

esri TECHNICAL SERIES

TECHNICAL SERIES No.4 December 1987

Data and Model Formulations used in
the Analysis of Profit Outflows from
Ireland

by

S. Scott and E. O'Malley

The Economic and Social Research Institute

4 Burlington Road

Dublin 4

Ireland

Telephone: Dublin 760115-9/760508/688873

Introduction

This technical paper accompanies the article entitled Determinants of Profit Outflows from Ireland published in The Medium Term Review 1987-1992.

The first section gives the data which consist of the following:

- PROF: Profits, dividends, royalties, etc. which form part of the debit side of Item 7, Trading and investment income, in the Balance of International Payments, quarterly, £ million.
- X: Selected exports, SITC categories 51 (Organic chemicals), 52 (Inorganic chemicals), 54 (Medicinal and Pharmaceutical products), 75 (Office machines and ADP), 76 (Telecommunications etc), 77 (Electrical Machinery etc), 87 (Professional, scientific and controlling apparatus, n.e.s.) from the Trade Statistics, quarterly, £ million.
- XF: As X above, but with the addition of 09, (Miscellaneous edible products and preparations).
- TU: Turnover of selected industries, NACE categories 257 (Pharmaceuticals), 33 (Office and data processing machinery), 34 (Electrical engineering), 37 (Instrument engineering).
- TUF: As TU above, but with the addition of NACE 411, 414, 415, 417/8 and 423 (Other foods).
- D1,D2,D3: Seasonal dummies for the first, second and third quarters respectively. In the article they are denoted Q_1 , Q_2 and Q_3 .

The second section gives the results of the F tests on the seasonal dummies.

The third section gives a selection of model runs, starting with the formulations given in the main text, following by runs with different lags and in log linear form. Lags are denoted by brackets, e.g. $X(-2)$ is exports lagged 2 quarters. In the article $X(-2)$ is denoted by X_{-2} .

SECTION I: DATA

PROF - DATE REVISED: 10/07/87
 QUARTERLY DATA FROM 1981 1 TO 1987 2

LHS VALUES FROM EQUATION 1 OF MODEL EQIN1

1981	1	74.	84.	103.	101.
1982	1	76.	116.	130.	177.
1983	1	181.	136.	161.	181.
1984	1	247.	187.	221.	328.
1985	1	280.	363.	336.	342.
1986	1	301.	277.	349.	419.
1987	1	290.	325.		

X - DATE REVISED: 12/07/87

QUARTERLY DATA FROM 1980 1 TO 1987 3

1980	1	212.4	232.2	234.3	247.3
1981	1	263.9	326.2	328.9	365.4
1982	1	374.1	448.9	404.3	453.8
1983	1	468.8	557.	589.8	652.
1984	1	711.6	813.	777.4	938.7
1985	1	985.6	962.6	854.6	895.2
1986	1	906.6	926.8	789.2	939.3
1987	1	924.	1053.	962.8	

TU - DATE REVISED: 10/07/87

QUARTERLY DATA FROM 1980 1 TO 1987 2

TU = TU(1)

1980	1	214.	234.7	224.7	276.9
1981	1	315.3	351.1	344.4	430.4
1982	1	402.1	460.8	435.3	482.
1983	1	519.4	557.5	538.5	679.4
1984	1	736.5	851.5	784.2	950.7
1985	1	993.5	910.1	798.	836.1
1986	1	855.7	927.2	763.1	905.6
1987	1	910.1	1021.8		

XF - DATE REVISED: 12/07/87
QUARTERLY DATA FROM 1980 1 TO 1987 3

1980	1	240.	267.2	268.4	276.6
1981	1	295.1	371.2	369.5	403.7
1982	1	413.8	507.2	451.	497.6
1983	1	516.7	616.2	660.2	725.2
1984	1	765.3	907.2	866.5	1021.
1985	1	1069.2	1073.9	963.3	1000.5
1986	1	999.1	1047.1	889.	1039.7
1987	1	1060.3	1265.8	1129.2	

TUF - DATE REVISED: 10/07/87
QUARTERLY DATA FROM 1980 1 TO 1987 2

1980	1	287.2	311.3	292.2	346.9
1981	1	393.3	448.2	439.1	520.1
1982	1	497.5	573.4	538.2	587.4
1983	1	624.	683.1	658.6	818.5
1984	1	842.6	1009.3	925.1	1081.6
1985	1	1147.6	1072.1	952.5	993.4
1986	1	1012.3	1095.2	919.7	1051.1
1987	1	1113.	1269.5		

D1 - DATE REVISED: 10/19/87
 QUARTERLY DATA FROM 1980 1 TO 1987 2

1980	1!	1.	0.	0.	0.
1981	1!	1.	0.	0.	0.
1982	1!	1.	0.	0.	0.
1983	1!	1.	0.	0.	0.
1984	1!	1.	0.	0.	0.
1985	1!	1.	0.	0.	0.
1986	1!	1.	0.	0.	0.
1987	1!	1.	0.		

D2 - DATE REVISED: 10/19/87
 QUARTERLY DATA FROM 1980 1 TO 1987 2

1980	1!	0.	1.	0.	0.
1981	1!	0.	1.	0.	0.
1982	1!	0.	1.	0.	0.
1983	1!	0.	1.	0.	0.
1984	1!	0.	1.	0.	0.
1985	1!	0.	1.	0.	0.
1986	1!	0.	1.	0.	0.
1987	1!	0.	1.		

D3 - DATE REVISED: 10/19/87
 QUARTERLY DATA FROM 1980 1 TO 1987 2

1980	1!	0.	0.	1.	0.
1981	1!	0.	0.	1.	0.
1982	1!	0.	0.	1.	0.
1983	1!	0.	0.	1.	0.
1984	1!	0.	0.	1.	0.
1985	1!	0.	0.	1.	0.
1986	1!	0.	0.	1.	0.
1987	1!	0.	0.		

SECTION II F TESTS

F Tests of Significance on Seasonal Dummies

$$F_{(n-k), q} = \frac{(e'_R e_R - e'e)/q}{e'e/(n-k)}$$

$e'e$ = sum of squared residuals, SSR, in the unrestricted run
 R = restricted run, i.e. without dummies
 q = no. of restrictions
 n = no. of observations
 k = no. of coefficients, incl. intercept, in unrestricted run

Restricted run: $PROF = a_1 + a_2 X_{-2}$

Unrestricted run: $PROF = a_1 + a_2 X_{-2} + a_3 D_1 X_{-2} + a_4 D_2 X_{-2} + a_5 D_3 X_{-2}$

Test of model using X_{-2} :

$$F = \frac{(21314.6 - 16116.3)/3}{16116.3/(26-5)} = 2.26 \quad \text{NOT SIGNIF.} \quad F_{.95}(21,3) = 3.07$$

$$F_{.99}(21,3) = 4.87$$

Test of model using XF_{-2} :

$$F = \frac{(19865.0 - 15893.1)/3}{15893.1/(26-5)} = 1.75 \quad \text{NOT SIGNIF.}$$

Test of model using TU_{-2} :

$$F = \frac{(23656.9 - 16957.4)/3}{16957.4/21} = 2.77 \quad \text{NOT SIGNIF.}$$

Test of model using TUF_{-2} :

$$F = \frac{(22145.1 - 17373.9)/3}{17373.9/21} = 1.92 \quad \text{NOT SIGNIF.}$$

SECTION III: MODEL RUNS

Models Used in the Paper

1 : PROF = A1+A2*X(-2)+A3*X(-2)*D1+A4*X(-2)*D2+A5*X(-2)*D3

NOB = 26 NOVAR = 5 RANGE: 1981 1 TO 1987 2
 RSQ = 0.940405 CRSQ = 0.929053 F(4/21) = 82.8443 PROB>F = 0.
 SER = 27.7027 SSR = 16116.3 DW(0) = 1.98725 COND = 6.41283
 MAX:HAT = 0.387382 RSTUDENT = 2.57318 DFFITS = 1.65827

COEF	ESTIMATE	STER	TSTAT	PROB> T
A1	-16.6621	14.4427	-1.15367	0.261598
A2	0.41265	0.024737	16.6816	0.
A3	-0.020823	0.023451	-0.88792	0.384641
A4	-0.054113	0.021835	-2.47824	0.021777
A5	-0.039649	0.023065	-1.71897	0.100328

2 : PROF = A1+A2*XF(-2)+A3*XF(-2)*D1+A4*XF(-2)*D2+A5*XF(-2)*D3

NOB = 26 NOVAR = 5 RANGE: 1981 1 TO 1987 2
 RSQ = 0.94123 CRSQ = 0.930036 F(4/21) = 84.0815 PROB>F = 0.
 SER = 27.5102 SSR = 15893.1 DW(0) = 2.01093 COND = 6.39041
 MAX:HAT = 0.382203 RSTUDENT = 2.37482 DFFITS = 1.55325

COEF	ESTIMATE	STER	TSTAT	PROB> T
A1	-18.1261	14.4145	-1.25749	0.222383
A2	0.370207	0.021996	16.8305	0.
A3	-0.019276	0.02076	-0.928509	0.363694
A4	-0.044159	0.019487	-2.26608	0.034136
A5	-0.02645	0.020748	-1.27482	0.216299

3 : PROF = A1+A2* $TU(-2)$ +A3* $TU(-2)$ *D1+A4* $TU(-2)$ *D2+A5* $TU(-2)$ *D3

NOB = 26 NOVAR = 5 RANGE: 1981 1 TO 1987 2
 RSQ = 0.937294 CRSQ = 0.92535 F(4/21) = 78.4743 PROB>F = 0.
 SER = 28.4165 SSR = 16957.4 DW(0) = 1.87892 COND = 6.84863

MAX:HAT = 0.39473 RSTUDENT = 2.15287 DFFITS = 1.40213

COEF	ESTIMATE	STER	TSTAT	PROB> T
A1	-38.7739	16.0409	-2.41719	0.024822
A2	0.44267	0.026771	16.5357	0.
A3	-0.005062	0.024576	-0.205958	0.838807
A4	-0.053878	0.022429	-2.40216	0.02563
A5	-0.04454	0.023528	-1.89306	0.072213

4 : PROF = A1+A2* $TUF(-2)$ +A3* $TUF(-2)$ *D1+A4* $TUF(-2)$ *D2+A5* $TUF(-2)$ *D3

NOB = 26 NOVAR = 5 RANGE: 1981 1 TO 1987 2
 RSQ = 0.935754 CRSQ = 0.923517 F(4/21) = 76.4676 PROB>F = 0.
 SER = 28.7633 SSR = 17373.9 DW(0) = 2.02996 COND = 7.18097
 MAX:HAT = 0.386131 RSTUDENT = 2.16435 DFFITS = 1.39316

COEF	ESTIMATE	STER	TSTAT	PROB> T
A1	-55.9031	17.188	-3.25245	0.00381
A2	0.389537	0.023648	16.4723	0.
A3	-0.004082	0.020722	-0.196994	0.845726
A4	-0.039522	0.019164	-2.06225	0.051773
A5	-0.029615	0.020145	-1.47011	0.156356

Other Models in Log Form

1 : LOG(PROF) = A1+A2*LOG(XF(-2))+A3*LOG(XF(-2))*D1+A4*LOG(XF(-2))*D2+A5*LOG(XF(-2))*D3

NOB = 26 NOVAR = 5 RANGE: 1981 1 TO 1987 2
 RSQ = 0.939326 CRSQ = 0.927769 F(4/21) = 81.2782 PROB>F = 0.
 SER = 0.14345 SSR = 0.432138 DW(0) = 1.9019 COND = 33.5569
 MAX:HAT = 0.247751 RSTUDENT = -3.53372 DFFITS = -1.58165 COMPARABLE R² = 0.939335

COEF	ESTIMATE	STER	TSTAT	PROB> T!
A1	-1.78725	0.399189	-4.47721	0.
A2	1.10386	0.061357	17.9907	0.
A3	-0.006126	0.012442	-0.492402	0.627544
A4	-0.016966	0.012259	-1.38397	0.180902
A5	-0.003336	0.012806	-0.260481	0.79703

2 : LOG(PROF) = A1+A2*LOG(XF(-2))+A3*LOG(XF(-3))+A4*LOG(XF(-2))*D1+A5*LOG(XF(-2))*D2+A6*LOG(XF(-2))*D3

NOB = 26 NOVAR = 6 RANGE: 1981 1 TO 1987 2
 RSQ = 0.939687 CRSQ = 0.924609 F(5/20) = 62.3207 PROB>F = 0.
 SER = 0.146555 SSR = 0.429568 DW(0) = 1.92893 COND = 302.28
 MAX:HAT = 0.372546 RSTUDENT = -3.42175 DFFITS = -1.565 COMPARABLE R² = 0.936703

COEF	ESTIMATE	STER	TSTAT	PROB> T!
A1	-1.73805	0.431924	-4.02396	0.
A2	0.933198	0.497343	1.87637	0.075275
A3	0.166578	0.481566	0.345909	0.733023
A4	-0.011162	0.019327	-0.577558	0.570008
A5	-0.017952	0.012844	-1.39763	0.177536
A6	-0.005927	0.015075	-0.393132	0.698381

$$3 : \text{LOG}(\text{PROF}) = A1 + A2 * \text{LOG}(\text{XF}(-3)) + A3 * \text{LOG}(\text{XF}(-3)) * D1 + A4 * \text{LOG}(\text{XF}(-3)) * D2 + A5 * \text{LOG}(\text{XF}(-3)) * D3$$

NOB = 26 NOVAR = 5 RANGE: 1981 1 TO 1987 2
 RSQ = 0.929489 CRSQ = 0.916058 F(4/21) = 69.2061 PROB>F = 0.
 SER = 0.154643 SSR = 0.502204 DW(0) = 2.01211 COND = 32.046
 MAX:HAT = 0.24259 RSTUDENT = -2.94044 DFFITS = -1.32581 COMPARABLE R² = 0.903349

COEF	ESTIMATE	STER	TSTAT	PROB> T
A1	-1.38248	0.408291	-3.38602	0.002788
A2	1.0639	0.064079	16.603	0.
A3	-0.038308	0.013376	-2.86394	0.009292
A4	-0.023786	0.01344	-1.76987	0.091269
A5	-0.020173	0.013928	-1.44837	0.162282

$$4 : \text{LOG}(\text{PROF}) = A1 + A2 * \text{LOG}(\text{XF}(-3)) + A3 * \text{LOG}(\text{XF}(-2)) + A4 * \text{LOG}(\text{XF}(-3)) * D1 + A5 * \text{LOG}(\text{XF}(-3)) * D2 + A6 * \text{LOG}(\text{XF}(-3)) * D3$$

NOB = 26 NOVAR = 6 RANGE: 1981 1 TO 1987 2
 RSQ = 0.939732 CRSQ = 0.924665 F(5/20) = 62.3704 PROB>F = 0.
 SER = 0.1465 SSR = 0.429247 DW(0) = 1.92694 COND = 305.95
 MAX:HAT = 0.380659 RSTUDENT = -3.42733 DFFITS = -1.55942 COMPARABLE R² = 0.936904

COEF	ESTIMATE	STER	TSTAT	PROB> T
A1	-1.73646	0.431821	-4.02125	0.
A2	0.17227	0.487396	0.35345	0.727449
A3	0.927404	0.503007	1.84372	0.080092
A4	-0.01123	0.019398	-0.578914	0.56911
A5	-0.018333	0.013071	-1.40253	0.176088
A6	-0.006078	0.01525	-0.39859	0.694419

Other Models with Different Lags

1 : PRDF = A1+A2*X

NOB = 26 NOVAR = 2 NCOEF = 2 RANGE: 1981 1 TO 1987 2
 RSQ = 0.830052 CRSQ = 0.822971 F(1/24) = 117.22 PROB>F = 0.
 SER = 43.7601 SSR = 45958.7 DW(0) = 1.57672 COND = 5.67066
 MAX:HAT = 0.147386 RSTUDENT = 2.66166 DFFITS = 0.785626

COEF	ESTIMATE	STER	TSTAT	PROB>T!
A1	-32.7557	25.0897	-1.30555	0.204084
A2	0.374725	0.034611	10.8268	0.

2 : PRDF = A1+A2*X(-1)

NOB = 26 NOVAR = 2 NCOEF = 2 RANGE: 1981 1 TO 1987 2
 RSQ = 0.824925 CRSQ = 0.81763 F(1/24) = 113.084 PROB>F = 0.
 SER = 44.4153 SSR = 47345.3 DW(0) = 2.32125 COND = 5.38932
 MAX:HAT = 0.138438 RSTUDENT = 4.49322 DFFITS = 1.03475

COEF	ESTIMATE	STER	TSTAT	PROB>T!
A1	-18.51	24.2802	-0.76235	0.453279
A2	0.370675	0.034857	10.6341	0.

3 : PRDF = A1+A2*X(-2)

NOB = 26 NOVAR = 2 NCOEF = 2 RANGE: 1981 1 TO 1987 2
 RSQ = 0.921182 CRSQ = 0.917898 F(1/24) = 280.5 PROB>F = 0.
 SER = 29.8011 SSR = 21314.6 DW(0) = 2.00024 COND = 5.07051
 MAX:HAT = 0.127469 RSTUDENT = 3.40836 DFFITS = 1.08758

COEF	ESTIMATE	STER	TSTAT	PROB>T!
A1	-16.0089	15.3936	-1.03997	0.308719
A2	0.382431	0.022834	16.7481	0.

4 : PROF = A1+A2*X(-3)

NOB = 26 NOVAR = 2 NCOEF = 2 RANGE: 1981 1 TO 1987 2
 RSQ = 0.874166 CRSQ = 0.868923 F(1/24) = 166.727 PROB>F = 0.
 SER = 37.6548 SSR = 34029.2 DW(0) = 2.36248 COND = 4.82182
 MAX:HAT = 0.125602 RSTUDENT = 2.53694 DFFITS = 0.81626

COEF	ESTIMATE	STER	TSTAT	PROB> T
A1	2.49914	18.5676	0.134582	0.894065
A2	0.368839	0.028565	12.9123	0.

5 : PROF = A1+A2*X(-1)+A3*X(-2)

NOB = 26 NOVAR = 3 NCOEF = 3 RANGE: 1981 1 TO 1987 2
 RSQ = 0.927463 CRSQ = 0.921156 F(2/23) = 147.041 PROB>F = 0.
 SER = 29.2039 SSR = 19615.9 DW(0) = 1.94726 COND = 25.5636
 MAX:HAT = 0.299828 RSTUDENT = 2.91115 DFFITS = 1.90501

COEF	ESTIMATE	STER	TSTAT	PROB> T
A1	-8.20505	15.0666	-0.51069	0.614435
A2	-0.127462	0.090318	-1.41126	0.171553
A3	0.502801	0.088179	5.70203	0.

6 : PROF = A1+A2*X(-2)+A3*X(-3)

NOB = 26 NOVAR = 3 NCOEF = 3 RANGE: 1981 1 TO 1987 2
 RSQ = 0.92166 CRSQ = 0.914848 F(2/23) = 135.297 PROB>F = 0.
 SER = 30.3496 SSR = 21185.2 DW(0) = 2.02865 COND = 24.679
 MAX:HAT = 0.317508 RSTUDENT = 3.32406 DFFITS = 1.07149

COEF	ESTIMATE	STER	TSTAT	PROB> T
A1	-15.5379	15.7272	-0.987967	0.333449
A2	0.34856	0.093343	3.73419	0.001086
A3	0.034625	0.092415	0.374673	0.711336