of the apparent suppression of information, a diffusion index or balance of replies yields the statistically most effective formulation of firms' reports on the trends in their output.

Further variables

However, the relationships shown in equations (1) and (2) between firms' reports of the trends in their output and the changes in the official index of manufacturing production (which one assumes record the same economic reality) leave sufficiently large discrepancies to suggest that the replies to the specific question on output trends are incomplete by themselves and should be supplemented by other information given in the Survey, or that at least a substantial minority of the firms replying are placing differing interpretations on the question posed.

Since firms are trying in the Survey to provide up-to-the-minute information, possibly on the basis of incomplete or provisional data, their assessment of their current output trends may be coloured by their expectations for the immediate future as they make their reports and possibly also by their earlier expectations for the period to which the reported trends refer. With both the four-monthly and the annual changes the introduction of current expectations E_t (in equations (9) and (10)) gives a slightly improved explanation over the representation with reported trends alone (table 3).

Two reasons may be suggested for the significance of current expectations. Because of the difficulties in compiling up-to-the-minute economic data a clear division cannot be drawn between the past and present, on which factual reports can be rendered, and anticipatory assessments of the future ; even firms themselves must to some extent ' forecast ' the present, under the influence of their expectations for the immediate future. Moreover, the representation of the change in the official index by the differences between the monthly figures as smoothed by a four-monthly moving average itself incorporates an element of the change which is recorded in the subsequent two months and to which, provided they can adequately anticipate output trends, firms' expectations refer directly. In neither equation are the lagged values E_{t-1} and E_{t-2} significant, which suggests that firms do in fact give a direct assessment of past trends

Table 3. Results of regression equations with additional variables

E denotes the balance of ' ups ' and ' downs ' for the expected trend of output, N the diffusion index of reported new orders, and C the balance of firms reporting excess capacity over those reporting full use of capacity : D^1 and D^2 are dummy variables representing the index of output in the months of May and September respectively. Other definitions are as for table 1.

	Constant term	Regression coefficients of independent variables									R^2	SE
		D^1	D^2	B_t	B_{t-1}	B_{t-2}	E_t	Z_{1t-1}		$Z_{1t-1}+Z_{1t-2}$		
(9) Z_{1t} =	−0.454	..	..	+0.084 (0.025)	−0.068 (0.017)	..	+0.060 (0.023)	..	..	..	0.722	1.06
(10) Z_{3t} =	−1.140	..	..	+0.154 (0.036)	+0.082 (0.035)	−0.053 (0.024)	+0.059 (0.033)	..	..	..	0.899	1.47
(11) Z_{1t} =	−0.598	..	..	+0.109 (0.028)	−0.068 (0.017)	..	+0.061 (0.023)	..	−0.274 (0.167)	..	0.738	1.03
(12) Z_{3t} =	−0.669	..	..	+0.099 (0.029)	−0.041 (0.038)	−0.006 (0.021)	+0.063 (0.025)	..	..	+0.792 (0.172)	0.943	1.10
(13) Z_{1t} =	−0.233	−1.258 (0.413)	+0.211 (0.401)	+0.146 (0.026)	−0.093 (0.015)	..	+0.051 (0.019)	..	−0.320 (0.143)		0.818	0.86
(14) Z_{3t} =	−0.247	−1.541 (0.425)	−0.071 (0.395)	+0.147 (0.026)	−0.068 (0.018)	..	+0.050 (0.020)	..	..	+0.712 (0.121)	0.965	0.87
				N_t	N_{t-1}		C_t	C_{t-1}				
(15) Z_{1t} =	+1.786	−1.470 (0.422)	−0.309 (0.436)	+0.093 (0.022)	−0.061 (0.022)	..	−0.081 (0.032)	+0.064 (0.027)	−0.164 (0.146)	..	0.817	0.86
						N_{t-2}			C_{t-2}			
(16) Z_{3t} =	+1.579	−1.195 (0.475)	+0.041 (0.501)	+0.096 (0.021)	−0.065 (0.027)	+0.029 (0.019)	−0.067 (0.031)	+0.027 (0.041)	+0.039 (0.028)	+0.729 (0.129)	0.969	0.81

rather than an assessment of the actual trend relative to their own earlier expectations.

A recent questionnaire from the CBI to a sample of the firms who participate regularly in the Survey suggests that markedly different interpretations are placed on the questions posed. The findings of the questionnaire are discussed by Glynn :

' 23 (of the 39 firms replying) said that they compared the four-monthly periods as a whole with the preceding or succeeding four months as a whole. Nine firms said they looked at the movement from the beginning to the end of the four-month period '. Several other individual interpretations were also quoted. In addition, ' some respondents were unsure whether to answer (say) ' up ' or ' same ' to questions asking for the trend over the next four months if they expected a continuation of an upward trend.

. . . 19 of the 39 firms reported that their business was either completely free from seasonal variations or that such seasonal variations as there are are not sufficiently significant to be taken into account . . .

. . . It is probably fair to guess that most of those whose business is subject to seasonal variations regard comparison with the previous year's experience as adequate for the assessment of the seasonal element in current business fluctuations.' [1]

[1] D. R. Glynn, ' The CBI industrial trends survey ', *Applied Economics*, August 1969.

In their replies, therefore, firms are in fact reporting several different variants of the trend in output :

(i) '*from the beginning to the end of the four-month period*'. For this Z_1 as used above (the change between the time of the previous report and the current report, e.g. between the end of September and the end of January) yields systematically better results than the use of the difference between the first and the last of the four months (e.g. October-January) ;

(ii) ' *the four-monthly period as a whole compared with the preceding four months as a whole* ', i.e. Z_{1t} relative to Z_{1t-1}. The use of the difference formalation (Z_{1t}-Z_{1t-1}) as dependent variable produces poor results ($R^2 = 0.293$, SE = 1.81, with B_t not significant). However, the representation with the lagged value Z_{1t-1} as an explanatory variable (in equation (11)) produces an improvement over the fit yielded by equation (9) ;

(iii) ' *the previous year's experience* ' may be represented directly by the annual change Z_3. However, since $Z_{3t} = Z_{1t} + Z_{1t-1} + Z_{1t-2}$, and the changes for the earlier two periods are known, they may be incorporated as explanatory variables (equation (12)). This improves significantly on the fit of equation (10), although B_{t-1} and B_{t-2} lose their significance, presumably due to collinearity with ($Z_{1t-1} + Z_{1t-2}$).

An examination of the residuals from fitting equations (11) and (12) reveals a tendency to a

cyclical pattern, with positive residuals in January and September and negative in May. This suggests the presence of seasonal influences for which firms make inadequate allowance. When dummy variables are introduced (equations (13) and (14)) to represent the months of May and September the fit is improved in both cases. In equation (14) B_{t-2} is no longer significant and fails to improve the statistical fit ; it has therefore been excluded.

Particularly from the point of view of forecasting future trends in output, the information on new orders is among the most valuable contained in the Survey. The extremely high degree of correlation between the reports of trends in new orders and trends in output ($r = 0.95$) precludes the inclusion of new orders as a further explanatory variable in these equations. The data can, however, be used independently, by formulating it into an alternative predictor of the change in the index of production. Since new orders are a measure of the strength of demand rather than of output directly, this relationship is improved by the inclusion of the level of capacity utilisation as a measure of supply potential (equations (15) and (16)). Somewhat surprisingly, this new orders-capacity formulation gives a statistical prediction of output changes which is fully as good as that based on the reported trends in output themselves.

When a relationship is designed primarily for use in forecasting whether of the present or the future, the standard statistical criterion of quality of fit, as summarised by the R^2 and the standard error of the residual, must be supplemented by the two further criteria of its reliability in identifying turning points in trends and its accuracy of prediction outside the period used in estimating the parameters. The actual changes in the official index and the values calculated from the four leading variants of the relationships, equations (13), (14), (15), and (16), are shown in chart 1. The four monthly change Z_1 presents a much less smoothed series than the annual change Z_3, with many more turning points, some of short-run significance only.

Conclusions

In the case of the four-monthly change both the reported output and the new orders-capacity formulation follow closely the trends in the official index, in particular picking up each of the major turning points. On only one occasion, in 1962, does the calculated trend deviate substantially from the actual trend ; the June Survey of that year reported a marked pause, followed in the next Survey by a report of a renewal of the upswing, while the index of manufacturing production indicated a minor reverse cycle of mid-year peak and then downturn. The official index must, in general, be accepted as the authoritative version of economic reality, but the trend suggested on this occasion by the Survey is not implausible, particularly in view of the virtual disappearance of the minor cycle from the official series when the annual change is considered. The Survey reports were also slightly late in picking up the beginning of the downswing in the autumn of 1963 ; by January 1964 the official index was indicating clearly that the downturn was under way while the Survey reports on output were still recording an upward trend and even the new orders formulation was indicating a pause rather than a definite reversal of the trend.

For 1969 both the series of actual and calculated values for the four-monthly change present a confused trend, the official index showing a sharp downswing followed by a recovery, the Survey showing continued expansion and then a marked downturn. These results highlight the difficulty of using the four-monthly change for short-term forecasting ; even when the fitted relationship closely follows the actual trend the series itself includes so many turning-points that the true trend is often difficult to discern on a period-by-period basis. For this reason the four-monthly change seems a relatively weak forecasting instrument, even although the statistical fit of the calculated series is probably sufficiently good to justify examination as each Survey becomes available.

The annual changes, on the other hand, give a strikingly clear picture. Both the actual and the calculated series bring out strongly the various phases of expansion in manufacturing production since 1958, the calculated series picking out each of the turning points simultaneously with the official index. The only deviation, a slight one, occurs in the spring of 1962, the Survey suggesting less a sustained trough and more a pronounced down-swing and reversal than the official index. In no case is there any significant discrepancy of trend between the two series. For 1969 also the results are essentially clear, although the fit is statistically less close ; both the actual and the two formulations of the calculated trend indicate a falling-off in the rate of expansion from the end of 1968.

The observations from 1969 represent a relatively stringent test of the forecasting efficiency of the formulations using the Survey data, since a major upper turning point had to be identified, when only two had previously occurred. In spite of the slight hesitation in the reported output formulation, the two series together give an unambiguous indication of the new trend with, currently, a four-month lead over the indications available from the smoothed series for the index of manufacturing production.