FORECASTING POWER OF PARTICULAR MODELS FOR IRELAND AND U.S.A.

Professor R. H. Scott of the University of Washington, Seattle, (on sabbatical leave in University College, Galway, 1965-66), is the pioneer in the establishment of behaviouristic relations between financial and non-financial data in Ireland.[1] The period studied is the eight years of growth 1958-1965. Four macro-variables were taken into account -

M = Money supply (= currency + total deposits)

Y = Gross national product at current market prices

R = Rate of interest

G = Net exports of goods and services plus net expenditures by public authorities.

Two series of equations were produced (i) annual and (ii) quarterly. For the quarterly series, the author ingeniously used bank debits to non-government accounts (D) as a proxy for GNP, having shown that, in the eight years the two series are closely related. His dependent variables are Y (or D) and R, his independent variables M and G. For each of the series, 11 equations are produced, using one or two independent variables. The coefficient of correlation r ($= \sqrt{r^2}$) and residual standard deviation is shown for each equation in each series. Though not so stated by the author, 6 (those numbered (2), (4), (5), (6), (8) and (9)) of his 11 annual equations, and 2 (those numbered (8) and (9)) of the 11 quarterly equations, are not significant at the 5 per cent probability level (using the F-test, i.e. two low values of r^2).

Annual

The actual values for the year 1967 are

M = £655.4 million

Y = £1,146 million (preliminary estimate)

R = 6.99 (yield to maturity of 6 per cent Exchequer Loan 1985/90)

G = £154 million (preliminary estimate).

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1 "Money and Income in Ireland: 1958-65" (Mimeograph, 1968).

Substituting these values for M and G in Scott's equations we find the following calculated values for Y and R for 1967:-

Equation Number	Calculated Value of Y	Equation Number	Calculated Value of R
	£m		
(1)	1,208	(2)	6.22
(3)	1,278	(4)	6.99
(5)	1,736	(6)	6.63
(10)	1,279	(11)	7.02

Calculated values for equations (7), (8) and (9), estimating ΔY and ΔR (2) have been omitted. Although their r^2 s indicate insignificance, estimates from equations (2), (4), (5) and (6) have been included above. Insignificance no doubt accounts for the bizarre value for Y from equation (5). Though (4) is insignificant it gives exactly the right value for R! Note that the calculated values for Y from (3) and (10), and of R from (4) and (11) are almost identical; (10) and (11) are two-stage LS estimates.

Omitting (10) and (11) (which are hard to interpret), following are the deviations of the calculated values from their actual values, the equation standard errors (SE) and the ratio of the two values.

Y				R			
Equation Number	Deviation	SE	Ratio	Equation Number	Deviation	SE	Ratio
(1)	62	14	4.4	(2)	0.77	0.37	2.1
(3)	132	13	10.2	(4)	0.00	0.40	0
(5)	590	105	5.6	(6)	0.36	0.40	0.9

All the calculated values of Y are much too large, yielding ratios well above the permitted value of about 2. The values of R, on the other hand, may be regarded as satisfying the ratio test but fail (as too low) because the SE's are impracticably large: it will be recalled that none of the equations, (2), (4), or (6) is significant.

If we "forecast" the value of Y for 1967 by applying the 1965 value of Y/M (using Scott's data) to the 1967 value of M our naive 1967 estimate of Y would be 1,175 compared to actual 1,146. It is much better than any of Scott's four estimates.

Quarterly

Actual values, values calculated from Scott's regressions for D and R and naive estimates for D (using the 1965 values of D/M for the respective quarters) for each quarter of 1967 are as follows:

	I	II	III	IV	Annual total/average
			Value of D (£m)		
Actual	1,254	1,359	1,272	1,398	5,283
Equation:-					
(1)	1,318	1,343	1,416	1,501	5,578
(3)	1,310	1,332	1,390	1,483	5,515
(5)	1,165	1,090	1,054	1,099	4,408
(10)	1,296	1,321	1,383	1,467	5,467
Naive	1,239	1,257	1,272	1,403	5,171
			Value of R		
Actual	7.19	6.90	6.87	7.00	6.99
Equation:-					
(2)	6.42	6.45	6.55	6.66	6.52
(4)	6.46	6.53	6.75	6.78	6.63
(6)	6.48	6.42	6.71	6.77	6.60
(11)	6.47	6.41	6.70	6.76	6.59

A further comparison is possible from equation (7) as regards ΔD during 1967:-

	II - I	III - II	IV-III	Total IV - I
Actual	+105	-87	+126	+144
Equation (7)	+30	+101	+118	+249
Naive	+18	+15	+131	+164

Without belabouring the point further it may be stated that Scott's formulae are unreliable for forecasting Y (or D) and R on an annual or quarterly basis. As with the annual figures for Y, the naive estimates of D were far superior to those from the regression formulae.[2] The considerable measure of consistency between the estimates of R from the formulae will be noted, yet none is acceptable.. A Belfast colleague, D. G. Slattery, who has formed some hundreds of regression estimates based on a certain body of Irish data, has noted the tendency for all forecasts to be markedly similar using least square regression whether one uses statistically "respectable" methods (by the r^2 and DW criteria, for example) or not. Statistical purity ex ante is no guarantee that the forecasts will be virtuous.

It goes without saying that the intention here is not to depreciate the work of Scott who, as stated at the outset, is a pioneer in the Irish field and so is deserving of credit. In his paper, indeed, he makes no claim to finality and is critical of his own findings, if not on the lines exploited in this note. His approach is conventional, though he uses fewer variables, eschews time-lagged terms and perhaps confines himself to too short and special a period. What the present writer is questioning is the usefulness of the whole macro-economic approach involving (usually linear) systems of equations, here or elsewhere, even if the solution of these equations satisfies all the conventional tests, simply using Scott's findings as an illustration.

The writer is indebted to The Central Bank of Ireland for data for 1967 kindly supplied, in connection with the foregoing.

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[2] Of course, naive methods are not recommended as substantive methodology - only as a check.

S. M. Goldfeid[3] has produced a fairly large model for U.S.A. with 32 endogenous variables and equations (including a few identities). Most of these variables pertain to banking (such as demand deposits, time deposits, borrowing, excess reserves, four interest rates etc., distinguishing "town" and "non-town" districts). Six endo-variables were non-financial macros: GNP, durable and nondurable consumption, fixed and inventory investment and disposable income. 48 quarterly sets of observations were used from III 1950 - II 1962. All the equations (except those for interest rates and non-financial items) were of the form $\Delta x = \lambda x_{-1}$ + linear expression in endo- and exo-variables, the latter considerable in number. Most of the equations contained at least 10 coefficients (including 3 dummies for seasonality correction). r^2 (corrected for degrees of freedom), standard error of estimate and DW are given for each of the 21 behaviouristic equations. The complete model was solved by two stage LS. There are a great number of subgroups examined for relationships. Generally a very thorough job was done, of its kind. The author would have been wise to omit the many coefficients he found insignificant by the t-test, and recomputing, so reducing the number of explanatory variables.

We are here interested only in the forecasting power of the model, as distinct from economic analysis, preliminary and final, which the author gives in full measure. He also gives a table (p.171) of short term predictions, for the two quarters following those to which his equations relate, namely III and IV 1962, for 21 variables. We prefer to examine <u>changes</u> between the quarters, as a more rigorous, but more realistic, test: standard errors of estimate (also given by the author) juxtaposed with absolute predictions tend to make the latter look better than they are. As regards the first column in the following table we need not be specific in describing the entities, or their units, granted our present objective.

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3 "Commercial Bank Behaviour and Economic Activity" (North Holland Publishing Company), 1966.

Variable Number	Change IV '62-III '62		Standard error(s) of	Ratio |P-A|/s	Ratio |A|/s
	Actual (A)	Predicted (P)			
1	2	3	4	5	6
1	+113	+ 22	58.0	1.57	1.9
2	+ 4	+ 7	49.5	0.06	0.1
3	+206	+ 82	188	0.66	1.1
4	+ 18	+ 49	33.9	0.91	0.5
5	+ 70	+280	104.6	2.02	0.7
6	+ 85	+146	116.4	0.52	0.7
7	+ 48	- 16	74.8	0.86	0.6
8	- 33	- 13	48.2	0.42	0.7
9	+ 48	+ 30	24.6	0.73	2.0
10	+ 16	+ 16	6.2	0.00	2.6
11	+ 76	+ 79	5.95	0.50	12.8
12	+ 45	+ 26	6.61	2.27	6.8
13	+ 56	+ 92	21.6	1.67	2.6
14	+,41	+ 31	72.7	0.14	0.6
15	+ 11	+ 12	1.74	0.58	6.3
16	+ 67	+ 48	11.09	1.71	6.0
17	+ 31	+ 29	10.10	0.20	3.1
18	+207	+155	61.4	0.85	3.4
19	+ 7	- 1	12.7	0.63	0.6
20	- 16	- 2	47.7	0.29	0.3
21	- 21	- 1	33.1	0.60	0.6

Note

Col. 4: s = $\sqrt{2}$ x standard error of prediction (given by author)

The signs test to which appeal is often made - "the signs are right" - are here subject to the qualification that so many of the actual are + that we must suspect a general rise in the economy (or perhaps a seasonal rise), affecting endo- and exo-variables alike. The showing of Column 5 is excellent: changes generally are in accordance with theory, in that only two of the ratios exceed 2 and we would expect one to do so in a set of 21 observations on the null-hypothesis.

The trouble really is the absolute magnitude in the difference between the figures in columns 2 and 3. Can we be satisfied with ultimately finding a rise of 113 in variable 1 while a rise of 22 was anticipated? While a few of the predicted changes are very accurate, the predictions generally, as measurements, are hardly satisfactory. Of course it is recognised that for many purposes (including many aspects of policy determination) precision is not required. Indeed exercises of the kind reviewed are well worth doing.

Column 6 makes the point more precisely. Suppose that the changes of column 2 could be regarded as typical in magnitude - it would, of course, have been preferable to use, for analysis, averages of absolute values of changes, but the author does not furnish his raw data. A really sound short-term forecasting model should have the property that the typical changes should be many times the standard error of estimate - perhaps the multiple should be 5 or 6. Only 4 (those numbered 11, 12, 15, 16) of the 21 variables satisfy this condition.

The author's painstaking analysis and the showing of column 5 are an excellent example of what should be a truism (but isn't) that for statistical efficiency it is not enough that "the errors are under control" (in the stochastic sense). It is of paramount importance that these errors should be small in relation to that magnitude of our estimates, and our efforts in model making must be unremittingly directed towards making them so.

<u>25 June 1968</u> R. C. Geary