Spanish Regional Unemployment Revisited: the Role of Capital Accumulation*

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May, 2007

Abstract

This paper provides evidence concerning the recent evolution of regional unemployment in Spain. For this end we apply the Chain Reaction Theory of unemployment, according to which the evolution of unemployment is driven by the interplay of lagged adjustment processes and the spillover effects within the labour market system. Our model includes national and regional exogenous variables and takes into account the limited labour and firm mobility in Spain. After conducting a kernal analysis we classify Spanish regions in two groups, high and low unmployment regions respectively. Our empirical approach shows that there exist substantial differences in the labour market systems between groups, and that the effect of common shocks has been rather different. Moreover, the main variable behind the regional unemployment evolution is the capital stock.

Keywords: regional unemployment, disparities, kernel, cluster

JEL Classifications: R23, J64

*Very preliminar and incomplete. Please, do not quote or circulate.

†Comments from the GAME research group members are acknowleged. All errors are our own responsibility.

‡Roberto Bande acknowledges financial support from Xunta de Galicia, through project PGIDIT05PXIA24201PR.

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1 Introduction

While the major unemployment differentials between EU countries have attracted a lot of interest over the years, the issue of substantial disparities in regional unemployment rates has only been addressed more recently (see, for example, Marston, 1985, Blanchard and Katz, 1992, Decressin and Fatás, 1995, Jimeno and Bentolila, 1998, Baddeley, Martin and Tyler, 1998 and Overman and Puga, 2002).

This paper aims to shed light in the dynamics of Spanish regional unemployment rates and determine the driving forces of their disparities. The Spanish economy has one of the highest unemployment rates in the EU and is characterised by severe regional disparities (see Bande *et al.*, 2005, 2007).

Elhorst (2003) argues that the issue of regional unemployment deserves special attention for the following two main reasons. First, the magnitudes of regional disparities are at least as large as the magnitudes of unemployment differentials among countries (OECD, 2001). For instance, in 2006, the Southern Spanish region of Extremadura had an unemployment rate of 13.4%; in contrast, the richer Northern Spanish region of Navarra experienced a modest unemployment rate of 5.3%. Such big differentials have not been witnessed by the EMU countries.

Second, regional unemployment differentials may be inefficient as they may reduce GDP and put upward pressure on inflation. In addition, there is wide agreement that the same nationwide unemployment rate may have different social repercussions depending on the distribution of regional unemployment rates.[1]

The standard macro models explain unemployment differentials on the basis of the differences in the institutions of the labour market like the wage bargaining mechanism, the degree of social protection, the tax system, etc. However, although there are differences in the labour market institutions of different countries, there are no such differences between the different regions of a European country.[2]

This led to the development of models that interpret unemployment disparities as the result of scant inter-regional labour mobility or of regional differences in the labour market - such as the sectorial composition of employment and the regional characteristics of the unemployed workers. These explanations, although valid and relevant, only offer an incomplete account of regional unemployment rates. The evolution of regional disparities cannot be explained by labour mobility and idiosyncratic elements alone.

In this paper we explain the evolution of Spanish regional unemployment rates by applying

[1] For example, consider the extreme case where a country has two regions of similar sizes. The social impact of, say, a 10% national unemployment rate is not the same when both regions experience a 10% unemployment rate, and when the unemployment rate in one region is 19% whilst in the other is 1%.

[2] The legal systems of European countries ensure that regional differences in labour market institutions are minimal.

the Chain Reaction Theory (CRT) of unemployment.[3] Following the CRT approach, we use a dynamic multi-equation labour market system to model regional disparities. Our model consists of three equations: labour demand, wage setting and labour supply. Arguments in favour of such a multi-equation model, as opposed to a single equation one, can be found in the survey by Elhorst (2003) and in Karanassou, Sala, and Snower (2003).

An advantage of a multi-equation labour market model over a single unemployment rate equation, is that growing variables (e.g. capital stock) can be included alongside the usual stationary ones (e.g. tax rates) to determine the unemployment rate. In addition, our model includes nationwide as well as region-specific variables. This will allow us to distinguish between idiosyncratic and nationwide labour market shocks.

The CRT postulates that the evolution of unemployment is driven by the interplay of lagged adjustment processes and the spillover effects of the shocks within the labour market system.[4] The implication is that unemployment can be viewed as the outcome of prolonged adjustments to shocks, where "shocks" refer to changes in the exogenous variables of the model. Since different regions may be exposed to different types of shocks and experience different adjustment processes, our approach incorporates elements of both the equilibrium and disequilibrium interpretations of regional disparities given above.

Our labour market model also takes into account the limited labour and firm mobility in Spain, and generally in Europe.[5] Workers do not move as a result of scant wage differentials (due, for example, to centralised wage bargaining), substantial housing price differentials, and family ties. Firms do not move as they tend to agglomerate in certain regions in order to enjoy the agglomeration externalities (see Puga, 1999).

Specifically, we show that disparities in regional unemployment rates depend on

- The *regional spillover effects*, i.e. on how shocks feed through the labour market system. Different feedback mechanisms generate different unemployment responses even when regions face shocks of the same type and size (e.g. an oil price increase).

- The degree of *regional labour market flexibility*. Labour market flexibility is a function of the interplay of lagged adjustment processes and spillover effects. Unemployment trajectories diverge because some regions adjust faster than others. The fact that all regions within a country are subject to the same labour market institutions does not imply that all regions will have identical lagged adjustment processes. For example, employment adjustment is not only related to firing costs - these are common to all regions as they are determined by the legal system - but also to hiring and training costs, which may be region-specific.

[3] The CRT was developed by Karanassou and Snower (1996). See also Karanassou (1998), Karanassou and Snower (1998, 2000), and Henry, Karanassou and Snower (2000).

[4] Spillover effects arise when shocks to a specific equation feed through the labour market system.

[5] This reinforces the equilibrium interpretation of regional disparities.

From this perspective we try to asses the role that exogenous variables of the labour market have exherted on the evolution of regional unemployment rates. Thus we seeks to answer the following questions: How have the various region-specific and nationwide explanatory variables contributed to regional unemployment? How has unemployment responded to actual shocks, i.e. the changes in the explanatory variables?

We find that capital stock is one of the main leading variables in the explanation of regional unemployment, a result in line with the findings of Bande and Karanassou (2007) and Karanassou, Sala and Salvador (2007).

The rest of the paper is organised as follows. Section 2 presents a summary of the evolution of regional unemployment rates in Spain. Section 3 outlines the theoretical framework of the CRT and presents the structure of the labour market model for the Spanish regional unemployment rates. Section 4 discusses data and estimation results. Section 5 measures the contributions of the exogenous variables to the evolution of regional unemployment. Section 6 evaluates the responses of unemployment to the actual shocks that occurred during the sample period. Finally, Section 7 concludes.

2 Regional unemployment in Spain: a kernel analysis

The Spanish unemployment rate has been among the highest of the European Union during the last decades, and has received a vast attention in the literature. In addition to the high unemployment rate levels (and unemployment persistence) an important regional dimension must be added: an important increase in the degree of regional unemployment disparities.

The existence and the evolution of regional disparities in the unemployment rate may be viewed under different perspectives. According to Marston (1985) the existence of regional unemployment disparities may reflect an equilibrium outcome - disparities exist in the long-run equilibrium of the economy because regions show different natural rates of unemployment (determined by demand, supply and institutional variables which evolve steadily through time) - or as a disequilibrium outcome - disparities exist because regional labour markets adjust differently to common shocks, giving rise to a polarization effect.

Blanchard and Katz (1992) show that in the US regional unemployment disparities are not persistent due to high labour and firm mobility. Workers move from high to low unemployment regions in search for better labour market prospects, while firms move to high unemployment regions to benefit from lower labour costs.[6] The Blanchard and Katz model focuses exclusively on idiosyncratic shocks in a perfect labour mobility framework. Despite its seminal impact on the regional labour market literature (see inter alia, Decressin and Fatas, 1995, Jimeno and Bentolila, 1998, Fredriksson, 1999, and Elhorst, 2003), this contribution is not exempt from

[6] This is because the large fraction of unemployed workers puts downward pressure on wages.

problems. Bartik (1993) and Rowthorn and Glyn (2006) show that the Blanchard and Katz results are strongly influenced by the small sample bias inherent in short time series data, and the large measurement errors in survey based series of employment status at the state level. Correcting for these biases, they find no support for the assumption of a highly flexible regional labour market in the US.

Bande *et alt.* (2005, 2007) find that the evolution of regional disparities in Spain is related to important imitation effects in the wage bargainings. They find that usually, the less productive sectors in the less productive regions link their wage growth to the conditions prevailing in the most productive sectors of the most productive regions. This increases unit labour costs and thus limits the ability to create employment during economic upturns.

Bande and Karanassou (2007) find that the different evolution of unemployment in two groups of Spanish regions is related to different adjustment to specific and to common aggregate shocks.

2.1 Changes in the regional unemployment distribution: a kernel analysis

Let us show the recent evolution of regional disparities in the unemployment rate in Spain through a simple analytical tool, the estimation of kernel density functions for the relative regional unemployment rates.[7]

In order to estimate the density of the regional relative unemployment rates we follow the approach suggested by Quah (1997) and Overman and Puga (2003), and we make use of a Kernel Density Estimator (KDE hereafter). A Kernel function is defined as

$$\int_{x=-\infty}^{x=+\infty} K(u)du = 1$$

A class of density estimators (the Ronsenblatt-Parzen Kernel density estimators) can be defined as:

$$\widehat{f}_K = \frac{1}{nh} \sum_{i=1}^{n} K\left(\frac{x - X_i}{h}\right)$$

where the function K refers to the Kernel function, n is the number of observations in the sample and h is the bandwidth. For the function K in our estimations we use the Gaussian Kernel,[8] while the bandwidth has been chosen following the Silverman option, such that the bandwidth h is given by $h = 0.9n - \frac{1}{5} min(s, \frac{R}{1.34})$, where n is the number of observations, s is the standard deviation and R is the interquartile range of the series (Silverman, 1986).

[7] Relative unemployment rates are defined as the regional unemployment rate over the aggregate unemployment rate.

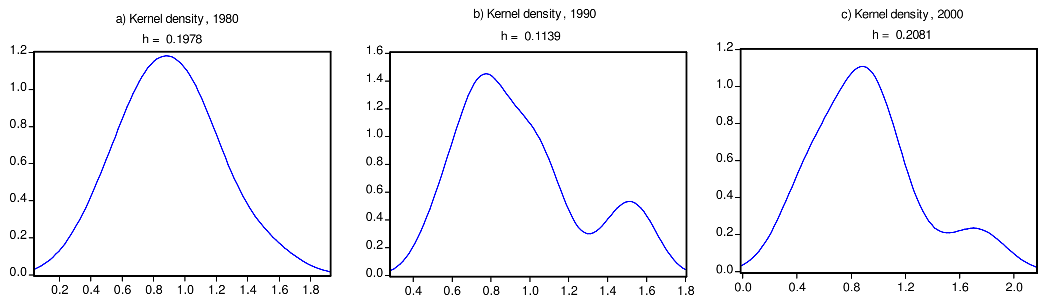
[8] The estimated results do not change much with the use of alternative kernel functions. Results are available upon request.

We estimate the kernel density in different moments of time and analyse the shape of the distribution. Results are summarised in Figure 1. Panel a) on this figure plots the estimated distribution in 1980. We clearly observe that regional unemployment rates were almost-normally distributed around the aggregate unemployment rate (i.e., a relative unemployment rate of 1), with a uni-modal shape for the distribution.

In 1990, however, the result is completely different. The kernel distribution for this year shows a bi-modal shape (panel b), one centered around 0.8 and the other one centered around 1.5. This result suggests that during the 1980-1990 period a divergence process has taken place among the Spanish regional unemployment rates. A number of regions reduced their relative unemployment rates with respect to the national average (lower relative unemployment rates) while a number of regions evolved in the opposite direction.

Moreover, this process has increased its intensity in recent years. Panel c) plots the kernel density for the year 2000. We observe that the group of regions with low relative unemployment rates has stabilised around 0.8, while the high relative unemployment group has shifted to the right, i.e., to a greater relative unemployment rate (around 1.8).

Thus this analysis suggests that during the 1980-2000 period, the evolution of regional unemployment rates in Spain has formed two groups of regions: a first group with low relative unemployment rates and a group with high relative unemployment rates.



2.2 Who is who? Cluster analysis of Spanish regional unemployment

In order to identify which regions should be included within each group, a clustering analysis is conducted (see Everitt, Landau and Leese, 2001, for different examples on cluster analysis). Starting from the results in the Kernel density analysis, exogenous regional data are used to identify the two groups of regions: namely, a first group which has increased its relative unemployment rate throughout the sample; and a second group which has improved its relative position. The classification criteria has been designed according to the regional participation rate, the regional relative per capita income level and the regional relative unemployment rate.

Our aim is not to group regions according to the performance of their unemployment rate alone, but rather to classify them as a function of socio-economic features that have an influence on such unemployment performance.

There are many potential candidate exogenous variables that could be considered, but among the most important, we consider the participation rate and the per capita income level, which doubtless are accurate indicators of social welfare.

The participation rate differs a lot across regions and depends on the socioeconomic and political enviroment. In the less developed regions, the participation rate needs to be necessarily high, because labour returns (productivity) is very low. On the contrary, in the most developed areas, the efficiency of labour and the high productivity allow theoretically for a lower participation rate.

On the other hand, the per capita income level is the main indicator of the economic performance and one of the key variables when talking about convergence. Results of the cluster analysis are summarised in Table 1.

Table 1 Cluster Analysis

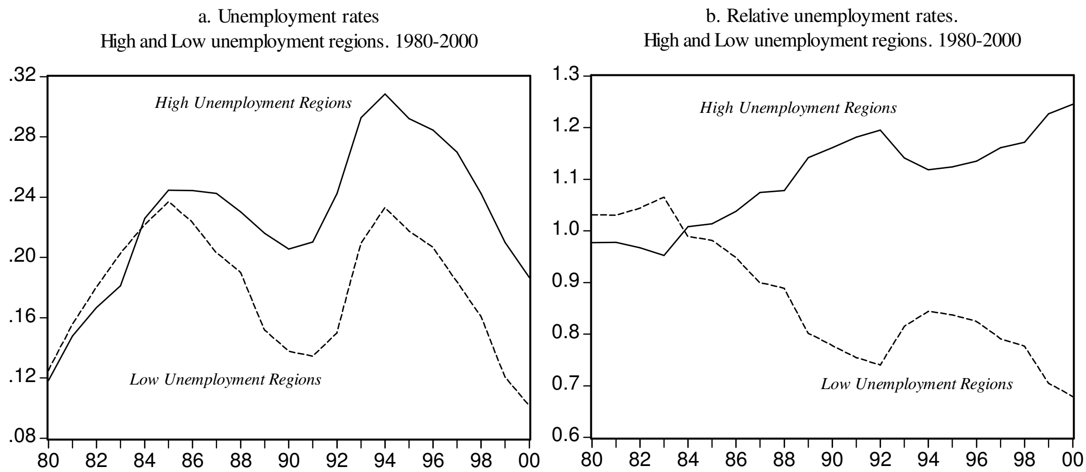
Groups of regions

High unemployment regions			**Low unemployment regions**		
Andalucia			Aragón		
Asturias			Baleares		
Canarias			Cataluña		
Cantabria			Madrid		
Castilla-La Mancha			Navarra		
Castilla y León			País Vasco		
Extremadura			La Rioja		
Galicia					
Murcia					
Comunidad Valenciana					
	Mean	Std. Dev.		Mean	Std. Dev.
Activity Rate	0.518	0.03	Activity Rate	0.539	0.03
Rel. p.c. income	0.856	0.09	Rel. p.c. income	1.209	0.06
Rel.unempl. rate	1.149	0.346	Rel.unempl. rate	0.655	0.208

Notes: Std. Dev. is the standard deviation.

From this table we conclude that the two groups are formed by the following regions. The High unemployment group is formed by Andalucía, Asturias, Canarias, Cantabria, Castilla-León, Castilla-La Mancha, Extremadura, Galicia, Murcia and Comunidad Valencia. The Low unemployment group is formed by Aragón, Baleares, Cataluña, Madrid, Navarra, País Vasco and La Rioja. This classification almost reproduces that found in Bande and Karanassou (2007) with the relative unemployment as the only grouping classification, even though they manage a shorter sample period (1980-1995). The only difference is the inclusion of Pais Vasco within the Low unemployment group.[9].

The first group is characterised by large relative unemployment rates, by lower relative per capita income levels and low participation rates. By contrast the second group is characterised by low unemployment, high per capita income levels and higher participation rates. Figure 2 plots the absolute and relative unemployment rate within each group.



The evolution through time of both absolute and relative unemployment rates has been drastically different. Actually, the clear different shape of the absolute unemployment rate series in each group hides a dramatic increase in the disparities, which can be observed in panel b) of Figure 2. The group of high unemployment regions has experienced a sustained increase in the relative unemployment rate since 1983, with the only exception of the 1992-1994 period, when the relative unemployment rate decreased. At the same time, the low unemployment rate group has exhibited a sustained reduction in the relative unemployment rate, except again during the recession period at the beggining of the nineties. Note also, that during the recession of the beggining of the eighties, the high unemployment group was in fact a "low unemployment group", being this status changed in 1984.

This fact points to a counter-cyclical behaviour of regional unemployment disparities: during booming years (1985-1991 and 1994-2000) the distance between the relative unemployment rates of the high and low groups respectively increases markedly, while during recessions (1980-1984 and 1992-1993) the distance is reduced. This behaviour is characteristic of the Spanish regional labour market. Bande *et al.* (2005) find that the coincidence of the booming period of 1985-1991 with a decentralization of the wage bargaining system (which was highly centralised and

[9] Detailed results on the cluster analysis are available upon request.

coordinated) gave rise to an important imitation effect. This effect allowed less productive firms in the less productive regions to link their wage growth to the performance of the most productive firms in the most productive regions, increasing unit labour costs and avoiding a higher employment creation.

Bande and Karanassou (2006) find that this evolution of disparities may be explained by a combination of i) different unemployment responses to similar shocks (due to different adjustment dynamics) and ii) different degrees of labour market flexibility, such that some regions adjust faster than others when faced to a labour market shock. They find that during good times high unemployment regions do not benefit as much (in terms of unemployment reduction) as low unemployment regions, while during bad times exactly the reverse holds. This explains why regional disparities in Spain show a marked counter-cyclical pattern, which is not present in other European countries.

The existence of these two groups with clearly different economic performace is the basis for the empirical approach followed in Section 4, where we estimate separately a regional labour market model for each group of regions, and show that there exist substantial differences bewteen both labour markets. However, before we proceed to summarize our empirical evidence , in the next section we provide an theoretical rationale for the different behaviour of the unemployment rate in both groups based on the Chain Reaction Theory of unemployment movements, which will explain our empirical modelling strategy.

3 The Chain Reaction Theory of Unemployment

An important dimension of the unemployment problem is that employment, wage setting, and labour force participation decisions are characterised by significant lags, and these lags interact with one another. The main salient feature of the chain reaction theory (CRT) is the use of dynamic multi-equation systems to model the structure of the labour market, and analyse the evolution through time of the unemployment rate. The predictions of the CRT lie in stark contrast to the unemployment rate predictions of the structuralist theory[10] which estimates single-equation dynamic models.[11]

In the context of autoregressive multi-equation models, movements in unemployment can be viewed as "chain reactions" of responses to labour market shocks. The network of interacting lagged adjustment processes is the propagation mechanism for these chain reactions and are well documented in the literature.[12] For example, firms' current employment decisions commonly depend on their past employment on account of costs of hiring, training, and firing; current

[10] Phelps (1994) gives a complete description of the structuralist theory.

[11] See Karanassou, Sala, and Snower (2006) for a detailed comparison of the chain reaction and structuralist theories.

[12] See, for example, Layard and Bean (1989), Lindbeck and Snower (1987), Nickell (1978), and Taylor (1980).

wage decisions depend on past wages due to staggered wage setting; labour force participation decisions depend on the past labour force on account of costs of entering and exiting from the labour force.[13] By identifying the various lagged adjustment processes, the CRT can explore their interactions and quantify the potential complementarities or substitutabilities among them.

To illustrate the workings of the CRT consider the following simple system of labour demand, wage setting, and labour supply equations:[14]

$$n_t = \alpha_1 n_{t-1} - \gamma w_t + \varepsilon_t^n, \tag{1}$$
$$w_t = \alpha_2 w_{t-1} - \delta u_t + \varepsilon_t^w, \tag{2}$$
$$l_t = \varepsilon_t^l, \tag{3}$$

where n_t is employment, w_t is real wage, and l_t is fabour force, the autoregressive parameters are $|\alpha_1, \alpha_2| < 1$, γ and δ are positive constants, and the error terms ε^n, ε^w, and ε^l are strict white noise processes independent of one another. All variables are in logs. The unemployment rate (not in logs) is[15]

$$u_t = l_t - n_t. \tag{4}$$

Let us rewrite the labour demand and real wage equations (1)-(2) as

$$(1 - \alpha_1 L)\, n_t = -\gamma w_t + \varepsilon_t^n, \tag{5}$$
$$(1 - \alpha_2 L)\, w_t = -\delta u_t + \varepsilon_t^w, \tag{6}$$

where L is the lag operator. Substitution of (6) into (5) gives

$$(1 - \alpha_1 L)(1 - \alpha_2 L)\, n_t = \gamma\delta u_t + (1 - \alpha_2 L)\, \varepsilon_t^n - \gamma\varepsilon_t^w. \tag{7}$$

Next, rewrite the labour supply (3) as

$$(1 - \alpha_1 L)(1 - \alpha_2 L)\, l_t = (1 - \alpha_1 L)(1 - \alpha_2 L)\, \varepsilon_t^l. \tag{8}$$

Finally, subtract from (8) the labour demand eq. (7) to get the *reduced form* unemployment

[13] Of course, the employment, wage, and labour force adjustment processes may arise for reasons other than the ones given above.

[14] For ease of exposition, and without loss of generality, this illustration ignores constants and explanatory variables. In Section 4 we estimate an extended version of this labour market model by including constants, several explanatory variables and the second lags of the dependent variables.

[15] Since labour force and employment are in logs, we can approximate the unemployment rate by their difference.

rate equation:[16]

$$[\gamma\delta + (1-\alpha_1 L)(1-\alpha_2 L)]\, u_t = -(1-\alpha_2 L)\,\varepsilon_t^n + \gamma\varepsilon_t^w + (1-\alpha_1 L)(1-\alpha_2 L)\,\varepsilon_t^l. \qquad (9)$$

Note that the above equation is dynamically stable since (i) products of polynomials in L which satisfy the stability conditions are stable, and (ii) linear combinations of dynamically stable polynomials in L are also stable.

Alternatively, the reduced form unemployment rate equation (9) can be written as

$$u_t = \phi_1 u_{t-1} - \phi_2 u_{t-2} - \beta_1\varepsilon_t^n + \beta_2\varepsilon_t^w + \beta_1\varepsilon_t^l + \theta_1\varepsilon_{t-1}^n - \phi_1\varepsilon_{t-1}^l + \phi_2\varepsilon_{t-2}^l \qquad (10)$$

where $\phi_1 = \frac{\alpha_1+\alpha_2}{1+\gamma\delta}$, $\phi_2 = \frac{\alpha_1\alpha_2}{1+\gamma\delta}$, $\beta_1 = \frac{1}{1+\gamma\delta}, \beta_2 = \frac{\gamma}{1+\gamma\delta}$, and $\theta_1 = \frac{\alpha_2}{1+\gamma\delta}$. This equation is also known as the univariate representation of unemployment, since it does not contain any other endogenous variables.

The above reparameterisation of the reduced form unemployment rate equation helps to explain the characteristic features of the chain reaction theory. First, the autoregressive parameters ϕ_1 and ϕ_2 embody the interactions of the employment and wage setting adjustment processes (α_1 and α_2, respectively).

Second, the coefficients β_1 and β_2 are the short-run elasticities and are a function of the feedback mechanisms that give rise to the spillover effects. We can thus refer to the βs as the "global" short-run elasticities. When γ and δ are non zero, all labour market shocks generate spillover effects. If $\delta = 0$, i.e. unemployment does not influence wages, then labour demand and supply shocks do not spillover to wages. If $\gamma = 0$, i.e. labour demand is completely inelastic with respect to wages, then shocks to wage-setting do not spillover to unemployment. In this case the influence of the shocks (ε_t^n, ε_t^w, and ε_t^l) on unemployment can be measured through individual analysis of their respective equations and the derivation of the univariate representation and the "global" elasticities is not necessary. In other words, the main feedback mechanism in this toy model is provided by the wage elasticity of labour demand.

[16] The term "reduced form" means that the parameters of the equation are not estimated directly - they are simply some nonlinear function of the parameters of the underlying labour market system.

3.1 Structure of the regional model

We use a structural vector autoregressive distributed lag model for the Spanish regions to analyse regional unemployment persistence and explain unemployment rate disparities:[17]

$$\mathbf{A}_0\mathbf{y}_{it} = \mathbf{A}_1\mathbf{y}_{i,t-1} + \mathbf{A}_2\mathbf{y}_{i,t-2} + \mathbf{B}_0\mathbf{x}_{it} + \mathbf{B}_1\mathbf{x}_{i,t-1} + \mathbf{C}_0\mathbf{z}_t + \mathbf{C}_1\mathbf{z}_{t-1} + \mathbf{e}_{it}, \tag{11}$$

where $\mathbf{y}_{it}$ is a vector of endogenous variables, $\mathbf{x}_{it}$ is a vector of regional exogenous variables, $\mathbf{z}_t$ is a vector of national exogenous variables, the $\mathbf{A}$'s, $\mathbf{B}$'s and $\mathbf{C}$'s are coefficient matrices, and $\mathbf{e}_{it}$ is a vector of identically independently distributed error terms.

Estimation of the above structural system (11) involves the selection of the exogenous variables and the number of lags to be included in each of its equations. As these are mainly judgemental decisions, the methodology of structural modelling relies heavily on discretion. This should be contrasted with vector autoregressions (VARs) that are associated with a minimal amount of discretion - the main modelling decision regards the ordering of the variables in the recursive model. Although there is hardly any economic intuition underlying the ordering of the variables, the estimation results crucially depend on it. Structural vector autoregressions (SVARs) addressed this critique by replacing the atheoretical identification of the VAR equations with an economic structure of the error terms. The main advantage of the (S)VAR methodology is that the overall influence of each variable on the rest of the system is gauged by its impulse response function (IRF). On the other hand, the lack of attention to the individual equations of the (S)VAR model (estimated VAR coefficients go unreported) is due to the fact that (S)VAR equations do not have an economic interpretation.

Thus the advantage of the structural modelling approach followed in this paper over SVARs is the economic intuition and plausibility that accompanies each of the estimated equations. Consequently, the dynamic structural model (11) can measure the contributions of the various exogenous variables to the evolution of the unemployment rate. Nevertheless, the important lesson of the SVAR literature is the use of impulse responses as a diagnostic tool of the plausibility of the labour market model. It is for this reason that we use the IRFs of the univariate representation of unemployment to changes in the exogenous variables to measure its persistence, and derive the "global" short- and long-run elasticities of the model.[18]

The multi-equation system (11) consists of (i) a labour demand equation, describing the equilibrium employment (n_{it}), (ii) a wage setting equation, describing real wage (w_{it}) determi-

[17] The dynamic system (11) is stable if, for given values of the exogenous variables, all the roots of the determinantal equation

$$\left|\mathbf{A}_0 - \mathbf{A}_1 L - \mathbf{A}_2 L^2\right| = 0$$

lie outside the unit circle. Note that the estimated equations in Section 4 below satisfy this condition.

[18] Note that, since we are interested in the responses of unemployment to changes in the exogenous variables, our analysis is not subject to biases arising from cross equation correlation.

nation, (iii) a labour supply equation, describing the equilibrium size of the labour force (l_{it}), and (iv) a definition of the unemployment rate (not in logs):[19]

$$u_{it} = l_{it} - n_{it}. \tag{12}$$

According to (11) the regional unemployment rate is determined by (i) local conditions measured by the regional exogenous variables $\mathbf{x}_{it}$ (such as capital stock), and (ii) nationwide variables $\mathbf{z}_t$ (such as oil prices) which are common to all regions. In contrast, the models in Blanchard and Katz (1992), and Decressin and Fatás (1995) emphasize regional dynamics as opposed to national dynamics, analysing exclusively the effects of regional specific shocks.

Each panel of regions is modeled along the lines of the structural system (11). Notwithstanding, our model does not allow for any labour or firm mobility between the high and low unemployment groups of regions. This is in line with the results for Europe by Decressin and Fatás (1995) but is in contrast to the findings of Blanchard and Katz (1992) who assume perfect mobility of workers and firms between regions, and find that this assumption is valid for the behaviour of US workers and firms.

The absence of labour mobility between the two panels of regions can be justified on the following grounds. First, wage differentials may not be sufficiently large to induce workers to move from the high unemployment regions to the low unemployment regions where wages are higher. This was exactly the case during the 1979-86 period when wage bargaining was centralised.[20]

Second, although wage differentials have increased since 1986, the scant labour mobility can be explained on the basis of the huge differentials in average housing prices between the high and low unemployment groups of regions. Housing prices act as a barrier to entry, given the small size of the real estate renting market and the high rate of house ownership in Spain (one of the highest among EU countries).[21]

Third, the combination of rising incomes with family and government support may have made people more sensitive to the amenities in their place of residence (de la Fuente, 1999). Attanasio and Padoa-Schioppa (1991) argue that young people, who are the bulk of emigrants, are less willing to move when unemployed because of the support provided by the rising family incomes. In addition, Antolin and Bover (1997) find that those unemployed receiving unemployment benefits are less likely to migrate.

These results are also supported by official statistics on internal migrations, which show a very

[19] Given then the labour force and employment are in logarithms, this is an approximation.

[20] See Bande *et al.* (2005) for an intuition of the effect of centralised wage bargaining on regional unemployment.

[21] See for instance *Ministerio de Fomento (2002)* for a detailed analysis of the Spanish regional housing market. This report finds that most of the regions included in our classification as "low unmeployment regions" are precisely those regions where average housing prices are the highest, especially in Madrid, Cataluña, Baleares, and Navarra.

limited impact of population movements. Jimeno and Bentolila (1998) find that labour mobility does not play a significant role in explaining regional labour market adjustment. This adjustment is done basically through labour force participacion rather than migration. Furthermore, Antolín and Bover (1997), Bentolila (1997) and de la Fuente (1999) find a limited impact of migration.[22]

Regarding firm mobility firms do not move from the low to the high unemployment regions, where wages are lower, for the following reasons.

First, the high unemployment regions in Spain are generally peripheral and have an inadequate endowment of public infrastructures (highways connecting poor regions with richer ones were finished during the last decade, for instance).[23] This leads to higher transportation costs and thus limits the willingness of firms to move.

Second, in contrast to the Blanchard and Katz (1992) findings for the US, Spanish firms do not move to lower wage regions due to aglomeration effects.[24] When firms locate close to large markets, they enjoy positive aglomeration externalities and increasing returns to scale. Hence, moving to another region would imply an overall increase in costs (the lower wage does not compensate for the loss of these externalities). In fact, firms have tended to locate mainly in the richer regions of Madrid, Ebro Axis and the Mediterranean coast.

In the following sections we attempt to identify the causes of regional unemployment in Spain by examining the interplay of labour market lags with region-specific and national shocks in each of the high and low unemployment groups of regions.

4 Estimation Results

In this section we estimate a regional version of the structural model presented in Section3. Thus, our estimated model comprises a system of labour demand, wage setting and labour force equations, and covers two panels of regions. A panel for the group of the ten high unemployment rate regions and a panel for the group of the seven low unemployment rate regions (see Table 1) given the results of the kernel and cluster analysis developed in Section 2.

4.1 Data description

A robust analysis of the evolution through time of regional unemployment disparities requires an ample number of observations. Pooled estimation enables us to use 210 and 147 observations

[22] See Table A1 in the appendix for recent data on Spanish internal migration movements. The main result in this table is that labour mobility between Spanish regions, despite of having increased in recent years, is still very limited when compared to the size of the labour force. This result is in line with the data reported by Antolín and Bover (1997) for the 1987-1991 period, who find that the regional migration rates are very low.

[23] Despite the high effort by the EU to improve the infrastructure endowments of poor regions, European regional funds have not succeeded in improving the performance of the high unemployment regions relative to the rest of the country.

[24] See Krugman (1998) for the arguments of the new economic geography on agglomeration effects.

for the high and low unemployment rate panels, respectively. The pooling of observations on a cross section of regions over several time periods can increase the efficiency of econometric estimates.[25]

The data sources are (i) Datastream, (ii) the BD-MORES dataset, elaborated by the *Dirección General de Análisis y Programación Presupuestaria* (Ministry of Economy) and the University of Valencia, and (iii) the Spanish Labour Force, elaborated by the Spanish Statistics Institute (*INE*). The sample frequency is annual and the period of analysis is 1980-2000, due to data limitations.[26] Table 2 gives the definitions of the variables.

Table 2: Definitions of variables

Regional variables		National variables	
n_{it} :	total employment	oil_t :	real oil price
l_{it} :	labour force	b_t :	real social security benefits per person
u_{it} :	unemployment rate $(= l_{it} - n_{it})$		
w_{it} :	real wage (=labour income per employee)	tax_t :	direct tax rate (as a % of GDP)
k_{it} :	real capital stock		
pop_{it} :	working age population		
pr_{it} :	real productivity		

All variables are in logs except for the unemployment rate u_{it}, real social security benefits, b_t and the indirect tax rate, tax_t

4.2 The econometric model

We estimate the lagged adjustment processes and long-run elasticities of the system of behavioural equations (11) by using a fixed-effects (FE) model of the type:

$$\begin{aligned} \mathbf{A}_0\mathbf{y}_{it} &= \mathbf{A}_1\mathbf{y}_{i,t-1} + \mathbf{A}_2\mathbf{y}_{i,t-2} + \mathbf{B}_0\mathbf{x}_{it} + \mathbf{B}_1\mathbf{x}_{i,t-1} + \mathbf{C}_0\mathbf{z}_t + \mathbf{C}_1\mathbf{z}_{t-1} + \mathbf{e}_{it}, \\ \mathbf{e}_{it} &= \boldsymbol{\mu}_i + \mathbf{v}_{it},\ i = 1, ..., N,\ t = 1, ..., T, \end{aligned} \tag{13}$$

The above equation shows that the vector[27] of disturbances $(\mathbf{e}_{it})$ follows a one-way error component model, where $\mathbf{v}_{it} \sim iid\left(\mathbf{0}, \boldsymbol{\sigma}^2_{\nu}\right)$ with $Cov\left(\mathbf{e}_{it}, \mathbf{e}_{jt}\right) = \mathbf{0}$, for $i \neq j$. The vector of scalars $\boldsymbol{\mu}_i$

[25] The advantages of using panel data sets for economic research are numerous and well documented in the literature. See, for example, Hsiao (1986) and Baltagi (1995) for a detailed exposition of stationary panel data estimation.

[26] The reason for restricting our analysis to the 1980-2000 period is twofold. First, the regional capital stock series are obtained from the BD-MORES dataset which currently covers the 1980-2000 period (see Dabán *et al.*,2002, for a detailed description). Second, in 2001 the Spanish Statistics Institute *(INE)* introduced fundamental changes in the Labour Force Survey (mainly related to the definition of labour force) in order to make the survey comparable to the Eurostat standards. The induced structural break in the labour force and unemployment rate series implies that the figures for these series are not compatible to the ones prior to 2001.

[27] This is a 3×1 vector representing the labour demand, wage setting, and labour supply equations in our system.

represents the effects that are specific to the ith region and are assumed to remain constant over time. In other words, the FE model assumes that slope coefficients and variances are identical across regions and only intercepts are allowed to vary.

In this model $\mathbf{y}_{it}$ is a vector of endogenous variables, $\mathbf{x}_{it}$ is a vector of regional exogenous variables, $\mathbf{z}_t$ is a vector of national exogenous variables, the $\mathbf{A}$'s, $\mathbf{B}$'s and $\mathbf{C}$'s are coefficient matrices, and $\mathbf{e}_{it}$ is a vector of identically independently distributed error terms.

The multi-equation system (11) consists of (i) a labour demand equation, describing the equilibrium employment (n_{it}), (ii) a wage setting equation, describing real wage (w_{it}) determination, (iii) a labour supply equation, describing the equilibrium size of the labour force (l_{it}), and (iv) a definition of the unemployment rate (not in logs):[28]

$$u_{it} = l_{it} - n_{it}. \tag{14}$$

According to (11) the regional unemployment rate is determined by (i) local conditions measured by the regional exogenous variables $\mathbf{x}_{it}$ (such as capital stock), and (ii) nationwide variables $\mathbf{z}_t$ (such as oil prices) which are common to all regions. In contrast, the models in Blanchard and Katz (1992), and Decressin and Fatás (1995) emphasize regional dynamics as opposed to national dynamics, analysing exclusively the effects of regional specific shocks.

The FE estimator[29] is the most common estimator for dynamic panels. In homogenous dynamic panels (i.e. models with constant slopes) the FE estimator is consistent as $T \to \infty$, for fixed N.[30] Baltagi and Griffin (1997) compare the performance of a large number of homogenous and heterogeneous estimators and provide evidence in support of the FE estimator. In particular, they find that (i) individual unit estimates (both OLS and 2SLS) exhibit substantial variability, whereas pooled estimators provide more plausible estimates, and (ii) accounting for potential endogeneity is "disappointing as the 2SLS estimators performed worse than their counterparts assuming all variables are exogenous."

As noted in the previous section, the empirical model consists of three estimated equations: labour demand, labour supply, wage setting, and the definition of the unemployment rate. The structure of our labour market system is in the spirit of the models presented in Karanassou and Snower (1998), and Henry, Karanassou and Snower (2000).

Dynamic panel data and nonstationary panel time series models have attracted a lot of attention over the past few years. As a result, the study of the asymptotics of macro panels with large N (number of units, e.g. countries or regions) and large T (length of the time series)

[28] Given then the labour force and employment are in logarithms, this is an approximation.

[29] The fixed-effects estimator is also known as the least squares dummy variables (LSDV) estimator, or the within-group or the analysis of covariance estimator.

[30] Kiviet (1995) showed that the bias of the FE estimator in a dynamic model of panel data has an approximation error of $O\left(N^{-1}T^{-3/2}\right)$. Therefore, the FE estimator is consistent only as $T \to \infty$, while it is biased and inconsistent when N is large and T is fixed.

has become the focus of panel data econometrics.[31] We test if it is appropriate to use stationary panel data estimation techniques by performing a series of unit root tests.

In particular, we test the order of integration of the national variables using the KPSS unit root test.[32] Table 3 presents these tests and shows that for all four national variables - real oil price, real social security benefits, direct tax rate, and trade deficit - we cannot reject the null hypothesis of (trend) stationarity.

Table 3: Unit Root Tests

	oil_t	b_t	tax_t	$trade_t$	5% c.v.
KPSS_c	0.48	0.31	0.45	0.09	0.46
$\text{KPSS}_{c,t}$	0.17	0.11	0.15	0.06	0.15

KPSS_c uses an intercept in the test.

$\text{KPSS}_{c,t}$ uses an intercept and trend in the test.

4.3 Panel Unit Roots

Since it is widely accepted that the use of pooled cross-section and time series data can generate more powerful unit root tests,[33] we examine the stationarity of the regional variables using panel unit root tests. We apply the simple statistic proposed by Maddala and Wu (1999) - this is an exact nonparametric test based on Fisher (1932):

$$\lambda = -2 \sum_{i=1}^{N} \ln p_i \sim \chi^2 (2N), \tag{15}$$

where p_i is the probability value of the ADF unit root test for the ith unit (region). The Fisher test has the following attractive characteristics. First, since it combines the significance of N different independent unit root statistics, it does not restrict the autoregressive parameter to be homogeneous across i under the alternative of stationarity. Second, the choice of the lag length and of the inclusion of a time trend in the individual ADF regressions can be determined

[31] Banerjee (1999) and Baltagi and Kao (2000), and Smith (2000) provide an overview of the above topics and survey the developments in this technical and rapidly growing literature.

[32] Kwiatkowski-Phillips-Schmidt-Shin (1992) proposed the following statistic to test the null hypothesis of stationarity:

$$\text{KPSS}(\kappa) = \frac{\sum_{t=1}^{T} S_t^2}{T^2 s^2(\kappa)},$$

where T is the sample size, $S_t = \sum_{i=1}^{t} \widehat{\varepsilon}_i$ is the partial sum of the residuals when the series is regressed on an intercept (and possibly on a time trend), and $s^2(\kappa)$ is a consistent non-parametric estimate of the disturbance variance. In particular, $s^2(\kappa)$ is constructed as in Phillips (1987) or Phillips and Perron (1988) by using a Bartlett window adjustment based on the first κ sample autocovariances as in Newey and West (1987). KPSS report critical values (c.v.) for the case of (i) a constant in the auxilliary regression: 1% c.v.=0.74, 2.5% c.v.=0.57, 5% c.v.=0.46, 10% c.v.=0.35, and (ii) both a constant and a trend: 1% c.v.=0.22, 2.5% c.v.=0.18, 5% c.v.=0.15, 10% c.v.=0.12.

[33] See, for example, Levin and Lin (LL) (1993), Im, Pesaran and Shin (2003), Harris and Tzavalis (1999), Maddala and Wu (1999). Note that the asymptotic properties of tests and estimators proposed for nonstationary panels depend on how N (the number of cross-section units) and T (the length of the time series) tend to infinity, see Phillips and Moon (1999).

separately for each region. Third, the sample sizes of the individual ADF tests can differ according to data availability for each cross-section. Finally, it should be noted that the Fisher statistic can be used with any type of unit root test. Maddala and Wu (1999), using Monte Carlo simulations, conclude that the Fisher test outperforms both the Levin and Lin (1993) and the Im, Pesaran and Shin (2003) tests.[34]

Table 4 reports the Fisher statistics for all the variables used in our structural equations. The null hypothesis is that the time series has been generated by an $I(1)$ stochastic process, and the test follows a chi-square distribution with 34 degrees of freedom (the 5% critical value is 48.32). Note that all the panel unit root test statistics are greater than the critical value, so the null of a unit root can be rejected at the 5% significance level.

Table 4: Panel Unit Root Tests

$\lambda(n_{it})$	= 65.26	$\lambda(w_{it})$	= 49.10	$\lambda(pop_{it})$	= 51.94
$\lambda(l_{it})$	= 55.94	$\lambda(k_{it})$	= 82.80	$\lambda(pr_{it})$	= 49.08

Notes: $\lambda(\cdot)$ is the test proposed by Maddala and Wu (1999).
The test follows a chi-square (34) distribution.
The 5% critical value is approximately 48.

Tables 3 and 4 indicate that we can proceed with stationary panel data estimation techniques.

4.4 Empirical results

Tables 5 and 6 present the estimated models for the high and low unemployment groups of regions, respectively. Fixed effects estimation implies that within a specific group, differences in labour market behaviour across regions is captured solely through fixed effects: only differing constants in the estimated equations (but identical coefficients for the exogenous variables and the endogenous regressors).[35] The Schwarz model selection criterion prefers this fixed-effect model over heterogeneous models containing individual region time series regressions.[36]

In the labour demand equation, employment depends negatively on the real wage, and positively on both the level and growth rate of the capital stock. The oil price and direct taxes (as a ratio to GDP) have a negative impact on labour demand. The lagged employment terms

[34] Levin and Lin (LL) proposed asymptotic panel unit root tests which are based on pooled regressions. The major criticism against the LL tests is that, under the alternative of stationarity, the autoregressive coefficient is the same across all units (i.e. $H_1: \rho_1 = \rho_2 = ... = \rho_N = \rho < 0$).

This restrictive assumption is relaxed in the asymptotic test proposed by Im, Pesaran and Shin (IPS). Like the Fisher test, and in contrast to the LL tests, the IPS test is based on the individual ADF regressions for each of the N cross-section units. While the Fisher test uses the probability values of the individual ADF tests, the IPS uses their test statistics. Compared to the Fisher test, the disadvantage of the IPS test is that it implicitly assumes the same T for all countries and the same lag length for all the individual ADF regressions.

[35] We do not show the region-specific coefficients, which are the constants or fixed effects of the model. Results are available upon request.

[36] Specifically, we select between each of the pooled equations presented in Tables 5 and 6 and the corresponding individual regressions by using the Schwarz Information Criterion (SIC). We compute the model selection criteria

capture the *employment adjustment* process. All the explanatory variables are highly significant in both groups of regions.

In the wage setting equation, real wage depends negatively on unemployment and the trade deficit, and positively on productivity and benefits. The lag of real wage captures the adjustment process due to *wage staggering*. All variables are statistically significant at conventional levels.

Finally, in the estimated labour supply equation, the size of the labour force depends positively on working age population and negatively on the real wage.[37] The statistical significance of past labour force is associated with the *labour force adjustment* process.

Table 5: High unemployment group of regions

Labour demand: n_{it}			Wage setting: w_{it}			Labour supply: l_{it}		
	coef.	p-value		coef.	p-value.		coef.	p-value
$n_{i,t-1}$	0.69 (0.03)	0.00	$w_{i,t-1}$	0.62 (0.04)	0.00	$l_{i,t-1}$	0.78 (0.04)	0.00
$w_{i,t}$	-0.30 (0.04)	0.00	u_{it}	0.49 (0.08)	0.00	w_{it}	-0.05 (0.01)	0.00
$k_{i,t}$	0.30 (0.03)	0.00	$u_{i,t-1}$	-0.61 (0.09)	0.00	pop_{it}	0.34 (0.06)	0.00
$\Delta k_{i,t}$	1.14 (0.22)	0.00	pr_{it}	0.20 (0.04)	0.00	Δpop_{it}	0.54 (0.22)	0.01
oil_t	-0.01 (0.006)	0.04	b_t	0.22 (0.05)	0.00			
tax_t	-0.56 (0.30)	0.06						
MLL=468.33			MLL=432.17			MLL=566.65		
S.C.=-4.25			S.C=-3.92			S.C.=-5.29		

Standard errors in parentheses; Δ denotes the difference operator.
MLL is the maximum log likelihood; S. C. is the Schwarz information criterion.
Regions included: AND, AST, CAN, CANT, CLM, CYL. EXT, GAL, MUR, VAL

as follows:

$$SIC_{pooled} = MLL - 0.5k_{pooled}\log(NT),$$
$$SIC_{individual} = \sum_{i=1}^{j} MLL_i - N\left[0.5k_i \log(T)\right], \ j = 11, 6$$

where MLL_{pooled}, MLL_i denote the maximum log likelihoods of the pooled model and the ith region time series regression, respectively; k_{pooled}, k_i are the number of parameters estimated in the fixed effects model and the individual region time series regression, respectively; N is the number of regions and T is the time dimension of the sample size. The model that maximises SIC is preferred. (Results are available upon request.)

[37] The negative impact of the real wage indicates that the income effect dominates.

Table 6: Low unemployment group of regions

Labour demand: Δn_{it}	coef.	p-value	Wage setting: w_{it}	coef.	p-value.	Labour supply: l_{it}	coef.	p-value
$n_{i,t-2}$	-0.35 (0.04)	0.00	$w_{i,t-1}$	0.50 (0.05)	0.00	$l_{i,t-1}$	0.68 (0.06)	0.00
$w_{i,t}$	-0.16 (0.04)	0.00	$u_{i,t}$	0.27 (0.09)	0.00	$w_{i,t}$	-0.10 (0.04)	0.01
$k_{i,t}$	0.26 (0.03)	0.00	$u_{i,t-1}$	-0.33 (0.10)	0.00	$w_{i,t-1}$	0.09 (0.04)	0.02
$\Delta k_{i,t}$	0.82 (0.19)	0.00	pr_{it}	0.29 (0.06)	0.00	$pop_{i,t}$	0.48 (0.09)	0.00
oil_t	-0.02 (0.007)	0.00	b_t	0.27 (0.07)	0.00	$\Delta pop_{i,t}$	0.51 (0.28)	0.07
tax_t	-1.15 (0.30)	0.00						
MLL=333.74			MLL=320.87			MLL=395.71		
S.C.=-4.54			S.C.=-4.16			S.C.=-5.22		

Standard errors in parentheses; Δ denotes the difference operator.

MLL is the maximum log likelihood; S.C.. is the Schwarz information criterion.

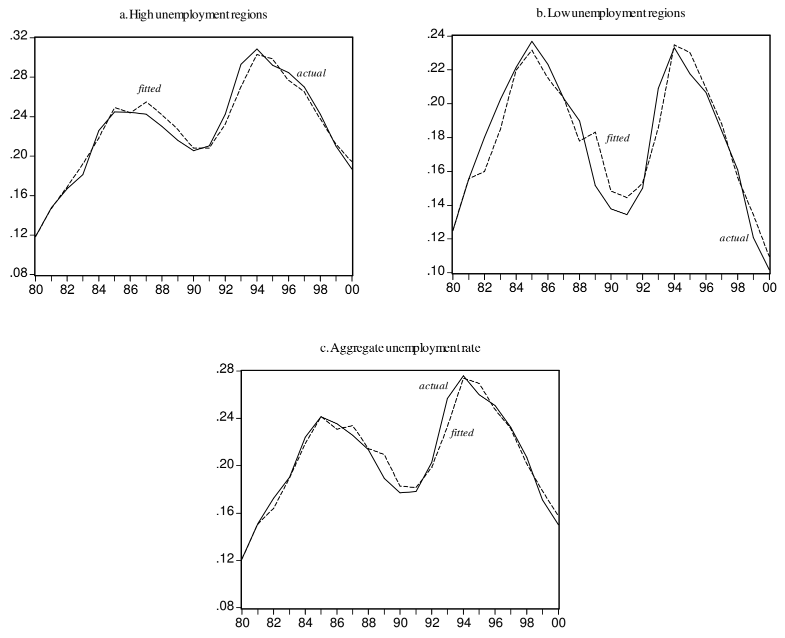
Regions included: ARA, BAL, CAT, MAD, NAV, PV, RIO

It is important to note that an essential feature of the above estimations is that the unemployment rate is influenced by the size of the capital stock both in the short-run and long-run. This is another salient feature of the CRT and is in sharp contrast to the influential form of the literature that asserts that policies that shift upward the time path of capital stock have no long-run effect on the unemployment rate (see Layard *et al.*, 1991). This assertion derives from the observation that the unemployment rate is trendless in the long-run. However, Karanassou and Snower (2004) argue that there is no reason to believe that the labour market alone is responsible for ensuring that the unemployment rate is trendless in the long-run. In general, equilibrating mechanisms in the labour market and other markets are jointly responsible for this phenomenon. Thus restrictions on the relationships between the long-run growth rates (as opposed to the levels) of capital stock and other growing exogenous variables are sufficient for this purpose.

Figure 3 shows that the fitted unemployment rate generated by our system tracks the trajectory of the actual unemployment rate very accurately.

In the following sections we seek to examine the role played by the lagged adjustment processes and their interplay with the changes in the exogenous variables in the evolution of the unemployment rate.

Figure. Actual and fitted values



5 Unemployment contributions of the exogenous variables and the role of capital accumulation

It is clear from Figure 1a that the evolution of the unemployment rate is characterised by three turning points: while it is increasing prior to 1985 and after 1991, it is decreasing between 1985 and 1991 and since 1995. Consequently, we are interested in measuring how each of the exogenous variables contributed to the trajectory of the unemployment rate during the booming period of the second half of the 80's, and of the second half of the 90's, and the recession years of the early 90's.[38]

First, we capture the unemployment effects of the changes of a given exogenous variable, say x, over the 1985-1991 period by keeping it constant at its 1985 level throughout the booming years and dynamically solving the resulting model. The simulated series represents the trajectory of the unemployment rate in the absence of any changes in x after 1985, and in the presence of all other shocks during that period.[39]

Figures 4a-4f plot the actual and simulated series. The distance between the two series

[38] Figure A in the Appendix gives the plots of the exogenous variables.

[39] It is important to note that this is simply a dynamic accounting exercise, answering the question: how much of the movement in unemployment can be accounted for by the movements in each of the exogenous variables. It does not tell us what would happen to unemployment if the exogenous variables followed different trajectories, because in that event agents may change their behavior patterns and thus the parameters of our behavioral equations may change (in accordance with the Lucas critique).

reflects the contributions of each of the exogenous variable to the unemployment rate over the 1985 -1991 period.

Investment (i.e. the growth rate of capital stock) and oil prices were the main driving forces of the downward trend in unemployment during the boom period. By 1991, the contribution of investment amounted to approximately 7 (9) percentage points, pp, decrease in the unemployment rate of the high (low) unemployment regions. The reduction of oil prices after the mid eighties also contributed to the decrease of unemployment by 7 (11) pp in the high (low) unemployment regions.

Benefits contributed by increasing unemployment 4 (1) pp in the high (low) group of regions. Taxes were responsible for an increase of no more than 1 pp in the unemployment rate of all regions, while import prices put an upward pressure on unemployment of around 2 pp. Finally, the contribution of working age population growth was negligible in the low unemployment regions and a decrease of less than 2 pp in the high unemployment regions.

Figures 5a-5f present the unemployment contributions of the exogenous variables over the recession years of the first half of the 90's.

The changes in investment over the 1991-1995 period put an upward pressure on unemployment. The unemployment contribution of investment was 9 (4) pp increase in the unemployment rate of the high (low) group of regions. It is worthwhile to note the asymmetry of the relative unemployment rate gains and losses of the two groups during the boom and recession periods. In the boom years 1985-1991, the high unemployment rate group benefited by 22% less than the low unemployment group of regions. In the recession years 1991-1995, the high unemployment regions were hit by more than twice as much as the low unemployment regions.

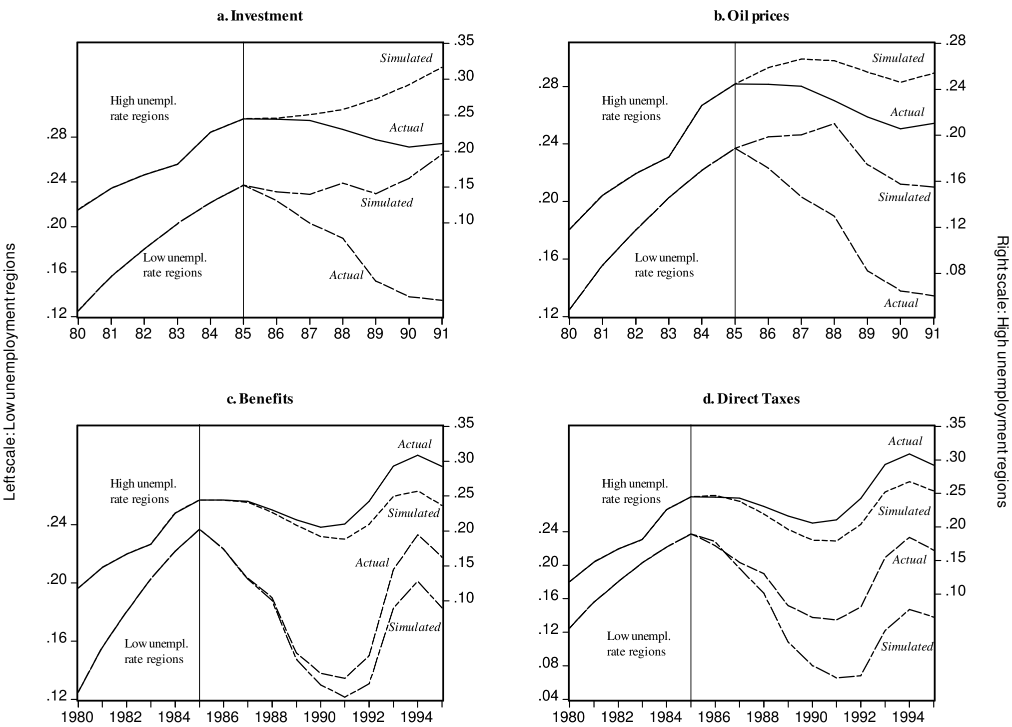
As expected, the unemployment contributions of oil prices were minimal after 1991 when oil prices stabilised at relatively low levels. The effects of benefits and taxes were quite small, the impact of competitiveness was negligible, while the growth of working age population led to an unemployment rate increase of 2 pp in all regions.

The above discussion shows that capital stock (investment) and oil prices have a substantial impact on the trajectory of the unemployment rate. Altough benefits, taxes, and competitiveness influence the unemployment rate, their role is less important. Had these variables remained at their 1985 levels, the resulting unemployment rate would not have been much different than the actual one in both groups of regions. On the contrary, had the capital stock remained at the (low) value of 1985 (in other words, had the economy not engaged in a strong investment process during the second half of the eighties) the uneployment rate would have been much higher, especially in the high unemployment group of regions.

The results for the 1995-2000 period are in line with those obtained in the preceeding analysis. It is mainly the evolution of the capital stock the variable behind the strong unemployment reduction in this period. Specifically, had the capital stock remained at the 1994 level, the unemployment rate in the high unemployment rate would have been of 26% instead of the actual 19%. In the low unemployment rate group had the capital stock remained at its 1994 level, the unemployment rate would have been of 14% instead of the actual 9%. Furthermore, the other exogeous variables (either national or regional) do not play a significant role as the capital stock.

Our results are in line with the work of Henry et al (2000) for the UK. They show that over the 1964-1997 period the NRU was reasonably stable (around 4%), and the long swings in unemployment were due to prolonged after-effects of transitory but long-lasting shocks: the oil price shocks of the 70's and the slowdown of investment in the 90's. These results are clearly against a conventional wisdom which claims that changes in unemployment are mainly caused by changes in the NRU, commonly due to changes in taxes and benefits.

Figure. Unemployment Contributions: 1985-1991



Unemployment Contributions: 1991-1994

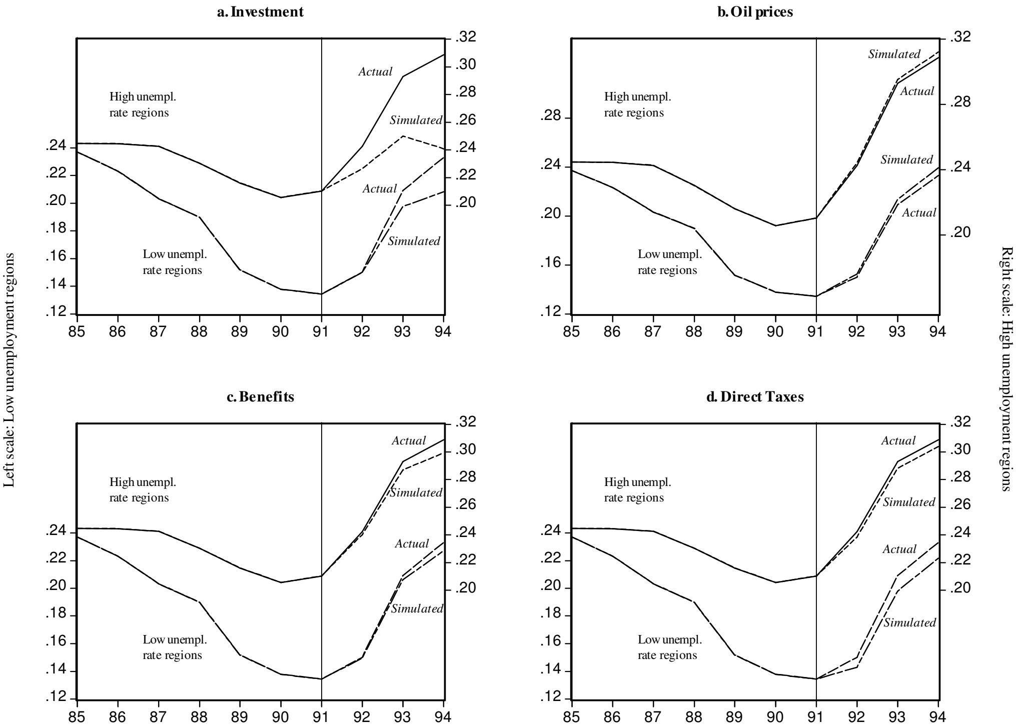
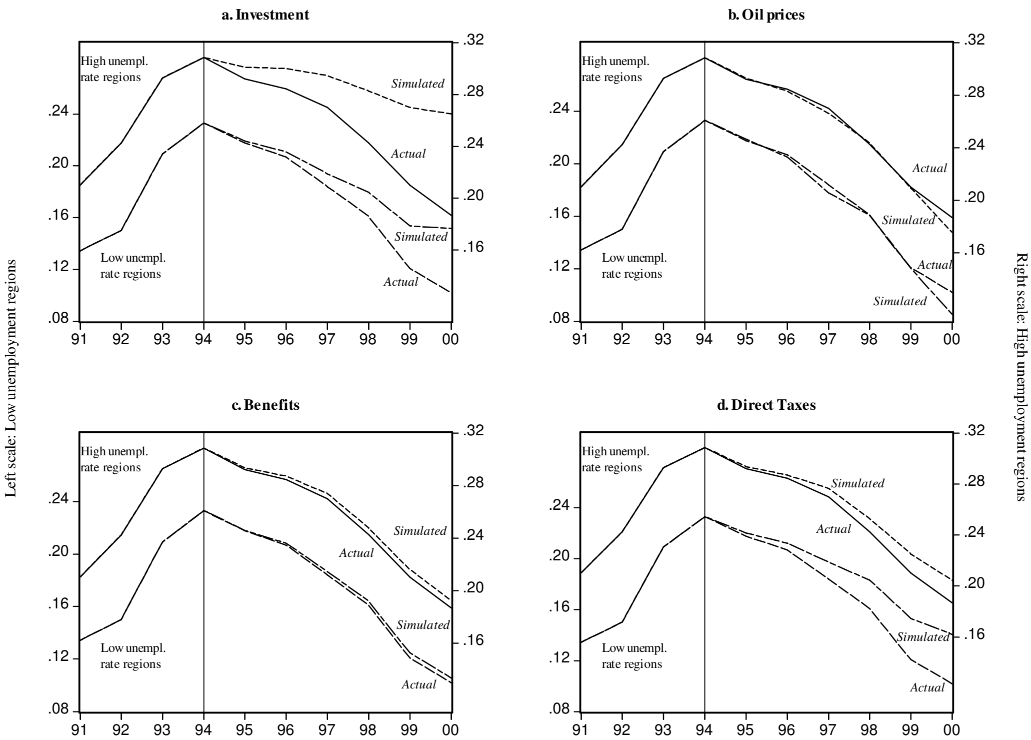


Figure. Unemployment Contributions: 1994-2000



6 Conclusions

In this paper we explained the evolution of regional unemployment rate disparities by modeling the dynamics of the Spanish labour market. We applied the chain reaction theory (CRT) of unemployment and estimated a standard labour market model consisting of labour demand, wage setting, and labour supply equations for the Spanish regions. We grouped the regions into high and low unemployment groups and showed that unemployment disparities depend on regional spillover effects and the degree of regional labour market flexibility.

In our analysis we first investigated how the short- and long-run unemployment responses differ between regions that face the same type and size of shocks.

We then identified the driving forces of regional unemployment rate disparities during the boom period of 1985-1991 and the recession years of the first half of the 90's by measuring (i) the contributions of region-specific and nationwide explanatory variables to the evolution of unemployment, and (ii) the total effects of actual shocks, i.e. changes in the explanatory variables that occured in our sample, on the unemployment trajectory. These two methodologies complement one another since they differ in one main respect. The "contributions" measure reflects the unemployment impact of the changes in an exogenous variable in the presence of all other shocks, whereas the "total effects" measure captures the impact of the changes in an exogenous variable in the absence of all other shocks.

Our findings can be summarised as follows. First, it takes several years before one-off shocks are completely absorbed by the labour market. In particular, 20% of the initial impact of the shock is still felt by the market after approximately two years (labour demand shock), five years (wage shock), and three years (labour supply shock). Both the real wage and labour supply shocks are far more persistent in the high unemployment regions than in the low unemployment regions.

Second, investment was the main driving force of the downward trend in unemployment during the boom period and the rise of unemployment during the recession years. Furthermore, the increase in the high unemployment regions was more than double of that in the low unemployment regions. This should be contrasted to the economic upturn of 1985-1991, where the decrease in the high unemployment rate regions was only 70% of the decrease in the low unemployment regions. That is, in bad times the high unemployment group is hit more severely than the low unemployment group, while in good times the high unemployment group does not benefit as much as the low unemployment group.

Third, although the influence of oil prices on unemployment was substantial during the boom period, it was negligible after 1991 when oil prices stabilised at relatively low levels.

Finally, the role of benefits, taxes, and competitiveness in the evolution of the unemployment rate is less important.

The policy implications that emerge from our analysis are that different policies should be applied to the high and low unemployment groups of regions in order to reduce regional unemployment disparities. This is in line with the recommendations made by Overman and Puga (2002). One of the lessons from our analysis is that both groups of regions will react differently to a labour market impulse, namely a policy decision. Policy makers should be aware of the different timing and intensity in the responses of unemployment to such stimulous if the policy aims at reducing the unemployment differentials among regions.

Also, the role of investment should be emphasized since we showed that this is a key variable in the explanation of regional unemployment swings. This result indicates the need for a debate on how the EU structural funds were spent in the high unempoyment regions. De la Fuente (2003) provides an attempt towards this direction. In addition, there should be an evaluation of the impact on the Spanish regional labour markets of the progressive reduction in EU structural funds in the forthcoming years.

Our results complement previous studies on the evolution of disparities in the Spanish regions, confirming the existence of clusters or groups of regions, regarding the unemployment rate, as Lopez-Bazo et al. (2002, 2005) have shown with provincial unemployment rates. Furthermore, the main novelty of our analysis is twofold: first, we focus on multi-equation labour market models, in contrast to the single reduced form equation approach followed in the literature; second, we analyse the effects of both regional and national shocks in the explanation of unemployment rates, and show that both groups of regions differ in the impact that idyosincratic and common aggregate shocks have on unemployment.

We have not dealt with the possibility of asymmetries in the labour market shocks. Recent contributions (Maza and Sánchez, 2002 and Maza and Villaverde, 2007) have shown that even though many of the shocks that have affected the Spanish regions have been mostly symmetric, asymmetric shocks cannot be ruled out. The effect that the degree of symmetry of labour market shocks may exhert on regional unemployment is left for future research. Also, the posibility of asymmetric responses of the different groups to changes in the business cycle (along the lines found by Pekkala and Kangasharju, 2002) is beyond the scope of this paper, but opens a potential line of future research.

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Figure A. Explanatory variables in the labour market model

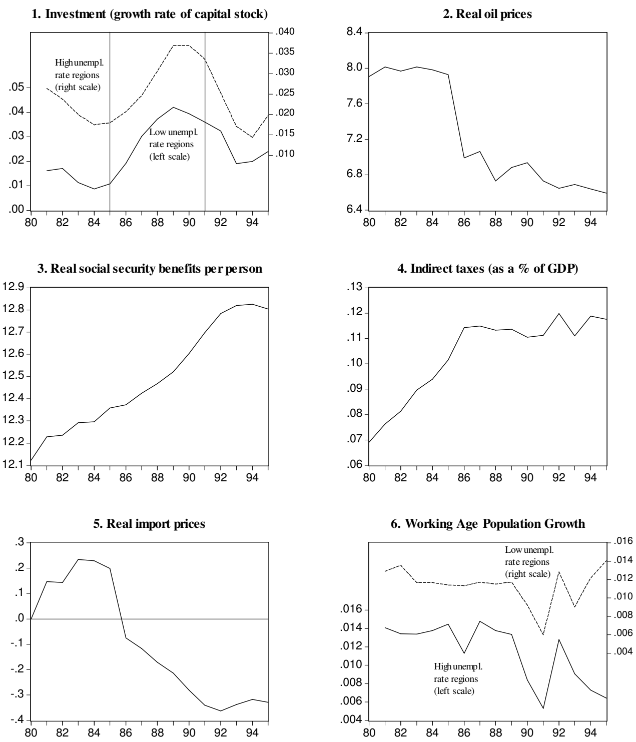

Figure 1:

Appendix

Table A1.

Net regional migration as a fraction of the labour force (in %)

Region	1996	1997	1998	1999	2000
Andalucía	0.12	0.15	0.26	0.27	0.24
Aragón	0.07	0.06	0.10	0.13	0.16
Asturias (Princip. de)	0.10	0.23	0.57	0.51	0.52
Baleares (Islas)	1.19	1.74	2.91	3.10	2.97
Canarias (Islas)	1.18	1.50	1.27	1.14	0.96
Cantabria	0.16	0.34	0.59	0.77	0.83
Castilla y León	0.28	0.42	0.45	0.56	0.76
Castilla - La Mancha	0.29	0.42	0.33	0.44	0.25
Cataluña	0.04	0.12	0.10	0.06	0.03
Comunidad Valenciana	0.33	0.43	0.48	0.59	0.74
Extremadura	0.00	0.13	0.47	0.51	0.70
Galicia	0.14	0.19	0.31	0.43	0.46
Madrid (Comunidad de)	0.37	0.42	0.33	0.36	0.26
Murcia (Región de)	0.29	0.31	0.42	0.40	0.14
Navarra(Com.Foral de)	0.29	0.32	0.53	0.58	0.45
País Vasco	0.48	0.47	0.50	0.55	0.52
Rioja (La)	0.29	0.35	0.53	0.96	1.04

Source: INE, Estadística de Variaciones Residenciales and Encuesta de Población Activa