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Wage Determination in Economies in Transition: Ireland, Spain and Portugal

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Abstract:
This paper considers the wage formation experience of three existing EU member states – Ireland, Spain and Portugal. The process of transition to full integration into the EU economy has affected both the demand for labour and the supply of labour in these economies. In the case of labour supply, the role of trade unions has changed, and EU membership has introduced free movement of labour. On the demand side, membership of the EU and the completion of the Single Market have altered the focus for many of the firms operating in these previously rather closed economies. This labour market experience of three economies in transition has lessons for future EU members.

1. Introduction

The process of transition from being a poor and relatively underdeveloped economy to becoming a modern economy with a standard of living close to the EU average is complex. Already many countries in Central Europe have embarked on this path and, with EU membership anticipated for many economies from 2004 onwards, this process of transition and convergence can be expected to accelerate. However, this path of transition is not a new one. A number of existing EU members have already followed it over the last thirty years and the lessons from their experience could prove useful in understanding the process of convergence in living standards facing the new EU members.

This paper considers the experience of three existing member states and how the process of convergence has affected, and in turn been affected by, the performance of their labour markets. It concentrates on the process of wage determination in three countries – Ireland, Spain and Portugal. In the case of Ireland, while EU membership occurred in 1973, the process of transition began around 1960 and has continued over a protracted period of forty years. For Portugal and Spain the process has been more concentrated. Liberalisation and democratisation of their economies took place in the 1970s and EU membership occurred in 1986. The changes that took place in these societies affected the labour market both directly and indirectly.[1]

In this paper we consider how the process of transition, including freeing of trade and EU membership, has affected both the demand for labour and the supply of labour. In the case of labour supply the role of trade unions has changed, with direct implications for the wage bargaining process itself. EU membership has also opened up the possibility of migration affecting labour supply. On the demand side, membership of the EU and the completion of the Single Market have changed the focus for many of the firms operating in these previously rather closed economies. Today firms producing tradable goods and services are competing in a global market and this has important implications for the factors driving their demand for labour.

In Section 2 of this paper we examine the labour markets of each of the economies over the period of convergence, discussing the development of wage rates, unemployment, taxes and migration in each country. In Section 3 we set out models of wage determination that allow for new effects on wage determination arising from the EU integration process. Section 4 describes the results obtained from estimating these models using data for Ireland, Spain and Portugal. Finally, our conclusions are discussed in Section 5.

2. Framework for Analysis

In this section we describe some of the principal factors driving the development of labour markets in Ireland, Spain and Portugal. These economies are all considered to be outliers from the core of the EU. As we will see, the Irish labour market has a unique structure having been so closely integrated with that of the UK in the past, and having a very elastic supply of labour through short-term migration. There are many similarities in the structure of the Iberian labour markets, such as relatively high levels of employment protection (see OECD, 1999), apparently similar architecture of wage bargaining and comparable generosity of unemployment insurance systems since 1989 (Bover et al., 2000). However, these similarities mask significantly different labour market outcomes, with Portugal enjoying one of the lowest unemployment rates in the EU (4.1% in 2001) while Spain suffers the highest (13% in 2001). In the following subsections we describe some of the main features underpinning these labour markets, identifying key similarities and differences.

2.1 Wage Rates and Labour's Share of Value Added

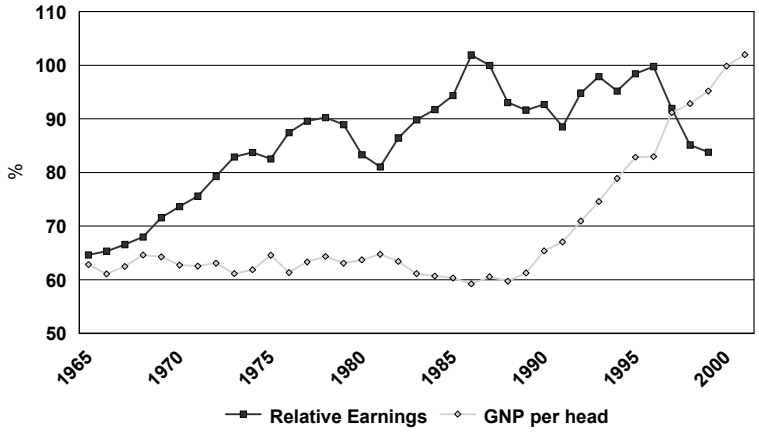
In looking at Ireland, Spain and Portugal we are considering three very different economies that have shown significant convergence towards the EU average standard of living over the last thirty years. All three have undergone radical transformation in that period and all three have become members of the EU since 1970. This process of convergence has affected the process of wage determination.

In a standard neo-classical model, if wage rates converge too rapidly towards the EU standard of living, then the incentive for firms to increase production in the converging economy will be reduced. This could slow, or even halt the process of convergence. On the other hand, if wage rates were to lag behind the convergence in living standards (measured in terms of output), then the enhanced profitability of firms could accelerate the convergence process. The rise in output and the rise in productivity will themselves affect the labour market through their effects on the demand for labour. EU membership and the broader process of EU integration could also be expected to affect the supply of labour through enhancing the opportunity for migration and, indirectly,

[1] For example, trade unions only became legal in Spain in 1977.

through changing expectations and the regulation of the labour market. Thus the behaviour of the labour market can play a potentially important role in determining the speed and nature of the convergence process.

Figure 1: Ireland - Wage and Output Convergence
GNP Relative to EU, Labour Costs Relative to UK



In Figure 1 we show Irish labour costs relative to the UK over the 40 years from 1960 to 2000.[2] Between 1960 and the mid-1970s Irish labour costs rose rapidly relative to the UK. However, from the late 1970s to today Irish labour costs have plateaued out, fluctuating around a level of 90 per cent of UK labour costs.[3] Since 1980 such changes as have occurred have arisen from changes in the exchange rate, with no obvious long-term trend in relative wage rates. This convergence in labour costs predates the convergence in living standards to the EU average, as shown in Figure 1. Whether the convergence in wage rates hindered subsequent convergence in output is discussed elsewhere (Duffy, Fitz Gerald, Kearney and Smyth, 1999). In this paper we are concerned with how the convergence process itself impacted on wage formation behaviour.

Figure 2: Spain - Wage and Output Convergence
GDP Relative to EU, Labour Costs Relative to France

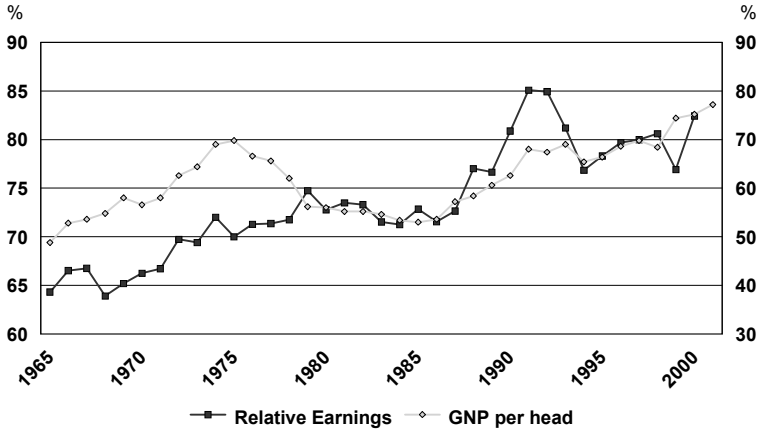


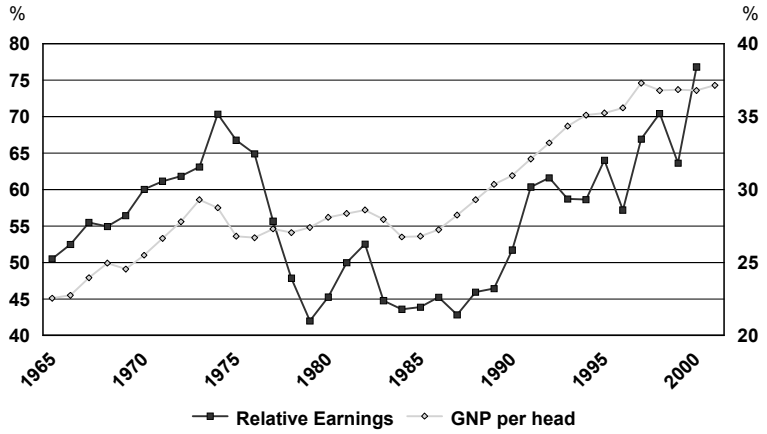
Figure 2 shows the path of wage and price convergence in Spain since the mid-1960s. While less dramatic than in the case of Ireland, relatively steady progress is seen in the process of convergence over the full period. In the case of labour costs, they rose much more rapidly in Spain in the early 1990s than in other partner EU

[2] The UK is used for comparison purposes due to the difficulty in obtaining a satisfactory series for EU wage rates covering the appropriate period. In the case of Ireland the openness of the capital and labour markets to movements to and from the UK make it the obvious country to use. For Spain and Portugal the choice is less obvious. In both cases we tested data for France and Germany and found that France appeared to provide a more relevant basis for comparison.

[3] The EU labour costs survey data for 1996 are used to benchmark Irish labour costs (wage rates and employers social insurance contributions) relative to UK levels.

countries.[4] However, within a few years there was a major downward adjustment, such that labour costs in Spain fell back below 70 per cent of the French level, while convergence in living standards continued.

Figure 3: Portugal - Wage and Output Convergence
GDP Relative to EU, Labour Costs Relative to France



As shown in Figure 3, since joining the EU in the mid-1980s Portugal has made fairly steady progress in terms of convergence in living standards towards the EU average. While still experiencing a significantly lower standard of living than the average, the gap has narrowed dramatically over the last fifteen years. Labour costs began the 1980s very much below labour costs elsewhere in the EU. They began to rise more rapidly than in France in the late 1980s, after the process of convergence in living standards had begun. Since then progress has continued over the 1990s. However, unlike the case of Spain and Ireland, they still remain very far below EU average levels. To some extent this reflects lower price levels in Portugal, so that the purchasing power of a given level of wages (in euros) is higher than in neighbouring countries. However, even allowing for this difference in prices, the figures still reflect the fact that the purchasing power of wages in Portugal remains well below that in the rest of the EU.

2.2 Unemployment

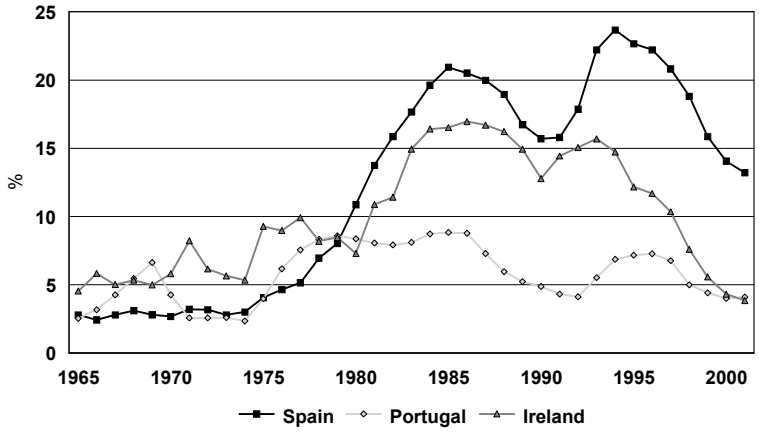
If the labour market cleared instantly then the explanation for the path of wage rates would be found through modelling labour demand and labour supply; the wage determination equation would just be a reduced form of the simple underlying structural model. However, as shown in Figure 4, the path of unemployment in Spain and Ireland indicates that the labour market has been very slow to clear. In Portugal, by contrast, unemployment never rose above 9 per cent of the labour force and the labour market has shown more rapid adjustment to the state of the economic cycle.

In the case of Ireland, unemployment rose rapidly in the early 1980s. While there was certainly evidence that it was affected by the state of the economic cycle, there was also extensive evidence of hysteresis. However, over the last five years we have witnessed a phenomenal reduction in the unemployment rate, as the domestic economy has boomed resulting in record levels of employment growth. The unemployment rate reached a historic low of 3.8% in 2001.

For Spain, the pattern of the unemployment rate mirrored that in Ireland, with little evidence that the labour market cleared in the short term. However, the rate increased to much higher levels in the early 1990's, and still remains high relative to the rest of the EU, even given a phase of rapid economic growth throughout the late 1990s. This contrasts sharply with the Portuguese unemployment rate, which has remained lower than most EU countries throughout the period under consideration. We mentioned some of the similarities between the two Iberian labour markets above, but it seems that the explanation for such different performance lies in differing labour market institutions and wage adjustment processes between Spain and Portugal. Demand- or supply-side shocks are unlikely to hold the key to explaining the differing performances, as both Spain and Portugal have been exposed to similar shocks since the 1960's. However, when different labour market institutions are exposed to similar shocks, this can lead to significantly different outcomes (Blanchard and Wolfers, 2000).

[4] A similar pattern is shown if Spanish labour costs are compared to those in Germany.

Figure 4: OECD Unemployment Rates



Blanchard and Jimeno (1995) identify the unemployment benefit system as one of the principal differences between the countries, with a generous system in operation in Spain whereas benefits were virtually non-existent in Portugal before 1986. Throughout the 1990's replacement ratios and benefit coverage have converged between the two countries, although the system remains more generous in Spain. Another similarity between the countries is the existence of minimum wage laws set each year, including collective bargaining agreements that set wage floors for the different occupation categories. However, these wage floors are set at a relatively lower level in Portugal, thus giving the employer more scope for manoeuvre. This results in actual wages exceeding the agreed minimum levels in Portugal (by about 10% for unskilled workers), but not in Spain (see Bover et al., 2000).

These data suggest that the Portuguese labour market has been more flexible than that of Spain and Ireland, with wage rates adjusting to clear the labour market over a relatively short space of time. However, recent labour market reforms in Spain have reduced employment protection (by narrowing the definition of an "unfair" dismissal) and also increased the number of workers on fixed term contracts, thus adding more flexibility to the system. Nevertheless, a more generous benefit system combined with less flexibility in wages helps to explain the large unemployment differential between Spain and Portugal.

2.3 Taxation

The data shown above for relative labour costs include both wage costs and social insurance contributions paid by employers. The after tax wages received by individual workers are significantly different from the cost to employers, due to the operation of the tax (including social insurance) system. For employees what concerns them in the long run is the development of real after tax wage rates. For employers it is the cost of employing a unit of labour relative to the price they get for their output. The "wedge" between these two prices is accounted for by changes in tax rates and changes in output prices relative to consumer prices.[5]

The rise in tax rates, especially when the rise was quite rapid, may have had an impact on wage determination. The evidence in Drèze and Bean, 1990, using data for an earlier period, found that the tax wedge did not have a significant effect on wage determination in many of the countries they considered. However, they did find a significant effect on Spanish wage rates (they did not consider Ireland). Anderton and Barrell (1995) did not find any long run effect of the tax wedge for Spain, but did find a significant effect for Ireland, consistent with Bradley and Fitz Gerald (Bradley *et al*., 1993). In this paper we re-examine this issue, including a tax wedge variable in the models estimated.

Although not shown, the ratio of personal taxation to personal income for Ireland, Spain and Portugal rose fairly steadily up to the 1980s. In the case of Ireland it peaked in 1987 and fell back by 1990, remaining relatively unchanged thereafter. In the case of Spain it continued to increase until the early 1990s, showing some small reduction in 1995. In Portugal, while showing a fairly continuous increase over the thirty years, it grew particularly rapidly in the second half of the 1980s.

[5] The difference between output prices and consumer prices is due both to the impact of indirect taxes and changes in the terms of trade (domestic prices relative to import prices).

2.4 Migration

The final factor that potentially affects labour supply in a global economy is migration and its related effect on employees' expectations. While in a closed economy, labour is assumed to choose between employment in the domestic economy and leisure (unemployment), in an open economy migration presents a third possibility. In a fully integrated market, labour in one country or region can choose between the after tax wage rate available in the home country or region and the after tax wage rate in other countries or regions. Obviously there are costs to migration so that the rate of return in the foreign country must significantly exceed that in the home country to adequately reward migration. The broad process of European integration improves information on living standards in neighbouring countries (or regions), and this may give rise to pressures for similar conditions domestically, even if the costs of migration prevent the bulk of the labour force from moving.

While in the case of Ireland, migration to the UK has been unrestricted for the last two hundred years, the same was not true for emigration from Spain and Portugal. In the latter two countries full free movement of labour only became possible with EU entry in 1986. However, even with the possibility of free movement of labour after EU entry, Blanchard and Jimeno (1995) find that migration has not played a major role in balancing the labour markets in Spain and Portugal. While we agree that migration is not a major determinant of labour supply in Spain, we believe that there may be some role for migration in the wage determination process in Portugal. In 1999, over half a million Portuguese were living in France, representing 5% of the total Portuguese population. If we look back to 1982, there were over three-quarters of a million Portuguese living in France, almost 8% of the total population (see OECD, 2001). Although the number living in France has declined, the number living in Belgium, Germany and Luxembourg has doubled over the same period. We return to this issue later.

A succession of papers highlights the importance for Ireland of substantial migration flows relative to the size of the labour force. These flows are driven by changes in both unemployment and wages relative to the UK (see Barrett (1998), Kearney, 1998, and O'Grada and Walsh (1994)). The Harris-Todarro specification used in these studies of migration implies an infinite elasticity of labour supply in Ireland in the long run. That is, labour will continue to migrate to or from Ireland to ensure an equilibrium wage or unemployment differential between the Ireland and the foreign labour market. The size of this differential is determined by the costs of migration. When the supply of labour in one country (Ireland) is infinitely elastic in the long run through migration, there will be no long-run Phillips curve effect. While changes in unemployment may exert a negative effect on wage rates in the short run, emigration will reduce unemployment in the long run, eliminating any downward pressure on wage rates.[6] The converse will be true for falls in unemployment that will attract immigration.

As discussed above, while migration has had a significant effect on wage determination in Ireland, this was not the case for Spain and the Portuguese case requires further investigation. However, it played a significant role in the post-unification German labour market and, with EU enlargement, there remains the possibility that it could play an important role in the convergence process for the new EU member states (see Conclusions).

2.5 Other Factors

In addition to the factors considered above, a range of institutional factors might have affected wage determination in the three countries examined. In Ireland, the advent of what is referred to as the "partnership process", beginning in 1987, introduced institutionalised wage bargaining between the government, employers and trade unions. The process involves an explicit trade off of tax-cuts for wage moderation. This arrangement has persisted up to and including the present. The institutional factors that exist in the Spanish and Portuguese labour markets are discussed when explaining the difference between their unemployment rates in Section 2.2.

Unionisation may also have played a significant role in affecting the wage bargaining process, changing the shape of the supply curve of labour. The evidence suggests that for Ireland, union density did play a significant role (Curtis and Fitz Gerald, 1994). However, unionisation was itself endogenous, and it may have picked up other aspects of structural change occurring in the economy. In the case of Spain unions only became legal in 1977, which means that any effect that unionisation could have is limited to the post-1980 period. Nevertheless, Blanchard and Portugal (2001) allude to differences in union power as a principal factor behind longer unemployment duration in Spain than other countries. In any event, data problems prevented the inclusion of unionisation in the empirical work carried out here.

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[6] As discussed in Fahey, Fitz Gerald and Mâitre, 1997, since the early 1980s migration into and out of Ireland was predominantly skilled. The high-level of unemployment reflected a high replacement rate that discouraged migration. For a detailed discussion of how this affected the labour market see Fitz Gerald and Kearney, 2000.

3. Modelling Labour Supply and Labour Demand

Wages are assumed to be determined as part of a bargaining process between employers and trade unions. The bargain is generally struck over wages and staffing ratios. Usually, the level of total employment is not covered by the bargain because of the operation of an insider/outsider structure between workers and the unemployed. The vast literature on the functioning of labour markets within a bargaining framework is both analysed and extended in Layard et al. (1991). We adopt their framework in this paper, and consequently our theoretical discussion is brief.

For the purposes of our analysis, the bargain determines the wage rate and employers then choose their level of employment conditional on the agreed wage rate and the other variables that determine their profitability.[7] Wages tend to be positively correlated with union power, but negatively correlated with the level of unemployment and the elasticity of labour demand. Wage pressure is usually higher when unemployment is declining. This is because wages have less of an impact on job security when unemployment is falling. Consequently, if unemployment is declining from high levels in the recent past, this can increase wage pressures and result in a high level of non-inflationary unemployment. This constitutes the basic insider mechanism of hysteresis, whereby one-off shocks can have permanent effects on unemployment, which is discussed later in the paper.

In this framework, equilibrium unemployment is not market clearing. Efficiency wage theory argues that firms may find it profitable to pay wage rates above the market-clearing level in order to motivate workers. Union power also helps to keep wages high, even when there is an excess supply of labour. This framework also allows for a degree of "nominal inertia" in both price- and wage-setting behaviour of agents. Consequently, demand or supply shocks can result in the system departing from equilibrium, and often taking some time to return. Wage bargaining and collective agreements that reduce the frequency of wage adjustments often cause such inflexibility in nominal wage rates.

In this paper we consider two variants of such a bargaining model. In the first "closed economy" model we assume that firms are operating in a national economy and are unaffected by the external environment. They are assumed to be supplying a domestic market and they are not directly affected by competitiveness relative to the outside world. In this closed economy model labour is also assumed to be immobile. As a result it is domestic prices and tax rates that affects bargaining behaviour. The second model we consider is an "open economy" model. In this model firms are assumed to be supplying a global market. It is the demand for their output on the world market that drives production and they are assumed to be competing against firms in the rest of the world. Hence their competitiveness relative to foreign firms affects their bargaining behaviour. Even if firms are not in the tradable sector, the discipline of the global market is assumed to have an indirect effect on their behaviour. Labour is also assumed to be mobile through migration. The after tax rate of return from employment in the home country is compared to the rate of return from employment elsewhere. The relative rate of return drives migration through a Harris-Todaro type model. Even if the proportion of the labour force that actually moves is small, there may still be a significant effect on expectations.

Our basic wage equation nests both an open and a closed economy specification in a single equation. We assume a log-linear form for the labour supply and labour demand equations, representing the objectives of the representative employer and employee, and these can be solved for the "equilibrium" wage rate w^*. A more formal derivation is given in Fitz Gerald (1999). The resulting specification for the wage rate encompassing both the closed and open economy models is of the form:

$$w^* = a_0 + a_1 q_w + a_2 (z-t) + a_3 p + a_4 w_w + a_5 (z_w - t_w) + a_6 e + a_7 (q - l) + a_8 U + a_9 U_w + a_{10} n \quad (1)$$

Where

l	=	employment	q	=	output in the home country
w	=	wage rates	p	=	the output price
z	=	consumer prices	t	=	the tax wedge
q/l	=	productivity	e	=	the exchange rate
n	=	unionisation	U	=	the unemployment rate

[7] Output prices, world demand and input prices.

Lower case variables represent the natural logarithm of the corresponding upper case variable. The w subscript represents the appropriate variable for the world economy, so q_w is a measure of world output, etc. In the Irish case, e is the expected bilateral Sterling/Punt exchange, while for Spain and Portugal it is the exchange rate relative to the U.S. dollar taken from the OECD's Main Economic Indicators.

From this general specification it is possible to test down the two very different models of wage determination. Both of these are formally derived in Curtis and Fitz Gerald (1994). The first of these is the closed economy model, which adopts the following specification for the demand and supply of labour:

$$l_d = f(q, w-p) \quad (2)$$

$$l_s = g(w, z, t, q/l, U, n) \quad (3)$$

The demand for labour is a function of output and the real wage, where the price is the price of industrial output (2). Wage rates and consumer prices, the tax wedge, productivity, the unemployment rate and unionisation determine the supply of labour (3).

To estimate the closed economy model, we impose the following restrictions on the nested model (1):

$$a_1 = 0;\ a_3 = 1 - a_2;\ a_4 = a_5 = a_6 = 0$$

When these restrictions are implemented the equation to be estimated takes the form:

$$w^* - p = a_0 + a_2 (z-t)-p + a_7 (q - l) + a_8 U + a_9 U_w + a_{10} n \quad (4)$$

The open economy model takes account of the fact that in a modern EU economy firms are producing for a wider EU market and the representative firm in the tradable sector has a choice between producing in the home country or elsewhere in the EU. Labour supply is also assumed to be affected by conditions in the external EU labour market, both directly through migration, and indirectly through changes in expectations. The resulting open economy model is:

$$l_d = f(q_w, w, w_w) \quad (5)$$

$$l_s = g(w, z, t, w_w, z_w, t_w, U, U_w, n) \quad (6)$$

The subscript w indicates the appropriate variable for the outside world and q_w is an appropriate measure of world output, namely the log of Gross Domestic Product of the European Union.

In the open economy model, the demand for labour in the home country is a function of world output, with the process of competition determining what share of that output is produced in the home country (5). In this model competitiveness is measured in terms of relative labour costs between the home country and the rest of the EU. In addition to the variables that appeared in the closed economy labour supply equation (3), the open economy equation (6) includes a representative EU wage rate, tax wedge and unemployment rates, reflecting the integration of the labour markets in the two countries[8].

In order to estimate the open economy model, it is necessary to impose the following restrictions:

$$a_3 = 0;\ a_5 = 1 - a_2 - a_4\ ;\ a_6 = 1 - a_2\ ;\ a_7 = 0$$

When these restrictions are implemented the equation to be estimated takes the form:

$$w^* = a_0 + a_1 q_w + a_2 (z-t) + a_4 w_w + (1-a_2-a_4) (z_w - t_w) + (1-a_2) e + a_8 U + a_9 U_w + a_{10} n \quad (7)$$

In implementing this specification it is assumed that actual wage rates adjust to their optimal or "equilibrium" level over time. In testing between the different specifications the adjustment process is specified as an error correction mechanism (8).

$$\Delta \log(w_i) = b_1 \Delta \log(w^*) + b_2 (\log(w^*_{-1}) - \log(w_{-1})) \quad (8)$$

The process of moving from a closed economy to a fully integrated economy within the EU may involve major shifts in both the supply and demand curves for labour. With integration firms will find that their potential markets increase but they may also face greatly enhanced competitive forces. Similarly labour may face important new opportunities as a result of the introduction of free movement of labour. If the process of integration happens very rapidly, as in the case of the former East Germany, the long run equilibrium wage rate may change dramatically in a very short space of time. However, both firms and labour may be much slower to change because of the high costs of adjustment.

In particular for firms, adjustment to take advantage of the new opportunities can only come about through investment. As a result, while economies are undergoing the process of transformation, the speed with which the gap between actual and long-run optimal wage rates is closed may be slow, depending on a build up of investment to shift the economy to its new production frontier.

[8] In practice, data limitations prevented us from estimating with a foreign tax wedge variable or a unionisation variable.

Equation (8) implies a constant proportional closure of the remaining gap each year between the optimal and actual level of wage rates (and output). Where there is a sudden opening up of the economy, this involves the biggest step in the adjustment process in the first year with the adjustment steps steadily falling in size thereafter, as the change each year remains proportional to the remaining gap to be bridged. However, it may be more realistic to assume a constant absolute step in the adjustment process each year. Such a process would be consistent with a situation where the costs of adjustment through investment rise non-linearly with the absolute size of the investment undertaken.

If this is the case for countries undertaking a major transformation, the ECM in (8) may be rejected by the data. Instead, over the period of the transition, wage inflation may exceed that in the EU by a constant absolute amount until the new equilibrium is reached.

In the case of Spain and Portugal the process of opening up their economies to free trade was relatively rapid, beginning in the mid-1970s and culminating with EU entry in the mid-1980s. In the case of Ireland the process took place over a period of fifteen to twenty years. For firms in Ireland facing this changing environment their reaction time was slow. They first of all had to be convinced that the change was irreversible and then the implementation of new investment took many years to achieve. This could explain a slow outward shift in the short-run demand curve for labour as firms gradually implemented their decisions to expand production for a global market. If the only factor were a shift in expectations shifting the supply curve, then the adjustment process should have been much more rapid.

4. Model Results

For each of the three countries considered we first of all estimate the general model. In each case, the general model fails to fully explain the wage determination process in any of the three economies over the entire period. This is because of a change in labour market behaviour that manifests itself as a break in sample in each of the countries sometime between the mid-1970s and the mid-1980s. The structural changes in each of the economies are associated with significant institutional changes, such as the development of democratic institutions in Portugal and Spain and membership of the EU for all three economies. In this paper, we focus our attention on the later period, the 1980s and the 1990s, where open economy characteristics have a much greater impact on the wage determination process. For each of the economies, this latter period incorporates full membership of the EU, which opened up both product and labour markets through the development of the Single Market and free movement of labour.

Estimation of the general model for the entire period confirms the importance of open economy characteristics in the wage setting process (See Appendix 1). In estimating the general model, we use an autoregressive distributed lag (ARDL) procedure. The existence of a long-run relationship between the wage rate and any other variable is tested for by estimating an unrestricted error correction ARDL model and computing the F-statistic for testing the significance of the lagged levels of the two variables. Once a parsimonious relationship has been established between the variables, we then estimate the long-run coefficients of the cointegrating relationship and the error correction model. The main advantage of the ARDL procedure is that it can be applied irrespective of whether the regressors are I(0) or I(1), and hence avoids the pre-testing problems associated with standard co-integration analysis that requires the classification of all variables into I(0), I(1) or higher (prices are often I(2)).

For each of the countries in this study, co-integrating relationships were found to exist between the wage rate and the other variables considered. This allowed us to continue to the second stage of the analysis and estimate the coefficients of the long-run relations. We initially estimated the most general model (equation 1) for the three countries. However, a Chow test of parameter stability for each country confirms the existence of a significant break in sample. These structural breaks are consistent with the opening up of each country's economy, changing the nature of their labour markets. Having established the relevance of these open economy variables in the wage determination process, we then impose the open economy restrictions (equation 7) and estimate for the later period.[9] The results for Ireland are described in Section 4.1, with those for Spain and Portugal presented in Sections 4.2 and 4.3 respectively.

The dependent variable in the models estimated in this paper is average annual earnings. This variable reflects the full costs to the employer of employing a unit of labour (including employers' social insurance contributions). In the case of Ireland, firms were assumed to be competing against other firms in the wider EU,

[9] Because of the limited number of observations it was not possible to test down from the general model using the shorter data sample. Instead the open economy restrictions were imposed in estimation.

while Irish labour was assumed to face a choice between employment in Ireland and employment in the UK. For Spain and Portugal, experimentation indicated that France was the most appropriate country for benchmarking purposes.

For this paper we use data from 1960 to 2000 for Ireland, Spain, Portugal, France, Italy and Germany taken from the OECD's Main Economic Indicators and Economic Outlook databases. For Spain and Portugal our dependent variable is average earnings for the economy, taken from the OECD Economic Outlook database, while for Ireland it is average earnings in the non-agricultural sector. For Ireland, the majority of the Irish data comes from the ESRI databank, which is based on the Irish National Accounts and is more up to date than the OECD data.

4.1 Ireland

The underlying data permitted an unrestricted estimation of the general model for the entire period 1960-99 and the long-run coefficients are presented in the Appendix. However, we expected, a priori, that the general model would not fully explain behaviour over the entire period. This is because Ireland's convergence in terms of relative earnings took place over a long period between 1960 and 1980. Although the labour market had been very open relative to the UK for many years, the 1960s and the 1970s was the period associated with the opening up of the product market. A Chow test confirms that a break in the sample occurs in the late 1970s.

We imposed the open economy restrictions, described in the previous section, and ran a Chow test of parameter stability on equation 7 over the full period. This also confirmed that there was a significant break in the sample. The Chow test indicated that the most significant break in sample came in 1983, so we estimate the open economy equation for the period 1983 to 1998 using Ordinary Least Squares. The estimated equation and long run results are given below.

Note that the dependent variable for Ireland is the natural logarithm of wage rates in the non-agricultural sector (W), while U represents the difference between Irish and UK unemployment rates.[10] In this specification world output (Q_W in Section 3) is represented by the level of GDP in the Germany.[11] The tax wedge term represents the gap between workers after tax wages and the wage that firms pay for labour. Foreign wages are given by UK wage rates (W_{UK}) and the foreign tax wedge is calculated using the same methodology as for Ireland using UK data ($Wedge_{UK}$). The exchange rate, E, is the bilateral Irish pound/sterling exchange.

$$\log(W) = A_0 + A_1 * \log(GDP_{GER}) + A_2 * \log(Wedge) + A_3 * \log(W_{UK}) + (1-A_2-A_3) * \log(Wedge_{UK}) + (1-A_2) * \log(E) + A_4 * U$$

Table 1: Long Run Results for Ireland

Adjusted R^2 = 0.9892		S.Error = 0.0116	
Durbin-Watson = 2.2248		DFFITS = -1.4139	
Coeff.	Estimate	St. Error	t-statistic
A_0	-7.8183	1.3822	-5.6564
A_1	0.3359	0.2417	1.3897
A_2	0.8973	0.0999	8.9830
A_3	0.5818	0.2510	2.3183
A_4	-0.0062	0.0019	-3.2772

These results yield the following long run relationship:

$$\log(W) = -7.8183 + 0.3359 * \log(GDP_{GER}) + 0.8925 * \log(Wedge) + 0.5818 * \log(W_{UK}) - 0.4791 * \log(Wedge_{UK}) + 0.1028 * \log(E) - 0.0062 * U$$

[10] Until the 1990s the UK was the main destination for the large number of Irish emigrants. Many studies show that emigration was sensitive to the unemployment differential between Ireland and the UK (Geary and O'Grada 1989, and Kearney 1998).

11 We tried other series as a proxy for world output, including GDP of the European Union, Industrial Output and GDP in the United Kingdom. German GDP gave the best fit and proved to be the most robust in the long run.

In the long run, all of the coefficients are significant with the exception of that on world output. The Irish tax wedge is significantly different from zero and its coefficient is not significantly different from one in the long run. This implies full pass through to wages of taxes, indicating a very elastic supply of labour, as was the case in Ireland over the period. The fact that the incidence of taxes on labour fell largely on employers partly explains the problems Ireland faced in the early 1980's – the substantial increases in tax rates raised labour costs making the economy uncompetitive. The significance of the tax wedge may also be capturing the impact of the partnership process on Irish wages. Since the late-1980s successive collective bargaining agreements have traded off tax cuts from the government for wage restraint from the social partners. The partnership agreements recognised the sensitivity of wage rates to changes in the tax wedge, and this has tool has been successfully used to maintain Ireland's competitiveness and reduce unemployment.

Wage rates in the UK are a very significant determinant of Irish wage rates. This is partly a result of migration affecting labour supply. The Harris-Todaro specification used by most studies of Irish migration (Kearney, 1998) implies an infinite elasticity of labour supply.[12] However, it also reflects the fact that UK wage rates affect the demand for labour by firms in Ireland competing against firms in the UK. Firms producing in Ireland are price-takers competing in a world market and in order to maintain output in Ireland they need to remain competitive. Labour costs in competing countries (the UK) affect their decisions on output location and, therefore, on what they are prepared to pay for labour in Ireland. As with the tax wedge, the coefficient on UK wage rates is not significantly different from one, implying full pass through in the long run.

Unemployment relative to the UK has a significant negative effect on Irish wage rates in the long run, although the coefficient is low relative to that estimated for Spain and Portugal. According to our estimates, a 1% increase in Irish unemployment relative to the UK will reduce Irish wage rates by 0.6% in the long run. Such a low coefficient is a consequence of a very elastic labour supply as a result of the opportunity to migrate. Hence, many of those that become unemployed simply emigrate rather than remaining in Ireland to put downward pressure on wages. However, the data suggest that sufficient numbers of unemployed remain in the Irish labour market to have an impact on wages.

The above specification permits can be interpreted as the reduced form of a structural model of the labour market. While the supply and demand schedules of this model are not very well identified, this equation yields an own elasticity of demand for labour of –0.31. This is very close to the estimate of average elasticity of demand for all countries considered by Hammermesh (insert reference). The own elasticity of supply for labour is 2.67, which is high relative to most developed countries. Such a figure is consistent with the very elastic labour supply through migration. The elasticity of the supply of labour with respect to the UK wage rate is –2.04, implying that a rise in UK wage rates significantly reduces labour supply in Ireland, again through migration.

Finally, we consider the short run dynamics by estimating the Error Correction Mechanism (ECM) for the open economy equation described above. Eliminating the insignificant variables yields a short run equation of the form given below.

$$\Delta\log(W) = C_0 + C_1 * \Delta\log(\text{Wedge}) + C_2 * \Delta\log(W_{UK}) + C_3 * \Delta\log(\text{Wedge}_{UK}) + C_4 * \text{ECM}(-1)$$

Table 2: Short Run Results for Ireland

Adjusted R^2 = 0.8276		S.Error = 0.0101	
Durbin-Watson = 1.7896		DFFITS = 1.7612	
Coeff.	Estimate	St. Error	t-statistic
C_0	0.0081	0.0077	1.0558
C_1	0.7519	0.1248	6.0269
C_2	0.6260	0.1886	3.3195
C_3	-0.4944	0.2110	-2.3426
C_4	-0.8566	0.2567	-3.3376

12 This is because migration is a function of the difference in the unemployment rates in Ireland and the UK. Under this specification any shock to the unemployment rate will result in migration continuing till the differential is restored to its long-run equilibrium value.

This implies that it Irish wage rates are driven by three factors in the short run; the domestic and UK tax wedges and wages in the UK. A 1% increase in the Irish tax wedge will increase wage rates by 0.75% in the short run, and this once again demonstrates the elasticity of labour supply in Ireland, with the burden of taxation increases being borne by employers.

A 1% increase in the UK wage rate will increase Irish wages by 0.63% in the short run, with the higher UK wage attracting workers from Ireland thus reducing the supply of labour in Ireland and increasing wages. An increase in the UK tax wedge reduces Irish wages in the short run. This is because, holding wage rates constant, an increase in the UK tax wedge makes Ireland a relatively more attractive place to work, thus increasing the supply of labour and putting downward pressure on Irish wages. The ECM term is also significant, and implies a very rapid speed of adjustment, with just over 86% taking place in the first year. This is higher than the estimates for Spain and Portugal, but is consistent with the unique structure of the Irish labour market through migration with the UK.

4.2 Spain

As in the Irish case, estimation of the general model for the entire period did not fully explain behaviour over the period. This is certainly a consequence of the development of democratic institutions in the mid-1970s, which led to fundamental changes to labour market in Spain, such as the legalisation of trade unions in 1977. The results are given in the Appendix. Only closed economy factors such as domestic prices, productivity and unemployment were significant in the long run equation, and many of the variables have an incorrect sign in the short run. A Chow test confirms the existence of a structural break, sometime between the mid-1970s and the mid-1980s. As a result we estimate the open economy model for the period 1975 to 1998.

$$\log(W) = A_0 + A_1*\log(Q_W(-1)) + A_2*\log(\text{Wedge}) + A_3*\log(W_{FRA}(-1)) + (1-A_2)*\log(E) + A_4*U(-1)$$

Table 3: Long Run Results for Spain

Adjusted R^2	= 0.9986	S.Error	= 0.0101
Durbin-Watson	= 1.3958	DFFITS	= -1.7693
Coeff.	Estimate	St. Error	t-statistic
A_0	-1.5950	0.2623	-6.0814
A_1	1.3253	0.1257	10.5471
A_2	0.64263	0.0717	8.9669
A_3	1.1754	0.0521	22.5589
A_4	-0.0078	0.0012	-6.4394

This gives an estimated long run equation of the form:

$$\log(W) = -1.5950 + 1.3253*\log(Q_W(-1)) + 0.6426*\log(\text{Wedge}) + 1.1754*\log(W_{FRA}(-1)) + 0.3574*\log(E) - 0.0078*U(-1)$$

For the Spanish data, the dependent variable is the log of the wage rate as defined by total compensation of employees divided by total employment from the OECD Economic Outlook database. World output (Q_W) is given by the level of GDP in the European Union. The tax wedge is calculated in the same manner as for Ireland. We use French wage rates for our W_W variable . The inclusion a foreign tax wedge variable did not improve the specification and proved insignificant, so we dropped it from our estimation. E represents the bilateral Peseta/Franc exchange rate, and U is a two-period average of Spanish unemployment.

The open economy equation fits very well over the period from 1975, and all the variables in the long run equation are significant. The coefficient on Q_W is positive, and a coefficient greater than one in the emphasises the impact of economic activity in its major trading partners on Spanish wage rates, with full pass through in the long run. In an open economy, an increase in activity in the EU will increase the demand for Spanish products abroad, thus increasing the demand for labour and hence wage rates in Spain.

The tax wedge is also significant in the long run, consistent with the findings of Drèze and Bean (1990). Although the coefficient is lower than that for Ireland, the implication is still that the very rapid rise in tax rates at the end of the 1980's had a considerable impact on Spanish labour cost competitiveness. This is reflected in the rise in Spanish labour costs relative to France (see Figure X), and this contributed to the rise in unemployment at that time.

French wage rates are also a significant determinant of Spanish wages in the long run, with the coefficient not significantly different from one. This implies that Spanish wages are responsive to developments in labour markets elsewhere in the EU, although the coefficient is lower than that for Portugal. This is probably due to the smaller rate of migration in the Spanish labour market, and although there is a stock of Spanish labour currently working in the French and German economies, this migration occurred in the past and current migration flows are relatively low. Estimation using German wages instead of French yielded very similar results, indicating that Spanish wages are influenced by labour market conditions elsewhere in the EU, but not specifically by conditions in a particular economy as in the case of Portugal (see below).

The domestic unemployment rate has a significant negative effect on wages in the long run. Firstly, this reflects the fact that today migration is not an important determinant of labour supply so that as the pool of unemployed labour increases, this exerts downward pressure on wages in the long run. Secondly, this specification implies hysteresis – a rise in unemployment affects the level of wage rates, not their rate of change. Hence, a one-off shock to unemployment has a permanent impact on the level of wage rates, but wage rates do not continue to adjust in order to clear the labour market. This is consistent with the experience of the Spanish economy since the mid-1980s, where unemployment has remained high over much of the last twenty years.

The open economy specification described above yields an elasticity of demand for labour of –0.27 for Spain. This is certainly plausible, and in line with Hamermesh's "best guess" for the constant-output elasticity of demand for homogeneous labour for a typical firm (Hamermesh, 1993). The elasticity of supply for labour is 0.49, which is considerably lower than that for Ireland. This is because migration is a much less significant factor in the Spanish labour market.

We consider the short run dynamics of the above equation by estimating the ECM for the same period. After eliminating the insignificant variables, the strongest impact on Spanish wages in the short run comes from French wages, but the exchange rate relative to the French Franc is also significant in the short run. This implies that competitiveness plays an important role in the wage determination process in Spain. The unemployment rate is also significant in the short run, although the coefficient is considerably lower than in the long run. The ECM term is significant, and implies a relatively rapid speed of adjustment, with almost 78% of the adjustment taking place in the first year.

$$\Delta\log(W) = C_0 + C_1*\Delta\log(W_{FRA}) + C_2*\Delta\log(E) + C_3*\Delta U + C_4*ECM(-1)$$

Table 4: Short Run Results for Spain

Adjusted R^2 = 0.8288		S.Error = 0.0107	
Durbin-Watson = 1.3218		DFFITS = 1.1730	
Coeff.	Estimate	St. Error	t-statistic
C_0	0.0119	0.0042	2.8528
C_1	1.2367	0.1219	10.1453
C_2	0.2392	0.0803	2.9778
C_3	-0.0056	0.0019	-2.9169
C_4	-0.7796	0.2677	-2.9117

4.3 Portugal

The general model for Portugal explains behaviour much better than for Spain or Ireland. The estimation results for the general model over the period 1966 to 1998 (presented in the Appendix) exhibit both open and closed economy characteristics. This is unsurprising given our a priori expectations that the Portuguese labour market remained relatively closed until EU membership in 1986, and has become much more integrated with and responsive to conditions in the rest of the EU since then. A Chow test confirms the existence of a break in sample, sometime in the early 1980s. The timing of the break is unsurprising given the revolution in 1974 and EU membership in 1986.[13] We estimate the open economy equation (equation 7) from 1980 until 1998. The results are given below.

[13] Also the political changes of the 1970s also raises questions regarding the validity of the data prior to 1980, and this provides further justification for estimating from 1980 onwards.

$\log(W) = A_0 + A_1*\log(Q_W(-1)) + A_2*\log(Wedge) + A_3*\log(W_{FRA}(-1)) + (1-A_2)*\log(E) + A_4*U(-1)$

Table 5: Long Run Results for Portugal

Adjusted R^2	= 0.9970	S.Error	= 0.0099
Durbin-Watson	= 1.8134	DFFITS	= -1.4045
Coeff.	Estimate	St. Error	t-statistic
A_0	-3.6964	0.3320	-11.1330
A_1	2.3939	0.1330	18.0060
A_2	0.8788	0.0671	13.1054
A_3	1.2573	0.0859	14.6312
A_4	-0.0105	0.0022	-4.8650

Hence, the estimated long run equation is of the form:
$\log(W) = -3.6964 + 2.3939*\log(Q_W(-1)) + 0.8788*\log(Wedge) + 1.2573*\log(W_{FRA}(-1)) + 0.1212*\log(E) - 0.011*U(-1)$

All of the variables in the long run equation are significant, and the open economy equation has a good fit over this later period. The coefficient on Q_W, which is EU GDP, is very high in the long run. This emphasises the openness of the Portuguese labour market, with economic activity in its trading partners being one of the principal driving forces behind wage rates in the long run. The coefficient is almost double that for Spain.

The coefficient on French wages is also greater in the long run for Portugal than for Spain, albeit marginally. This result is noteworthy for two reasons. First of all, it demonstrates that Portuguese wages are influenced by labour market developments elsewhere in the EU. The significance of French wages is not surprising, as we noted in Section 2, there is a relatively large stock of Portuguese labour currently living in France, Germany, Belgium and Luxembourg.

In contrast to much of the international literature (Drèze and Bean, 1990, Anderton and Barrell, 1995), we find the tax wedge term to be significant in the long run. In fact, the coefficient on the domestic tax wedge is greater for Portugal than for Spain. This suggests that any increase in the tax wedge reduces the supply of labour and increases producer wages. Once again, this implies a relatively elastic labour supply, with the incidence of tax increases being borne by employers.

The domestic unemployment rate (a two-year average) has a statistically significant negative effect on Portuguese wage rates in the long run. The coefficient is considerably larger than that for both Spain and Ireland. This greater sensitivity to unemployment has helped to keep the unemployment rate lower in Portugal than in Spain (see Figure X). A complete explanation of the gap in unemployment rates between these two countries requires a consideration of institutional factors, such as differences in employment contracts and in the benefit systems. These institutional differences, combined with a greater sensitivity to unemployment, mean that the Portuguese labour market is much more flexible in the short run, and this has contributed to keeping the unemployment rate so low over the period.

The open economy estimation results allow tentative computation of the elasticities of supply and demand for labour in the implicit structural model. The implied elasticity of demand is very low at –0.05. However, this may be the result of estimating using a reduced form of the underlying structural relationship, which makes it more difficult to interpret the estimated elasticities. The elasticity of labour supply is 0.37, which is slightly lower than that for Spain. Once again, this is consistent with a labour market where migration doesn't play a significant role in the wage determination process.

We then consider the short run dynamics of the open economy specification by estimating the ECM for the same period. After eliminating the insignificant variables, we are left with the results below. Both the French wage rate and world output are significant in the short run, once again emphasising the importance of external factors in the wage determination process. As in the Spanish case, unemployment is significant in the short run but the coefficient is again much lower than in the long run. The ECM term is significant, and implies adjustment of almost 83% in the first year. This implies a more rapid adjustment to any shock than in Spain, providing further evidence of the greater flexibility of the Portuguese labour market.

$\Delta\log(W) = C_0 + C_1 * \Delta\log(Q_W(-1)) + C_2 * \Delta\log(W_{FRA}(-1)) + C_3 * \Delta U(-1) + C_4 * ECM(-1)$

Table 6: Short Run Results for Portugal

Adjusted R^2 = 0.8721		S.Error = 0.0093	
Durbin-Watson = 1.2324		DFFITS = 0.9229	
Coeff.	Estimate	St. Error	t-statistic
C_0	0.0031	0.0067	0.4575
C_1	2.1171	0.4719	4.4860
C_2	1.2651	0.1283	9.8626
C_3	-0.0062	0.0035	-1.7945
C_4	-0.8255	0.2674	-3.0867

One final point to note is that competition for investment in Portugal also comes from countries outside the EU with low labour costs. This is particularly true in many unskilled sectors such as the clothing industry. It is possible that the inclusion of wage costs from those countries that were competitive with the Portuguese tradable sector could also prove significant, and for this reason the current specification may underestimate the openness of the Portuguese labour market.

5. Conclusions

EU integration, and the broader process of globalisation, changes the environment in which economies work in a number of fundamental ways. For firms in the tradable sector they change from competing on a domestic market to competing in a global market. This opening up of the economy changes the factors that affect the price they are prepared to pay for their factor inputs, including the price of labour. To remain competitive they have to consider the global demand for their product and their competitiveness compared to foreign producers.

In the case of labour supply, the potential to choose employment in different labour markets can directly affect expectations of individual workers. Even if the extent of migration is low, the potential for migration (the option value of a job abroad) affects wage expectations of individual employees. In turn this can affect the domestic supply of labour.

Our analysis shows that integration into the European Union has significantly affected the wage determination process in Ireland, Portugal and Spain. This means that the process of wage determination shifted from the traditional closed economy model to an open economy model. However, the speed with which this took place was country specific and, because integration is a lengthy process, the model of wage determination also changes over time.

In each of the three countries considered there is evidence of a change in wage formation behaviour as because of the process of EU integration. As a result, labour market conditions elsewhere in the EU now directly affect domestic wages in the long run. The results are consistent with Ireland having the most open labour markets, with a lower degree of openness for Spain and Portugal. This reflects the fact that Irish labour supply is much more sensitive to labour market conditions abroad through migration, than is the case for the other two countries. For all three countries the bargaining behaviour of firms was affected by the process of EU integration.

Earlier research by Drèze and Bean, 1990, found that Spain, alone of the countries they examined, displayed a significant tax wedge effect.[14] However, our results indicate that a tax wedge effect has also had a long-run effect on wage formation in Ireland and Portugal. As a result, the rise in taxes to fund enhanced public services on joining the EU had a knock-on effect on domestic wage rates and labour cost competitiveness.

For the EU accession countries undergoing a fast-track accession process these results have important implications. The research that predicts major migration flows as a result of enlargement (Sinn and Werding,

[14] They did not consider Ireland or Portugal.

2001) fails to adequately take account of the likely impact of EU membership on the labour markets of the new members. The experience of Ireland, Portugal and Spain suggests that EU integration will cause wages to adjust upwards in the accession countries, as these economies begin the process of convergence. This will reduce the potential for migration flows, since the incentives to emigrate are much lower than a static model would suggest. This is what happened in Portugal when they joined the EU in 1986. However, the potential for migration may still be sufficient in the accession countries to have an appreciable impact on labour supply as people adjust their expectations to the advent of free movement of labour.

Appendix – Nested Model Results

Ireland

Estimated Long Run Coefficients using the ARDL Approach
ARDL(1,0,0,1,1,1,0,0,0) selected based on Schwarz Bayesian Criterion

Dependent variable is log(WNA)
37 observations used for estimation from 1962 to 1998

Regressor	**Coefficient**	**Standard Error**	**T-Ratio[Prob]**
$Log(GDP_{UK})$	0.25247	0.72457	0.34844[.731]
Log(Wedge)	2.7867	1.6269	1.7128[.100]
Log(P)	-2.5204	1.8443	-1.3666[.184]
$Log(W_{UK})$	-0.090330	0.80118	-0.11275[.911]
$Log(WEDGE_{UK})$	0.58390	0.84280	0.69281[.495]
Log(E)	0.39233	0.61561	0.63730[.530]
Log(Productivity)	0.58880	0.71968	0.81815[.421]
U	0.4764E-3	0.011077	0.043004[.966]
Constant	0.38786	5.1132	0.075855[.940]

Error Correction Representation for the Selected ARDL Model
ARDL(1,0,0,1,1,1,0,0,0) selected based on Schwarz Bayesian Criterion

Dependent variable is Δlog(WNA)
37 observations used for estimation from 1962 to 1998

Regressor	**Coefficient**	**Standard Error**	**T-Ratio[Prob]**
$\Delta Log(GDP_{UK})$	0.040958	0.13637	0.30034[.766]
ΔLog(Wedge)	0.45209	0.18464	2.4485[.021]
ΔLog(P)	0.76530	0.20880	3.6651[.001]
$\Delta Log(W_{UK})$	0.66339	0.10491	6.3235[.000]
$\Delta Log(WEDGE_{UK})$	-0.56657	0.12587	-4.5013[.000]
ΔLog(E)	0.063647	0.10268	0.61987[.541]
ΔLog(Productivity)	0.095522	0.066096	1.4452[.160]
ΔU	0.7728E-4	0.0017975	0.042994[.966]
ΔConstant	0.062923	0.81111	0.077576[.939]
ECM(-1)	-0.16223	0.10955	-1.4809[.150]

ECM = log(WNA) - 0.25247*log(GDP_{UK}) - 2.7867*log(Wedge) + 2.5204*log(P) + 0.090330*LOG(W_{UK}) - 0.58390*LOG($Wedge_{UK}$) - 0.39233*log(E) - 0.58880*log(Productivity)
- 0.4764E-3*U - 0.38786*Constant

R-Squared	.97775	R-Bar-Squared	.96662
S.E. of Regression	.010208	F-stat. F(9, 27)	117.1729[.000]
Mean of Dependent Variable	.10119	S.D. of Dependent Variable	.055872
Residual Sum of Squares	.0025007	Equation Log-likelihood	125.1384
Akaike Info. Criterion	112.1384	Schwarz Bayesian Criterion	101.6674
DW-statistic	2.9054		

Spain

Estimated Long Run Coefficients using the ARDL Approach
ARDL(1,0,1,1,1,0,0,0) selected based on Schwarz Bayesian Criterion

Dependent variable is log(W)
33 observations used for estimation from 1966 to 1998

Regressor	**Coefficient**	**Standard Error**	**T-Ratio[Prob]**
$Log(Q_W)$	-1.9711	0.84827	-2.3237[.030]
Log(Wedge)	-0.71814	0.94162	-0.76267[.454]
Log(P)	1.0126	0.19318	5.2417[.000]
$Log(W_{FRA})$	0.10561	0.18829	0.56089[.581]
Log(E)	0.084390	0.14464	0.58346[.566]
Log(Productivity)	3.1556	0.85386	3.6957[.001]
U	-0.017826	0.0055320	-3.2224[.004]
Constant	0.59577	1.2015	0.49586[.625]

Error Correction Representation for the Selected ARDL Model
ARDL(1,0,1,1,1,0,0,0) selected based on Schwarz Bayesian Criterion

Dependent variable is Δlog(W)
33 observations used for estimation from 1966 to 1998

Regressor	**Coefficient**	**Standard Error**	**T-Ratio[Prob]**
$\Delta Log(Q_W)$	-0.72619	0.18935	-3.8352[.001]
ΔLog(Wedge)	0.22389	0.28265	0.79212[.436]
ΔLog(P)	0.62283	0.12847	4.8482[.000]
$\Delta Log(W_{FRA})$	-0.44302	0.12535	-3.5342[.002]
ΔLog(E)	0.031090	0.048271	0.64408[.526]
ΔLog(Productivity)	1.1626	0.20833	5.5805[.000]
ΔU	-0.0065675	0.0011553	-5.6844[.000]
ΔConstant	0.21949	0.39240	0.55935[.581]
ECM(-1)	-0.36841	0.10188	-3.6161[.001]

ECM = log(W) + 1.9711*log(Q_W) + 0.71814*log(Wedge) - 1.0126*log(P) - 0.10561*log(W_{FRA})
- 0.084390*log(E) - 3.1556*log(Productivity) + 0.017826*U - 0.59577*Constant

R-Squared	.97550	R-Bar-Squared	.96266
S.E. of Regression	.0047251	F-stat. F(8, 24)	104.5098[.000]
Mean of Dependent Variable	.053953	S.D. of Dependent Variable	.024454
Residual Sum of Squares	.4689E-3	Equation Log-likelihood	137.3435
Akaike Info. Criterion	125.3435	Schwarz Bayesian Criterion	116.3645
DW-statistic	2.0765		

Portugal

Estimated Long Run Coefficients using the ARDL Approach
ARDL(1,1,1,1,1,0,1,1) selected based on Schwarz Bayesian Criterion

Dependent variable is log(W)
33 observations used for estimation from 1966 to 1998

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
Log(QW)	1.8122	0.21266	8.5218[.000]
Log(Wedge)	0.96479	0.47207	2.0438[.056]
Log(P)	0.66134	0.059468	11.1211[.000]
Log(WFRA)	0.42747	0.071759	5.9570[.000]
Log(E)	0.079182	0.054805	1.4448[.166]
Log(Productivity)	-0.35486	0.15818	-2.2434[.038]
U	-0.0076408	0.0012569	-6.0791[.000]
Constant	-3.9944	0.41087	-9.7219[.000]

Error Correction Representation for the Selected ARDL Model
ARDL(1,1,1,1,1,0,1,1) selected based on Schwarz Bayesian Criterion

Dependent variable is Δlog(W)
33 observations used for estimation from 1966 to 1998

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
ΔLog(QW)	0.015458	0.22403	0.068999[.946]
ΔLog(Wedge)	0.19974	0.31672	0.63065[.534]
ΔLog(P)	0.14018	0.078153	1.7936[.085]
ΔLog(WFRA)	0.77748	0.19896	3.9077[.001]
ΔLog(E)	0.053048	0.036496	1.4535[.159]
ΔLog(Productivity)	-0.026111	0.096780	-0.26980[.790]
ΔU	0.1963E-3	0.0016049	0.12229[.904]
ΔConstant	-2.6760	0.37156	-7.2022[.000]
ECM(-1)	-0.66995	0.080541	-8.3181[.000]

ECM = log(W) -1.8122*log(Q_W) -.96479*log(Wedge) - 0.66134*log(P) - 0.42747*log(W_{FRA})
-0.079182*log(E) + 0 .35486*log(Productivity) + 0.0076408*U + 3.9944*Constant

R-Squared	.97880	R-Bar-Squared	.96231
S.E. of Regression	.0047544	F-stat. F(8, 24)	103.8913[.000]
Mean of Dependent Variable	.061807	S.D. of Dependent Variable	.024491
Residual Sum of Squares	.4069E-3	Equation Log-likelihood	139.6828
Akaike Info. Criterion	124.6828	Schwarz Bayesian Criterion	113.4590
DW-statistic	2.0097		

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