The Evolution of the Rate of Unemployment in Ireland 1962-1983

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I. *Introduction*

For decades an objective of policy in Ireland has been to lower the rate of unemployment — indeed to achieve full employment. Yet instead of falling, the rate of unemployment has increased rather dramatically to record levels. Many possible explanations for this state of affairs have been advanced.

One view looks at the demand for labour and points to the slow growth in the world economy and to a failure of real wages to respond sufficiently to the energy price shocks of the 1970s. Job losses in the 1970s and 1980s have been the key source of unemployment according to this view.

An alternative interpretation notes the sharp reversal of net emigration during the last decade and a half and attributes the growth in unemployment to a corresponding surge in labour supply at home.

According to a third, less plausible perspective, the increase in unemployment is largely a function of an increase in the propensity of those not genuinely seeking work to apply for (increasingly generous) unemployment assistance or benefits or in an increase in the time spent searching for suitable jobs.

Probably each of the three factors has played a part in governing the evolution of the rate of unemployment in Ireland over the past two decades, though their relative importance is the subject of much dispute.

In other larger countries, unemployment has also increased sharply. The role of migration there is obviously small, and the explanation is usually shared between the other two factors. For Ireland, however, migration may be a dominant element in the long run providing the link with unemployment conditions in other countries.

As labour market conditions improve at home or deteriorate abroad Irish workers who might otherwise have emigrated are slower to do so. Also Irish participants in foreign labour markets, especially in Britain, look homeward for job opportunities. This puts upward pressure on the unemployment rate here. When unemployment has worsened sufficiently at home, further net

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immigration will be discouraged. The reverse process can be envisaged following an improvement in labour market conditions abroad, with increased net emigration leading to a reduction in unemployment at home.

There can also be booms and slumps in the demand for labour at home. While these can result in temporary changes in the unemployment position at home, the response of migration will tend, eventually, to eliminate this change, except to the extent that the initial change in unemployment at home has been accompanied by simultaneous and corresponding changes abroad.

The migration theory just outlined is not new. It has been embodied in most of the work which applied econometricians have conducted in the field of aggregate labour market statistics in Ireland over the past few years. In this paper we present a sharper and more conclusive version of this model than has previously been derived. We argue that the Irish unemployment rate, while it can deviate from its average differential *vis-à-vis* the UK unemployment rate, has, in the last 20 years, had a tendency, after reaching abnormal differentials, to converge back towards the average differential. On the basis of past experience, substantial changes in the international unemployment differential can perhaps be expected to be transitory.[1]

Of course it can be argued that the past may be a poor guide to the future in this case. A protracted period of net immigration in the 1970s has depleted the pool of persons abroad likely to return in future years, and has weakened the network of contacts which made it so easy for would-be emigrants to get established abroad. That may be so, but this line of reasoning tends to neglect the continued high level of international mobility of Irish people. Even in those years of high immigration, 1971-76, the level of emigration of young persons was consistent with almost a tenth of each cohort of school-leavers having emigrated.

However, we do not wish to place too much emphasis on the migration theory, as our methodology is not specifically designed to test this theory. There could be other reasons for the international convergence in unemployment rates which we document. Our statistical results can be interpreted in the context of the migration theory, but are of independent interest.

The paper reports on a statistical exploration of the quarterly unemployment rate. We find that an equation consistent with the migration theory — but not exclusively bound to that theory — fits the data rather well. The key explanatory variable is unemployment in the UK. (Previous models have also taken account of relative wages and relative social security benefits as additional indicators of the push and pull factors which influence migration. While we do not disagree with this, we find that our simpler approach using only unemployment rates gives good results. Our account of the determinants of migration takes unemployment rates to be an indicator of job availability, but this is not inconsistent with a role of labour supply behaviour in influencing unemployment).

We examine a list of additional explanatory variables and find that they only have at most a transitory effect on unemployment (although they can have

[1]It is interesting to note that regional unemployment rate differentials within Ireland have also remained roughly constant, cf. Geary and Hughes (1970), Walsh (1974).

an enduring effect on the level of employment). These variables include the Government deficit, real wages, employment in manufacturing and GNP. Our list of explanatory variables could be augmented, and it is hoped to pursue further work along these lines.

The main message which the data seem to reveal is that movements in the Irish unemployment rate are correlated with those in the UK rate, with a tendency for the Irish rate, if disturbed, to return eventually from abnormally high, or low, levels by reference to the UK rate.

II. Methodology

It has not been customary in Ireland to regard unemployment as a variable which should be modelled in a single stochastic equation. The usual methodology, going back to Geary and McCarthy (1976), Walsh (1977), and employed in the various versions of the macromodel (Bradley *et al.*, 1981) is to model unemployment as the difference of labour supply and labour demand functions which are estimated independently. Labour supply is influenced by demographic variables, particularly migration, which in turn are affected by economic variables such as relative labour market conditions at home and abroad as measured by cross-channel differentials in wages, unemployment rates and social benefits. Labour demand is influenced by planned economic activity and by wage rates.

These models use the published data on migration. The quality of these data is thought to be extremely poor (Keenan, 1981) and this mars the empirical implementation of the approaches adopted to date.

The present work pursues an alternative reduced form type of approach which bypasses the migration data problems and explores the determination of the unemployment rate in terms of its own dynamics and possible forcing variables such as unemployment conditions abroad and economic activity at home.

A caveat must be entered with regard to the data. It is well known that the figures on unemployment are subject to a number of uncertainties and difficulties of interpretation. In particular, it has been suggested that they may be affected by registration bias related to the precise conditions governing unemployment benefits. This study stops short of an analysis of this problem, which may not be fully answerable in the context of an aggregate employment equation (see footnote 4). Our results must, therefore, be read with the possibility of specification bias borne in mind.

III. The Basic Dynamics of Irish Unemployment

The unemployment rate[2] in Ireland (U) has had a mean value of 8.8 per cent (1960:3—1983:2) and a standard deviation of 3.5 per cent. It is plotted in

[2]We are here modelling the seasonally adjusted insured unemployment series, i.e., the number of persons who are insured and who register themselves as unemployed at local employment exchanges expressed as a percentage of the insured population (excluding Agriculture, Fishing and Private Domestic Service). Like all of the unemployment series this is marred by changes in definitions and questions about its relevance to economic concepts of unemployment. Some other series were explored in a limited way. The only qualitative difference to be noted was that, when normalised by interpolated labour force instead of insured population, the relative magnitude of the coefficients on A and A(−1) in the equation corresponding to (3) below were reversed, implying a possible, though small, permanent negative impact of A. However, almost all of the estimated effect of A was still transitory.

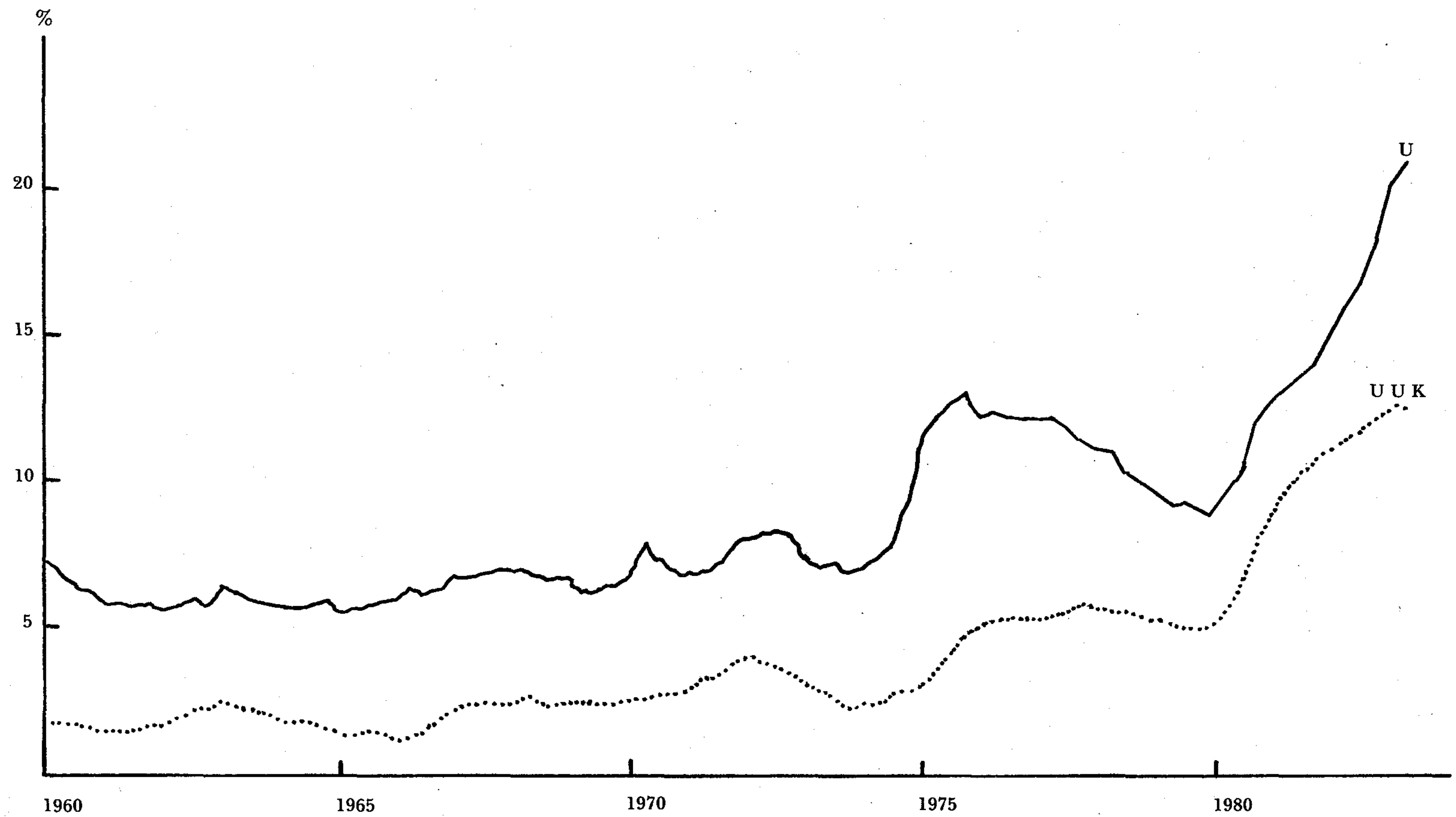


FIGURE 1: Unemployment Rates 1960-83
Ireland = U
United Kingdom = UUK

Figure 1. The pronounced upward drift is confirmed by the following simple but satisfactory autoregression, i.e. (with t-statistics in parentheses)

$$U = \underset{(63.34)}{1.026U(-1)} + \underset{(4.96)}{0.496(U(-1) - U(-2))} - \underset{(1.04)}{0.149} + \underset{(3.52)}{1.515D751} \quad (1)$$

$R^2 = 0.985$ SER = 0.416 Durbin h = 0.42 62:1 – 83:1

We have included an intercept shift dummy (D751) for the biggest outlier: the first quarter of 1975. Definitional changes in the unemployment series may have had a part in making this an exceptional observation[3], and it seems desirable in any case on statistical grounds to prevent its interfering with our estimates.

The coefficient on U(–1) being greater than one (albeit not significantly so) indicates that the Irish unemployment rate has shown no tendency to settle down at, or about, a given level. This suggests that some forcing variable might be postulated to explain the upward drift. In line with existing theory we are inclined to use the unemployment rate in the United Kingdom as a forcing variable. There are good empirical as well as theoretical reasons for doing this. A visual examination of the two series (Figure 1) reveals common features, especially the sharp upturn after 1973:4. Furthermore, the difference between Irish and UK rates, which has a mean of 4.87 per cent, has a standard deviation of only 1.24 per cent, little over one-third that of the Irish rate, illustrating a strong positive correlation between the two series. The difference, U*, is plotted in Figure 2.

A satisfactory autoregression for the cross-channel difference in unemployment U* is

$$U^* = \underset{(26.37)}{0.915U^*(-1)} + \underset{(3.49)}{0.360(U^*(-1) - U^*(-2))} + \underset{(2.47)}{0.414} + \underset{(4.13)}{1.625D751} \quad (2)$$

$R^2 = 0.912$ SER = 0.373 Durbin h = 0.49 62:1 – 83:1

The estimated deterministic process for U* is stable, and the coefficient on U*(–1) is significantly different from unity. The standard error of estimate is substantially lower than that for U.

It may be noted that the fit of Equation (2) is comparable (in fact better) in terms of residual standard error to that obtained in the only other quarterly study known to the author (i.e., O'Casaide, 1983).

Rewriting Equation (2) (and ignoring the dummy) we have

$$(U^* - 4.87) = 0.915\,(U^*(-1) - 4.87) + 0.360\,(U^*(-1) - U^*(-2))$$

According to this simple mechanical scheme, each quarter sees a tendency towards closing the gap between the cross-channel difference in unemployment rates and its "normal" level (4.87), with a shrinking factor of 0.915; at the same time there is a partial persistence of last period's change to the extent of 0.36 times the previous change. Movements in the difference in

[3]What we have in mind here is the abolition of the upper income limit for eligibility about one year previously but in view of the many changes in definition over the years not too much should be made of this. Actually our main conclusion concerning the conservative properties of the cross-channel unemployment differential is not at all influenced by the decision to include this dummy.

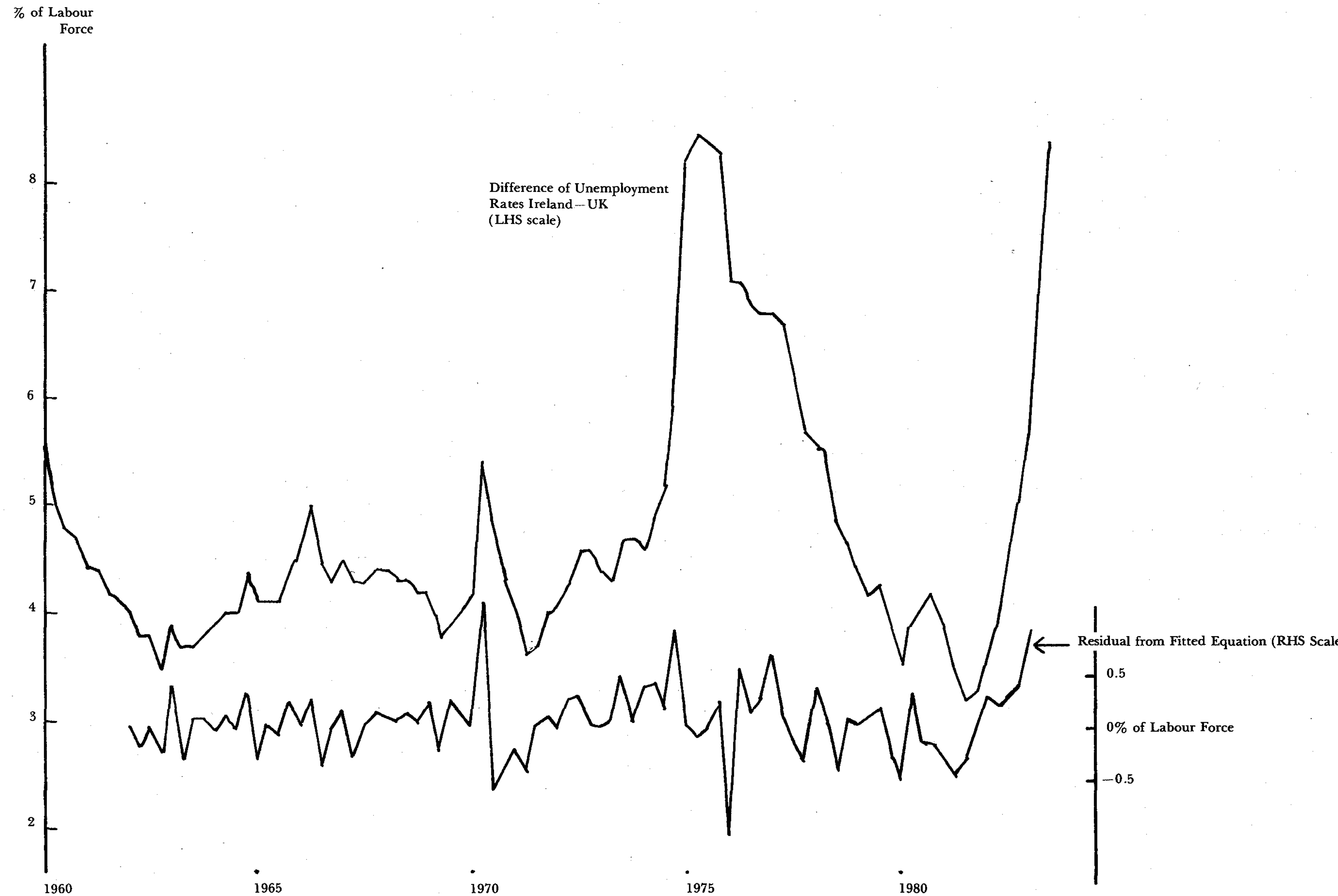


FIGURE 2: Difference of Unemployment Rates Ireland — UK 1960-1983, U* (LHS scale) Residual from Fitted Equation (RHS scale)

unemployment rates have a momentum: any movement once started tends to continue to some extent, but there is also the tendency towards equilibrium.

We can compute how the difference in unemployment rates would react to a once for all disturbance, according to this model, and an example is plotted in Figure 3. This shows how, while the Irish unemployment rate may vary independently of the UK rate, there is, according to the equation, a tendency to restore the "normal" differential.

As with all statistical models, there is a range of uncertainty about the parameters. Accordingly, it should not be thought that a constant "normal" differential has been ascertained with precision. The fact of convergence from abnormal differentials is not altered by the consideration that the exact focus of convergence is not known precisely, nor that it may change gradually over time. In the next section we address the question of influences on this "normal" differential in a preliminary way.

We do not look at unemployment in the 1950s in this paper, but it should be noted that the average cross-channel unemployment differential in that decade was significantly higher than in our sample period.

The speed of adjustment is also subject to uncertainty, and the fact that adjustment in our model seems to take several years is another reason for noting that our sample extends over only two decades.

IV. Transitory and Permanent Influences in the Cross-Channel Unemployment Differential

The autoregressive model outlined in the previous section does not allow any scope for permanent changes in the cross-channel differential. According to these equations, this differential always tends towards a fixed amount. But the equations do have residual errors which might conceal other, possibly permanent, influences on unemployment.

In order to examine this possibility we chose four potentially exogenous influences on unemployment. These were: two concepts of the Government deficit A and B (B excludes National Debt Interest), real wages in manufacturing C, employment in manufacturing industry E, and GNP growth F. In all cases but E we used smoothed, interpolated annual data. Apart from avoiding data lacunae, this should have served to help identify permanent influences.

We began by adding both current and lagged values of each of these variables in turn to Equation (2). The results are shown in Appendix Tables 1 and 2. These tables explore the possibility that, in addition to a transitory effect of these variables on unemployment there might be a permanent effect. Appendix Table 1 allows for both permanent and transitory effects by including both current and lagged values of these variables without restricting the value of their coefficients. We found that, notably, in each case current and lagged values have coefficients of approximately equal absolute magnitudes, but opposite signs. For instance, in the case of the Government deficit variable A, we estimated:

$$U^* = \underset{(25.33)}{0.886}\, U^*(-1) + \underset{(3.28)}{0.33}(U^*(-1) - U^*(-2)) + \underset{(2.34)}{0.40} + \underset{(4.43)}{1.70}D751 - \underset{(2.00)}{1.27}A + \underset{(2.31)}{1.48}A(-1) \quad (3)$$

$$R^2 = 0.920 \qquad SER = 0.360 \qquad DW = 2.03$$

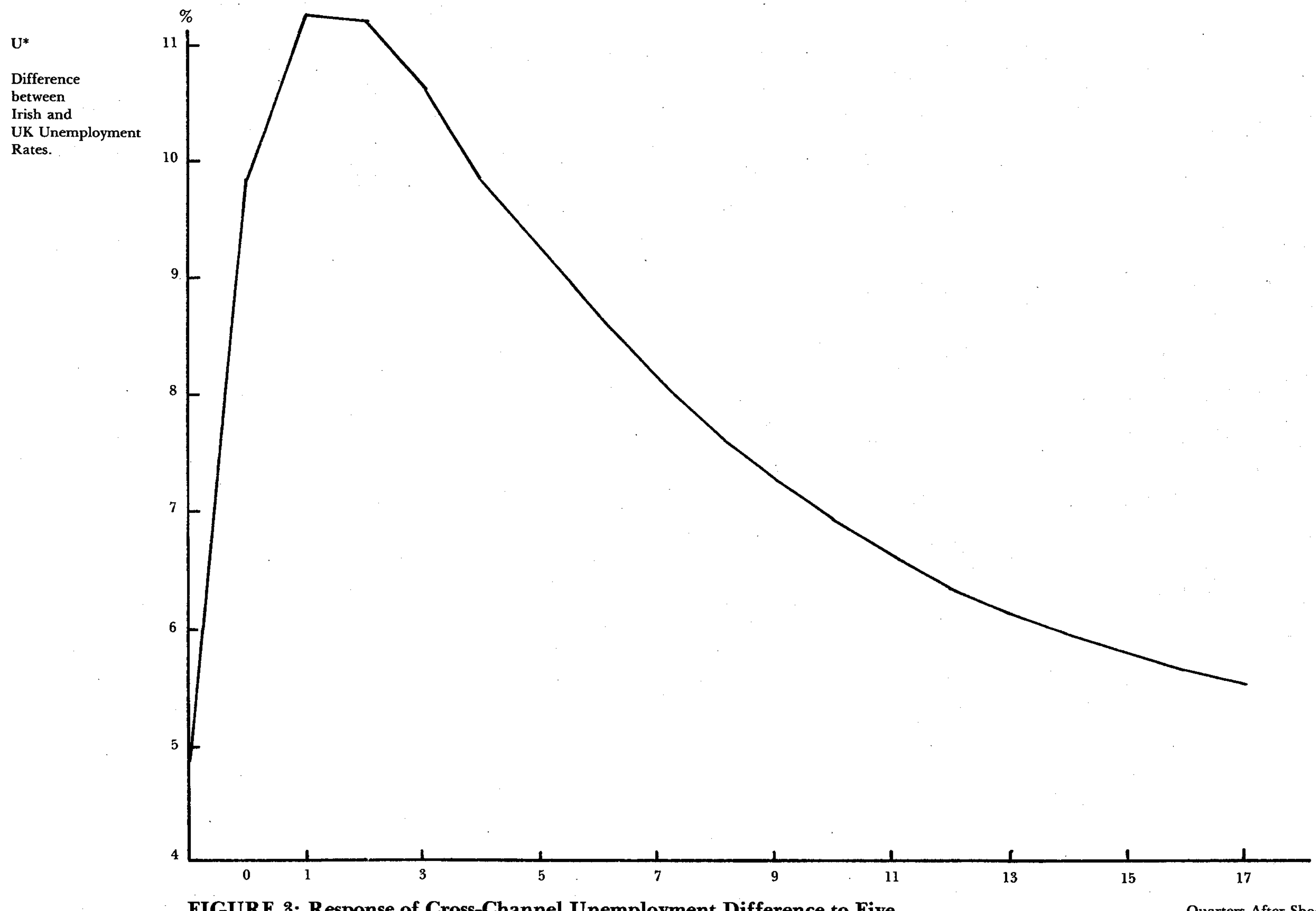


FIGURE 3: Response of Cross-Channel Unemployment Difference to Five Percentage Point Shock. (Based on EQN 2′).

The mathematical implication of equal but opposite-signed coefficients on the current and lagged values is that the impact of these variables on the unemployment differential is only a transitory one. The initial effect, even though it may be spread out over many quarters, is almost exactly offset, with a lag. The pattern of impact is along the lines of Figure 3 above.

To verify that the differences in the absolute magnitude of current and lagged effects were statistically insignificant we re-estimated the equations with the first difference (current minus lagged) of each of the extra explanatory variables instead of the current and lagged separately. The results are shown in Appendix Table 2: there is hardly any deterioration in fit, and the "marginal F-test" for the hypothesis that the deterioration in fit is not significant is failed only for Equation (3′). For each of the explanatory variables other than A, therefore, we cannot reject the hypothesis that there is no permanent effect. Consulting Equation (3), we find that, even if there is a small permanent effect for A it is in the direction of having an expansion in the deficit A *increase*, rather than reduce, unemployment.

So far as the variables we have examined are concerned, therefore, it seems from these estimates that changes in them will only have a transitory effect. That is in line with the assumptions of the theoretical framework of Geary and McCarthy (1976), (cf. McCarthy, 1979; Honohan, 1982). This is the first time that that hypothesis has been subjected to a satisfactory test. Nevertheless, the results should be treated with caution, especially since interpolated data were used. Even though we believe that interpolation has not in any way helped to produce the effects we have found — on the contrary, it probably made them less evident — nevertheless the data series cannot be considered ideal. All the same, as indicated above, relatively smooth series such as we have used reflecting long-run expected or "permanent" movements are to be preferred in this context to series dominated by transitory movements. (The alternative, available for A, of using cash figures for Exchequer returns seemed, on limited investigation, to yield comparable results.)

Reviewing Appendix Table 2, we see that the wage variable C and the GNP variable F are not significant in first differences. Furthermore, C has what might be regarded as an unexpected sign: an increase in wages seems to be associated with lower unemployment. This procyclical evolution of wages is familiar from other countries; actually it does not capture a causal path from wages but is due to a simultaneous equations bias. To see this we first estimate Equation (8), as in Appendix Table 3, and then, using instruments for ΔC, (8′). The significance of ΔC and ΔF falls dramatically between the two regressions[4].

[4]It is possible that cross-channel wage differentials could play a role on the side of labour supply, as has been suggested by many authors. This was not explored here in view of the particular difficulty of placing reliance on available data as truly representing expected cross-channel wage differentials applicable to any given segment of the labour force.

Another possibility is that unemployment benefits could be a relevant variable. O'Casaide (1983) examined this question and concluded that the magnitude of the effect of unemployment benefits was considerable. In an extended version of this paper (available from the author) it is shown that much of this effect hinges on the rather special functional form used by O'Casaide. When his variables (which he kindly made available) are added to our best equation, the estimated impact is small, largely transitory and depends heavily on one observation: 1974:4. The role of benefits needs further exploration, and is unlikely to be revealed by an aggregative approach such as the present one; cf. Hughes and Walsh (1983).

We are left with the Government deficit ΔA (or ΔB) and manufacturing employment growth ΔE as variables to be included. Our best equations so far are thus (6′) and (9):

$$U^* = \underset{(27.68)}{0.908}\, U^*(-1) + \underset{(2.18)}{0.224}\, (U^*(-1) - U^*(-2)) + \underset{(3.03)}{0.483} + \underset{(3.73)}{1.421}\, D751 - \underset{(1.72)}{1.053}\, \Delta A - \underset{(3.27)}{0.648}\, \Delta E \qquad (9)$$

$$R^2 = 0.926 \qquad SER = 0.347 \qquad \text{Durbin h} = 0.19$$

The residuals from (9) are plotted in Figure 2 (right-hand scale)[5]. It is clear that we are still not capturing several of the high frequency fluctuations: especially at 1970:2 and implicitly in the post-sample observation 1983:2. (Coefficient estimates seem generally robust to inclusion of an intercept dummy for 1970:2.)

To give an impression of the magnitude of the estimated effects of ΔA and ΔE, we may note that ΔE is scaled by the labour force, so that, by (9), an increase in manufacturing employment equivalent to 10 per cent of the labour force reduces the unemployment rate by 6.48 percentage points at first. ΔA is expressed as a fraction of GNP, so an increase in the Government's deficit equivalent to 10 per cent of GNP will lower the unemployment rate by 10.53 percentage points at first.

V. Refining the Dynamic Structure

It remains to test the proposed dynamic structure against more general hypotheses and to examine alternative structures. Two alternatives suggested themselves. The first is a simple error correction model, the second a first-order autocorrelation in the residuals in lieu of the second lag on U. The estimated equations for these, and for a rather general linear lag structure, are reported in Appendix Table 4.

It would be possible to test formally each of the equations in Appendix Table 4 against the others. We have simplified slightly by confining attention to six equations which can be placed in a nested structure as shown in Figure 4.

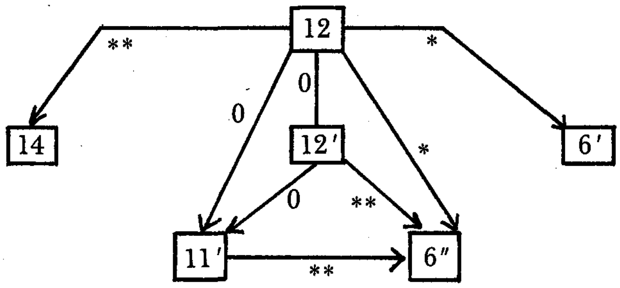
The sequence of F-tests reveals a preference for the error correction model (11′). Either this equation or (11) should probably be taken as the best representation of the dynamic structure, though comparison of the standard errors indicates that the margin of advantage is small[6]. The error correction model essentially weakens the assumption that the immediate response of Irish unemployment to shocks in British unemployment tends to be one hundred per cent, while retaining the assumption that the ultimate response will be so. Equation (11) indicates that a change in the UK unemployment rate tends to be associated with a contemporaneous change in the Irish rate of about one half the magnitude. This reduced contemporaneous effect is the main difference between (11) and (6′):

[5]This seems much to be preferred to the usual practice of plotting actual against fitted — a procedure which often deceives the eye.

[6]In the error correction model equation (11) the variable ΔA is not quite significant at five per cent. Including it does not alter the other coefficients by much.

FIGURE 4: Nested Hypothesis Testing

(*denotes significant at 5%, **at 1%, 0 not significant at 5%).



This figure indicates whether or not the various nested hypothesis tests were satisfied. The numbers denote equations. An arrow indicates a test of a more restricted equation (at the head of the arrow) against a less restricted (at the end of the arrow). Asterisks denote significant F-statistics (*: 5% **: 1%) indicating failure of the restriction. A zero means that the restriction could not be rejected at 5%.

$$\Delta U = \underset{(3.27)}{0.501} + \underset{(3.86)}{0.586}\,\Delta UUK - \underset{(2.55)}{0.83}U^*(-4) + \underset{(3.50)}{1.28}D751 - \underset{(4.57)}{1.037}\,\Delta E \qquad (11)$$

$$R^2 = 0.633 \qquad SER = 0.339 \qquad DW = 1.77 \qquad Q(12) = 12.2$$

(The Box-Ljung Q-statistic indicates no rejection of serial independence in the residuals.) As seen from comparison of (11) and (11′), the choice of lag length for U* does not really alter things much. In practice, the dynamic response of the two systems (6′ and 11) to shocks is little different, as can be seen from Figure 5.

For Equation (11), the estimated focus or "normal" differential is 6.04 per cent — higher than for Equation (2) because of the inclusion of ΔE. To check for structural stability of the equation over time, we split the sample in two halves. The Chow test was significant at 5 per cent but not at 1 per cent implying some evidence of instability. The estimated "normal" differentials in the two subperiods were 4.67 and 6.53 per cent. This gives an idea of the somewhat imprecise nature of this number.

A byproduct of these tests is the statistical confirmation (by the comparison of (14) with (12)), that UK unemployment is a relevant variable in the determination of Irish unemployment.

As for the autocorrelated errors model 13, an approximate F-test on the restriction $\rho = 0$ is not rejected, thus providing further indirect support for the error correction model.

VI. Conclusion

Although the Irish unemployment rate is unusually high by comparison with

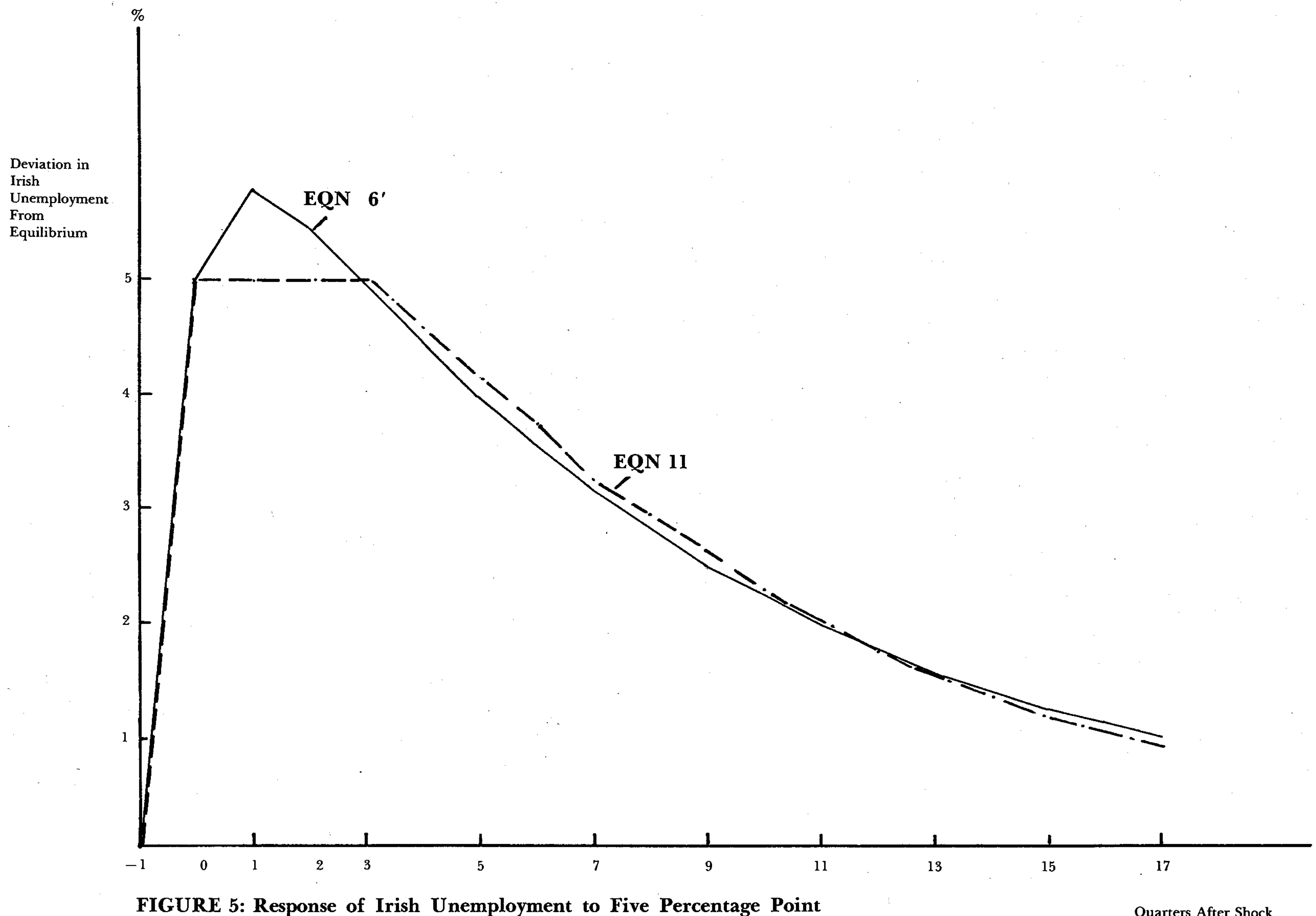


FIGURE 5: Response of Irish Unemployment to Five Percentage Point Disturbance (From Equilibrium)

that in the UK at the time of writing, we believe the past pattern of a closing of unusually large gaps between the two rates may reassert itself in the future.

This closing of the gap has sometimes in the past been facilitated by an upsurge in the demand for labour, as in the late 1970s. To that extent the convergence may have been merely coincidental. Furthermore, there have been substantial and broadly parallel changes in the level of social security benefits over the past two decades, and also in social attitudes. However, if there is a response of migration to unemployment differentials, then the convergence of evolution in unemployment rates here and in the UK may not be purely fortuitous.

While we are inclined to think that this is the case, and that the migration story outlined in the introduction is the chief explanation for the conservative properties of the cross-channel unemployment differential, it has to be admitted that our results need not necessarily be interpreted in this way.

After all, a weakening demand for labour could have occurred simultaneously in both countries, due to a common external cause. And a greater tendency to spend longer on the dole voluntarily could have arisen due to internationally correlated changes in attitudes and in the levels of benefit. But the relatively long lags which we encounter in the response of Irish to UK unemployment would seem to be somewhat more in keeping with the migration story.

The low level of unemployment in the UK in the 1960s may have facilitated migration flows to be more responsive to labour market conditions at home than could be expected now. And a weakening of the traditional channels of communication with the UK labour market, resulting from the sharply reduced emigration of the 1970s, could also modify migration behaviour in the future. Only time will tell whether our description of the past two decades will have relevance for the years ahead.

Finally, we would caution against drawing unduly strong policy conclusions from the simple model presented above. The full story about unemployment is much more complex and the objective here has been to highlight some salient features. In particular, it has been pointed out that unemployment in the 1950s was, on average, much higher, relative to the UK, than in the last 20 years which we have studied. The whys and wherefores of that fact are another day's work.

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APPENDIX TABLE 1: Role of Additional Explanatory Variables: Levels. (Dependent Variable: Difference in Unemployment Rates U*)

1962:1 — 1983:1

	(3)	(4)	(5)	(6)	(7)
Additional Variable:	A	B	C	E	F
U*(−1)	0.886 (25.33)	0.883 (24.99)	0.904 (25.17)	0.920 (27.8)	0.909 (25.47)
U*(−1) − U*(−2)	0.33 (3.28)	0.33 (3.26)	0.35 (3.39)	0.23 (2.15)	0.34 (3.28)
D751	1.70 (4.43)	1.68 (4.39)	1.60 (4.08)	1.32 (3.45)	1.55 (3.89)
Constant	0.40 (2.34)	0.46 (2.79)	0.24 (0.97)	0.59 (1.15)	0.27 (1.35)
Additional Variable: Current	−1.268 (2.00)	−1.301 (2.03)	−0.96 (0.79)	−0.70 (3.36)	0.41 (0.87)
Additional Variable: Lagged	1.481 (2.31)	1.560 (2.40)	1.07 (0.90)	0.69 (3.41)	−0.44 (0.95)
R^2	0.920	0.920	0.915	0.923	0.915
SER	0.360	0.360	0.372	0.353	0.372
DW	2.03	2.04	1.904	1.89	1.91
Durbin h	<0	<0	0.48	0.53	0.44

A = Government deficit.
B = Government deficit excluding National Debt interest.
C = Real wages in manufacturing industry.
E = Employment in manufacturing industry.
F = GNP growth.

APPENDIX TABLE 2: Role of Additional Explanatory Variables: Changes. (Dependent Variable: Difference in Unemployment Rates U*)

1962:1 — 1983:1

	(3′)	(4′)	(5′)	(6′)	(6″)	(7′)
Additional Variable:	ΔA	ΔB	ΔC	ΔE	ΔE	ΔF
U*(−1)	0.903 (26.03)	0.901 (25.93)	0.914 (26.36)	0.919 (28.15)	0.930 (28.16)	0.919 (26.22)
U*(−1) − U*(−2)	0.34 (3.36)	0.34 (3.34)	0.35 (3.33)	0.23 (2.24)		0.34 (3.23)
D751	1.73 (4.42)	1.73 (4.44)	1.60 (4.08)	1.32 (3.47)	1.45 (3.78)	1.56 (3.87)
Constant	0.48 (2.86)	0.49 (2.90)	0.44 (2.59)	0.43 (2.70)	0.38 (2.38)	0.42 (2.49)
Additional Variable	−1.258 (1.95)	−1.344 (2.06)	−1.27 (1.08)	−0.68 (3.42)	−0.84 (4.41)	−0.422 (0.90)
R^2	0.916	0.917	0.913	0.923	0.918	0.913
SER	0.367	0.366	0.373	0.351	0.359	0.374
DW	1.98	2.00	1.88	1.89	1.54	1.88
Durbin h	0.10	0.00	0.58	0.53	2.23	0.58
Marginal F	4.65*	3.88	0.72	0.16		2.17

*Significant at 5% (but not at 1%)
Δ denotes first difference

APPENDIX TABLE 3: Multiple Additional Explanatory Variables (Dependent Variable: Difference in Unemployment Rates U*) 1962:1—1983:1

	(8)	(8′)	(9)	(10)
Method	OLS	IV	OLS	OLS
U*(−1)	0.892 (27.28)	0.898 (26.07)	0.908 (27.68)	0.930 (28.16)
U*(−1) − U*(−2)	0.19 (1.90)	0.20 (1.93)	0.224 (2.18)	
D751	1.49 (4.00)	1.48 (3.94)	1.421 (3.73)	1.454 (3.78)
Constant	0.57 (3.58)	0.53 (3.08)	0.483 (3.03)	0.381 (2.38)
ΔA	−1.629 (2.56)	−1.482 (2.04)	−1.053 (1.72)	
ΔC	−3.06 (2.47)	−2.25 (0.94)		
ΔE	−0.82 (3.86)	−0.79 (3.45)	−0.648 (3.27)	−0.843 (4.41)
ΔF	−0.933 (1.77)	−0.770 (1.15)		
R^2	0.932	0.931	0.926	0.918
SER	0.337	0.338	0.347	0.359
DW	2.01	2.01	1.96	1.54
Durbin h	<0	<0	0.19	1.74

APPENDIX TABLE 4: Refining the Dynamic Structure 1962:1—1983:1

(11): $\Delta U = \underset{(3.27)}{0.501} + \underset{(3.86)}{0.586}\Delta UUK - \underset{(2.55)}{0.083}U^*(-4) + \underset{(3.50)}{1.28}D751 - \underset{(4.57)}{1.037}\Delta E$

$R^2 = 0.633$ SER = 0.339 DW = 1.77

(11′): $\Delta U = \underset{(2.65)}{0.407} + \underset{(3.68)}{0.566}\Delta UUK - \underset{(1.90)}{0.061}U^*(-1) + \underset{(3.45)}{1.29}D751 - \underset{(5.39)}{1.192}\Delta E$

$R^2 = 0.621$ SER = 0.345 DW = 1.75

(12): $U = \underset{(2.21)}{0.350} + \underset{(11.11)}{1.129}U(-1) - \underset{(2.01)}{0.206}U(-2) + \underset{(2.38)}{0.533}UUK - \underset{(1.57)}{0.652}UUK(-1)$

$+ \underset{(0.99)}{0.227}UUK(-2) + \underset{(3.51)}{1.305}D751 - \underset{(3.91)}{0.927}\Delta E$

$R^2 = 0.990$ SER = 0.335 DW = 2.10

(12′): $U = \underset{(2.01)}{0.319} + \underset{(29.69)}{0.934}U(-1) + \underset{(3.03)}{0.480}UUK - \underset{(2.34)}{0.385}UUK(-1) + \underset{(3.76)}{1.402}D751 - \underset{(4.99)}{1.11}\Delta E$

$R^2 = 0.990$ SER = 0.340 DW = 1.80 Durbin h = 0.96

(13): $U^* = \underset{(2.23)}{0.429} + \underset{(23.29)}{0.921}U^*(-1) + \underset{(3.61)}{1.308}D751 - \underset{(3.84)}{0.793}\Delta E, \ \rho = 0.20$

$R^2 = 0.884$ SER = 0.353 DW = 1.88 Durbin h = 0.59

(14): $U = \underset{(0.37)}{0.049} + \underset{(71.00)}{1.014}U(-1) + \underset{(2.27)}{0.228}U(-2) + \underset{(2.60)}{1.005}D751 - \underset{(5.24)}{1.25}\Delta E$

$R^2 = 0.988$ SER = 0.361 DW = 2.06

Method: OLS except 13: GLS Auto.