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The Causes of Ireland's Unemployment*

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Abstract: We outline a small model of the Irish labour market and use it to explain what has happened over the last 10 years. We conclude that Irish unemployment problems in the 1980s were due to international demand-side factors, such supply-side factors as taxes and unemployment relief, and demographies, in the approximate proportion 4:2:3.

I INTRODUCTION

In the paper that follows we outline a small model of the Irish labour market and use it to explain what has happened to Ireland over the last 10 years. Technicalities aside, the story we tell is a very simple one. Irish unemployment is determined by the interaction of three relationships:

1. Labour demand $n^d = n^d(w,\sigma)$ which says that employment is a function of real labour cost w ("the real product wage") and perturbations in aggregate demand σ. This relationship follows from the hiring decisions of firms.
2. A wage relationship $w = w(n,z)$ which says that real wages are determined by the tightness of the labour market which is itself related to

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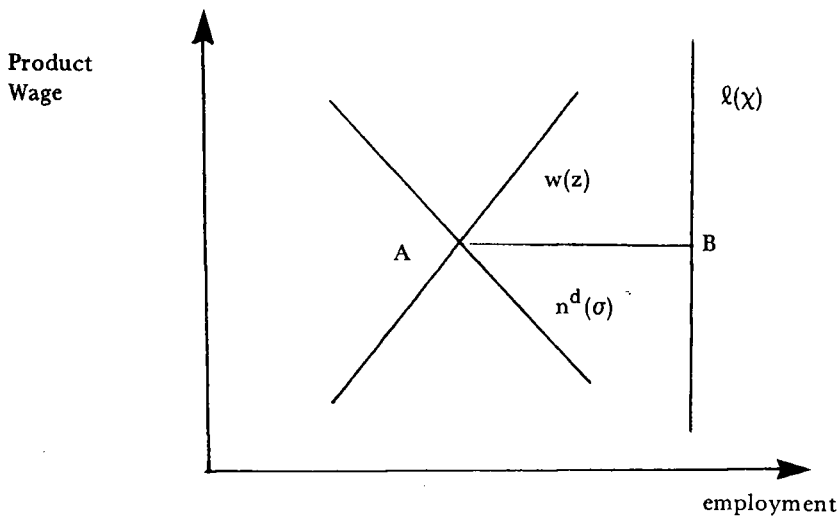
the level of employment n; and a collection of supply side shift factors z, to be nominated shortly. It is assumed that this relationship follows from the bargaining behaviour of workers and firms.

3. A participation equation $\ell = \ell(\chi)$ which says that the proportion of the population offering themselves for work depends on the demographic factor χ.

The equilibrium outcome determined by these three relationships is given in Figure 1. Employment and the wage are determined at position A and unemployment is distance AB. What we do in this paper is to fit these three equations to Irish post-war data and to use them to explain Irish unemployment. As a control for these experiments, we model analogously a full set of OECD countries. It is an important conclusion of the paper that Ireland looks much like any other country in economic structure. Notice that the curves are shifted by three sets of factors: demand shocks σ, supply side shift factors z, and demographics χ. We argue in the paper that each set of factors moved adversely for Ireland in the 1980s, i.e., demand shocks caused n^d to shift left; supply side factors caused the wage curve w to shift left as well; and demographics caused the ℓ intercept to shift right. We discuss each factor in turn.

Figure 1: *The Irish Labour Market*



1. Demand shocks. We nominate high real interest rates and a contraction in trade opportunities (most importantly due to the UK recession of the early 1980s) as the two most important demand factors impingeing on recent Irish economic history. We believe the UK recession added about two points to Irish unemployment over the 1980s. World real interest rates have been high throughout the 1980s, a general tendency which the Irish monetary authorities presumably could not have resisted. We believe these interest rates added about two and a half points to unemployment over the period. It does not seem, however, as if Irish real interest rates were set higher than need be, as there seems to be no trend divergence between UK and Irish real rates. We do not believe that the fiscal contraction after 1982 has been a major cause of the rise in Irish unemployment from the demand side. Using the most favourable index of fiscal stance from our experiments, we found that fiscal policy over this period could add at most about one percentage point to unemployment by 1986. Thus we conclude opposite to Dornbusch (1989) both on interest rates (he believes they were especially high in Ireland) and on fiscal policy (which he believes was especially contractionary).

2. Supply-side factors. We think two supply-side factors are important for Ireland in the 1980s, the level of unemployment benefits, and the level of taxes. Unemployment benefits are bad for employment as they enable bargainers to set high wages without worrying about the consequences for displaced workers; and high taxes cause wage claims to rise to maintain consumption levels. While the Irish replacement rate has perhaps never been high by OECD standards, we calculate that the sharp increase at the end of the 1970s had contributed about one point by the end of the 1980s. In our view taxes exert at most a transient influence on the labour market for the simple reason that, in an economy growing in *per-capita* terms, an increase in taxes, from 40 to 60 per cent say, merely places workers in the same position they were a decade or so ago and hence has no obvious implications for unemployment. But we *do* think they have an important transient effect as workers seek to protect consumptions levels in the short run. We calculate that increases in Irish taxation added around about one point to unemployment over the period.

3. Demographics. The Irish labour market has been called upon to absorb an increased workforce over the past decade or so. The Irish population of working age began to increase about 1970; and the labour force shows a strong increase from the middle of the 1980s, caused both by natural increase and changes in trend participation. This meant that the rate of growth of Irish wages had to slow to enable this increase to be absorbed. The partial failure of this to happen added, we calculate, about three points to the unemployment rate.

In summary our view is that the Irish unemployment problems in the 1980s have been caused by demand shocks, supply-side factors and demographics in the approximate ratio 4:2:3, respectively. The demand shocks were external in origin; and the demographic factors were obviously beyond conventional government control. On the supply side, the increase in taxes was caused in part by world interest rates; and the Irish replacement rate is not exceptionally generous. It seems to us Ireland's problems had more to do with bad luck than bad management.

II THEORETICAL OUTLINE AND DEVELOPMENT OF THE ECONOMETRIC MODEL

2.1 *Labour Demand*

We assume that the typical firm sells into an imperfectly competitive market. Its initial decision is to set its price for the following period of operation. For simplicity, let the firm face uncertainty only over demand during this period. The firm knows its (constant returns to scale) technology and capital stock. We take it that the wage holds for the pricing period, is bargained over at the same moment as the price is being set and is known to the firm when the price is set. Manipulation of the MR = MC price-setting rule yields an equation for expected employment, n^e, in a log-linear form,

$$n^e - k = -\alpha(w-p) \tag{1}$$

where the elasticity of demand is a constant which we omit. Given that price has been set in advance, profit maximisation intra-period entails that the firm supplies all output demanded, provided that this is not so large that it drives marginal cost above price. Ignoring that possibility, actual employment over the period will be

$$n = n^e + (n-n^e) = k - \alpha(w-p) + \delta(y-y^e) \tag{1'}$$

given the production function $y-k = (n-k)/\delta$.

We have investigated elsewhere (Newell and Symons, 1988a; 1988b) at some length the general level of support for systematic rather than surprise effects on labour demand from aggregate demand variables. We found that the only strong demand variable across countries and eras is the real interest rate ρ: see Table 2 of Newell and Symons (1987). In our earlier research we interpreted the real interest rates as a supply-side variable, measuring the cost of holding stocks; but the parameter relative to the wage parameter was always too large for that to be the full story. It is plausible that the real interest rate

is constant in expectation; and if this were the case then it could be legitimately included as a component of $y-y^{\epsilon}$. Even if this were not the case, it is still likely that it is a better index of monetary shocks than could be constructed via monetary aggregates themselves, given the financial innovations of the last 15 years. The real interest rate is unlikely to be the only source of demand shocks, and we shall experiment with other possibilities.

2.2 *The Wage Equation*

Wages are set by bargaining between the firms and a group of m workers (insiders), which we shall take as those currently employed. Assume for the present that the output price p is known to both sides to the bargain, and that this price also reflects the price of consumer goods. Assume that a wage will be agreed upon which reflects the capital-labour ratio, k-m, of the parties at the bargaining table, and which also reflects opportunities available elsewhere for this group of workers, the outside wage $\bar{w}-p$. The bargaining outcome is then, in logs

$$w-p = \nu_0(k-m)+\beta_0(\bar{w}-p)+z \tag{2}$$

which is conveniently rewritten

$$w-p = \nu(k-m)+\beta(\bar{w}-w)+z \tag{2'}$$

where z represents any shift variables. Note here that $y-y^{\epsilon}$ does not enter the bargain outcome. This is important, since it means that these shocks can alter employment at given wages.

To develop (2') further we need to specify m and $\bar{w}$. We represent m by the lagged level of employment, n_{-1}. To specify the outside wage we first assume that employed workers are known to have some probability of getting a job, $\pi = \pi(u)$, where u is the unemployment rate, and if they do not get a job they receive social security payment. The level of the outside wage is then a weighted sum of the economy-wide bargained wage and the benefit level with weights given by $\pi(u)$. A linear version is then

$$\bar{w}-w = \theta r-u \tag{3}$$

where r is the replacement rate. An alternative, obtained by assuming $\pi = u$ is

$$\bar{w}-w = 1-u(1-r) \tag{3'}$$

The final wage equation is then obtained from (3) and (2′):

$$w-p = \nu(k-n_{-1})+\beta(\theta r-u)+z \qquad (4)$$

As it stands (4) determines the product wage. What about the consumption wage? Consider for example an increase in income tax. If a union's objective is to maximise the after-tax income of its members, it will do this by maximising the before-tax income, and this will be done by choice of the product wage, not the consumption wage. Thus taxes should not be incident upon the product wage in a bargaining model. Indeed the same holds true in a competitive model unless it is asserted that labour supply is elastic in the long run, a position difficult to sustain. On the other hand, it does not accord with common observation that workers meekly take a consumption wage cut whenever there is an increase in taxation (or equivalently in this context, import prices). We shall investigate this empirically. We find in fact that the tax and import price wedge has a transient effect on the product wage.

2.3 *Participation*

If we could assume that the labour force is exogenous, (1′) and (4) would complete the model, together with the approximation for the (log) labour force, ℓ.

$$\ell = n+u \qquad (5)$$

We endogenise ℓ by assuming that the appropriate signal for households to supply labour is expected income, $\overline{w}$, relative to household income, w. Thus,

$$\ell-h = \zeta(\overline{w}-w)+\chi \qquad (6)$$

where h is the population of working age and χ is any demographic migration, education or retirement factor. As above $\overline{w}-w$ may be approximated by either (3) or (3′).

2.4 *Equilibrium Properties*

If we take (1′), (4), (3), (5) and (6), omit any shocks and consider the case where $n_{-1} = m = n$, then we have the system:

labour demand	$n-k = -\alpha(w-p)$
wage determination	$w-p = \nu(k-n)-\beta(u-\theta r)$
participation	$\ell-h = \zeta(u-\theta r)$
labour force	$\ell = n+u$

There are four endogenous variables, n, w-p, ℓ, and u. Solving for u we obtain:

$$u[(1-\alpha\nu)(1+\zeta)+\alpha\beta] = \theta[\alpha\beta r-(1-\alpha\nu)\zeta] + (1-\alpha\nu)(h-k)$$

Note that unless $\alpha\nu = 1$, the unemployment rate will depend on the population-capital ratio. Since the latter has trended down in all industrialised countries, while the former has no long-run trend, this restriction is very likely to hold in the data. We call it capital neutrality. Imposing capital neutrality leads to these reduced forms:

$$\begin{aligned} u &= \theta r \\ \ell &= h \\ n &= h-\theta r \\ w-p &= (k-h)/\alpha+(\theta/\alpha)r. \end{aligned}$$

Thus, in equilibrium, the unemployment rate depends only on the replacement rate, the labour force is proportional to the population, employment follows from the labour force definition, and the wage depends positively on both the capital-population ratio and the replacement rate.

III RESULTS FOR THE OECD AND THE EC

We now turn to empirical work. Our first task is to establish the general level of support among OECD countries for the labour demand equation and the participation equation. Secondly, we will report some experiments with variants of the wage equation. Our overall aim here is to establish a basis of comparison for Ireland.

3.1 *Labour Demand*

Table 1 gives EC average and OECD average estimates of Eqation (1′). We represent $y-y^{\epsilon}$ by the real interest rate and "other output shocks", i.e., the residuals from a regression of y on itself lagged, capital, the real wage and the real interest rate. The equation includes a measure of technical progress to reflect outward shifts of the marginal product of labour schedule not captured by k: see the Data Annex for construction. The real interest rate is an average of current and lagged rates. We have allowed goodness-of-fit criteria to determine whether the real product wage should be current or the lagged. Here and elsewhere the EC results are an arithmetic average of results from Belgium, Denmark, France, Germany, Italy, the Netherlands, and the United Kingdom, i.e., all the EC countries on our database except Ireland. Overall, we confirm our previous findings: employment is slow adjusting, with an OECD average mean lag of around 2.5 years with respect to current perturbations.

The product wage exerts a slow-acting but ultimately powerful influence on employment, with a long-run elasticity of -0.81 for the OECD on average, and -0.86 for the EC on average. The impact effect of real interest rates is around the same magnitude as that of product wages. The insignificance of technical progress on average is readily understandable if we recall that the

Table 1: *Labour Demand Equations, Dependent Variable* Δn_t

Expalanatory Variable	*EC (Average Parameter)*	*OECD (Average Parameter)*
Δn_{t-1}	0.30	0.24
	(2.4)	(1.6)
$n_{t-1}-k_t$	-0.22	-0.21
	(3.0)	(2.7)
$(\text{real product wage})_t$*	-0.19	-0.17
	(3.0)	(2.4)
$(\text{real interest rate})_t$*	-0.19	-0.17
	(2.9)	(2.5)
$(\text{technical progress})_t$	0.00	-0.03
	(0.2)	(0.2)
$(\text{other output shocks})_t$*	0.40	0.34
	(3.3)	(2.8)
se	0.0076	0.0086
DW	2.24	2.23
sample	1956-1986	1956-1986

Notes: (1) The exact timing of the real wage effect was allowed to vary between countries. For the majority of countries the contemporaneous real wage gave the best result, but for Australia, Denmark, France, Italy, the Netherlands, Norway and Sweden, the wage was lagged one year.

(2) Exact starting dates vary across countries depending on data availability. See the data annex for details.

(3) Method of estimation: instrumental variables. Variables marked * were instrumented by the lagged real wage, lags of inflation and nominal interest rates, the current change in M1, the change in the world terms of trade, and the lag of the unemployment rate. In subsequent tables, we continue to indicate endogenous variables by *.

(4) t-statistics in parentheses. For the EC and OECD columns these are average t-statistics. If the true value of a coefficient is zero, t-statistics on that coefficient have an approximately N(0,1) distribution, so if errors in coefficient estimates were independent across countries, the 17 country OECD average t-statistic of about 0.5 would reject, at a 5 per cent significance level, the hypothesis that the true coefficient is zero in all countries. Previous work on OECD wage equations (Newell and Symons, 1988b) found that the upward bias in the average t due to error correlation was quite small, say 10 per cent. This may not be so true for employment equations, where error correlation tends to be higher. Our experience suggests that on average t between 0.8 and 1.0 tends to be robust across specifications, while values less than this are not.

sign of the long-run effect depends on whether the wage elasticity is greater or less than unity in magnitude. The OECD average equation suggests that a 3 per cent output shock would change employment by about 1 per cent, which, given a fixed labour force, accords well with Okun's Law.

3.2 *Wage Equations*

Define the equilibrium wage as the wage at which n_{t-1} workers could be sustained in equilibrium employment from the labour demand equation. If the unemployment rate is unaffected in the long run by the capital-labour ratio and technical progress, then the capital neutrality restriction discussed in Section 2.4 will hold. In the context of the wage equation estimates given in Table 2, where the change in the product wage is the dependent variable, this means that the lagged level of the product wage and the equilibrium wage should enter with equal and opposite signs, so that the equation solves in the long run for a wage-independent unemployment rate. We impose this restriction in the equations given in Table 2, and report t-tests for it.

Table 2: *Wage Equations 1956-1986*[1] *Dependent Variable:* $\Delta(w-p)_t$

Explanatory Variable	*EC (Average Parameter)*	*OECD (Average Parameter)*
$(\text{real product wage})_{t-1}$	-0.23	-0.26
	(2.2)	(2.7)
$(\text{equilibrium wage})_t$	0.23	0.26
	restricted, (t=0.8)	restricted, (t=0.1)
$(\Delta \text{ wedge})_t$*	0.08	0.41
	(0.2)	(1.7)
$(\text{unemployment rate})_t$*	-0.77	-1.02
	(3.7)	(2.8)
Shift, 70-75	0.025	0.028
	(2.8)	(2.8)
se	0.018	0.019
DW	1.87	1.85
"h"	0.5	0.5

Notes: (1) Starting dates vary according to data availability: see the data annex.
(2) Starred variables were instrumented by their lagged values, the change in the world terms of trade, lagged inflation and lags of the rate of change of world raw materials prices. See the data annex for sources.
(3) For other conventions see notes to Table 1.

Our lack of replacement rate data for many countries means that this variable is missing. We include an extra variable, an intercept shift for the years 1970-1975 inclusive. This is a crude proxy for the well-documented world-wide wage explosion during that period.

Unemployment has a strong negative influence on real wages. The change in the wedge is well-determined for the OECD, and the shift dummy suggests a wage increase of about 10 per cent by 1975. The EC equations are very similar, except for the wedge parameter, which is badly affected by a large and significant wrong sign for Italy. In order to demonstrate that the model we will use for Ireland is robust on average we tested a number of variables and restrictions employing these average equations. The following variables were found to be quite insignificant across the OECD: the level of the wedge; the demand shock variables from Table 1; the change in inflation (implying no general nominal rigidities); mismatch (c.f. Layard and Nickell, 1986); the *change* in unemployment (c.f. Alogoskoufis and Manning, 1988); and log U (c.f. Blanchflower and Oswald, 1989).

3.3 *Participation*

Table 3 gives simple versions of the participation Equation (6). Scarcity of replacement rate data again forces us to omit this variable, so this and any other demographic effect is proxied by a quadratic time trend. Note that unemployment has a strong negative effect on participation: the discouraged worker effect.

Table 3: *Participation Equations. Dependent Variable* $(\ell-h)_t$, *1960-1986*

Explanatory Variable	*EC (Average Parameter)*	*OECD (Average Parameter)*
$\ell_{t-1}-h_t$	0.72	0.73
	(9.4)	(7.3)
$(\text{unemployment rate})_t$*	-0.23	-0.18
	(1.6)	(1.2)
trend	$-0.59\text{x}10^{-4}$	$-0.88\text{x}10^{-5}$
	(0.7)	(0.0)
trend squared	$0.2\text{x}10^{-4}$	$0.2\text{x}10^{-4}$
	(1.0)	(0.9)
se	0.0063	0.0074
DW	1.87	1.87
"h"	0.4	0.4

Notes: (1) Conventions as Table 1.
(2) The unemployment rate was instrumented by two lags of itself.

In the next section we shall develop this system for the Irish economy.

IV THE REPUBLIC OF IRELAND

The measure of demand shocks employed above for the full panel of OECD countries was, of necessity, quite rudimentary, and for Ireland we have conducted a large number of experiments to try to identify the transient shifts of the labour demand curve. The shock variable showing up consistently across various specifications was a measure of the shock to UK GDP (deviations from a quintic time trend). Our chosen labour demand function is reported in Table 4. We have been able to discard the term in Δn_{t-1} (t=1.2). The equation is quite like the OECD average, except that the long-run wage elasticity is rather larger in magnitude at -2.3. It is clear from Table 4 that if employment were a simple univariate process, then a unit root could not be rejected. On the other hand, there are in the equation two noisy shock variables, the real interest rate and the UK shock, and Grubb and Symons (1987) show that

Table 4: *The Irish Labour Demand Equation, 1955-1986. Dependent Variable, the Change in (log) Employment,* Δn_t.

	Coefficient	*t-statistic*
$n_{t-1}-k_t$	-0.12	2.1
(real product wage)$_{t-1}$	-0.28	3.3
(real interest rate)$_t$*	-0.32	3.1
(UK shock)$_t$	0.31	2.2
(technical progress)$_t$	0.11	3.0
constant	0.40	3.4
se	0.0103	
DW	1.76	
$\bar{R}^2$	0.44	
"h"	0.72	

Notes: (1) Wald test for structural break 1970/71 $\chi^2_6 = 3.9$ (5% = 12.6)
Wald test for structural break 1980/81 $\chi^2_6 = 4.9$ (5% = 12.6)
LM test for 1st order autocorrelation $\chi^2_1 = 1.0$ (5% = 3.8)
"t" test for constant returns capital restriction, t = 0.8.
Long-run wage elasticity, -2.34.

(2) The real interest rate term was instrumented by lagged interest rate and output price inflation terms, as well as lags of the rate of change of both world manufactured export prices and world raw material prices.

the presence of such variables reduces the Hurwicz bias on the parameter considerably. Given these facts, it is our opinion that Monte Carlo analysis is virtually certain to reject the unit root hypothesis in this context but we do not perform it here.

Table 5 summarises a collection of experiments with alternative demand terms in the labour demand equation. We give only the parameter of the included variable. In theory all variables should receive a positive sign if they are to be interpreted as a Keynesian demand shock. We try two variants of each, "shock" which is deviations from a quintic in time, and "change" which is a first difference. All variables are in logs, and exactly defined in a data annex. Examination of the table suggests that only shocks to real money balances and shocks to UK output are important. When these two were included together, rather than separately as in Table 5, we found that UK output shocks dominated, which leads directly back to the model in Table 4.

Table 5: *Labour Demand Experiments*

	Shock	*Change*
Export Competitiveness	-0.08(1.0)	0.01(0.1)
UK Competitiveness	-0.11(1.6)	0.04(0.8)
Real Import Prices	0.11(1.6)	-0.02(1.2)
Terms of Trade	0.01(0.1)	0.03(0.6)
Government Spending	-0.03(0.3)	-0.24(0.9)
Government Deficit	0.01(1.0)	0.00(0.0)
Real Money Balances	0.08(2.0)	-0.01(0.2)
World Output	0.02(0.1)	0.07(0.5)
UK Output	0.23(1.6)	0.05(0.4)
Demand	0.32(0.8)	—

Notes: (1) Each cell contains the coefficient (t-ratio) that the variable received when entered separately in the labour demand equation. In each case "shock" is defined as the deviation of the log of the variable from a quintic time trend, and "change" is the first difference of the log of the variable.

(2) All variables are defined in conventional ways, see the data annex, except "demand", which is derived from the following regression (1954-1986),

$y_t = 0.25g_t + 0.07(m-p)_t + 0.15y^*_t$ + lagged dependent variable,

where y_t is log real GDP,
g_t is log real government expenditure,
$(m-p)_t$ is a log of M1 deflated by the CPI,
y^*_t is a log of an index of GDP for the industrialised countries.

"Demand" is the deviation from a quintic trend of the weighted sum of g_t, $(m-p)_t$, and y^*_t, with weights as above.

When an earlier version of this paper was presented at the NESC, many Irish economists felt that the 1982 recession was almost certain to have been fiscal in origin. Subsequently we conducted a number of experiments with a variety of indices of fiscal stance. We obtained the most favourable results (t=2.0) with the *level* of the central government deficit to GDP ratio (1988 IMF yearbook). While this does not measure a shock (it has a large systematic component) and hence is not in the spirit of our approach, we simulated its contribution to unemployment over the late 1980s, finding the fiscal contribution after 1982 contributed about one point by 1986. Since this is the most favourable result we could find, we regard it as an upper bound. Further evidence on this issue is given by the residuals from our labour demand equation in Table 4. The average residual from 1977 to 1982 is about 0.75 of a point, while from 1983 to 1985 the average is about -1.2. This fact is consistent with the fiscal shocks of the 1980s being captured by the residuals of our model. We shall see subsequently that the residuals contribute about two points to the rise in unemployment between 1979 and 1986.

Our chosen wage equation is quite simple: see Table 6. Since unemployment benefit series are available for Ireland, we could experiment with both formulations of the $\bar{w}$-variable, (3) and (3'). We found that the multiplicative

Table 6: *The Irish Product Wage Equation 1955-1986. Dependent Variable: Δ Log Product Wage*

	Coefficient	*t-statistic*
$(\text{real product wage})_{t-1}$	-0.45	4.5
$(\text{equilibrium wage})_t$	0.45	imposed, (t = -0.7)
$(\Delta \text{ wedge})_t$*	0.40	2.5
$u_t(1-r_t)$*	-0.71	3.5
constant	0.70	3.9
se	0.0216	
DW	1.67	
$\bar{R}^2$	0.655	
"h"	1.23	

Notes: (1) Wald test for structural break 1970/71 $\chi^2_4 = 0.38$
Wald test for structural break 1980/81 $\chi^2_4 = 1.65$
$\bar{R}^2$ here measures the proportion of explanation of *deviations of the wage from equilibrium.*

(2) The change in the wedge and the composite unemployment, replacement rate term were treated as endogenous. The instrument set comprised lags of these terms plus separate lags of the unemployment rate and replacement rate and acceleration terms in the world price of raw materials and the consumer price index.

version (3′) fitted better, and that in this formulation it was quite easy to impose the capital neutrality restriction. The equation is quite fast-adjusting, but not remarkably so by international standards. We tested a number of alternative specifications and some of these tests are reported in Table 7. Four of the results presented there are worthy of comment. The 1970-1975 shift was relatively weak in this equation, so we discarded it. There is some evidence for the non-linearity of the unemployment effect as row A(9) in Table 7 shows, and we could have pursued this line, but we were dissuaded by the weight of international evidence against it. In a similar spirit, there does not appear to be much evidence in favour of the Layard and Nickell (*op. cit.*) finding for the UK that only the short-run unemployed are effective in holding down wages: see line A(6). Finally, we tested what we considered to be the four most important restrictions jointly, i.e., capital neutrality, the u[1−r] restriction, the level wedge = 0 restriction and the no price shocks restriction. As row B(2) shows in Table 7, we found that these were easily accepted.

Table 7: *Wage Equation Experiments*

		t-statistic
A.	*Single variable experiments*	
	(1) the level wedge, $(p_c - p)$	−0.7
	(2) the replacement rate r_t	−0.6
	(3) the acceleration of inflation $\Delta^2 p_c$	1.1
	(4) the change in unemployment, Δu	0.4
	(5) mismatch	−0.1
	(6) the short-term unemployment rate	0.3
	(7) shift, 1970-1975	1.8
	(8) the UK consumption wage relative to the Irish consumption wage	0.2
	(9) log (u[1−r])	−1.8
	(10) labour demand shock(2)	0.4
B.	*Wald tests for non-linear and joint tests*	
	(1) the u[1−r] restriction	$\chi^2_2 = 1.1$ (5% = 6.0)
	(2) the u[1−r] restriction, the $\alpha v = 1$ restriction, level wedge = 0, and $\Delta^2 p_c = 0$	$\chi^5_2 = 1.8$ (5% = 11.1)

Notes: (1) See text for discussion.
(2) The labour demand shock is a weighted sum of the real interest rate and the UK shock variable, with weights taken from Table 5.

The full story of Irish participation requires mention of migration. Walsh (1987) states that net emigration amounted to about 2 per cent of the population between 1979 and 1986. Migration will affect participation in the short run if, as seems likely, migrants exhibit atypical participation patterns. Thus we should consider modifying (6). We could enter migration into the participation equation and develop a migration equation separately, or we could enter the determinants of migration directly into our participation equation. We tried both approaches.

Table 8 displays four versions of the equation. Column 1 is the basic specification. Note that we have adopted the multiplicative formulation of the outside wage here as in the wage equation. The restrictions which this formulation imposes on the unemployment and replacement rate coefficients were tested in a number of alternative specifications and were always accepted. In this case, i.e., Column 1, a Wald test gave $\chi^2(2) = 3.95$ (5% = 5.99). We have included an intercept shift at 1969 to account for an increase in the school leaving age. Neither of the time trend terms are significant, but, importantly, an F-test of their joint significance emphatically rejected their exclusion.

Table 8: *Participation Equations for the Republic of Ireland 1955-1986. Dependent Variable: Log of the Ratio of Labour Force to the Population Aged 15-64, ℓ-h*

Explanatory Variable	*(1)*	*(2)*	*(3)*	*(4)*
$\ell_{t-1}-h_t$	0.88(14.2)	0.86(16.5)	0.90(15.6)	0.88(14.5)
$u_t(1-r_t)$*	-0.42 (3.1)	-0.46 (3.8)	-0.40 (4.1)	-0.43 (4.0)
education dummy	-0.010(2.8)	-0.013(3.7)	-0.012(3.3)	-0.010(2.8)
(change in migration)$_t$	–	-0.94 (1.8)	–	–
(UK-Irish relative wage)$_t$	–	–	-0.056(2.3)	–
(UK unemployment)$_t$	–	–	0.24 (4.2)	–
trend x 10^4	0.90 (0.1)	-7.6 (0.8)	–	–
trend squared x 10^4	0.29 (1.2)	-0.52 (2.0)	–	0.31 (2.9)
se	0.0048	0.0042	0.0039	0.0048
DW	1.81	1.65	2.19	1.81
"h"	0.6	1.0	-0.6	0.6

Notes: (1) t-statistics in parentheses. For other conventions, see Table 6.

(2) As usual, variables marked * were treated as endogenous. Instruments for $u_t(1-r_t)$ were u_{t-1}, r_{t-1} and their product, while instruments for the relative wage term were the lagged Irish consumption wage and the current UK consumption wage.

Thus, controlling for the outside wage and the educational reforms, we find a positive trend in participation. We performed many experiments designed to unearth the source of this. Our first line of thought was that it was due to increased female participation, and we added the female share in the labour force to proxy this, but it was not significant, and the significance of the trend terms remained. As an alternative, we added the EC average participation rate to the equation, in order to proxy Europe-wide participation trends, but that was always insignificant, and usually received a negative coefficient. The trend terms remained significant when we added migration (the ratio of net migration to population aged 15-64). Experimentation with this variable suggested strongly that it should enter as a first difference. This version is given in Column 2. The migration coefficient is large but rather poorly determined, and the rest of the equation is largely unchanged. It seems to us that the costs of complexifying the model on the basis of a t-statistic of 1.8 outweighed the potential benefits, so we turned to our second strategy of entering the determinants of migration directly. Informed by the work of Geary and O'Grada (1987) and also by some experiments of our own, we included the UK-Irish consumption wage differential and the UK unemployment rate. The results are given in Column 3 of Table 8. Both variables are significant and correctly signed, although the wage term is small and adds little to the explanatory power of the equation. This equation provides a very good fit, but the magnitude of the UK parameter caused us some concern. Allowing for the replacement rate, the equation implies that UK and Irish unemployment rates have roughly equal and opposite effects on Irish participation. Thus the UK effect seemed too large to us, especially since the trend terms were not significant in this formulation: the UK unemployment rate is clearly standing proxy for all other possible trends. We finally decided to proceed to system estimation on the basis of the equation reported in Column 4, where the insignificant linear trend term is omitted. In our simulation work, to be reported below, we tried the Column 3 equation as well as Column 4, and obtained very similar results.

Three stage least squares estimates of our system, employing the equation of Tables 4, 6 and 8 (Column 4) are presented in Table 9. The equations change little except that the precision of the estimates is enhanced in most cases. These are our preferred estimates. The parameters were used for simulation, to which we now turn.

We simulated the model of Table 9 in order to see how our model explains the rise in Irish unemployment from 1979 to 1986. We performed a sequence of dynamic simulations of the model, holding an extra exogenous variable constant at its 1979 value in each successive simulation. The change in the simulated rise in unemployment in each run was then apportioned to the

Table 9: *Three Stage Least Squares*[1] *Estimates of the Irish Model, 1966-1986*

A. *Labour Demand*

$$\Delta n_t = 0.43 - 0.13\ (n_{t-1} - k_t) - 0.30(w-p)_{t-1} - 0.32\rho^*_t + 0.29\ (\text{UK shock})_t + 0.12a_t,$$
$$(4.5)\ (3.9) \qquad (5.0) \qquad (5.0) \quad (2.9) \qquad (4.0)$$

standard error = 0.0093, Durbin-Watson = 1.74, Durbins "h" = 0.75.

B. *Product Wage*

$$(w-p)_t = 0.73 + 0.53\ (w-p)_{t-1} + 0.47(\tilde{w}) + 0.46\ \Delta\text{wedge}^* - 0.78u_t(1-r_t)^*,$$
$$(4.3)\ (4.6) \qquad \text{imposed}\ (3.9) \qquad (3.0)$$

standard error = 0.0202, Durbin Watson = 1.62, Durbins "h" = 1.40.

C. *Participation*

$$(\ell-h)_t = -0.43 + 0.88(\ell_{t-1} - h_t) - 0.36(u_t(1-r_t))^* + 0.008(\text{educ.dummy}) + 0.27\text{x}10^{-4}t^2$$
$$(2.1)(18.1) \qquad (4.3) \qquad (2.8) \qquad (3.1)$$

standard error = 0.0041, Durbin-Watson = 1.76, Durbins "h" = 0.71.

Notes: (1) TSP 4.1.
(2) t-statistics in parentheses.
(3) Variables marked (*) were treated as endogenous. Instruments were as in Tables 4, 6 and 8.
(4) Capital neutrality was tested using a Wald procedure. The test statistic was $\chi^2_1 = 0.097$.
(5) The variable $\tilde{w}$ is the equilibrium wage, defined in the text; and ρ is the real interest rate.

variable newly held constant. Table 10 gives the result of this procedure. The model captures the rise in unemployment well, simulating a rise of 11.2 percentage points compared to an actual rise of 11.4. Our exogenous variables explain 9 points of that rise. Of these, the real interest rate is the single most important, raising unemployment by a little over 2.5 percentage points. This is very much in line with the size of the effect which we have found for the OECD in general (1988a). Irish real interest rates mirror the high real interest rates that have been a prominent macroeconomic feature of this decade. Why these rates have been so high for so long is an unanswered question, to our knowledge. Lindbeck (1988) opts for changes in saving behaviour, but we believe world-wide monetary stringency is at least as important. The weight of explanation is spread fairly evenly over the remaining variables: about half of the explained rise of 9 points is due to demand-side variables, leaving the other half to the supply side. The remainder of 2.2 per cent will be due in part to the continued working through of any adverse shock prior to 1979 and in part to the continued slowdown of Irish productivity growth through the 1980s, which will imply a temporary upward shift in unemployment,

Table 10: *Explaining the Rise in Unemployment 1979-1986*

	Percentage Points
Actual change in the unemployment rate	11.4
Simulated change	11.2
due to:	
real interest rate	2.6
UK demand shocks	1.7
changes in the wedge	0.7
the replacement rate	1.2
population increase	1.3
trend participation	1.7
total of these	9.0
Remaining rise	2.2

Note: The total is not exactly the sum of the components due to rounding.

since capital neutrality holds only in the long run. One further feature which is worthy of comment is the relative unimportance of the tax and import price wedge in the simulation. The tax rises experienced in Ireland through the 1980s have been large (see Walsh, 1987; OECD, 1988), but enter our model as changes, so that high but steady tax rates have no effects. We have shown that this is a very general finding, and one with a convincing theoretical foundation, but it disallows an explanation of Irish unemployment based on the supply-side effects of fiscal stringency.

V CONCLUSION

Our work suggests strongly that the Irish labour market operates, in aggregate, in similar ways to other OECD countries. The rise in unemployment from 1979 to 1986 was due to the simultaneous onset of a number of adverse factors, roughly evenly split between those affecting labour demand and those affecting labour supply. It is noteworthy that none of the factors detailed in Table 10 reduced unemployment. Ireland was dealt nothing but bad cards in the 1980s. The model could be extended, improved and reinvestigated in a number of ways, but we are confident that the big picture will remain substantially unaltered.

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DATA ANNEX

The seventeen countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Norway, Sweden, Switzerland, United Kingdom and United States. For most variables a common source and construction was used for all countries. These variables are described first. Extra Irish data are described subsequently. The starting dates for all regressions are as stated, except for Japan (1961), and Austria, Italy and Norway (1964).

n — *total employment* — source: OECD Labour Force Statistics (OECD, LFS)

k — *gross capital stock* at 1980 prices, derived from OECD National Accounts (OECD, NA) investment data.

$w-p$ — *the product wage*. This is defined as

$$\log [w(1+t_1)/(p(1-t_3))]$$

where w is hourly earnings in manufacturing (OECD Main Economic Indicators (OECD, MEI); t is social security tax rate borne by firms (OECD, NA); p is the GDP deflator (OECD, NA) and t_3 is the indirect tax rate (OECD, NA).

ρ — *the real interest rate*. This is defined as a short nominal interest rate (source IMF International Financial Statistics (IMF, IFS) minus the future rate of change of p, defined above.

a — *total factor productivity*. This is calculated using the Solow residual method, and then smoothed via a quintic time trend.

(p_c-p) — *the wedge*. This is defined as

$$p_c - p = \log[p_c(1+t_1)/(p(1-t_2)(1-t_3))]$$

where p_c is the consumers expenditure deflator (OECD, NA) and t_2 is an average mean tax rate (OECD, NA), p, t, t_3 are defined above.

u — *the unemployment rate*, defined as ut/(n + ut) where ut is total unemployment (OECD, LFS) and n is defined above.

h — *the population aged between 15-64 years*. Source: OECD, LFS.

mismatch, $|\Delta sh_m|$ where sh_m is the share of manufacturing in total employment. Source: OECD, LFS.

Instruments

World raw material prices: UN Monthly Digest of Statistics (UNMDS).

World manufacturing export prices: UN Monthly Digest of Statistics.
The world terms of trade variable is the ratio of these two series.

Irish Data:

Net Migration – Source: OECD, LFS.

r – the replacement rate

$$r = \frac{B}{WW}$$

where B is average weekly unemployment benefit (weighted by family type) and WW is weekly wages in manufacturing, net of direct taxes. The B series was kindly provided by Professor Patrick Geary of Maynooth College.

Export Competitiveness
Log of the ratio of the world price of manufactured exports in US dollars (UNMDS) to the export deflator for Ireland (OECD, NA), brought to a common currency using the annual average exchange rate (IMF, IFS).

UK Competitiveness
Log of the ratio of UK to Irish GDP deflators (OECD, NA) bought to a common currency using the annual average exchange rate (IMF, IFS).

Real Import Prices
Log of .the ratio of import deflator to total final expenditure deflator (OECD, NA).

Terms of Trade
Log of the ratio of export to import deflators (OECD, NA).

Government Spending
Log of government final consumption expenditure at constant (1980) prices (OECD, NA).

Real Money Balances
Log of M1 (IMF, IFS) deflated by the consumers expenditure deflator (OECD, NA).

World Output
Log of an index of GDP for the industrialised countries (IMF, IFS).

UK Output
UK GDP at factor cost (CSO, Economic Trends Annual Supplement).

Sources for other UK data employed are available on request from the authors.