Journal of the Statistical and Social Inquiry Society of Ireland
Vol XXVI, Part II

HYSTERESIS AND THE NATURAL RATE OF UNEMPLOYMENT IN IRELAND

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(read before the Society, 23rd November 1989)

"This lecture is delivered under the auspices of the Barrington Trust (founded in 1836 by the bequest of John Barrington Esq.) with the collaboration of the Statistical and Social Inquiry Society of Ireland."

1. INTRODUCTION

Conventional Keynesian or Classical macroeconomic theories must be considered inadequate to explain unemployment experiences such as the Irish one. Rigidities that one might associate with fixed contracts, or even adjustment costs in relation to prices or quantities, can hardly account for 17 years of rising unemployment. Indeed, surely such an upturn in conjunction with the apparent breakdown of the unemployment-inflation relationship serves to challenge the existence in Ireland of a ***stable*** "natural" rate of unemployment towards which the economy would gravitate and at which the level of inflation would remain constant.

Within this context it is compelling to consider the existence of hysteresis in the labour market - i.e. the possibility that an increase in umemployment could have a direct impact on the natural rate or, to put it another way, that this year's equilibrium unemployment depends upon last year's actual rate.

This paper examines the presence of hysteresis in the Irish labour market and in so doing enables estimates for the Irish natural rate of unemployment to be calculated. In all cases the long-term equilibrium rate of unemployment is considered to be the same as the natural rate.

In Section 2 competing explanations for the hysteresis phenomenon, specif-

ically physical capital, human capital and insider (union members)-outsider (non-union members) explanations are discussed. The following section briefly considers some econometric issues which may arise in the presence of hysteresis while Section 4 is concerned with some discrete time dynamics associated with the natural rate of unemployment. In Section 5 a procedure for testing for hysteresis is derived from the analysis in the preceding two sections. The paper then goes on to apply this test to Irish data and discusses the implications of the results. Since no such work has been done in an international context, it was not possible to compare the Irish outcome with that for other economies. In so far as possible mathematical considerations are dealt with in the appendices.

2. THEORIES OF HYSTERESIS

The word hysteresis derives from a Greek word meaning to be behind or to lag. In the context of the labour market the term is currently being applied to the case where the labour market equilibrium is path dependent. In simple terms in the context of unemployment, hysteresis describes the situation where if unemployment deviates from its equilibrium level then this deviation will cause the equilibrium level itself to change. Hence a shock to unemployment in a single period could have long term effects. The importance of hysteresis in the labour market is crucial, for if adverse shocks have caused a period of high unemployment and hysteresis has caused its persistence, then a strong role for Government policy exists.

There are a number of competing yet in some ways complementary explanations for why a shock to unemployment will change the equilibrium rate.

(i) Physical Capital Explanations

The essence of these explanations is that the adverse shocks which cause unemployment also result in a reduction in capital stock. Then lower capital stock causes subsequent demand for labour to remain low thereby causing a protraction of the increase in unemployment. Hence a prolonged increase in the equilibrium rate of unemployment is associated with an initial increase in unemployment i.e. hysteresis is exhibited. This argument has received some sympathy within the European context where it is frequently claimed that existing capital stock is simply inadequate to employ the current labour force. However, historical examples supporting this explanation are difficult to find.

Indeed, Blanchard and Summers[1] discount this explanation for hysteresis by citing the successful wartime build up prior to the second world war in the United States and the maintenance of low unemployment after the war in the face of a massive reduction in civilian capital. In neither event was the capital stock's role decisive.

Nevertheless it must be said that the justification for such an inference through time is questionable. To see that this is so one only need consider the assertion from Mitchell (1947) that (unlike present day Europe) the American pre-war economy was not at high capacity utilization rates while pent up demand combined with Government encouragement such as interest rate subsidies served to spur the post-war U.S. economy. In addition, in the present context it is noteworthy that present physical capital stocks are possibly at a lower level than is appreciated. A jump in energy prices can increase the rate at which capital becomes obsolete[2].

(ii) Human Capital Explanations

A point frequently made in this context is that the longer a person remains unemployed the more likely they are to experience a depreciation (at the very least in relative terms) in their skills and as a result the less employable they become. Recognising that the upshot of this de-skilling process has been a reduction in the marginal benefit to job search[3] the unemployed typically exhibit a lowering search intensity with increasing duration of unemployment spell. Additionally there is a sense in which employers use unemployment experience as a screening device.

Since cohorts of those unemployed for any length of time are not homogeneous with the most employable tending to find jobs quickest, then surely those who are left unemployed are signalling to employers that, *ceteris paribus*[4], the likelihood that they are 'lemons' in the Akerlof[5] sense is quite high. Should it not be then that employers will exhibit greater discrimination towards those unemployed for a long rather than a short period.

A further related, and by no means independent point, runs as follows: If a period spent in the army is said to have a permanent effect on one's living habits, such as early rising, then could it not be the case that a period of unemployment will adversely affect one's suitability for rejoining the employed labour force in aspects such as punctuality, reliability or ability to work with other people[6].

The upshot of all such points is that the *effective* supply of labour is reduced by the factors causing a decrease in search intensity while the *effective* demand for labour is reduced by the factors associated with the inability of employers to find suitable employees. Relating to these points is the evidence presented by Budd et al.[7] that the probability of leaving the live register is a decreasing function of the duration of unemployment. In other words a low probability of leaving the live register would be associated with high employer discrimination and a low search intensity. In this light, then, following an adverse shock to employment the ratio of long term unemployment to total unemployment will firstly fall and then after a period of 12 months will jump up to a much higher level and tend towards a new higher steady state ratio[8].

As a result, a significant structural change in the labour market would occur since *on average* employer discrimination would rise while search intensity would fall. Hence, it can be appreciated that the changes in the *effective* demand and *effective* supply of labour, outlined above, which would be consistent with a rising equilibrium unemployment level, would actually have been due to the rise in the rate of unemployment itself in the first instance. In any case if human capital explanations of hysteresis were deemed to be appropriate a reflation of demand with an emphasis on the long-term unemployed would obviously go a long way towards reducing unemployment.

(iii) Insider-Outsider Explanations

These explanations make use of the distinction between typically employed workers with union membership (the insiders) and typically unemployed workers lacking union membership or union "representation" (the outsiders). In this context it is conventional to make the assumption that unions set nominal wages which in view of aggregate demand will maintain last period's level of employment for members. Firms simply mark up over this nominal wage. In these models the possibility of persistence in unemployment comes because of a dynamic interaction between employment and the size of the group of insiders. Two explanations for the observed persistence of unemployment at high levels can then be offered by these theories[9]. Firstly, for a given fixed union membership rule a sequence of adverse shocks will lead to change in union membership and hence, by changing the expected level of employment in the union's objective function will alter the level of employment permanently.

Secondly, in bad times currently employed workers take over the union and disenfranchise the unemployed from union representation[10]. The central element in such theories is the lack of concern of the employed for the unemployed. It is the fear of job losses and not the outstanding labour pool that restrains wage demand. But insider-outsider models are really theories of why the unemployed are not hired, not theories of why lay-offs take place. In any case, it can easily be appreciated in the context of these types of explanations that unemployment will tend to follow a random walk in the presence of adverse shocks and in this sense is determined by the history of shocks. Once employment has fallen it remains in the absence of other shocks permanently at the lower level. Layard[11] has advised caution in emphasising these insider- outsider explanations for persistent unemployment. They do not allow for economy wide influences to impact on industry wage settlements or the Union objective function used therein[12]. In addition if each year firms lose some employees through turnover or quitting, then surely, given that the Union's objective function only takes account of currently employed workers, employment should fall continuously. It must also be said of insider-outsider theories that although they do document the importance of hysteresis and suggest some explanations for the persistence of unemployment they are most difficult to test directly. If such explanations for unemployment persistance are correct, then a reflation of demand accompanied by some form of temporary incomes policy would go a long way towards solving the problem.

All of these "hysteresis type" explanations for the persistence of unemployment have a logical appeal. But to contend that only one such story is true would obviously be premature since the truth could conceivably contain elements of them all. As a result the testing of the existence of hysteresis in the labour market is a complex issue with problems being caused by the possible interaction of the above explanations.

3. SOME ECONOMIC ISSUES

The essence of what has been said so far is as follows:

Unemployment is serially correlated. Any number of factors, such as slow wage adjustment, could lead to a degree of serial correlation. This dependence, however, only reflects the speed with which unemployment returns to its equilibrium level (assuming of course that unemployment does have an equilibrium level). A second potential type of dependence, called hysteresis, does more than affect the speed of adjustment. It shifts the level

towards which unemployment gravitates. If hysteresis exists, a period of high unemployment will raise the equilibrium rate. Likewise, a period of low unemployment will lower the equilibrium rate.

To distinguish these two effects, the following two equation systems will be useful:

$$U_t = U_{t-1} + p(U_t^* - U_{t-1}) + e_t \qquad 0 < p < 1 \qquad (1)$$

where U_t^* = equilibrium unemployment rate in period t

$$U_t^* = U_{t-1}^* + b(U_{t-1} - U_{t-1}^*) + V_t \qquad 0 < b < 1 \qquad (2)$$

The first equation says that this year's unemployment equals last year's plus some proportion of the deviation of last year's unemployment from the equilibrium rate. The first type of dependence mentioned, serial correlation, is reflected in p.

In the extreme case, if $p = 1$, then unemployment immediately adjusts to its natural rate. If $p = 0$, then unemployment follows a random walk. Equation (2) models hysteresal movement in the equilibrium rate. It says this year's equilibrium rate equals last year's plus a proportion of last year's deviation. The coefficient b reflects the degree of hysteresis in the system. If $b = 1$, then last year's unemployment rate is this year's equilibrium rate. Supply and demand shocks are reflected in the error term e_t. The error term in (2) allows for shocks directly to the natural rate.

Solving the above system, we get[13]

$$U_t = (2 - b - p + bp)U_{t-1} - (1 - p)(1 - b)U_{t-2} + e_t - (1 - b)e_{t-1} + pV_t \qquad (3)$$

So this system reduces to an ARMA (2,1) process where the coefficients on the lags sum to one. Even with more complicated lag structures this will always distinguish hysteresis.

However, one would be unable to deduce from such a regression the source of the hysteresis. The problem here is that in their reduced forms all the above theories of hysteresis are observationally equivalent[14].

Blanchard and Summers[15] used a reduced form wage equation to measure hysteresis in the U.K., Germany, France and the United States[16]. They found evidence for this phenomenon in the first three of these countries only.

The problem with their conclusion is that they maintained that their results validated only their insider-outsider hypothesis for unemployment persistence while the equation they estimated was consistent with virtually all explanations for hysteresis.

Another point worth noting in relation to the concept of hysteresis runs as follows. Most research suggests that the natural rate of unemployment has risen over time. Although some of this effect may be autonomous (e.g. demographic changes etc.), the regression time trend might also be picking up hysteresis effects. Thus when significant time trends are found but not completely explainable (e.g. Jackman et al.)[17] some form of double-counting might be in order[18]. It is important as a consequence that time trends are carefully examined for this possibility.

4. NATURAL RATE DYNAMICS

The following discrete time model borrowed from Darby et al.[19] is useful for describing the type of dependence alluded to in equation (1) above - i.e. serial correlation.

Let: U = the unemployment rate,
L = the size of the labour force,
s = the number of unemployed (searchers)
g = the growth rate of the labour force $\frac{dL}{L_{-1}}$
f = the number of people per period who fall into unemployment,
π = the probability per period that one will leave the live register,
di = the discrete time change in i, (Δi),
and subscripts denote discrete time lags,

allows us to write the following[20]:

$$UL = s \qquad (18)$$

i.e. the unemployment rate multiplied by the labour force equals the number of unemployed (searchers).

Then by virtue of the analysis in appendix 4 we can write:-

$$dU = r - [(\Pi + g)/(1 + g)]\, U_{-1} \qquad (4)$$

where $r = \frac{f}{L}$ and represents the proportion of the labour force who become unemployed in any period.

$(\Pi + g)/(1 + g)$, denoted hereafter by Π^*, has been defined by Darby et al. (1985) as the growth adjusted probability of leaving the live register in any period. Obviously Π is the dominant variable therein and so equation (4) has an intuitive appeal in that it implicitly says that unemployment will rise if the flow onto the live register exceeds the flow off the live register.

If we have long run equilibrium values $\bar{\pi}$, $\bar{g}$ and $\bar{r}$ then setting the change in unemployment $(du) = 0$ as would be the case in equilibrium, we get

$$\bar{U} = \bar{r} \,/\, \bar{\pi}^* \qquad (5)$$

where $\bar{U}$ is the long run equilibrium or natural rate of unemployment over time and so corresponds to U^* in equation (1). This again has an intuitive appeal if one considers that $(1/\bar{\pi}^*)$ is really the (equilibrium) growth adjusted duration of search. For what it implies is that the natural rate of unemployment is the equilibrium search rate multiplied by the adjusted equilibrium duration on the live register.

Following a shock we must allow for deviation from these equilibrium[21] rates.

Confirmation of the equilibrium rate of unemployment at any period after a shock is given by :

$$\bar{U} = \frac{(U - U_{-1})}{\bar{\pi}^*} - \frac{(r - \bar{r})}{\bar{\pi}^*} + \frac{\Pi^* U_{-1}}{\bar{\pi}^*} \qquad (6)$$

Of course none of this is of any surprise since what equation (6) tells us is that following a one period shock which causes $(r - \bar{r})$ to be > 0 and $(\pi^* - \bar{\pi}^*) < 0$ for only period 1, then from period 2 onwards

$$U_t = U_{t-1} + \Pi^*(\bar{U} - U_{t-1}) \qquad (7)$$

This of course is the same as equation (1) above exhibiting serial correlation. However, p from equation (1) has now been replaced by the easily observable $\bar{\pi}^*$, i.e. the steady state equilibrium value for the adjusted probability of leaving the live register after one period. Obviously the lower is $\bar{\pi}^*$, the more persistent the effects of any shock to unemployment will be i.e. the longer the equilibrium duration which one should expect to stay on the live register the slower the effects of any shock will be to disipate. Again this conclusion is intuitively appealing.

However, if following the adverse shock hysteresis effects materialized and human capital explanations were deemed to be appropriate then the associated reduction in search intensity and increase in employer discrimination as outlined in Section 2 above would combine to shift the value for the probability of leaving the live register to a new lower level for a very long time in relative terms. In other words $\bar{\pi}$ will fall to a lower value. On the other hand if one were to consider insider-outsider explanations to be appropriate then the result of our shock would be to increase the number of outsiders in the bargaining process. Given (in the extreme context) that Unions do not allow for employing new people in their wage negotiations it is not too difficult to perceive the probability of leaving the live register remaining low (as before) as a greater number of job seekers will compete for the same amount of new jobs per period as existed before the shock, [*obviously* an extreme example for convenience]. In either case hysteresis would manifest itself in the $\bar{\pi}$ coefficient. This changes dramatically the time path of unemployment described by equation (1). No longer does unemployment gravitate towards its initial equilibrium, instead the increase in unemployment has resulted in a new equilibrium rate of unemployment. Through a process such as this, hysteresis can be seen to impact on the natural rate of unemployment.

5. TESTING FOR HYSTERESIS

Given that hysteresis enables us to generate equation (3) above where all the coefficients on lagged unemployment sum to unity and given also the assertion that the serial correlation coefficient (p) from equations (1) to (3) can be replaced by the easily observable $\bar{\pi}^{*}$[23], (i.e. the equilibrium (growth adjusted) probability of leaving the live register in any period) then we can derive a simple test for the presence of hysteresis in the labour force. We can rewrite equation (3) as follows[24].

$$\frac{1}{1-p}[U_t - (2-p)U_{t-1}] = -bU_{t-1} - (1-b)U_{t-2}$$

$$+\frac{1}{1-p}e_t - \frac{(1-b)}{(1-p)}e_{t-1} + \frac{p}{(1-p)}V_t \qquad (8)$$

or

$$\mu = -bU_{t-1} - (1-b)U_{t-2} + \varepsilon_t \qquad (9)$$

where

$$\mu = \frac{1}{1-p}[U_t - (2-p)U_{t-1}]$$

with the observable Π^{*} substituted for p

and

$$\varepsilon_t = \frac{1}{1-p}e_t - \frac{(1-b)}{(1-p)}e_{t-1} + \frac{p}{(1-p)}V_t$$

Now if we can satisfy the hypotheses that the coefficient on U_{t-1} is not equal to zero while the sum of the coefficients on U_{t-1} and U_{t-2} are equal to -1 then not only can we say that unemployment exhibits hysteresis as described by equations (1) - (3) but we also have an estimate, b, of the extent of hysteresis. As a result then (using Irish data) we will be able to apply this coefficient to equation (2) above to get estimates for the equilibrium (natural) rate of unemployment in Ireland over time.

6. DATA

In estimating the values for the growth adjusted probability of leaving the live register ($\bar{\pi}^*$), I followed directly the procedure used by Darby et al (1985) which takes account of the age composition of the labour force. The figures used for numbers unemployed, inflow onto the live register and employment were those published in the Trend in Employment and Unemployment, in the Irish Statistical Bulletin and in Eurostat publications. In some cases obtaining a figure for a variable involved some transformations, but in all cases, such transformations were just mechanical.

Since the data for each age group can only be generated for one month in the years from 1966 to 1980, I have had to assume the data thereby recorded to represent average annual observations.

All other issues in relation to the data are discussed in Appendix 7.

7. RESULTS

The values of the growth adjusted probability of leaving the live register within one month of becoming unemployed are as recorded in Table 1. As can be seen this probability has declined considerably since 1968. The biggest decline came between 1979 and 1982. During that period the probability of a representative male leaving the live register within one month of becoming unemployment fell from 16.07% to 11.23%. Currently the figure is 9.4%.

Since the inverse of this probability represents the duration which a person could expect to spend on the live register, Table 1 tells us that in 1971 a person who became unemployed could have expected to remain so for 4.18 months. By 1988 his expected duration had increased to 10.6 months.

Estimating equation (9) using the values for $\bar{\pi}^*$ from Table 1 as proxy estimates for the serial correlation coefficient (p), gives the following results:-

$$\mu = \underset{(.28054)}{-.46073\ U_{t-1}} \; \underset{(.30380)}{-\ .51034\ U_{t-2}} \qquad [25]$$

$R^2 = .9484$
Durban Watson = 1.9568
Standard error of the estimate = .010873

first order rho = - .0698
standard errors in parentheses.

The first thing to comment on is the fact that since the two explanatory variables are closely related, an equation with high explanatory power (R^2) combined with low t-statistics should have been expected. That being so, this equation is still very useful.

The second thing to notice is that the sum of the coefficients on U_{t-1} and U_{t-2} are not significantly different from -1.

We now have an estimate (.461) for the extent of hysteresis in the Irish labour market and we can be practically 90% certain that this phenomenon is significant.

If we accept this then what it tells us is that, following any shock which causes unemployment to deviate from its equilibrium level, 46% of the resulting change in unemployment will become permanent in the absence of any new shock. The mechanisms which cause this percentage to become permanent cannot be specifically determined by this approach. However, it is reasonable to assume that physical capital, human capital and union representation factors as outlined above all play a major role.

The estimate of .461 for the hysteresis coefficient is now applied to equation (2) describing the time path of the equilibrium or natural rate of unemployment over time in the presence of hysteresis. The calculated natural rates are recorded in Table 2 below.

The results from this table are remarkable in that they suggest for Ireland a natural rate very close to the actual rate of unemployment. The time paths for both the actual and calculated natural rates are shown in diagram 1 below.

As can be seen, the estimates show a natural or equilibrium rate of unemployment in Ireland of 17.75% in 1989. This is virtually equal to the recorded rate of unemployment. It suggests that the Irish labour market clears i.e. that the ***effective*** demand and the ***effective*** supply of labour are equal.

8. IMPLICATIONS

The above results have a number of implications.

Firstly in terms of modelling the labour market, they suggest that simply assuming that the presence of unemployment in the economy indicates that the labour market does not clear is misleading. This is important given bias which modellers have for imposing a disequilibrium framework on their analysis. Typically, in such cases, the level of unemployment is used as a proxy variable for the extent of the disequilibrium in the labour market. However, to do so assumes that the equilibrium or natural rate of unemployment is fixed. This analysis challenges that view. Indeed, a recent theoretical paper by Lee (1988A) shows that even with everything else fixed, the natural/equilibrium rate of unemployment changes over time if the tax regime is progressive.

Estimating Irish Phillips Curves (i.e. the relationship between wage inflation and unemployment) has proved to be very difficult since the mid-1970's. A stable relationship has not been found. This is, of course, not surprising since according to the above analysis, the natural rate of unemployment itself is not stable. Geary and Jones (1975) estimated a very weak relationship between Irish unemployment and wage inflation. The analysis above suggests that an even weaker one may exist today.

In discussing the policy implications of the above results one must be very careful. The equation estimated and the analysis behind it do not allow us to say much about the proportion of Irish unemployment which can be explained by Human Capital, Physical Capital or Union Membership factors. Indeed, as mentioned above, it is probably unrealistic to assume that these factors are mutually exclusive. Hence, given that the presence of hysteresis in the Irish labour market is accepted it seems reasonable to prescribe policies which would redress some of the rigidities outlined in the section dealing with the competing explanations for hysteresis.

In this context policies designed to increase the turnover of the live register might prove to be successful in reducing the long-run equilibrium rate of unemployment. Practices such as training programmes for the unemployed should be successful in this sense. However, preventing short-term unemployed (i.e. persons unemployed for under one year duration) from participating in such programmes limits the potential success of such policies in lowering unemployment permanently. The longer a person remains

unemployed then the more de-skilled they become, the lower the intensity with which they search for jobs and the greater the degree of employer discrimination they would be subjected to. Consequently, the greater the level of training and councelling they would require to find re-employment. To exclude the shorter-term unemployed from training and other human capital inducing programmes, lowers the average level of search intensity and skill of the labour force and increases average employer discrimination against the unemployed. These factors, as outlined above, cause the effective demand and supply of labour to be below their potential and as a result the effectiveness of such policies will be retarded.

Another policy prescription which could prove to be successful is the re-enfranchisement of the unemployed in union representation. In very few situations in this country do workers continue to be union members once they become unemployed. Consequently, when it comes to negotiating with employers, unions have no incentive to trade off potential wage increases for increases in employment. If unemployed workers had such representation then they would exert downward pressure on wages and so succeed in "pricing" themselves back into jobs. Without such representation, this mechanism is severely impeded and as outlined in the section above on insider-outsider explanations for hysteresis, it remains the fear of job losses and not the outstanding labour pool which restrains wage demands.

Finally, if one accepts that the current level of unemployment is close to an equilibrium level, then one further issue presents itself. The Irish economy is expected to perform well in terms of economic growth over the next few years. This growth is expected to increase employment significantly. However, in the context of a labour market in which effective labour demand and effective labour supply are equal this employment growth is unlikely to occur, ceteris paribus, without generating a significant wage inflation stimulus.

The average level of income taxation is known to be an important shift parameter in the equilibrium rate of employment. As a result further serious consideration should be given to trading off reductions in taxation for lower wage increases. If such a course of action were followed then a rise in the equilibrium rate of employment could be accommodated with less upward pressure on wages than might otherwise have been the case. Recourse to more conventional forms of incomes policy to restrict such pressure would only serve to generate a labour market disequilibrium.

9. CONCLUSION

Hysteresis describes how unemployment persists. There are three competing types of explanations for this phenomenon. Firstly, lower physical capital stock levels imply lower demand for labour and so employment can remain low for a long time. Secondly, being unemployed causes one's human capital to disipate and reduces the effective supply of labour. Additionally, the fact that a person is unemployed can be interpreted as a signal that they would not make a good employee. Employers can discriminate against such people and so lower the effective demand for labour. Finally union membership rules can cause unemployment to persist if the unemployed have no representation in the wage setting process.

We have derived a test for the presence of hysteresis using the equilibrium growth adjusted probability of leaving the live register as a proxy variable for the serial correlation coefficient in unemployment. Applying this test to the Irish labour market yields a hysteresis coefficient of .461. This tells us that 46% of any increase in measured unemployment will become permanent in the absence of any new positive shock to the labour market.

Using this estimate for the hysteresis coefficient allowed us to calculate the equilibrium (or natural) rate of unemployment for Ireland over time. These conclusions implied that the Irish labour market is effectively a market which clears i.e. that measured unemployment does not indicate a disequilibrium.

This analysis suggests that policies to increase the turnover of the live register may have a lasting effect in reducing the level of unemployment. In addition, changes in union membership rules which give the unemployed a voice in the wage setting process would also be likely to have a lasting effect. Finally the conclusion that the Irish labour market clears, suggests that trading off tax reductions for wage increases is likely to reduce the inflationary stimulus generated from the expected increase in Irish employment in the coming years.

FOOTNOTES

1 Blanchard and Summers (1986).

2 See Baily (1981).

3 In this context Daniel (1983) [Policy Studies Vol. 3, Part 4] has demonstrated how the experience of unemployment may make it more difficult for workers to retain jobs successfully in the future as a result of the possible existence of a demoralising or de-skilling process.

4 It is often argued that employers should, if rational, revise upward their assessment of the *relative* ability of the long-term unemployed after a recession which results in an increase in their numbers.

5 See Akerlof, O.J.E., August 1970.

6 See Phelps (1977)

7 See Budd et al. (1985)

8 See Budd et al. (1985)

9 See Blanchard and Summers (1986) for a good example of one such theory.

10 In this context these theories normally assume that employees maintain union membership for some time after they become unemployed.

11 See Layard European Economic Review, Vol. 31 (1987)

12 Pissarides and McMasters, [LSE Working Paper No. 805, 1985], have shown that they do affect industry wage settlements.

13 See Appendix 1

14 See Appendix 2

15 See Blanchard and Summers (1986)

16 They regressed the change in wages on to expected inflation, unemployment and lagged unemployment and sought a sum of zero for the coefficients on unemployment and its lag.

17 See Jackman et al. (1985)

18 See Appendix 3

19 Darby et al. (1985)

20 See Appendix 4 for the following.

21 See Appendix 5

22 This simply requires re-writing equation (A5,2) from Appendix 5 to get equation (6) here.

23 Darby et al. calculate this for the U.S. labour force.

24 See Appendix 6

25 See Appendix 8 for fuller results.

Table 1: Growth Adjusted Probability of leaving the Live Register with in one month of becoming unemployed

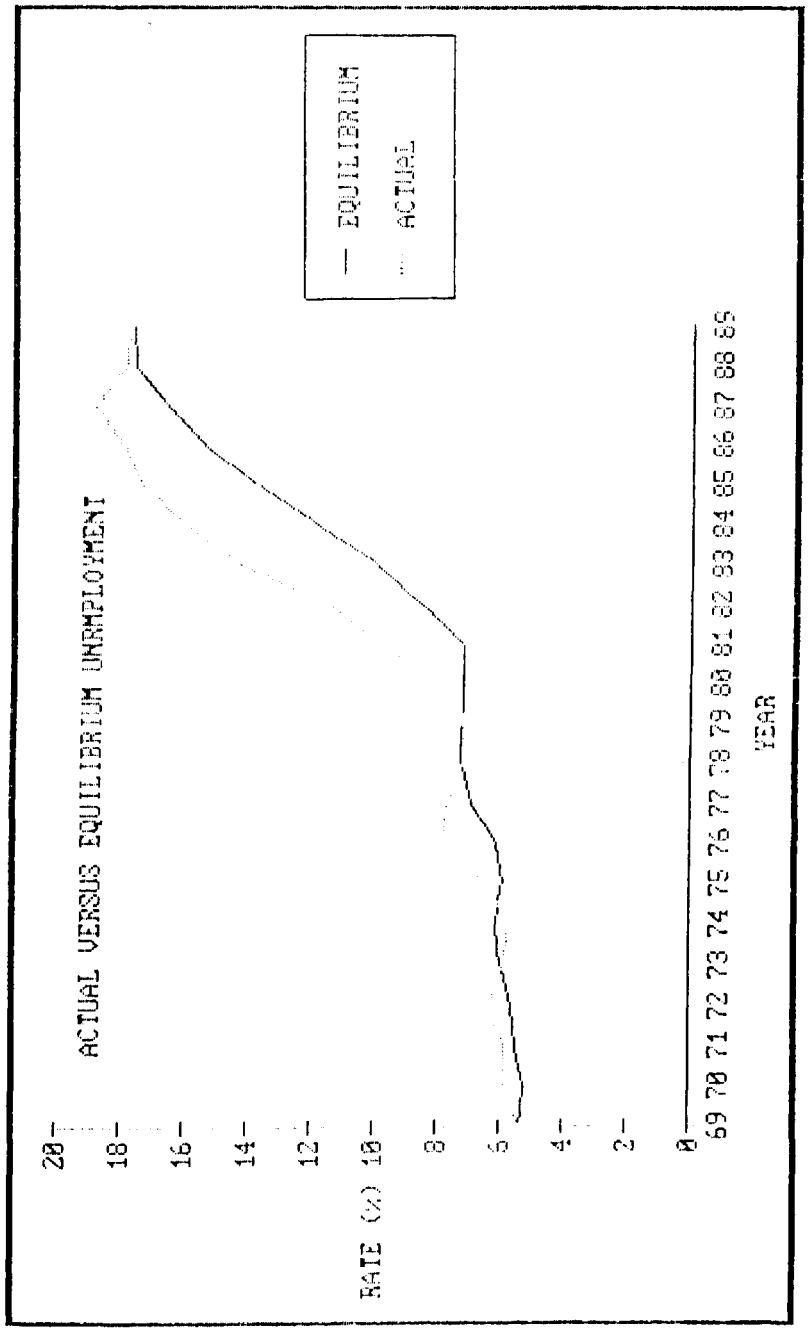
Year	Probability $\bar{\pi}^*$
1968	.1910
1969	.1700
1970	.1730
1971	.2392
1972	.1653
1973	.1318
1974	.1630
1975	.1425
1976	.1334
1977	.1434
1978	.1407
1979	.1607
1980	.1497
1981	.1351
1982	.1123
1983	.1166
1984	.0691
1985	.1006
1986	.1051
1987	.0932
1988	.0941

Table 2: The calculated equilibrium/natural rates of unemployment in Ireland over time

Year	Equilibrium Rate %
1969	5.38
1970	5.22
1971	5.51
1972	5.66
1973	5.99
1974	6.17
1975	5.96
1976	6.18
1977	6.97
1978	7.30
1979	7.26
1980	7.25
1981	7.31
1982	8.56
1983	9.94
1984	11.90
1985	13.79
1986	15.45
1987	16.62
1988	17.62
1989	17.75

NOTE: In calculating these rates over time, I have assumed that the labour market was in equilibrium in 1968 with approximately 5% unemployment.

CHART 1


ACTUAL VERSUS EQUILIBRIUM UNEMPLOYMENT
RATE (%)
20
18
16
14
12
10
8
6
4
2
0
69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
YEAR
EQUILIBRIUM
ACTUAL

Appendix 1

From (1) we get

$$U_t = (1-p)U_{t-1} + pU_t^* + e_t \qquad (A1,1)$$

and from (2) we get

$$U_t^* = (1-b)U_{t-1}^* + bU_{t-1} + V_t \qquad (A1,2)$$

from (3) we get

$$U_t^* = \frac{U_t}{p} - \frac{(1-p)U_{t-1}}{p} - \frac{e_t}{p} \qquad (A1,3)$$

Lagging yields

$$U_{t-1}^* = \frac{U_{t-1}}{p} - \frac{(1-p)U_{t-2}}{p} - \frac{e_{t-1}}{p} \qquad (A1,4)$$

substituting (A1,3) and (A1,4) into (A1,2) yields

$$U_t = (2-b-p+bp)U_{t-1} - (1-p)(1-b)U_{t-2}$$
$$+e_t - (1-b)e_{t-1} + pV_t \qquad (A1,5)$$

Appendix 2

In order to appreciate this point, consider the following simplified one period model where hysteresis exists due to the impact of long term unemployment.

$$U_t = (1-p)U_{t-1} + pU_t^* + e_t \qquad (A2,1)$$

i.e. equation (3) repeated

$$U_t^* = bU_{t-1} + (1-b)U_{t-1}^* + \Delta U_t^{Lt} + V_t \qquad (A2,2)$$

where ΔU_t^{Lt} = the change in long term unemployment

$$\Delta U_t^{Lt} = C\Delta U_t \qquad (A2,3)$$

where C is a constant.

Then in a fashion corresponding to the generation of equation (3) above we can show that

$$U_t = \frac{(2-b-p+bp-pC)U_{t-1}}{D} - \frac{(1-p)(1-b)U_{t-2}}{D}$$
$$+\frac{e_t}{D} - \frac{(1-b)e_{t-1}}{D} + \frac{pV_t}{D} \qquad (A2,4)$$

where $D = (1-pC)$. Note that the $\sum_{i=1}^{n} A_i = 1$ condition still applies and the reduced form is still an ARMA (2,1) process.

Appendix 3

For example, if for some reason unemployment follows the following simplified model:

$$U_t = U_t^* + e_t \qquad e_t \sim N(0, \sigma^2) \qquad (A3,1)$$

$$U_t^* = U_{t-1}^* + b(U_{t-1} - U_{t-1}^*) \qquad (A3,2)$$

and the innovation term in (14) changes the natural rate more when it is positive (excess unemployment) than when it is negative (insufficient unemployment), as seems a plausible description of reality[1], a time trend will emerge.

Consider the extreme ratchet case for an illustration:

$$\begin{aligned} U_t^* &= U_{t-1}^* + b\ max[0, U_{t-1} - U_{t-1}^*] \\ &= U_{t-1}^* + b\ max[0, e_{t-1}] \end{aligned} \qquad (A3,3)$$

Substituting (A3,3) into (A3,1), differencing, and then taking expectations yields,

$$E[\Delta U_t] = E[\Delta U_t^*] + E[\Delta e_t] = b\ E[max(0, e_{t-1})] \geq 0^2 \qquad (A3,4)$$

Thus, regressing U_t on U_{t-1} and time yields:

$$U_t = U_{t-1} + \hat{\Theta} T$$

where

$$\Theta T = b\ E[max(0, e_{t-1})] \qquad (A3,5)$$

Hence a time trend may emerge which actually proxies a ratcheting hysteresis. It is important, as a consequence, that time trends be carefully examined for this possibility, among others, since significant time trends may be capturing hysteresis.

Appendix 3 (contd.)

[1] e.g. Employed people may not care about the level of the replacement ratio while they have a job. However, once a negative shock has forced them into unemployment, high replacement ratios may discourage job search thereby protracting the duration of Unemployment Spells. This effect would lead to a ratchet effect as negative shocks would have a more significant effect on the natural rate than positive shocks.

[2] Remember $E(\Delta e_t) =$ zero since e_t is unanticipated.

Appendix 4

NATURAL RATE DYNAMICS IN MORE DETAIL

$$UL = s \qquad (A4,1)$$

$$\Rightarrow U = sL^{-1}$$

$$\Delta U = \frac{1}{L}\Delta s - \frac{1}{L}\frac{s_{-1}}{L_{-1}}\Delta n$$

Δ = discrete time change = d hereafter

$$\Rightarrow dU = \frac{1}{L}ds - \frac{dL}{L_{-1}}\frac{s_{-1}}{L}$$

$$\Rightarrow dU = \frac{1}{L}ds - g\frac{s_{-1}/L_{-1}}{L/L_{-1}}$$

$$\Rightarrow dU = \frac{1}{L}ds - g\frac{U_{-1}}{L/L_{-1}}$$

but

$$L/L_{-1} = \frac{L - L_{-1} + L_{-1}}{L_{-1}} = \frac{dL}{L_{-1}} + 1 = g + 1$$

hence

$$dU = \frac{1}{L}ds - \frac{g}{1+g}U_{-1} \qquad (A4,2)$$

Appendix 5

Letting $\tilde{r} = r - \bar{r}$ and $\tilde{\Pi}^* = \Pi^* - \bar{\pi}^*$ then from equation (5)

$$dU = (r - \bar{r}) - (\Pi^* - \bar{\Pi}^*)U_{-1} + \bar{r} - \bar{\Pi}^* U_{-1} \qquad (A5,1)$$

so that we can write[1]

$$dU = \tilde{r} - \tilde{\Pi}^* U_{-1} + \bar{\pi}^*(\bar{U} - U_{-1}) \qquad (A5,2)$$

[1] Remember from equation (21) $\bar{r} = \bar{\pi}^* \bar{U}$

Appendix 6

To get to equation 8

$$U_t = (2 - b - p + bp)U_{t-1} - (1 - p)(1 - b)U_{t-2} + e_t - (1 - b)e_{t-1} + pV_t \qquad (A6,1)$$

$$\Rightarrow U_t = (1 - p)(1 - b)U_{t-1} + U_{t-1} - (1 - p)(1 - b)U_{t-2} + e_t - (1 - b)e_{t-1} + pV_t \qquad (A6,2)$$

$$\Rightarrow \frac{1}{1-p}U_t = (1 - b)U_{t-1} + \frac{1}{1-p}U_{t-1} - (1 - b)U_{t-2} + \frac{1}{1-p}e_t - \frac{(1-b)}{1-p}e_{t-1} + \frac{p}{1-p}V_t \qquad (A6,3)$$

$$\Rightarrow \frac{1}{1-p}U_t = -bU_{t-1} + \frac{1-p+1}{1-p}U_{t-1} - (1 - b)U_{t-2} + \frac{1}{1-p}e_t - \frac{(1-b)}{(1-p)}e_{t-1} + \frac{p}{1-p}V_t \qquad (A6,4)$$

$$\Rightarrow \frac{1}{1-p}[U_t - (2 - p)U_{t-1}] = -bU_{t-1} - (1 - b)U_{t-2} + \epsilon_t \qquad (A6,5)$$

Appendix 7

Past changes in eligibility rules for unemployment payments have impacted less on males than on females. This coupled with the lack of data (available to me) on female unemployment neccessary to calculate the required variables confined me to the use of data for male unemployment only.

In estimating values for $\bar{g}, \bar{\pi}, \bar{r}$ and $\bar{U}$ over time, I followed directly the procedures used by Darby et al (1985) to take account of the age composition of the labour force. Accordingly π and r were calculated as

$$\pi = 1 - \frac{(S - S^{0-4})}{S_{-1}}$$

and

$$r = \frac{S^{0-4}}{L}$$

where S^{0-4} represents the inflow into unemployment over the last four weeks. The figures for S, S^{0-4} and L used were those published in the trend in employment and unemployment, the Irish Statistical Bulletin and Eurostat. (in some cases obtaining a figure for a variable involved transformations, but in all cases such transformations were just mechanical).

For each year $\bar{\pi}$ was defined as

$$\bar{\pi} = \frac{\sum_i L_{i-1}\bar{U}_{i-1}}{\sum_j L_{j-1}U_{j-1}}\bar{\pi}_j$$

where the i's refer to age groups and the -1's refer to lagged observations. Notice here the use of normal unemployment ($\bar{U}_i$) instead of actual unemployment rates since the latter would lead to spurious procyclical movements (as Darby et al outline) in measured $\bar{\pi}$. In addition $\bar{\pi}$ is defined by

$$\bar{\pi}_i = 1 - annual\ average\ \frac{(S_i - S_i^{0-4})}{S_{i-1}}$$

I have assumed that since data for each age group can only be generated for one month in the years from 1966 to 1980 then the observations for S_i etc. thereby given are the average annual ones.

For each year $\bar{r}$ is defined as

$$\bar{r} = \sum_i \frac{Li}{L} \bar{r}_i$$

where

$$\bar{r}_i = average \ \frac{S_i^{0-4}}{L_i}$$

Estimating the male labour force (MLF) in each age group posed a problem. To get around it, made necessary the assumption that male unemployment (MU) as a proportion of male labour force (MLF) was equal to female unemployment (FU) as a proportion of the female labour force. This was the assumption with which I was least comfortable. However, it enabled the values for L_i to be estimated since one could then say that

$$MLF_i = \frac{MU_i}{TU_i} \times TLF_i = L_i$$

where TU_i is total unemployment and TLF_i is total labour force in that age group.

Finally, the value for $\bar{g}$ was calculated as

$$\sum_{i=1}^{n} \frac{L_i}{L} \bar{g}_i$$

when dl_i was one twelfth the annual change in n_i.

Appendix 8

```
subproblem no.  1          solo 8 21
ols 9 3 4 / fo max
this problem can be run with par =     8

dependent variable =     9 mu                    21 observations

r-square =  .9484      r-square adjusted =  .9457      bartens r-square =  .9438
variance of the estimate =    .11821E-03
standard error of the estimate =    .10873E-01
log of the likelihood function(if depvar linear) =  66.2050
log of the likelihood function(if depvar log) =  68.0088
amemiya prediction criterion =  .129471E-03
raw moment r-square =  .9887

                        analysis of variance
                    ss          df          ms                  f
explained        .41260E-01      1.      .41260E-01              .000
unexplained      .22460E-02     19.      .11821E-03
total            .43506E-01     20.      .21753E-02


 variable     estimated    standard    t-ratio     partial  standarized  elasticity
 name  no.  coefficient     error       19 df       corr.  coefficient  at means

urate1     3 -.46073       .28054     -1.6423     -.3526  -.46300       .49813
urate2     4 -.51304       .30380     -1.6887     -.3613  -.46705       .51454

the intercept is suppressed

durbin-watson = 1.9568     von neuman ratio = 2.0546     first-order rho =  -.069
residual sum =    .22855E-01  residual variance =    .11821E-03
sum of absolute errors=    .15816
r-square between observed and predicted =  .9514
coefficient of skewness =  .6620 with standard deviation of  .5012
coefficient of kurtosis = 1.1625 with standard deviation of  .9719

     goodness of fit test for normality of residuals -  6 groups
observed    .0  2.0  7.0  9.0  2.0  1.0
expected    .5  2.9  7.2  7.2  2.9   .5
chi-square =     2.0297 with  2 degrees of freedom

jarque-bera asymptotic lm normality test
chi-square =     1.9288 with  2 degrees of freedom

end of subproblem  1
       .000 sec. cpu time
```

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DISCUSSION

J.D. Fitzgerald: I am happy to second the vote of thanks to Mr. Lee for the most interesting paper he has presented. The issue which he is concentrating on, the growth in what appears to be the underlying rate of unemployment in Ireland, is central to all discussions of economic policy in Ireland. A cursory examination of the data does suggest that hysteresis will describe the pattern of growth in the unemployment rate over time. However, it does not provide an explanation for this rise. As a result, it can not provide an adequate basis for drawing conclusions about the appropriate policy response.

Overall Approach

In talking about the hysteresis phenomenon and the variety of estimates of the NAIRU over countries and time Walsh (1987) quotes from Solow:

> Can we rationalise these differences in terms of labour market institutions and other factors in a convincing way?... A natural rate that hops around from one triennium to another under the influences of unspecified forces, **including past unemployment rates**, is not *natural* at all. *Epiphenomenal* would be a better adjective; look it up.

Thus if we find that hysteresis describes the data we have only arrived at a secondary symptom of an underlying problem. This highlights the problem from an economic point of view in relying on a reduced form model of the whole labour market. Even if the results from estimating the model were satisfactory, it would still be consistent with a myriad of potential stories about the Irish labour market. To prove that hysteresis exists it is necessary to understand the forces which give rise to it. As Mr. Lee says in his paper the model estimated does not allow one to distinguish between the possible causes of hysteresis. To do this it would be necessary to specify and estimate a much more complex model.

A number of crucial factors are missing from the model discussed in the paper. In particular the importance of migration in determining labour supply in Ireland is ignored. Given the results of Honohan (1984), Walsh (1987) and Bradley *et al.* (1989) this seems particularly serious.

Econometric Results

Turning to the estimation results, the assertion in the paper that the coefficient p in equation 1 can be replaced by the steady state equilibrium value for the adjusted probability of leaving the live register after one period is not justified in the paper. This seems unwarranted given the evidence from many sources on the role of other factors, in particular of migration, in affecting movement onto and off the live register.

The coefficients in the estimated equation, taken separately, are not significantly different from zero at the standard 95% significance level. In particular the coefficient on the U_{t-1} term is not significant so that the hypothesis of hysteresis must, in Scottish legal parlance, be found *not proven*. Many other underlying models could have generated these data.

The results were not subjected to any stability tests. Experience indicates a reduced form model, such as that in the paper, may prove unstable when estimated. It is essential that such models are subjected to rigorous test of their stability over time.

The error structure of the equation to be estimated takes a particular form as shown in equation 8. As a result, it should be estimated using generalised least squares. Failure to do so can seriously bias the results.

Taken together, these problems make it difficult to draw any conclusions from the results in section 7 of the paper.

Detailed Points

The author asserts that if the human capital explanation for hysteresis were correct a fiscal stimulus would cure it. However, all the evidence from a range of sources (Bradley *et al.*, 1989, and Fitzgerald, 1987) indicates that the Irish economy is so open that fiscal stimuli leak out through the balance of payments and have little beneficial effect on employment, even in the short-term. The experience of the late 1970s highlights the long-term problems which such an approach to structural unemployment can cause in an open economy. Under the adverse circumstances of the early 1980s the fiscal stimuli of the late 1970s led to a net loss of employment and contributed to a long-term rise in structural unemployment. The same strictures apply to tax cuts funded by borrowing.

The author's suggestion that a stable Phillips curve does not exist for Ireland is wrong. Bradley, 1988, found that a stable relationship between the rate of wage inflation and the change in the unemployment rate did exist for Ireland. Walsh, 1987, showed that the effect of changes in short-term and long-term unemployment on wage rates (and migration) were different. This pattern of behaviour is consistent with Bradley's findings.

However, the fact that a stable relationship was found between wage inflation and the **change** in the unemployment rate (rather than the absolute level of the unemployment rate) is consistent with the existence of hysteresis in the Irish labour market. It means that a stable high (or low) rate of unemployment is consistent with a stable rate of wage inflation.

The author's estimate of the probability of leaving the live register should be re-examined in the light of the more detailed work by Hughes and Walsh, 1983 and O'Mahony, 1983.

The suggestion in the conclusions that changes in trade union structure could reduce unemployment are somewhat naive. The assumption that trade union leaders are not concerned with unemployment is not correct. The problem which the author deals with arises more from the fact that trade union leaders must bow to the desires of individual workers who wish to maximise their own earnings even if it is at the cost of employment. It is primarily market forces and individual expectations which drive wage bargaining. We can see to-day that trade union legislation in the UK has not prevented market forces raising wage rates well above the rate of inflation, even at the cost of a serious loss of competitiveness.

Alternative Stories

While this paper does not prove the existence of hysteresis in the Irish labour market it is consistent with the data. However, a wide range of models could explain such a behaviour. I set out here a possible story which could explain this behaviour. It is a version of the human capital approach. No proof is adduced and this **story** should be merely treated as a hypothesis which may be worth testing.

The unwise fiscal policy of the 1970s left us with a burden of debt and a high rate of government borrowing in the early 1980s. This burden was greatly aggravated by the nature and strength of the world recession which ensured. By raising interest rates the recession greatly aggravated

the problems of debtor countries such as Ireland. The result was considerable deflation, both due to direct government action and to the related effects of the world recession. This provided a very serious shock to the labour market. Instead of merely halting recruitment of new young workers the severity of the recession was such that many married workers lost jobs. When these changes were combined with the differential migration patterns of young and settled workers (Walsh, 1987), the result was a big rise in numbers unemployed. The settled workers who lost their jobs chose not to emigrate. On the other hand, young entrants to the labour market did choose to emigrate. However, even after the job losses ceased and firms started hiring, the number of long-term unemployed has not fallen significantly. This may be because firms prefer to hire younger workers. The result is a fall in emigration, not a fall in unemployment. Meanwhile because older settled unemployed people prefer not to emigrate, the numbers of long-term unemployed remain high.

If this hypothesis were correct it would indicate that future growth in employment will tend to reduce emigration much more than the numbers of long-term unemployed. If this is true, special measures to deal with the problem of long-term unemployment are needed.

Conclusions

The hypothesis of hysteresis does fit the data for unemployment in Ireland but this paper does not prove that it is the only possible explanation for recent economic history. As a result, it is not possible to draw any policy conclusions from the paper. However, the paper represents a useful start to a re-examination of this central problem of economic policy in Ireland.

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Walsh, B.M., 1987. *Why is Unemployment so High in Ireland Today?*

P. Neary: This is an interesting and innovative paper which raises a number of important issues. It should be welcomed as the first application to the Irish labour market of the exciting new literature on hysteresis and for its original blend of time series and cross section data. At the same time, I have a number of concerns about both the analytic and the policy aspects of the paper. Since John Fitzgerald has voiced reservations similar to my own concerning the paper's rather strong policy recommendations, I will concentrate on the underlying economic analysis.

The key question which the paper addresses is the size of b, the hysteresis parameter introduced in equation (2). All previous writers on Irish unemployment have effectively assumed that this is zero (so that the natural rate of unemployment is constant or at least does not vary significantly from year to year). By contrast, George estimates that the coefficient equals .46. The policy implications of this finding, if it were true, would be immense, with a strong Panglossian (not to mention monetarist!) flavour: the natural rate of unemployment is never far from the actual rate, so any attempt to reduce unemployment is likely to raise inflationary pressures. It seems important, therefore, to examine how the result is derived.

There are two key analytic steps in the paper. The first is to combine an adjustment process for the ***actual*** rate of unemployment, equation (1), with an adjustment process for the ***natural*** rate, equation (2). This gives equation (3) in the paper. My first comment is that this equation can be greatly simplified by rewriting it in terms of the first difference of the actual rate of unemployment ΔU_t, equal to $U_t - U_{t-1}$:

$$(3') \qquad \Delta U_t = (1-p)(1-b)\Delta U_{t-1} + \xi_t$$

Here ξ_t is a composite disturbance term, related to the disturbances in the two original equations. I will say noting more about it, though I suspect that professional econometricians would take George to task for neglecting the restrictions implied by his model between the coefficient of ΔU_{t-1} and the components of ξ_t. Concentrating therefore on the non-stochastic part of (3'), it shows clearly that the economics of the model can be summarised as a simple autoregressive process in the ***first difference*** of the unemployment rate. Moreover, there is a clear identification problem: without further information, it is not possible to estimate the coefficients p and b separately.

The second key analytic step is then to use cross-section data to derive

an extraneous estimate for p, the adjustment coefficient for the actual unemployment rate, and to substitute this estimate into (3) to obtain (9). This allows the crucial hysteresis parameter b to be identified. However, as my simpler derivation than that in the paper shows, any *underestimate* of p inevitably implies an *overestimate* of b. This is of particular concern for at least two reasons. Firstly, there is an old literature on the effects of combining time series and cross section data which suggests that the practice is dangerous. Secondly, George admits in Appendix 7 that he was obliged to estimate p using data on male unemployment only, whereas my conjecture would be that the true figure for male and female unemployment combined is higher. For these reasons, therefore, I am sorry to say that I am not convinced by the paper's results, far less by its policy conclusions. At the very least, some sensitivity analysis should be carried out to try to determine how robust is the estimated value of b (and its confidence interval, which is not reported) to mismeasurement of p. Nevertheless, the author is to be congratulated on breaking new ground in the analysis of Irish unemployment and I hope that he or others will follow in refining the approach adopted in this paper.