The mystery of regional unemployment differentials

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THE MYSTERY OF REGIONAL UNEMPLOYMENT DIFFERENTIALS; A SURVEY OF THEORETICAL AND EMPIRICAL EXPLANATIONS[1]

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SOM-Theme C: Coordination and growth in economies

Abstract

This paper attempts to provide an integrated overview of theoretical and empirical explanations used in the applied literature on regional unemployment differentials. On the basis of 41 empirical studies, four different model types covering nine theoretical constructs of regional unemployment determination and 13 sets of explanatory variables are identified. The overall conclusion is that theoretical and empirical explanations help to reduce the weaknesses in each other. While theory is found to predict that the regional unemployment rate depends on labour supply factors (a collection of factors which affect natural changes in the labour force, labour force participation, migration and commuting), labour demand factors and wage-setting factors, it is the empirical studies that gain a more profound understanding of the explanatory variables involved. Conversely, whereas most empirical studies provide clear-cut explanations for the signs of the explanatory variables, it is theory that shows that some of these explanations might be out of proportion. By grouping many studies together, this paper shows that there are indeed clear-cut trends.

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1 INTRODUCTION

Unemployment varies with location but is often considered from only a national perspective. There are at least three reasons to consider unemployment from a regional perspective as well. First, the magnitude of unemployment disparities among regions within countries is almost as large as the magnitude of unemployment disparities among countries themselves (see Elhorst, 1995; Taylor and Bradley, 1997; European Commission, 1999). It is these regional unemployment disparities that are invariably referred to in discussions of the performance of regional labour markets and the regional problem. This is understandable because the unemployment rate is one of the most widely used indicators of an area's socio-economic balance. The performance of the labour market and sometimes the entire economic record of governments are judged by unemployment trends. Furthermore, the designation of areas to be assisted is also strongly influenced by regional disparities in the unemployment rate.

Second, macroeconomic studies give no explanation for the existence of regional unemployment disparities. Many macroeconomic studies have tried to explain unemployment disparities between countries (Beenstock, 1988; Layard et al., 1991; Phelps, 1994; Malinvaud, 1994; Bean, 1994; OECD, 1994; Scarpetta, 1996; among others). From these studies it emerged that the major explanation of unemployment disparities between countries is found in differences in labour market institutions, such as the wage bargaining, social security, retirement and tax systems. However in many countries labour market institutions do not differ to any great extent between regions, thus other explanatory variables of regional unemployment disparities must be found.

Third, regional unemployment disparities may be inefficient. According to Taylor (1996), reducing regional unemployment disparities will lead to higher national output and lower inflationary pressure. Furthermore, reducing these disparities produces substantial social benefits. It lessens the adverse effects related to geographical concentrations of high unemployment and counteracts the downward spiral effect of economically depressed regions, experiencing increasing difficulty keeping pace with economically thriving regions. This is because depressed regions experiencing a net loss of population tend to suffer from reduced demand for locally produced goods and

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services and from selective out-migration of high-skilled workers. Both effects may lead to an increase, rather than a decrease, in regional unemployment disparities.

This paper attempts to provide an integrated overview of theoretical and empirical explanations used in the applied literature on regional unemployment differentials. This literature consists of 41 empirical studies in which unemployment has been explained with the help of regional data (see table 1). These studies were selected by systematically searching the main international journals on regional and labour economics from the year 1985 onwards. Based on references made in these studies, this list was extended by including other studies also appearing within this period. Finally, some works before 1985 were added due to their prominent role in the literature, which was apparent from many authors' references to these studies.[3] It should be stressed that we did not distinguish between studies in which the regional unemployment rate has been estimated in level, logarithmic or logistic form, or as the change over a certain period, as the difference with (or the ratio to) the national unemployment rate, or as any combination of these (see also table 1). We also gathered studies investigating regions of different size and type. Only studies investigating spatial units smaller than local labour markets (e.g. jurisdictions), or greater than or equal to countries were omitted.

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[3] We also searched through some French and German journals but, regrettably, the yield was poor. This is probably because a lot of French and German studies have not been published in journals and also because not all French and German journals are easily accessible.

Table 1 *Recent labour market research on regional unemployment*

Study	Country	Type of regions	Dep. var.	Type of study (SEM = single equation model)
Cheshire (1973)	UK	nuts1 (7)	$\log u_R$	SEM based on UV – relationship
Fleisher & Rhodes (1976)	US	urban (99)	u_R	3-equation interaction model with male and female participation rate
Burridge & Gordon (1981)	UK	urban (126)	u_R	(implicit) SEM after net migration rate equation has been substituted in the accounting identity
Siegers (1983)	Netherlands	urban (80)	$\ln (u_R/1-u_R)$	10-equation interaction model among which male and female participation rate and birth rate
Taylor & Bradley (1983)	UK	urban (28)	$u_R^{\text{long run}}$	SEM for $u_R^{\text{long run}}$, which in turn are derived from cyclical sensitivity model for each single region
Van der Veen & Evers (1983)	Netherlands	nuts2 (11)	u_R-u_{nat}	8-equation interaction model among which female participation rate, migration and commuting
Chalmers & Greenwood (1985)	UK	local (346)	$u_{R,t1}/u_{R,t0}$	10-equation interaction model among which male and female participation rate, migration, earnings and employment
Murphy (1985)	US	states (50)	$\log u_R$	SEM, one for each region
Summers (1986)	US	states (51)	u_R	SEM
Gordon (1987)	UK	nuts1 (7)	$\log u_R$	SEM, one for each region, based on theoretical model of UV-relationship
Hyclak & Johnes (1987)	US	local (43)	$u_R^{\text{long run}}$	SEM for $u_R^{\text{long run}}$, derivation of $u_R^{\text{long run}}$ not specified
Gordon (1988)	UK	London (1)	$\Delta(u_R-u_{nat})$	(implicit) SEM after participation, net migration and net commuting rate equations have been substituted in the accounting identity
Simon (1988)	US	urban (91)	u_R	SEM
Blackley (1989)	US	states (26)	$u_R^{\text{long run}}$	implicit SEM for $u_R^{\text{long run}}$, which in turn are defined as region-specific NAIRUs
Hofler & Murphy (1989)	US	states (50)	$u_R^{\text{long run}}$	SEM for $u_R^{\text{long run}}$, which in turn are derived from cyclical sensitivity model for each single region

Johnes & Hyclak (1989)	UK	nuts1 (10)	$u_R^{long\ run}$	implicit SEM for $u_R^{long\ run}$, which in turn are defined as region-specific NAIRUs
	Germany	nuts1 (11)	$u_R^{long\ run}$	implicit SEM for $u_R^{long\ run}$, which in turn are defined as region-specific NAIRUs
	Italy	nuts1 (11)	$u_R^{long\ run}$	implicit SEM for $u_R^{long\ run}$, which in turn are defined as region-specific NAIRUs
Pissarides & McMaster (1990)	UK	nuts1 (9)	u_R/u_{nat}	implicitly postulates u_R/u_{nat} from net migration rate equation
Bilger et al. (1991)	Germany	nuts1/2 (7)	u_R	5-equation interaction model with participation, migration, earnings and employment
Holzer (1991)	US	local (28)	$\ln u_R/u_{nat}$	SEM
Johnson & Kneebone (1991)	Canada	prov. (10)	$\ln u_R$	SEM, one for each region
Layard et al. (1991)	UK	nuts1 (10)	$u_{nat}-u_R$	implicitly postulates $u_{nat}-u_R$ from net migration rate equation
Neumann & Topel (1991)	US	states (48)	u_R	SEM based on theoretical model of industrial diversity
Blackaby & Manning (1992)	UK	nuts1 (10)	$\ln u_R/u_{nat}$	2-equation interaction model with earnings
Blanchard & Katz (1992)	US	states (51)	$u_{nat}-u_R$	3-equation interaction model with participation and employment, one for each region
Jones & Manning (1992)	UK	nuts1 (10)	u_R	SEM, one for each region
Holzer (1993)	US	local (28)	$\log u_R$	SEM based on UV – relationship
Malizia and Ke (1993)	US	urban (255)	$u_R^{long\ run}$	SEM for $u_R^{long\ run}$, which in turn is the average of three different years over 16-year-period
Evans & McCormick (1994)	UK	nuts1 (10)	u_R	SEM
Samsom (1994)	Canada	regions (5)	u_R	SEM, one for each region, based on UV-type-of-relationship

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Taylor and Bradley (1994)	UK	nuts3 (54)	$\Delta(u_R-u_{nat})$	SEM
Decressin & Fatás (1995)	EU-12	nuts0/1/2 (51)	$u_{EU}-u_R$	3-equation interaction model with participation and employment, one for each region
Elhorst (1995)	EU-12	nuts2 (146)	u_R-u_{nat}	SEM
Molho (1995a)	UK	local (280)	$\ln(u_R/1-u_R)$	(implicit) SEM based on theoretical model of migration flows
Molho (1995b)	UK	local (80)	$\ln(u_R/1-u_R)$	SEM
Partridge and Rickman (1995)[a]	US	states (48)	u_R	SEM
Payne (1995)	US	states (25)	$\Delta u_R^{long\,run}$	SEM for $\Delta u_R^{long\,run}$, which in turn is the change between two endpoints, both averaged over a 4-year-period, over 24-year period
Gripaios & Wiseman (1996)	UK	local (277/322)	Δu_R	SEM for change over 3-year period
Vedder & Gallaway (1996)	US	states (50)	$u_R^{long\,run}$	SEM for $u_R^{long\,run}$, which in turn is the average over 31 years
Hyclak (1996)	US	urban (200)	u_R	SEM
Groenewold (1997)	Australia	regions (8)	u_R-u_{nat}	implicitly postulates u_R-u_{nat} from net migration rate and wage rate equation
Taylor and Bradley (1997)	Germany	nuts2 (31)	u_R	SEM
	Italy	nuts2 (20)	u_R	SEM
	UK	nuts2 (35)	u_R	SEM

a   Two other studies of Partridge and Rickman (1997a, 1997b) are left out as these nearly reproduce their 1995 study

Although it would be wrong to say that the regional labour market requires a wholly new set of theoretical and empirical constructs, it is fair to say that the applied literature on regional unemployment differentials has produced an additional set of constructs, a fact which standard economic textbooks do not address. Textbooks designed for courses in labour economics and regional economics generally do contain a set of constructs that will help the reader to think more coherently and consistently about unemployment, but not about regional unemployment.[4] In this respect the *Handbook of Labor Economics* is probably the most outstanding example (Ashenfelter and Layard, 1986, volumes 1 and 2; Ashenfelter and Card, 1999, volume 3A, 3B and 3C); although this book now consists of 53 chapters and 3630 pages, it still takes no notice of the regional unemployment problem. We hasten to point out that previous outlines on regional unemployment differentials are available, though there is ample room for supplementation since most outlines omit or discuss only a limited number of theoretical and/or empirical explanations (Gleave, 1987; Hasluck, 1987; Armstrong and Taylor, 1993, Ch.8; Taylor, 1996).[5] In this respect the contribution of Crampton to the *Handbook of Regional and Urban Economics* is most thorough (Crampton, 1999), though this outline only deals with interurban (as well as intraurban) unemployment differentials.

From our inquiry of the empirical literature it emerged that four different model types covering nine different constructs of regional unemployment determination can be identified: (i) the single equation model covering the empirical single equation model, the unemployment-vacancy relationship, the cyclical sensitivity model, and the amenity model; (ii) the implicit model covering the migration-based model, the NAIRU model and the Blanchard and Katz model; (iii) the accounting identity; and (iv) the

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[4] Typically, textbooks on regional economics do pay attention to almost the same subjects as textbooks on labour economics: the measurement of unemployment, types of unemployment, the unemployment-vacancy relationship to identify the size and relative importance of different types of unemployment, differences in the rate of unemployment among population groups and the most familiar explanations for unemployment: the neo-classical view, the Keynesian view and the stock-flow approach.

[5] Other outlines being found are part of an overall paper in which the main accent is on finding an adequate empirical model of the regional unemployment rate. These outlines are generally rather short and not comprehensive (OECD, 1989, Ch.3; Molho, 1995b; Martin, 1997).

simultaneous model dealing with interactions. This first part of this paper seeks to outline these constructs. The second part of this paper gives a further description of the explanatory variables of regional unemployment, thereby relying on those variables most commonly used in empirical work. Prior to that it should be noted that in view of the existence and persistence of regional unemployment disparities that can be observed in several countries, almost all theoretical models of regional unemployment determination result in, and almost all empirical studies depart from, a stable equilibrium of regional unemployment differentials. It is this central hypothesis that theoretical and empirical studies have in common and in fact makes it possible to link the two.

2   MODELS OF REGIONAL UNEMPLOYMENT

2.1 SINGLE EQUATION MODELS

Empirical studies
Although almost every study recorded in table 1 attempts to verify the causes of variation in unemployment rates from a theoretical viewpoint, the majority does not specify the theory in a mathematical model. Instead, they restrict themselves to a brief textual description, sometimes singling out one element to be further investigated, or to an enumerative description of the explanatory variables.

The main disadvantage of the single equation approach is that information will be lost on the source of the explanatory variables, causing an interpretation problem. This is because a positive/ negative sign of one particular explanatory variable in a single equation model of the regional unemployment rate may have one of four different explanations:
1)   the variable only affects labour supply positively/negatively;
2)   the variable only affects labour demand negatively/positively;
3)   the variable affects labour supply positively/negatively and labour demand negatively/positively; or

4) the variable affects both labour supply and labour demand positively/negatively, but the former effect exceeds/falls short of the latter.

Consequently, it is difficult to assess from a theoretical viewpoint whether an explanatory variable in a single equation model has the right sign, as well as to give an explanation for the sign.

The unemployment-vacancy relationship

The unemployment-vacancy relationship, or the Beveridge curve, establishes an inverse relationship between the unemployment rate and the vacancy rate. It can be estimated with the help of regional data by taking the unemployment rate as a left-hand side variable and the vacancy rate as a right-hand side variable. It should be noted that this set-up does not have a particular causal interpretation; the variation in the vacancy rate is used to decompose the variation in the unemployment rate rather than to explain it. Additional right-hand side variables may be added to account for inward or outward shifts in the unemployment-vacancy locus. Examples are Cheshire (1973), Gordon (1987), Jones and Manning (1992), and Holzer (1993). However, as the main difference is that the vacancy rate is part of explanatory variables, these studies can also be characterised as empirical studies following the single equation approach.

The cyclical sensitivity model

Cyclical sensitivity models can be characterised by the fact that they explain the regional unemployment rate by the national unemployment rate, $u_{reg} = a_0 + a_1 u_{nat}$. Thirlwall (1966) originally introduced the cyclical sensitivity model formulated in first differences, and Brechling (1967) both in levels and logarithms. In addition to this, Brechling also dealt with a deterministic linear or quadratic time trend and leading and lagging relations. The central point of this type of model is the parameter a_1 that measures cyclical sensitivity, the extent to which a region's unemployment rate changes when the national rate changes. Naturally, this type of model only makes sense if a regression equation is estimated separately for each region; otherwise a_1

will be equal to unity.[6] Although a great deal of research has already been carried out to extend this model[7], it has also been criticised concurrently. The main objectives concern the instability of the cyclical component to the chosen estimation period (Dunn, 1982; Owen and Gillespie, 1982; Byers, 1990; Chapman, 1991), the nature of the relationship and the lack of a theoretical basis. According to Byers (1990, 1991) and Martin (1997), the relationship between the regional and the national unemployment rate is an equilibrium, rather than a cyclical, relationship. They argue that two nonstationary variables may show a close association through time even if they are independent, known as a spurious regression. Only if the combination of two nonstationary variables is stationary is there a tendency of the variables to move towards some equilibrium configuration, known as cointegration (Engle and Granger, 1987). Byers and Martin, as well as Pehkonen and Tervo (1998) and Baddeley et al. (1998) found that regional and national unemployment rates form such an equilibrium configuration.

Although the last finding is consistent with the hypothesis that regional unemployment differentials are stable, the observation that regional and national unemployment rates parallel each other does not address the causal factors of regional unemployment disparities. Some studies have recognised this problem by dividing the regional unemployment rate into two components, one short-run and one long-run (also called non-cyclical, equilibrium or frictional), the latter being explained by a set of variables (Taylor and Bradley, 1983; Hyclak and Johnes, 1987; Hofler and Murphy, 1989). One objection to this approach is the separation of the two model stages. In the first stage a Brechling-Thirlwall type model is estimated for each single region to construct the long-run component, and in the second stage an explicative model of the long-run component is estimated for all regions taken together. It is more likely that the stages are interdependent, since short-term shocks may have

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[6] Provided that all regions within the country are being investigated and weighted by the size of the labour force. If this is not the case, a_1 will be different from unity. See, for example, Taylor and Bradley (1997).

[7] Distributed lags (Gordon, 1985a); the relationship between the cyclical sensitivity of unemployment and employment differentials (Gordon, 1985b); industry-specific estimates (Forrest and Naisbitt, 1988); spatial autocorrelation (Hanink, 1988).

major long-run structural impacts through hysteresis effects, and, conversely, structural shocks may change the cyclical dynamics of certain regions (see Baddeley et al., 1998). To address this objection, time series data of different regions should be pooled within one framework, but this approach is only conducive if the cyclical parameter remains different for different regions. At this time, we have not found such an application in the literature.

The last criticism is that models linking regional and national unemployment are 'theoretically agnostic'. Except for the inverse relationship between the national unemployment rate and the willingness to migrate (Gordon, 1988), there is no hypothesis as to the existence of that relationship or why it should vary across regions (Chapman, 1991; Martin, 1997).

In conclusion, it can be said that cyclical sensitivity models have added to a greater understanding of the regional unemployment problem, and that there are possibilities to further improve and extend this type of model. The two main objections are that the relationship between the regional and national unemployment rates is not of much help in understanding their mutual difference, and that the relationship itself is weakly underpinned.

The amenity model

Following Hall (1972), Reza (1978), Roback (1982), Marston (1985), and Montgomery (1993), a long run or static equilibrium structure of regional unemployment differentials in its simplest form[8] may be explained by the underlying distribution of amenities. These amenities enter the workers' utility function and/or firms' production function. In equilibrium, workers are indifferent across locations since expected utility (V) is constant across regions

$$V(w_i^*, A_i) = V_k, \quad V_w^* > 0, \ V_A > 0, \tag{1a}$$

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[8] That is, leaving aside a composite tradable consumption good and a nontradable consumption good land or, more general, housing (see for details Roback, 1982).

where w^* is the effective wage rate at region i, that is, the wage rate adjusted for the likelihood of being employed, $w^*=w(1-u)$, with w the real wage rate and u the unemployment rate; A is the value of local amenities at region i, and V_k is the nationally given level of utility.

In equilibrium, firms are also indifferent across locations. For firms with constant returns to scale production functions, this implies that unit costs equal product price across regions, which may be assumed unity

$$C(w_i^*, A_i)=1, \quad C_w^*>0. \tag{1b}$$

If local amenities enhance productivity then $C_A<0$.

According to this model, the equilibrium unemployment rate in each region will be some function of amenities in the region, that is, amenities may be considered as a compensating differential for the higher probability of unemployment. In practice, the modelling of local amenities to explain regional unemployment does not appear to be very popular. Burridge and Gordon (1981, pp.282-285) best illustrate the reason for this. They report that they had to abandon a whole set of '*potentially relevant area characteristics (for migration decisions) as housing conditions, property values, mortality and crime rates, status of services centres and levels of air pollution simply on account of their non-significance*'.[9] Overall, only Vedder and Gallaway (1996) and Partridge and Rickman (1995) find amenities or disamenities in their final model but these appear to be insignificant as well.

Except amenities, higher wages may also be accepted as a compensating differential for unemployment. Several studies have found a positive and significant relationship between these two variables (Hall, 1972; Reza, 1978; Adams, 1985; Roback, 1987; Pissarides and McMaster, 1990; Layard et al., 1991; Groenewold, 1993), though not all (Roback, 1982; Montgomery, 1993). Moreover, the causality in the majority of these studies runs from the unemployment rate to the wage rate. Although

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[9] According to Isserman et al. (1986, p.548), several studies of migration that have incorporated measures of the quality of life and amenities were also not very successful in explaining the variation in migration rates.

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from a theoretical viewpoint these rates are jointly determined, in empirical work the unemployment rate is apparently believed to determine the wage rate and not the converse. We return to this in the discussion of the wage-setting equation in the Blanchard and Katz model.

2.2 IMPLICIT MODELS

In an implicit model, the regional unemployment rate is not explained but solved from either a theoretically postulated, or an empirically estimated, type of model. Three types of implicit models have been identified.

The migration-based model
In a small number of studies, the migration of people is considered as the variable, with the most crucial role being mediating the effects of labour supply and demand factors. In view of this, Pissarides and McMaster (1990) and Layard et al. (1991) first proposed and estimated a net migration rate equation. By defining a long-run equilibrium as a situation of zero migration and no changes in wages, they then postulated regional unemployment rates by reversing this net migration rate equation. In a slightly different way, this approach was also followed by Molho (1995a). He first proposed a theoretical model of migration flows, then postulated an unemployment rate equation by reversing this specification, and, finally, rearranged and estimated the resulting unemployment rate equation. It is Groenewold (1997) who has recognised that the assumption of zero migration is only a special case of a larger set of equilibria. Except for a net migration rate equation, Pissarides and McMaster (1990) and Layard et al. (1991) also estimated a dynamic wage-setting equation. Solving this wage-setting equation in static form[10], they were then able to postulate regional wages as a compensating differential for unemployment. In Groenewold, wages and unemployment are solved simultaneously so

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[10] The static solution can be obtained by elimination of the dynamics in an error correction model, in econometric terms better known as the long run cointegrated equilibrium relationship.

that it cannot be said that one is compensation of the other. Together, they can also be compensation for other factors.

Taking all these studies together, the most important point is that the reduced form equation model that eventually explains the regional unemployment rate is embedded in a richer theoretical framework.

The NAIRU model

A second model that implicitly solves for the regional unemployment rate is the Phillips or wage-setting curve. To determine equilibrium unemployment differentials among regions, one may start from a set of region-specific Phillips or wage-setting curves to get region-specific non-accelerating inflation rates of unemployment (NAIRUs). These region-specific NAIRUs may then be explained by a set of explanatory variables. This way of modelling has been applied by Johnes and Hyclak (1989), Blackley (1989) and Payne (1995). The main objection to this type of research is that Phillips and wage-setting curves are well established in macroeconomics, but not in regional economics. The estimation of a separate NAIRU for regional units requires the assumption of significant interregional variation in the structure of wage determination. Johnes and Hyclak (1989) adhere to this assumption by arguing that regional differences in the wage adjustment process might be explained by regional differences in unionisation, industry mix, the importance of insider-outsider relationships, and the fact that regions may be separate political entities. In our opinion, it is questionable whether this assumption is valid since regional economies are far more open than national economies, especially due to migration and commuting. This does not imply that the Phillips or wage-setting curve is unimportant, but that it should be examined within a broader framework, such as in the Blanchard and Katz model below.

The Blanchard and Katz model

The theoretical model presented in the seminal paper of Blanchard and Katz (1992) is probably the most extended model that implicitly solves for the regional unemployment

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rate currently available.[11] In this model it is assumed that regions produce different bundles of goods, all sold on the national market, and that labour and firms are mobile across regions. The theoretical framework is a simple four-equation model

$$w_{it} = -a(LS_{it} - u_{it}) + z_{it}, \qquad\qquad a>0, \qquad\qquad (2a)$$

$$w_{it} = -bu_{it} + X_i^W, \qquad\qquad b>0, \qquad\qquad (2b)$$

$$LS_{i\,t+1} - LS_{i\,t} = cw_{it} - gu_{it} + X_i^S + \varepsilon_{it}^S, \qquad c,g>0, \qquad\qquad (2c)$$

$$z_{i\,t+1} - z_{i\,t} = -dw_{it} - ku_{it} + X_i^D + \varepsilon_{it}^D, \qquad d,k>0, \qquad\qquad (2d)$$

where the index i denotes regions, t denotes time, where w_{it} is the log wage, LS_{it} is log labour supply, u_{it} is the unemployment rate, and ε_{it}^S and ε_{it}^D are white noise capturing labour supply and labour demand shocks. In the Blanchard and Katz model, LS_{it}, w_{it} and u_{it} are all measured to their national counterparts at time t. The first equation is the short-run labour demand relation. The factor $L_{it} - u_{it}$ is roughly equal to the log level of employment.[12] The coefficient a is positive, reflecting the downward-sloping demand curve for each product. The final term z_{it} measures long-run effects of labour demand.

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[11] It is to be noted that Blanchard and Katz present four different models in their paper: (i) A regression equation for each single region to test for unit roots in the log level of employment, the unemployment rate and the log wage rate, all relative to their national counterparts; (ii) A theoretical background model of regional evolutions; (iii) A regression equation for each single region relating the change in the log level of employment, the unemployment rate and the log wage rate, to their national counterparts to find out how much of the regional evolutions is common to all regions and how much is region-specific; (iv) A VAR model for each single region to simulate the effects of shocks. This section presents the second model with two notable extensions: (1) u_{it} has been added to equation (2b) and (2) X_i^W has been added to equation (2c). In addition, it should be noted that the third model belongs to the class of cyclical sensitivity models, and that the results recorded in table 1 refer to the fourth model.

[12] To see that, let U, E and L^* denote the levels of unemployment, employment, and the labour force. If we compute the unemployment rate by the ratio of the number of unemployed and the number of employed, $u=U/E$ (instead of $u=U/(U+E)$), we may note that $u=U/E\approx\log(1+U/E)=\log L^*-\log E$. Thus $\log L^*-u\approx\log L^*-(\log L^*-\log E)=\log E$.

The second equation is the wage-setting relation. To some extent, the effect of the unemployment rate on the wage rate is uncertain. Traditionally, higher unemployment is assumed to lead to lower wages; the bigger the coefficient b the more the regional labour market may be compared with a neo-classical world in which unemployment is resolved instantaneously by wage reductions. On the other hand, a small number of studies have found that higher wages may be accepted as a compensating differential for the probability of being unemployed, turning the relationship between wages and unemployment into a positive one (Hall, 1972; Reza, 1978; Adams, 1985; Roback, 1987; Pissarides and McMaster, 1990; Layard et al., 1991; Groenewold, 1993). Nevertheless, it seems that more influential work (Blanchflower and Oswald, 1994; Card, 1995) adheres to the traditional view which states that there is a wage curve: *'The wages of individuals who work in labour markets with higher unemployment are lower than those of similar workers in markets with lower unemployment'* (Card, 1995, p. 798). Finally, X_i^W is a shift term containing factors other than the unemployment rate that affect the regional wage rate.

The third equation determines labour supply. Essentially, it tells us that labour supply increases through more labour force participation, net inward migration and net inward commuting within a region when the wage rate increases and the unemployment rate decreases. Admittedly, although from a theoretical viewpoint the unemployment rate can also have a positive effect on labour force participation, known as the additional worker effect instead of the discouragement effect, the latter dominates empirical research on labour force participation (see Elhorst, 1996). Finally, X_i^S is a shift term containing factors other than the wage and unemployment rates that affect labour supply.

The fourth equation describes the long-run effect on labour demand in a region. The wage rate has a negative effect on labour demand within a region; a lower wage makes a region more attractive to firms. The effect of the unemployment rate is uncertain. On the one hand, a higher unemployment rate implies a larger pool of workers from which to choose and this can be attractive to firms. On the other hand, a shortage in the demand for labour in a particular region will induce an outward migration of the most mobile workers. These tend to be younger, well-qualified

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workers with high skill levels. The region will not only be left with a workforce more vulnerable to unemployment, but will also be less attractive to firms. On the assumption that depressed regions experiencing a net loss of population face difficulties to keep pace with economically thriving regions, the second effect will be stronger. Note that this is one of the three reasons given in this paper's introduction to study regional unemployment disparities. Finally, X_i^D is a shift term containing factors other than the wage and unemployment rates that affect labour demand.

According to the four-equation model above, regions can exhibit different unemployment rates in the long run. To see this, we can solve for the equilibrium unemployment rate under the assumption that $u_i^* = u_{it} = u_{it-1}$ and after the effect of shocks have settled, to get

$$u_i^* = \frac{a}{a(bc+g)+bd-k} X_i^S - \frac{1}{a(bc+g)+bd-k} X_i^D + \frac{ac+d}{a(bc+g)+bd-k} X_i^W. \qquad (3)$$

This solution shows that regional unemployment rates can have different means, with X_i^S, X_i^D and X_i^W as forcing terms. As a rule, an underlying positive shift in labour supply, X_i^S, an underlying negative shift in labour demand, X_i^D, or an underlying positive shift in the regional wage rate, X_i^W, leads to higher-than-average unemployment, and vice versa. Similarly, it can be shown that there is long-run convergence of wages and employment growth rates across regions, again with X_i^S, X_i^D and X_i^W as forcing terms.

In conclusion, we may say that the Blanchard and Katz model links the regional unemployment rate with labour supply, labour demand and wage-setting factors. For the sake of completeness, it should be noted that the emphasis in their paper was on the migration of people and firms, while the labour force behaviour of people was nearly omitted, but this is more a matter of interpretation. In the follow-up study of Decressin and Fatás (1995) on regional unemployment in the EU, the emphasis was on the labour force behaviour of people.

2.3 THE ACCOUNTING IDENTITY

One of the oldest models of regional unemployment determination is the accounting identity. The accounting identity holds true for every geographical labour market – (local, urban, regional), and reads as

$$U_L = PW*L + NC - E, \tag{4a}$$
$$\text{with } \Delta PW = G + NM, \tag{4b}$$

where U_L is the level of unemployment, PW is the working age population, L is the labour force participation rate, NC is net inward commuting, E is the level of employment, G is the balance between new entrants into, and departures from, the working age population, and NM is net inward migration. The first two variables on the right-hand side measure labour supply, taking into account the intensities of net commuting and net migration, and the last variable on the right-hand side measures labour demand. The last variable can be further decomposed into growth and contraction, along with creation, closures and location changes of firms, also known as firmographic models (Gordijn and Van Wissen, 1992; Van Wissen and Ekamper, 1995).[13]

Table 2 shows the direct effects on the unemployment level and rate of one extra job or one extra citizen within a region, based on the accounting identity. In this table the rate of unemployment is defined as the number of unemployed in the numerator, the number of employed and unemployed in the denominator, and the number of employed counted in terms of their place of residence. From table 2 it can be seen that the greatest reduction in unemployment occurs when an unemployed person fills a new job. If a new job is filled by a non-participant (e.g. a graduate or housewife), if a new or a vacant job is filled by a job in-migrant, or if someone who settles in the region happens to be an out-commuter, the number of unemployed remains the same but the unemployment rate falls slightly.

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[13] See also Armstrong and Taylor (1993, pp.248-262) and Taylor (1996) for a brief survey of several empirical studies investigating the economics of new firm start-ups.

Table 2 *The impact of one extra job or one extra citizen within a region on the level and rate of unemployment*

	1 extra job			1 extra citizen	
filled by	change in U_L	change in u_R	type of citizen	change in U_L	change in u_R
unemployed	-1	$-\dfrac{1}{LF}<0$	unemployed	+1	$\dfrac{U_L+1}{LF+1}-\dfrac{U_L}{LF}>0$
non-participant	0	$\dfrac{U_L}{LF+1}-\dfrac{U_L}{LF}<0$	non-participant	0	0
job in-migrant[*]	0	$\dfrac{U_L}{LF+1}-\dfrac{U_L}{LF}<0$	job in-migrant[*]	+1	$\dfrac{U_L+1}{LF+1}-\dfrac{U_L}{LF}>0$
in-commuter[*]	0	0	out-commuter[*]	0	$\dfrac{U_L}{LF+1}-\dfrac{U_L}{LF}<0$

$U_L=$ level of unemployment, u_R = rate of unemployment, LF = labour force, $U_L<LF$ by definition
* The job migrant is assumed to change place of work and place of residence between two regions, the commuter is assumed to change either place of work (left column) or place of residence (right column)

This is because the denominator rises by 1 person. If a new job is filled by an in-commuter, or if the population increases due to a non-participant (permanent or temporary, e.g. a student or tourist, respectively), both the level and rate of unemployment remain unchanged. If the population increases due to an unemployed person settling in the region (e.g. a jobless in-migrant), or due to a job in-migrant displacing another worker, both the level and the rate of unemployment increase. This is because $U_L<LF$ by definition.

Interesting applications of the accounting identity have been found in Burridge and Gordon (1981), Gordon and Lamont (1982) and Gordon (1988). In these studies, the regional unemployment rate is derived from the accounting identity after one or more of its components have been substituted by a theoretically supported, or empirically estimated, equation. In Gordon (1988), the most extensive study in this field, the accounting identity is first reformulated in terms of rates and differentials, so that the change in the regional unemployment rate can be written as a function of

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the rate of natural growth in labour supply, the rate of employment growth, the net migration rate, the change in the participation rate, and the change in the net commuting rate.[14] Second, it is assumed that the net migration rate, the change in the participation rate and the change in the net commuting rate are all liable to vary with the region's unemployment rate and an additional (but in each case different) set of explanatory variables, $NM_R=NM_R(u_R,X_{NM})$, $\Delta L_R=\Delta L_R(u_R,X_L)$ and $\Delta NC_R=\Delta NC_R(u_R,X_{NC})$. Finally, on substituting these three equations in the accounting identity, Gordon yields an equation for unemployment rate changes. The advantage of this approach is that it explicitly takes into account the interrelations between regional labour supply and demand. It links the regional unemployment rate with the explanatory variables of the three main factors determining labour supply (participation, migration and commuting), and with the rate of employment growth, a variable being used in many empirical studies, as we will see in the second part of this paper. But on further consideration, it is questionable whether this way of modelling is a feasible approach to more extended models. The main problem is that it gets quickly entangled in a mix of level and change variables as well as a decomposition problem between natural growth and migration versus participation rate changes, which can both only be solved by making additional simplifying assumptions.

2.4 THE SIMULTANEOUS MODEL DEALING WITH INTERACTIONS

The central idea behind the simultaneous model dealing with interactions is that the regional unemployment rate is not determined in a vacuum but both affects, and is affected by, one or more additional regional labour market variables. By far the most widely used regional labour market variable is the labour force participation rate, either of the total working age population (Bilger et al., 1991; Blanchard and Katz,

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[14] One objection against this approach is that he divided both sides of the accounting identity by the number of employed. Consequently, he used an improper definition of the unemployment rate: the number of unemployed divided by the number of employed, instead of the number of employed and unemployed taken together.

1992; Decressin and Fatás, 1995) or of the total working age population divided into male and female (Fleisher and Rhodes, 1976; Siegers, 1983; Van der Veen and Evers, 1983; Chalmers and Greenwood, 1985). Other variables often used are the degree of employment and earnings. The degree of employment can be seen as an indicator of regional labour demand and is included in four studies (Chalmers and Greenwood, 1985; Bilger et al., 1991; Blanchard and Katz, 1992; Decressin and Fatás, 1995). Earnings can be seen as an indicator of regional wages and are included in three studies (Chalmers and Greenwood, 1985; Bilger et al., 1991; Blackaby and Manning, 1992). Finally, variables more seldom used are natural changes in the labour force (Siegers, 1983), the migration rate (Van der Veen and Evers, 1983; Chalmers and Greenwood, 1985), and the commuting rate (Van der Veen and Evers, 1983), variables that, together with the labour force participation rate, can be seen as indicators of labour supply. In sum, the general picture emerging from the literature when all empirical studies dealing with interactions are gathered is that the regional unemployment rate both affects and is affected by regional factors of labour supply, labour demand, and wages. The feedback effects of the regional unemployment rate on labour supply, labour demand and regional wage-setting in simultaneous models dealing with interactions are comparable to those in the model of Blanchard and Katz. Conversely, the impact these factors may have on the regional unemployment rate is subject to discussion in the second part of this paper.

As it is clear that not one single study dealing with interactions covers all the mutual relationships being studied, these models have a potential interpretation problem. Without loss of generality, we can illustrate this interpretation problem with the help of the following three-equation model

$$u = \alpha_0 + \alpha_1 Y + \alpha_2 Z + \alpha_3 X_u, \tag{5a}$$
$$Y = \beta_0 + \beta_1 u + \beta_2 Z + \beta_3 X_Y. \tag{5b}$$
$$Z = \gamma_0 + \gamma_1 u + \gamma_2 Y + \gamma_3 X_Z. \tag{5c}$$

In each equation one endogenous variable is regressed on the other two endogenous variables as well as on a set of explanatory variables directly related to the left-hand

side variable. Let u denote the regional unemployment rate and Y and Z two other regional labour market variables. Disturbance terms are left aside because they do not alter the discussion below.

Except for equation (5a), the investigator has the choice between three other estimation models to explain the regional unemployment rate: (I) $u = f_1(X_Y, X_Z, X_u)$, (II) $u = f_2(Y, X_Z, X_u)$, and (III) $u = f_3(X_Y, Z, X_u)$. Model (I) is a single equation model, better known as the reduced form equation. We already saw that the investigator who estimates the reduced form equation only obtains the overall effect of the explanatory variables on the unemployment rate. If a particular variable is or is likely to be part of more than one of the three sets of explanatory variables X_u, X_Y or X_Z, the underlying sub-effects on u, Y and Z remain unknown when estimating model (I). Consequently, it becomes difficult to assess whether a particular explanatory variable has the right sign.

The other two models are in fact partly reduced, since the resulting model is disposed of either the endogenous variable Y or Z, but not both. If a particular explanatory variable is or is likely to be part of both X_Y and X_Z, the coefficient estimates of this explanatory variable in f_2 and f_3 are no longer comparable to each other. Theoretically, it could well be that the sign in f_2 is the opposite of that in f_3. Also, note the possibility that the investigator who estimates the model $u=f'(Y, X_u)$ but erroneously ignores Z, so that the true model is $u = f_2(Y, X_Z, X_u)$, while at the same time $X_u = X_Z$, is unaware of the fact that the effect of X_Z is hidden in the coefficients of X_u. Just as in a single equation model, it thus becomes difficult to assess whether a particular explanatory variable in a simultaneous model has the right sign.

2.5 CONCLUSIONS ON MODELS OF REGIONAL UNEMPLOYMENT

Whichever model is used, we may conclude that they all result in the same reduced form equation of the regional unemployment rate. Basically, it does not matter whether the unemployment rate is only a left-hand side variable (as in a single-equation model or in the accounting identity), only a right-hand side variable (as in an implicit model), or both a left-hand and right-hand side variable (as in a simultaneous model dealing

with interactions). In each model, the unemployment rate eventually depends on factors of labour supply (a collection of factors which affect natural changes in the labour force, labour force participation, migration and commuting), labour demand, and wage-setting.

Admittedly, it would be wrong to think that these models cover all of these factors. Simultaneous equation models dealing with interactions are rarely, if ever, complete. NAIRU studies only take into account wage-setting factors, whereas studies based on the accounting identity precisely ignore wage-setting factors. The Blanchard and Katz model considers labour supply as one aggregate and thus does not make a distinction between natural changes in the labour force, labour force participation, commuting and migration, while migration-based studies ignore the first three labour supply factors. Nevertheless, the reduced form equation that characterises so many studies on regional unemployment is best illustrated as a relationship between the regional unemployment rate and a collection of labour supply, labour demand and wage-setting factors. The only problem with this equation is that it gives no further interpretation of these factors. Judging from discussions we have had with others about this, it is difficult to assess whether this is a very useful result. On the one hand, the direction in which the explanatory variables must be searched for are clear-cut. On the other hand, it still leaves room for a broad set of explanatory variables that can all be classed among these three main categories of factors.

One way to gain a more profound understanding of the explanatory variables of the regional unemployment rate is to rely on those variables most commonly used in empirical work. The discussion of these variables constitutes the second part of this paper.

3   THE EXPLANATORY VARIABLES OF REGIONAL UNEMPLOYMENT

Natural change
According to Olsen (1994), one of the principal determinants of the size of the labour force is the birth rate. Most studies on regional unemployment ignore variations in the

birth rate, probably because these variations have no immediate effect on the labour force in the short and intermediate term (<15 years). Furthermore, if the birth rate or other demographic effects are included, they are mostly treated as being exogenous; the consequences of natural changes in the labour force are incorporated, but its causes are not. According to Burridge and Gordon (1981), Layard et al. (1991, p.306), Vedder and Gallaway (1996), and Groenewold (1997), a region faces a more stubborn unemployment problem if its natural population growth rate exceeds its employment growth rate, which typically occurs in depressed regions with high birth rates. In Johnson and Kneebone (1991), the birth rate has an upward effect on the unemployment rate in seven out of ten regions (two significant).

There have also been studies investigating whether the age structure of the population affects the regional unemployment rate. These studies find mostly that regions with a relatively young population struggle with a more stubborn unemployment problem (Hofler and Murphy, 1989; Johnson and Kneebone, 1991; Elhorst, 1995), and that regions with a relatively old population experience a less stubborn problem (Elhorst, 1995; Molho, 1995a, 1995b; Partridge and Rickman, 1995). In our opinion, these results are comparable to those found for the birth rate, since the birth rate usually changes by small amounts. Generally, if the birth rate is high the share of the younger population (<25 years) tends to be large and that of the older population (>25 years) to be small, and vice versa.

Even though natural changes in the working age population may not have an immediate effect on the size of the labour force, there is a tendency that children reduce the labour force behaviour of women. This connection is well known, and is more pronounced the younger the children. In Siegers (1983), the only study in which a simultaneous model has been estimated in which both the birth rate and the unemployment rate are treated as being endogenous, the birth rate has a significant and restraining effect on the female participation rate. Below we show that a lower female participation rate generally leads to a higher regional unemployment rate. When treating the birth rate as a proxy for having young children, which seems to be a reasonable assumption, we thus again find a positive relationship between the birth rate and the regional unemployment rate.

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Participation

The literature has produced controversy about the effect of the participation rate on the unemployment rate. According to Fleisher and Rhodes (1976), the effect is negative since factors determining low participation rates in a particular region also reflect relatively low investments in human capital and low commitment to working life, resulting in higher risks for people with these characteristics to become unemployed. They are more likely to be laid off when employers reduce workforces and they are more likely to experience some unemployment when re-entering the labour force after temporary absence. This negative effect is possibly dampened by the fact that regions with male and female participation rates smaller than their national counterparts tend to have high levels of hidden unemployment; hence the actual unemployment rate is underestimated in these regions (Elhorst, 1998). Conversely, regions having male and female participation rates greater than their national counterparts tend to have low levels of hidden unemployment; hence the actual unemployment rate is closer to reality in these regions (ibid, 1998).

According to the accounting identity and in contrast to Fleisher and Rhodes (1976), the effect of the participation rate on the unemployment rate should be positive; if the participation rate increases, the number of unemployed must go up, *ceteris paribus* (cf. eq. (4)). However, it is questionable whether this effect is also positive, *mutatis mutandis*. First, increased participation encourages the growth of more local jobs. There have been studies which predict that the growth of jobs almost fully compensates for the growth of the labour force, better known by the phrase '*people cause jobs*' (Layard, 1997), as a result of which the unemployment rate would hardly increase. Second, more jobs encourage more people to enter the labour market. Table 2, based on the accounting identity, shows that the unemployment rate falls when a non-participant fills one extra job.

A closer look at the empirical literature, not only the literature investigating the interaction between the unemployment and participation rates within a simultaneous equations model, but also the literature investigating the impact of the participation rate on the unemployment rate within a single equation model, shows the following:

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(i) four studies report a negative and significant effect of the male participation rate on the unemployment rate (Fleisher and Rhodes, 1976; Siegers, 1983; Van der Veen and Evers, 1983; Partridge and Rickman, 1995); One study reports a positive but insignificant effect (Chalmers and Greenwood, 1985); and only one reports a positive and also significant effect (Blackley, 1989);

(ii) six studies report a negative and significant effect of the female participation rate on the unemployment rate (Fleisher and Rhodes, 1976; Van der Veen and Evers, 1983; Blackley, 1989; Malizia and Ke, 1993; Hofler and Murphy, 1989; Holzer, 1993; the latter two only in a particular model variant); One reports a negative but insignificant effect (Gordon, 1988); Three studies report a positive but insignificant effect (Siegers, 1983; Holzer, 1993; Samsom, 1994); and only one reports a positive and also significant effect (Chalmers and Greenwood, 1985);

(iii) 2 studies report a negative relationship between the participation rate of the total population of working age and the unemployment rate, though only figuratively since the corresponding estimation results are lacking (Blanchard and Katz, 1992, pp.32-33; Decressin and Fatás, 1995, pp.1644-1645).

In sum, the overall conclusion must be that the negative effect of the participation rate is dominant.

Migration

According to Chalmers and Greenwood (1985), the effect of net in-migration of people on regional unemployment is an empirical question because it causes both regional labour supply and demand to increase; the former directly and the latter indirectly. The labour supply effects have already been recorded in table 2. The labour demand effects of a net increase of people may be the result of the following: (i) If, relative to the receiving population, migrants possess different endowments of human capital in the form of education, accumulated skill, or entrepreneurial talent, their skills, inventiveness and innovativeness will contribute to local productivity (Chalmers and Greenwood, 1985; Ghatak et al., 1996); (ii) Increased expenditures due to the fact that new workers and their families require a whole range of locally produced goods and services. Such demand is likely to be high in the first instance, the demand for housing

being an obvious example (Armstrong and Taylor, 1993, p.133; Van Dijk, 1986, p.34); (iii) Migrants may cause investment to increase, since regions endowed with skilled labour, especially high-skilled labour, are more attractive to firms.

Relying on the neo-classical explanation, the supply-side effects dominate the demand-side effects; workers move towards the prosperous regions, thereby helping to reduce regional differences in unemployment. However, the effect of labour migration on regional unemployment disparities is an issue fraught with controversy. One case in which the effect of migration may take the opposite direction is the effect of selective out-migration of high-skilled workers on the region of their origin. In this reversed case, the balance between the negative supply-side effects (which reduce the unemployment rate) and the negative demand-side effects (which drive up the unemployment rate) is often believed to be positive instead of negative, since under these circumstances it becomes harder for this region to attract the investment necessary for its regeneration.

Three studies dealing with interactions have estimated the effect of net migration on regional unemployment, though with rather mixed results. Bilger et al. (1991) estimated an unemployment rate equation for each single region and found a negative effect for six out of seven regions (three significant), but one objection against this study is that the simultaneous equations model has been estimated by OLS, which gives biased and inconsistent parameter estimates. Van der Veen and Evers (1983) also found a negative effect when estimating the model by OLS, but a positive and significant effect when estimating the model by FIML. Chalmers and Greenwood (1985) used 3SLS and found the expected neoclassically positive effect, both for males and females. However, on dividing the sample into regions for which net migration is positive and negative, this result changed into a negative effect for the latter set of regions, again significant for both males and females. This latter result corroborates the proposition that regions with negative net migration rates face difficulties to keep pace with economically thriving regions, and demonstrates that it might be useful to distinguish regions of origin from regions of destination when determining the effects of migration on the unemployment rate. Finally, Hofler and Murphy (1989), the only researchers estimating the effect of net migration on the unemployment rate within a single equation model, found the expected neoclassically positive effect.

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Commuting

Most studies do not give much attention to commuting since one of the standard requirements for a spatially delineated area to be considered a regional labour market is that commuting across the boundary is insignificant (Fischer and Nijkamp, 1987). In theory, commuting may be ignored, provided this requirement is satisfied, but in practice theory is remote. Most empirical studies depart from administratively defined areas, often in order to fulfil another, and perhaps even more important, requirement, i.e., to have access to enough data. Another reason might be to enable researchers to evaluate the effects of labour market policy measures taken by planning authorities.

The driving force behind commuting is the suburbanisation process; a higher level of welfare has created the possibility for more people to leave urban areas and buy single-family dwellings on larger housing lots situated farther from their work (Simpson, 1987; Simpson and Van der Veen, 1993). Improved transport infrastructure and generally low transport costs have reinforced this process. As a result, a significant change has taken place in the population composition of urban areas and their surroundings. High-skilled workers especially have chosen to reside outside the city, and now travel back and forth daily, whereas low-skilled workers, as well as low-income ethnic minorities, are left behind (Hanson and Pratt, 1988, pp.306-307). This translates into higher unemployment rates in urbanised areas combined with higher net inflows of commuters, and lower unemployment rates in the surrounding areas where these commuters reside (see also table 2).

When administrative regions are awkwardly defined (researchers do not group these areas together), commuting flows across the boundaries of these regions may become spatially asymmetric and anything but insignificant (Fothergill et al., 1986; Clark, 1989, pp.23-25; Marshall and Wood, 1995; Boeckhout and Haverkate, 1995, pp.164-168). Under these circumstances, commuting should not be ignored.

There are two ways to deal with the effects of commuting. The first is to explain the regional unemployment rate by the net commuting rate. When commuting is considered a substitute for migration, which might be true especially over shorter distances or between adjacent regions, the relationship between unemployment and commuting becomes identical to that of unemployment and migration. Just as net

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inward migration of people causes both regional labour supply and demand to increase, so does net inward commuting, though in this case it is even more likely that the supply-side effects dominate the demand-side effects since commuters (and their dependants) tend to spend more income in their home region than in their work region. The only two studies investigating the effect of the net commuting rate on the regional unemployment rate indeed found empirical evidence that this relation is positive (Burridge and Gordon, 1981; Van der Veen and Evers, 1983, model variant estimated by FIML).

The second way to take account of the effects of commuting is to switch to a reduced form specification, that is, to replace the commuting rate by its explanatory variables being the level of welfare and/or the educational attainment of the population. This is in fact what happens in the studies erroneously assuming that commuting across the boundary is insignificant; the effect of commuting is hidden in the coefficients of those explanatory variables (see the situation sketched at the end of section 2.4).

Wages
Traditionally, higher wages are believed to have a positive effect on labour supply and a negative effect on labour demand, hence unemployment will increase if wages go up. Nine studies have investigated the relationship between the regional unemployment rate and wages (Burridge and Gordon, 1981; Murphy, 1985; Hyclak and Johnes, 1987; Hofler and Murphy, 1989; Blackaby and Manning, 1992; Partridge and Rickman, 1995, 1997a, 1997b; Gripaios and Wiseman, 1996; Molho, 1995a, 1995b); and indeed seven found this relationship to be negative and significant. When a positive relationship was found, it was insignificant (Molho, 1995a, 1995b).

Although the most widely used indicator of wages in these studies appears to be gross average earnings over a certain time period (week, month and year), these studies too easily ignore the problem of whether wages should be nominal or real. Regarding labour supply, it should be noted that depressed regions characterised by relatively low nominal wages can still be attractive to people due to lower cost of living and housing prices, which considerably raise the purchasing power of these nominal wages. Also note the opposite possibility that nominal wages in prosperous regions might be higher

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as a compensating differential for the higher cost of living and housing prices (Blackaby and Manning, 1992). From this viewpoint, the real wage rate obtained by deflating the nominal wage rate by a regionally based price index is a better indicator of regional labour supply than the nominal wage rate alone. On the other hand, local government, to provide a higher quantity and quality of governmental services for residents, might tax a significant fraction of a worker's total earnings. This implies that the inclusion of local taxes in an area deflator could distort the real wage rate, making the nominal wage rate in turn a better index of a worker's welfare (Reza, 1978).

Regarding labour demand, purchasing power across regions is not relevant. If a firm produces for the national market or exports its product, either the nominal wage rate or the real wage rate, obtained by deflating the nominal wage rate by a nationally based price index, is the better indicator of regional labour demand. This is because a firm, in choosing its production location, compares wage costs across the country. This explains why some studies have used relative wage rates, that is, the regional wage rate divided by its national counterpart (Murphy, 1985; Hofler and Murphy, 1989). In addition to this, Taylor and Bradley (1997) and the European Commission (1997, pp.75-83) have pointed out that firms are concerned not with the wage per se, but with the wage in relation to labour productivity, since productivity differences tend to compensate for wage differences across regions.

In sum, although the availability of data forbids many useful extensions in this field, we nonetheless believe that a reconsideration of the wage rate measured as gross average earnings over a certain time period may significantly improve the fit of many regional unemployment studies. Nominal wages corrected for regional differences in purchasing power better approaches labour supply, while unit labour costs better approaches labour demand. If the former is not possible, one may alternatively use regional prices of certain products, especially houses, as in Blackaby and Manning (1992). If the latter is not possible, one may alternatively use relative wages, as in Murphy (1985) and Hofler and Murphy (1989).

Unionisation

One variable related to the wage rate is the proportion of the labour force that is unionised. Six studies have found that union density is positively related to regional unemployment (Summers, 1986; Blackley, 1986; Hofler and Murphy, 1989; Johnson and Kneebone, 1991; Vedder and Gallaway, 1996; Partridge and Rickman, 1995), the last three finding this relation to be significant. The idea is that unions set a wage floor, thereby reducing labour demand. Employers are less willing to hire when explicit contracts specify job durations in excess of their optimal lengths and restrict an employer's ability to assign individual workers to different types of jobs as production conditions warrant. Furthermore, to the extent that unions successfully raise the relative price of labour, there is an employer incentive to substitute new technologies and additional capital for labour. According to Summers (1986), unions may also cause transitional unemployment, especially if the economy is subjected to large intersectoral shocks. High and rising union wage premiums are likely to cause job losses in the unionised sector of the economy and also to make those who lose high-wage jobs more reluctant to accept lower-wage employment.

It should be noted that the literature investigating the effect of unionisation on the regional unemployment rate is exclusively North American. This is remarkable since the proportion of the labour force that is unionised also differs between regions within European countries. The explanation might be that the wage bargaining system in many European countries is much more centralised than in the US and Canada.

Employment

The effect of employment growth on the unemployment rate is negative almost by definition. The results obtained from the accounting identity in table 2 clearly showed that the unemployment rate decreases as a result of one extra job, whether it is filled by an unemployed, a non-participant or a job migrant. Consequently, it is quite common to relate the unemployment rate to one (or a set of) lagged employment growth variable(s). No less than 16 studies have taken up this variable, almost all of them with a negative sign. In eight studies the negative sign appears to be significant (Fleisher and Rhodes, 1976; Van der Veen and Evers, 1983; Summers, 1986; Neumann and Topel, 1991;

Malizia and Ke, 1993; Molho, 1995a, 1995b; Hyclak, 1996); in one study it appears to be insignificant (Taylor and Bradley, 1983); while in three studies no information could be found regarding the significance of the negative sign (Blanchard and Katz, 1992; Decressin and Fatás, 1995; Groenewold, 1997). In three studies the sign is not always negative for each sector (Gordon, 1988), for each region (Bilger et al., 1991) or for each country (Taylor and Bradley, 1997), though if in these cases a positive sign is found it is never significant. There remains only one study, which at first sight seems to have found a positive and significant effect of employment growth (Burridge and Gordon, 1981), but on further consideration employment growth in this study also appears to be part of another explanatory variable. If these two variables are taken together, the sign becomes negative as well.

Although these empirical studies thus set one trend, it should be stressed that the effect of employment growth on unemployment does not have to be negative in theory. Harris and Todaro (1970) pointed out that efforts to create more urban jobs to cope with rising unemployment in developing countries may in fact, through induced rural-urban migration, lead to higher, instead of lower, unemployment rates. This feature has been empirically verified by Todaro (1976) and has since been known as the Todaro paradox. Nakagome (1989) has pointed out that the Todaro paradox may also hold to urban areas located in developed countries as the creation of more jobs increases the radius of the urban labour market, though this model has not been empirically tested.

In sum, it may be concluded that employment growth variables are well represented in empirical studies and, currently, are sufficient and unambiguous. A serious objection against explaining the regional unemployment rate by employment growth variables is that such an explanation ignores the mechanism by which employment growth itself is generated.

Gross regional product
One candidate for explaining employment growth is gross regional product. According to Isserman et al. (1986, pp.562-567), this variable is probably the most widely used indicator of regional labour demand. The difficulty when considering this variable is the functional relationship between the regional unemployment rate and gross regional

product. Generally, it is easy to find a close relationship between the regional unemployment rate and the level of GRP per capita (European Commission, 1996, p.100). On investigating the order of integration[15], most studies have found that the regional unemployment rate is integrated of order 0 (Blanchard and Katz, 1992; Martin, 1997), though often shift terms must be included to achieve this finding (Baddeley et al., 1998; Pehkonen and Tervo, 1998). By contrast, the level of employment and GRP per capita are often found to be integrated of order 1, and only their growth rates to be integrated of order 0 (regarding employment, see Blanchard and Katz [1992] for regional US data and Decressin and Fatás [1995] for regional EU data). This means that the regional unemployment rate and the employment growth rate move towards an equilibrium configuration, justifying the relationship between these two variables, which has been investigated in so many empirical studies. By contrast, the regional unemployment rate and GRP per capita do not move towards an equilibrium configuration. In other words, the negative relationship sometimes found between the unemployment rate and gross regional product per capita might be a casual cross-sectional finding that does not hold over time.

In this respect a better variable might be the deviation of GRP per capita from its full employment or long-run trend level, provided that the evolution of these deviations represents demand fluctuations (Taylor and Bradley, 1997; Murphy, 1985 [16]). This variable can be derived from Okun's law, a popular relationship in macroeconomic analysis that short-circuits the rather complex relationship that links output and employment (Gordon, 1984; Paldam, 1987; Prachowny, 1993).

Market potential
Another variable that can be considered as a mechanism generating economic growth is the market potential, a variable with a long tradition in economic geography (sometimes also called the agglomeration potential or demand potential). At the end

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[15] A series of observations over time is integrated of order d, denoted I(d), if the series becomes stationary after being first differenced d times. A stationary variable has a tendency to return to its mean value. One way to find out whether a series is stationary is to test for the absence of a unit root.

[16] Murphy also used the explanatory variable 'real per capita personal income'.

of the 1960s, Clark et al. (1969) proposed the idea that two fundamental questions affect a firm's decision on location. First, the main sources of inputs and the main markets for the product must be determined, and second, an appraisal must be made of the costs, incurred due to distance, of reaching these from any particular point. Increasingly, it is the regions with dense populations that will provide some of the most vital inputs as well as being the main markets. Such regions can generally provide a large and diversified labour force, which is beneficial, since the former increases the probability of realising economies of scale and the latter increases the possibility of developing specialised services. Both, in turn, increase the probability of realising product or process innovations (Lambooy, 1977, p.152). Consequently, the place of the greatest attraction to a firm will be the region where the distance costs to all possible markets are at a minimum. This central location is likely to become of increasing importance as the production size of individual firms expands due to economies of scale, and each firm is able to supply a larger market. Therefore, the further a market is from the firm, the less attractive it will be. In this respect a thin population might deter investment by firms from outside the region due to a variety of distance costs – (transporting finished products to markets; telecommunication, postal and information-gathering; keeping in close contact with customers; obtaining rapid and accurate information about changing demand and supply conditions, hence competing effectively for sales; and additional organisational and administrative costs [Keeble et al., 1988, pp.2-7]). Furthermore, it should be stressed that the perception of the existence of such distance costs may be just as important as their reality.

Although indices of the market potential seem to have a great deal of power in explaining the location of manufacturing industries (Keeble et al., 1982; Van den Berg, 1999, pp.58-63), only a few years ago Krugman (1995) showed that the incentive for geographically concentrated production might be derived, rather than assumed, from a monopolistic competition model including economies of scale and transport costs.

Three studies recorded in table 1 include the market potential (Elhorst, 1995; Molho, 1995a, 1995b) and they all found this variable to have a significant downward effect on the unemployment rate. Alternatively, Hyclak and Johnes (1987) included the

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distance of a region to its major trading area, which has a comparable, that is upward and significant, effect on the unemployment rate. Overall, we have reasons to expect the number of applications based on the market potential approach to increase. It has a long tradition, it can be theoretically supported, and in the few instances in which it has been applied it succeeded in explaining the regional unemployment rate.

Size and density

The impact of a spatial unit's size and density on its unemployment rate is frequently subject to study, though mostly only in studies concentrated on urban, instead of regional, labour markets. From a theoretical viewpoint the sign of both variables is uncertain. On the one hand, a more sizeable and dense urban labour market may affect the efficiency of matching workers to jobs; more job offers and job seekers imply more choice at both sides of the labour market, thereby leading to better and quicker matches (Hasluck, 1987, pp.113-114; Blackley, 1989; Hyclak and Johnes, 1987; Taylor and Bradley, 1997). To some extent, the size effect may also capture diversity since urban labour markets with multiple specialisations are likely to be larger (Malizia and Ke, 1993). On the other hand, a more sizeable and dense urban labour market may increase the time needed to gather information about job vacancies and job seekers and may present spatial frictions which reduce the likelihood of quick matches (Burridge and Gordon, 1981; Hasluck, 1987, pp.113-114; Taylor and Bradley, 1983, 1997). In addition, an urban labour market's size and density may be considered as an amenity, as in Roback (1982), when it has an upward effect on unemployment.

It is questionable whether labour market size and density still matter when switching from urban to regional labour markets. First, because not a single study investigating regional labour markets considered the size variable and, second, because the greater a region, the more the density variable loses its significance due to increasing intraregional differences. We have nonetheless counted three studies that investigated the density variable's impact when analysing regional labour markets, though with rather mixed results. Blackley (1989) and Partridge and Rickman (1995) investigated the effect of population density in US states; remarkably, the effect found in both studies is significant but the signs are opposite. Taylor and Bradley (1997)

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investigated the effect of employment density in nuts-2 regions of the UK, Germany and Italy and found a positive effect (for two countries, also significant).

The industry mix explanation

It is often argued that one of the main causes of regional unemployment disparities is the location of declining or growing industries in particular regions. There are two propositions here. The first is that declining industries show generally high unemployment rates, and growing industries low rates. The second is that the unemployment rate is specific to industries rather than to regions. According to Armstrong and Taylor (1993, pp.179-180), it is possible to measure the extent to which regional differences in industry mix account for regional differences in the unemployment rate by constructing an expected unemployment rate for each region based upon: (i) the region's industry mix; and (ii) the national rate of unemployment in each industry. This expected unemployment rate can then be compared with the actual unemployment rate to measure the extent a region's actual unemployment rate can be accounted for by its industry mix. Note that this method is only applicable when registered in industries where the unemployed have formerly been working.[17] Most empirical applications, however, have indicated that spatial differences in industry mix account for little, if any, of the variation in unemployment rates between regions (Cheshire, 1973; Dixon and Thirlwall, 1975, pp.69-79; Taylor and Bradley, 1983; Summers, 1986).[18] Furthermore, the same industry seems to experience different unemployment rates in different regions (Martin, 1997).

As an alternative, another set of studies simply controls for the shares of different industries in employment, though it is not always clear which sign these control variables should have. Intuitively, regions specialised in declining industries such as agriculture and manufacturing are expected to exhibit higher structural unemployment rates than regions specialised in growing industries, such as market and public

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[17] In several countries this is not the case. Further note the problem that part of the unemployed have not been working formerly, most notably school-leavers.

[18] One study that has found that the industry mix significantly accounts for regional unemployment disparities is of Hyclak and Johnes (1987).

services. On the other hand, the employment multipliers of one job in agriculture and one job in manufacturing are generally larger than the employment multiplier of one job in services, since service sector activities are largely dependent on the demand created by the other two sectors of the economy. Furthermore, although it is true that employment in agriculture and manufacturing steadily eroded during the 1980s and 1990s, employment growth in the services was insufficient to offset the loss of jobs in agriculture and manufacturing, causing, contrary to a growing share of employment in the services, unemployment to increase *structurally* - in 1992 the percentage of recorded unemployment in the EU was more than three times as high as 20 years earlier (see OECD, 1992, p.219). Consequently, the signs of employment shares in agriculture, manufacturing and market and public services are highly uncertain. Table 3 gives a picture of the rather mixed results occurring in different studies as a result. The conclusion must be that shares are not an efficient frame of reference. The main objection is that a share can change value even if the level of employment in that sector remains the same; when employment in agriculture and manufacturing falls, the share of employment in services automatically increases. It is not likely that such an artificial increase may contribute to a reduction of the unemployment rate. Additionally, growing industries are no guarantee that the unemployment rate reduces, since non-participants may enter the labour market and in-migrants and in-commuters may absorb some of the new jobs (see table 2). When these labour supply effects are strong, the regional unemployment rate may be left unaffected as a result. This is no objection as long as these labour supply effects have been modelled adequately, but we have seen that many studies do not extend that far.

Some studies have stated that the process of labour reallocation, in response to the shifting pattern of employment demand itself, may be a source of unemployment. If workers are perfectly mobile and perfectly substitutable, shifts in the sectoral composition of demand for labour that do not simultaneously alter the aggregate level of demand for labour should have no effect on the unemployment rate. Employment losses in contracting sectors are exactly matched by employment gains in expanding sectors. However, if frictions are present, then shifts in employment demand can lead to at least temporary increases in unemployment.

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Table 3 *The share of employment in agriculture, manufacturing, market and public services and its effect on the regional unemployment rate in 10 empirical studies: + = positive, - = negative, * = significant*

Study	Country	Agriculture	Manufacturing	Market services	Public services
Siegers (1983)	Netherlands			-	
Summers (1986)[a]	US		+ and + *		
Hofler and Murphy (1989)[b]	US		- and + *	- * and +	- and + *
Blackley (1989)	US		+ *		
Jones and Manning (1992)	UK		- (each region)		
Holzer (1993)	US		- and +	-,-*,+ and +*	
Malizia and Ke (1993)	US	+ *			
Taylor and Bradley (1994)	UK	- *			
Elhorst (1995)	EU-12	- *	- *	+ *	
Partridge and Rickman (1995)[c]	US	- *	+	- and +	+ *
Taylor and Bradley (1997)	Germany	- *		- *	+ *
	Italy	+ *		+ *	+ *
	UK	- *		- *	+ *

a. manufacturing = high-wage industries: manufacturing, construction, mining and public utilities
b. manufacturing = manufacturing and construction; services = transportation, public utilities, wholesale and retail trade, finance, insurance, real estate, and services
c. services = transportation, public utilities, finance, insurance and real estate

This is the basis for the relationship posited in the macroeconomic study of Lilien (1982) between σ_t, the variance in industry employment growth, and u_t the unemployment rate, and which appeared to explain much of the year-to-year change

in the US unemployment rate from 1948 to 1980. Abraham and Katz (1986) refuted this conclusion, not because the basis for Lilien's conclusion was wrong but because they showed that a positive relation between σ_t and u_t may also be obtained due to a pure aggregate demand shock, which they showed to have been the case. Lilien's work has been followed and improved by other researchers, also at regional level (Neumann and Topel, 1991; Holzer, 1991; Samsom, 1994; Hyclak, 1996), but partly due to Abraham and Katz's study the explanatory variables used to investigate the strength of the sectoral shift hypothesis, although still based on the industry mix, have become rather advanced and complex. To construct an index of job reallocations, Holzer (1991) and Samsom (1994) switched to firm-level data, Hyclak (1996) switched to sectoral job creation and job destruction data, while Neumann and Topel (1991) switched to an independent econometric model estimated with the help of quarterly data on sectoral employment shares. By doing so, they all came to the conclusion that (structural) sectoral shifts have a significant upward effect on the regional unemployment rate.

Finally, it has been suggested that a region's unemployment rate may be negatively related to its industrial diversity. Industrial diversity is greater as the distribution of employees across industries is more even. The argument is that regions with diverse sources of employment are likely to provide greater opportunities for labour redeployment between firms and industries in response to their changing employment needs. Five studies have investigated this potential relationship between regional unemployment and diversity (Taylor and Bradley, 1983; Neumann and Topel, 1991; Malizia and Ke, 1993; Simon, 1988; Partridge and Rickman, 1995), using Herfindahl's specialisation index, Theil's entropy index, or again a rather advanced index based on an independent econometric model (Neumann and Topel, 1991).[19] Except for Partridge and Rickman (1995), all these studies found the

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[19] This econometric model also covers the following situation. Consider a two-sector regional labour market in which each sector can 'borrow and lend' labour with the other. It is clear that this arrangement is only useful if both sectors do not require extra labour simultaneously. If their demand fortunes tend to positively co-vary, a larger regional labour force will be required to accommodate both sectors' needs during booms. Correspondingly, the average unemployment rate boosted by the larger number of surplus workers during periods of lower

expected negative effect; in the first three studies this negative effect also appears to be significant.

In sum, it might be concluded that the industry mix does matter, though not by employment shares but by indices of sectoral shifts and diversity, whose calculations have become rather advanced and complex.

Economic and social barriers

One important result of those studies investigating the relationship between migration and unemployment is the contrast between the disequilibrium and equilibrium view on regional unemployment. The disequilibrium view states that regional differences in unemployment reflect the slow operation of equilibrating mechanisms due to economic and social barriers, whereas the equilibrium view states that regional differences in unemployment endure due to amenities and/or disamenities. In practice, the relative importance of both the disequilibrium and equilibrium view is difficult to assess since they are not mutually exclusive, and exogenous shocks accompanied by sluggish adjustment can lead to changes in the equilibrium unemployment rate via hysteresis effects (Baddeley et al., 1998; Pehkonen and Tervo, 1998). Below we further discuss the effects of economic and social barriers (the effects of amenities and/or disamenities have already been discussed in the first part of this paper). First, it is important to note that part of migration behaviour may never be fully explained by economic concepts, therefore we cannot be complete.[20]

Economic and social barriers may separate regional labour markets. If these barriers severely restrict mobility, then weak labour demand in one region will raise the unemployment rate there above that in regions with stronger labour demand. Three types of economic and social barriers stand out:

(i) Barriers raised by the housing market, a topic fully dominated by the British literature. The regional unemployment rate has been found to be positively related

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demand for both sectors will be relatively higher than in a region with low-covariance industries.

[20] See Greenwood (1985, 1997) and Ghatak et al. (1996) for the immense variety of factors that have been shown to exert influences on migration.

to the proportion of households in the public housing sector (Taylor and Bradley, 1983; Hughes and McCormick, 1987; Molho, 1995a, 1995b). This can be understood by the fact that public tenants are predominantly manual, or blue-collar, workers with few educational qualifications. According to Hughes and McCormick (1987), one could realistically treat this type of labour as immobile between regions. That does not mean that manual workers stay put; they do move often from one public house to another in the same region, but they very rarely leave a region. A low rate of interregional mobility increases mismatch, since the various regional labour markets are partly segmented. Regions with high unemployment and few vacancies, reflecting excess supply, coexist with regions with low unemployment and many vacancies, reflecting excess demand. This wide dispersion of excess demands across regions increases aggregate unemployment, and adds to the persistence of regional unemployment differentials.

The regional unemployment rate has also been found to be positively related to the proportion of households in the owner-occupier sector, though to a lesser extent (Hughes and McCormick, 1987; Taylor and Bradley, 1994; Molho, 1995a, 1995b; Partridge and Rickman, 1995).[21] This can be understood by the fact that owner-occupiers are more mobile than public tenants, yet less mobile than private renters in that they face greater opportunity costs in relocating after a negative economic shock.[22] According to Muellbauer and Murphy (1991), the rate of mobility of public tenants, owner-occupiers and private renters is approximately 0.3 to 1 to 1.7. Hughes and McCormick (1987) found comparable ratios.

Another feature of the housing market is its inelastic supply, partly due to planning controls. This, in combination with a mortgage interest tax relief and the absence of a capital gains tax on one's principal residence, can have a substantial upward effect on house prices during economic upswings and a downward effect during economic recessions. Since fluctuations in housing wealth constitute a

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[21] Partridge and Rickman (1995) is the only non-British study in this field.

[22] Note that three types of tenures are usually considered: owner-occupation, public rental (including housing associations), and private rental (furnished and unfurnished).

significant source of variation in consumption spending, housing prices are assumed to be negatively related to unemployment across regions. Bradley and Taylor (1994), Evans and McCormick (1994), and Molho (1995a, 1995b) all found empirical evidence that this relationship is negative; the first for the regional unemployment rate equation formulated in changes, the second in levels, and the third in logistic form. In addition to this, Taylor and Bradley (1994) showed that the impact of housing prices depends on the number of households in a region which are owner-occupied, appearing from the fact that the prosperous regions in the south of the UK have been more severely affected than the depressed regions in the north by the collapse of the housing prices during 1988-1992.

(ii) Barriers created by the government's social security policy, a topic fully dominated by the North American literature. The availability and generosity of the social security system in general, and of the unemployment insurance benefit system in particular, is assumed to be positively related to the regional unemployment rate for three reasons. First, it decreases the cost of being unemployed and so increases people's reservation wages, thereby increasing the gap between the quantity of labour demanded and quantity of labour supplied. In other words, it deters job search and hence reduces the likelihood of migration. Second, if transfer programs entail work registration requirements, transfer recipients may be counted as unemployed. If recipients of such transfers are difficult to employ or are not seriously interested in finding work, then the likelihood they will leave unemployed status is lower than the likelihood that exists for the general population of the unemployed (Hofler and Murphy, 1989). Third, it may lead to implicit worksharing, wherein firms and employees are induced to arrange for employees to quit or be laid-off during periods of slow sales and rehired by the same firm when sales improve. In this way, firms lower labour costs with the assurance that the employee will be available for rehiring and employees enjoy leisure with the assurance of being rehired. Implicit worksharing is also possible for seasonal industries (Johnson and Kneebone, 1991).

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Nine studies have investigated the effect of the availability and generosity of the social security system and, with the exception of one model variant in Hofler and Murphy (1989), all found empirical evidence in favour of the assumed positive relationship (Murphy, 1985; Blackley, 1989; Holzer, 1991, 1993; Johnson and Kneebone, 1991; Vedder and Gallaway, 1996; Partridge and Rickman, 1995; Hyclak, 1996).

Additionally, three studies have suggested and have usually found significant empirical evidence that a minimum wage system has an upward effect on the regional unemployment rate, in that it further decreases the quantity of labour demanded and further increases the quantity of labour supplied (Hofler and Murphy, 1989; Johnson and Kneebone, 1991; Samsom, 1994).

All these studies are carried out either for US States or Canadian provinces. The reason that there are no comparable studies for European countries is that the social security system does not differ to any great extent between regions within European countries.

(iii)   The general tightness of the labour market. In a slack labour market, job opportunities dry up, partly because employers would find it less necessary to advertise vacancies outside their local region, and migration falls. Some of these effects also apply to commuting. According to Gordon (1988) and Bentolila (1997), the national level of unemployment is the best indicator of the general tightness of the labour market. The effect of national unemployment on mobility in Gordon's study is assumed to be a decreasing and convex function, with some degree of migration and commuting persisting irrespective of the level of unemployment. According to Burridge and Gordon (1981), Taylor and Bradley (1983) and Gordon (1987), it is not the national unemployment rate but the unemployment rate in contiguous or hinterland regions that best indicates of the tightness of the labour market. Generally, a region's unemployment rate is assumed to be higher when surrounded by regions in which unemployment is also high, rather than when surrounded by regions in which there exists an excess demand for labour. This is because structural problems tend to be transmitted

from one region to another, especially if industrial linkages between regions are strong.

The educational attainment of the population

The population's educational attainment is added to the set of explanatory variables in nine studies. Without exception it appears to have a downward effect on the unemployment rate. In six studies this effect also appears to be significant (Burridge and Gordon, 1981; Siegers, 1983; Simon, 1988; Holzer, 1993; Malizia and Ke, 1993; Partridge and Rickman, 1995). The three studies in which this effect does not appear to be significant are Murphy (1985), Blackley (1989), and Hofler and Murphy (1989). The literature offers three explanations for this unambiguous result. First, for several reasons, the better educated are better off than the lower educated: (i) they possess skills more often demanded in an economy with continued technological progress, (ii) they are likely to conduct more efficient searches, and (iii) they are less prone to layoffs and so exhibit more stable patterns of employment. Second, regions with a low level of human capital may get caught in a low-skill poverty trap from which it may be extremely difficult to escape. A poor economic performance encourages an outflow of workers with the highest skill levels, thereby further depleting the productivity of the region's workforce due to an above-average fall in output demand, which in turn has adverse effects on the quality of new entrants into the workforce (Taylor, 1996, p. 109). Third, depressed regions with higher-than-average unemployment rates provide no motive for outward migration for the lower educated, as they are relatively uncompetitive in other regional labour markets. Furthermore, it is the lower educated who face the barriers in the housing market (Burridge and Gordon, 1981; Evans and McCormick, 1994). Conversely, the high unemployment among the lower educated is no deterrent to immigration of the better educated for whom prospects may be as good as anywhere else.

Unemployment lagged in space or time and its long-term component

Many studies explain the regional unemployment rate by itself, one or more periods lagged in time (Chalmers and Greenwood, 1985; Gordon, 1987; Holzer, 1991;

Blackaby and Manning, 1992; Blanchard and Katz, 1992; Samsom, 1994; Decressin and Fatás, 1995; Vedder and Gallaway, 1996; Hyclak, 1996; Groenewold, 1997) or in space (Burridge and Gordon, 1981; Taylor and Bradley, 1983; Gordon, 1987; Molho, 1995b). This is mainly a statistical matter. Regional unemployment rates are highly correlated in time and in space, since they change usually by small amounts and often in the same direction simultaneously across space. If the null hypotheses of no serial and no spatial autocorrelation in a static model must be rejected as a result, one remedy could be to re-estimate the model using methods that assume the errors are generated by a first-order serial and spatial autoregressive process. Hendry and Mizon (1978) were among the first to point out that serial autocorrelation correction cannot be considered as a serious effort to find the 'correct' equation (see also Mizon [1995] for a recent update). Instead of improving an initial econometric model when it appears to be unsatisfactory, one better starts with a more general model containing, nested within it as special cases, a series of simpler models that ideally should represent all the alternative economic hypotheses requiring consideration. The general model Hendry and Mizon have recommended as a generalisation to the first-order serial autocorrelation model (see Hendry, 1995, Ch.7) is the first-order serial autoregressive distributed lag model, a linear dynamic regression model in which Y_t is regressed on Y_{t-1}, X_t and X_{t-1}.

Hendry and Mizon's model is a typical time series model. Its counterpart in the spatial regression literature, the first-order spatial autoregressive distributed lag model covering the first-order spatial autocorrelation model as a special case, has been described by Anselin (1988, pp.226-230), among others.

Naturally, it is also possible to combine these two types of models, but applications of this kind have not been found. As this kind of modelling is mainly a statistical device, we do not go into further detail. Nevertheless, it should be realised that a regional unemployment rate equation estimated with the help of a cross-section of time series data that does not take account of spatial and serial dynamic effects, or has not been tested for the absence of spatial or serial autocorrelation, may be seriously misspecified.

A somewhat different explanatory variable of the regional unemployment rate is the ratio of long-term unemployment to total unemployment. The idea behind this

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variable is that unemployment may strengthen unemployment as a result of the hysteresis effect; search intensity for a job may decline, while employers may use unemployment duration as a sorting device (Jones and Manning, 1992).

4 CONCLUSIONS

This paper has examined one of the central issues in regional economics: the existence and persistence of large spatial disparities in unemployment within national economies. If markets were efficient, no significant long-run spatial disparities in unemployment at sub-national level would exist, because the equilibrating forces of capital and labour mobility and change in relative prices would eventually eliminate unemployment above frictional levels. By contrast, in view of the existence and persistence of large spatial disparities in unemployment within national economies, almost all theoretical explanations of regional unemployment determination result in, and almost all empirical explanations depart from, the central hypothesis of a stable equilibrium of regional unemployment differentials. In other words, the traditional competitive theory does not have many adherents.

The main determinants of the regional unemployment rate are *labour supply, labour demand and wage setting factors*. This phrase best illustrates the *reduced form equation* that different theoretical explanations (sometimes partly) result in. The extent to which this finding is useful is more difficult to assess. On the one hand, the direction in which the explanatory variables must be searched for is clear-cut. On the other hand, it still leaves room for a broad set of explanatory variables that can all be classed among these main categories of factors. We have posited that a more profound understanding of the explanatory variables of the regional unemployment rate involved can be obtained by relying on those variables most commonly used in empirical work.

From the three main determinants of the regional unemployment rate, the labour demand factors have received the least attention in applied research. It is quite common to relate the regional unemployment rate to one, or a set of, employment growth variable(s), without explaining by which mechanism employment growth itself is

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generated. In our opinion, there are two new movements in the economic literature that can cast more light on the type of explanatory variables involved: the endogenous-growth theory and the new location theory. The endogenous-growth theory has discarded the assumption that economic growth is pegged by the rate of exogenous technological progress; instead it attempts to explain the long-run growth rate from within. The only problem is that the explanatory variables of the long-run growth rate, which have been investigated in the empirical growth literature, are numerous. In an overview of the empirical growth literature on cross-country regressions, Durlauf and Quah (1998) counted 36 categories of variables and 87 specific examples. The new location theory has been reinvestigating the economic basis for the localisation of industry. In his seminal book, Krugman (1995) shows how the incentive for geographically concentrated or dispersed production can be derived from a monopolistic competition model in which two location factors are important: transport costs and economies of scale. The few applications explaining the regional unemployment rate by the market potential may be seen as a first attempt to replace the effect of employment growth with the effect of these two location factors.

Generally, it is difficult to place sign expectations on the explanatory variables of the regional unemployment rate. First, because controversial theories go around on the impact many of these explanatory variables may have and, second, because the overall effect of a particular explanatory variable that jointly affects regional labour supply, regional labour demand and regional wage-setting rate is most uncertain. Consequently, the possible effect of a particular variable is mostly an empirical question. In practice, this problem seems insignificant. Most studies provide clear-cut explanations for the signs of their explanatory variables. By gathering many studies we have seen that there are indeed clear-cut trends, but this is no guarantee that the most obvious sign is always found, or is even correct. In sum, when a particular sign is found, one should carefully consider whether it could be presented as fitting into economic theory.

Following the central hypothesis that regional unemployment rate differentials are stable, one may ask why regional unemployment rates differ so markedly between regions. This paper has produced a sort of "checklist" of the important variables. We complete this paper by offering thirteen categories of explanatory variables found to

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be responsible for the regional unemployment problem. This overview is based on all the variables reviewed and their impact on the regional unemployment rate most often found:

(i) the population is relatively young, which is equivalent to saying that the birth rate is relatively high, a result of which a region's natural population growth rate exceeds its employment growth rate;

(ii) the labour force participation rate, the net migration rate and the net commuting rate are relatively low;

(iii) the employment growth rate is relatively small, and gross regional product per capita is relatively far below its full employment or long-run trend level;

(iv) the proportion of households in the public rental sector and, to a lesser extent, in the owner-occupier sector (as compared to the private rental sector) is relatively high. Furthermore, housing prices are relatively low;

(v) the social security system is relatively generous and the minimum wage level is relatively high;

(vi) the region is gifted with amenities;

(vii) wages paid by employers in relation to labour productivity and wages paid to employees in relation to cost of living are both relatively high. Furthermore, the proportion of the labour force that is unionised is relatively high;

(viii) sectoral shifts in employment demand are relatively high, while industrial diversity is relatively low;

(ix) the vacancy rate is relatively small;

(x) the market potential of the region is relatively low;

(xi) the educational attainment of the population is relatively low;

(xii) the national unemployment rate or the unemployment rate in contiguous or hinterland regions is relatively high; and

(xiii) the share of long-term unemployment is relatively high.

In principle, each of these variables should be part of an empirical model in a present-day study explaining the regional unemployment rate. Apart from lack of data, there are three reasons why variables may not appear in a particular study. First, certain variables do not differ to any great extent between regions within countries. The most outstanding

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example is the social security system. Whereas the American literature pays much attention to the effect of differences in the availability and generosity of the social security system between US States, this factor is missing in the European literature. From a European point of view, only the integration of both macroeconomic and regional economic research on unemployment enables the evaluation of both labour market institutional variables on the one hand and typical regional economic explanatory variables on the other. This is also crucial to arrive at more balanced policy proposals to deal with unemployment both at the regional and national levels of European countries.

The second reason is that the explanatory variables partly overlap. We have seen that there are two categories of explanatory variables: Explanatory variables that stand alone, and those that are often the subject of further analysis in that they are treated as dependent variables to be explained in other equations as well. Overlap occurs when one or more of the first category of variables explains one or more of the second category of variables. If both categories are available, the investigator has the possibility to estimate three different types of models: those not reduced with respect to the second category of explanatory variables, those partly reduced, and those completely reduced. It has been shown that these models may not be comparable with each other. Theoretically, it could well be that the sign of a particular variable in one model is the opposite of that in another model. This makes the choice of model rather difficult and partly explains why some studies present the estimation results of different regression equations next to each other.

Finally, the third reason is multicollinearity. The fact that some of the listed explanatory variables are highly correlated with each other is a difficult problem in the analysis of regional unemployment differentials. Theorists believe that in anything other than a purely descriptive regression analysis, the proper approach would be to seek to include variables on the basis of their relevance to distinct causal hypotheses, and then see whether the data is adequate to discriminate between their respective influences. This is a second reason why some studies present the estimation results of different regression equations next to each other.

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