Geographical Distribution of Unemployment:

An Analysis of Provincial Differences in Italy

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GEOGRAPHICAL DISTRIBUTION OF UNEMPLOYMENT:
AN ANALYSIS OF PROVINCIAL DIFFERENCES IN ITALY

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Abstract

Unemployment rates appear to vary widely at a subregional (e.g., local or provincial) level. Using spatial econometric models for spatial autocorrelation, this paper focuses attention on the spatial structure of regional unemployment disparities of Italian provinces. On the basis of findings from the economic literature and of the available socio-economic data, various model specifications including different explanatory variables are tested to investigate the geographical distribution of unemployment in the 103 provinces of Italy for the years 1998 and 2003. The results suggest that there is a clear explanation of unemployment differentials in terms of spatial equilibrium and disequilibrium factors and a significant degree of spatial dependence among labour markets at the provincial level in Italy. Provinces marked by high unemployment, as well as those characterized by low unemployment, tend to be spatially clustered, demonstrating the presence of unemployment 'persistency' in space and time regimes.

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1. Introduction

Geographic unemployment rates are often regarded as signposts for the socio-economic performance of regions. And consequently, the analysis of regional unemployment differences has attracted increasing interest in the economic literature. Despite this interest, regional unemployment disparities do not represent the exclusive core of theories on regional economic development; most studies concentrate, principally, on growth and convergence of per capita income (see Meliciani 2006). Also the new economic geography – according to which multiple equilibria may exist – focuses attention on income rather than on unemployment (Fujita et al. 1999). Nevertheless, there is an abundance of empirical literature that tries to explain the differences between geographical areas in terms of unemployment rates (see, e.g., Decressin and Fatás 1995; Jimeno and Bentolila 1998; López-Bazo et al. 2002). These empirical studies have brought to light some interesting stylized facts, notably: a) regional labour markets in Europe and the US differ significantly; b) regional differences in unemployment in European regions are more persistent than in the US; c) the persistence of unemployment differences in European regions is mainly due to poor flexibility of wages and low mobility of workers. In particular, in Italy, as in several other European areas, the persistence of unemployment is due to both structural problems in the economy and the inability of Italian regions to absorb specific shocks (on the demand or on the supply side) (for details, see Dohse et al. 2002).

The functioning of regional labour markets has been the subject of intensive research in the regional economic literature (see, e.g., Fischer and Nijkamp 1987; Longhi 2005; Longhi et al. 2005; Puga 2002; Overman and Puga 2002). Taylor and Bradley (1997) state in a comparative empirical study that disparities between regional labour markets in Italy, Germany and the UK are more marked than unemployment disparities between each of these countries and other European areas.

The principal aims of the empirical literature on regional unemployment are usually to examine the persistence of unemployment differentials and to develop a model that investigates its determinants. The applied analyses are mainly based on time series data, using standard statistical methods, both parametric and non-parametric (see Decressin and Fatás 1995; Jimeno and Bentolila 1998; Martin 1997; Lopez-Bazo et al. 2005). There are only a very few analyses using spatial data and spatial parametric tools (see Molho 1995; Aragon et al. 2003; Niebuhr 2003, Lopez-Bazo et al. 2002).

Taking into account the location of labour markets, our paper uses spatial econometric methods – based on spatial autocorrelation techniques – to explore the geographical distribution of unemployment for the 103 Italian provinces for the years 1998 and 2003. More specifically, we will test whether the time persistency, as empirically supported by findings from Italian researchers (see, e.g., Contini and Trivellato 2005), corresponds to a 'spatial persistency' (i.e., adjacent provinces tend to have similar unemployment rates in space and in different periods of time). As far as we know, this study is the only empirical spatial analysis of the Italian labour market. Moreover, we

will investigate whether the unemployment differentials in Italy depend on distinct equilibrium or disequilibrium factors.

The paper is structured as follows. Section 2 presents the principal theoretical interpretations of local unemployment disparities on labour markets. Next, Section 3 presents some underlying characteristics of Italian labour markets. Section 4 introduces the statistical models and the data used in our empirical application. In Section 5, the empirical findings are presented and interpreted. And, finally, some concluding remarks are made in Section 6.

2. Literature Review on Local Unemployment Disparities

Most of the theoretical labour market literature – like most empirical analyses of local unemployment disparities – explains and interprets unemployment differentials by starting from the hypothesis of a stable equilibrium of spatial labour markets. Molho (1995: 642) defined *equilibrium* as "*a situation of uniform utility across areas for (each) homogeneous labour group, such that there are no incentives for further labour migration (a further condition would be uniform profits such that capital movements are eliminated)*". The *equilibrium* interpretation of the local labour market has over the past decades received empirical and theoretical support from, amongst others, Hall (1970), Marston (1985) and Rosen (1974, 1979).

When the effect on local or regional unemployment caused by short run shocks is dissipated, the persistence of differentials in unemployment rates can be interpreted in terms of disequilibium in nature (Marston 1985). According to Marston (1985), there is an equilibrium relation of unemployment rates across areas, and in each area it is a function of the amenities and the endowments of the land. Workers migrate to areas where new jobs are created until there is no further incentive to move. In other words, the spatial distribution of unemployment under an equilibrium interpretation is characterized by a constant utility across areas: high unemployment in the i-th area is compensated for by some other positive factors (e.g., local amenities, climatic conditions, quality of life, local housing prices, etc.) which are a disincentive to migration. Similar considerations can be put forward with regard to firm migration.

In contrast to the previous interpretation, local unemployment differentials can also be explained in terms of disequilibrium. The disequilibrium view assumes that in the long run the unemployment rate will level off across areas. The adjustment process may be faster or slower and, depending on its speed, differences in unemployment across areas may persist for a long time. The speed of adjustment may depend on determining factors connected to both labour demand and supply.

In addition to earlier studies, Partridge and Rickman (1997) – following the equilibrium-disequilibrium interpretation of labour markets – extended the set of factors that might influence the regional disparities of unemployment; they related regional unemployment rates to disequilibrium factors (e.g., employment growth rates) and to an equilibrium component, that is a function of market equilibrium variables (e.g., industry and services shares), demographic variables and amenities.

According to the findings from the empirical literature[1], areas of unemployment can be classified into three groups, on the basis of the degree of persistence of the aggregate and regional relative unemployment: 1) low persistence of aggregate and regional relative unemployment (this is the case for the US); 2) high and low persistence of, respectively, aggregate and regional relative unemployment (this is the case for most of the EU); 3) high persistence of aggregate and regional relative unemployment; this is the case for some European countries like Italy or Spain (Jimeno and Bentolila 1998).

Concerning the latter point, a recent analysis of Lopez et al. (2005) showed a clear evidence of disparities of unemployment in Spain; the authors assess spatial differences of unemployment for two periods 1980-85 and 1992-97 considering equilibrium and disequilibrium explanation factors. They show that spatial unemployment disparities across Spanish provinces are mainly caused by equilibrium component, while disequilibrium variables only have a limited effect on the behaviour of clusters of provinces characterized by low or high unemployment rates.

Generally, regarding the Italian labour market, the literature reviewed stresses the different behaviour of the Italian labour market with respect to both other European countries and the US. The most stylized facts of the Italian labour market point at both a high persistence of aggregate and regional relative unemployment and the North-South dichotomy (see, e.g., Faini et al. 1997; Prasad and Utili 1998; Brunello et al. 2001). According to Gambarotto and Maggioni (2002), this dichotomy actually hides a patchwork of local facts that could be better explained by a provincial analysis.

In the light of the above considerations, we will explore in our study unemployment differentials of Italy at a provincial level by considering the spatial characteristics of the distribution of unemployment. Mainly, following the empirical framework of Partridge and Rickman (1997), the unemployment disparities will by explained by distinct equilibrium and disequilibrium variables; moreover, to take into account the eventual spatial interactions across provincial labour markets, spatial econometric tools will be used. Then a brief description of the Italian labour market (Section 3), data and empirical models will be presented.

The analysis will be performed for the years 1998 and 2003, which represent two 'strategic' years in the recent new regulation of the Italian labour market. In particular, 1998 is a critical year, because the new regulation in support of labour market flexibility – which started at the mid-nineties – became fully operational[2].

We aim to explore whether the laws of the mid-nineties on labour market regulation have had a clear impact to reduce both the level and the regional differences of unemployment among Italian regions. In addition, we investigate the main determinants of unemployment differences in Italy; the latter ones are, despite a reduction in the past years, large and persistent.

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[1] See Eichengreen 1992; Decressin and Fatás 1995, and Jimeno and Bentolila 1998.

[2] In order to consider specific latent characteristics of provinces, a panel data analysis might be performed; however, as our aim is to catch the effects of the new regulation on the labour market, both at the beginning and some years later after its effectuation, a cross-section analysis was made for two time periods.

3. The Italian Labour Market: Some Stylized Facts

Analyses of the Italian labour market reveal usually various stylized facts: (i) the spatial distribution of unemployment has become more uneven over the nineties; (ii) nowadays, it presents a dichotomic structure (North-South). While some regions in the North have reached an unemployment rate lower than 5%, other regions in the South appear to show unemployment rates over 20%; (iii) in the past years unemployment differentials have become wider and persistent over time.

Amendola et al. (1999), focussing mainly on the most important stylized facts characterizing the dynamics of the Italian labour market in the period 1981-1995, underlined and identified a clear territorial structure, with medium- and long-term performances that are strongly differentiated at the local level.

Various factors have been identified to explain the regional disparities in the eighties and the first years of the nineties. On the one hand, labour market conditions in the South have worsened as a result of a faster growth of the labour force (i.e., young people) in contrast to a lower growth of new jobs (or vacancies). On the other hand, the northern and central regions in Italy appeared to show growing rates of employment and lower growth rates of labour force than the southern provinces. Moreover, labour mobility from the southern towards the northern and central areas, has significantly declined starting from the eighties. Indeed, inter-regional migration in Italy is less than half as large as in northern countries, like the Netherlands, United Kingdom, France etc. (see e.g., Puhani 1999).

The aforementioned developments have taken place for at least three reasons: (i) the reduction in wage differences. Actually, the abolition of 'wage cages' ('*gabbie salariali*') at the end of the sixties has led to a progressive convergence of net and gross wages among the southern and the northern regions; (ii) the increase of migration costs. Indeed, in Italy, in contrast to other European countries, the unemployed tend to rely on a wide family and friends network in their job-searching, with the aim to avoid mobility costs, when these are relatively high; (iii) the cost of housing transactions and the difficulties of finding a rented accommodation at a reasonable price (see Faini et al. 1997).

Figure 1 shows the nation-wide unemployment rate, as well as the minimum and the maximum value of unemployment over the years 1993 and 2003. The choice of the period depends critically on the availability of comparable data; the Italian Institute of Statistics provides only homogeneous data from a survey on the labour force starting from 1993, and hence we decided to analyse the unemployment trend for 10 years focussing on the year 1998, which was characterized by effects of a new legislation on the Italian labour market.

<< Insert Figure 1 about here>>

Figure 1 shows clearly the significant intensity of unemployment differences across Italian provinces, a fact that appears evident if we compare the straight line of maximum and minimum

values over time. The variability of unemployment rates among provinces is more evident in 2003, where the coefficient of variation is equal to 0.80, even though in the same year the decrease in the minimum and maximum values with respect to 1998 is noteworthy (see Table 1). The reduction of the minimum and maximum value might be related to the new regulation of the Italian labour[3] market that started as of 1997, and which has aimed to enhance the flexibility on the labour market in Italy.

<< Insert Table 1 about here>>

For the period analyzed, the lower and higher unemployment rates appear to correspond to the provinces of the North and the South of the country, respectively; this finding illustrates the dichotomic structure of unemployment in Italy[4]. This aspect is highlighted by the Moran-I statistics; in fact, in 1998 and 2003 this Moran statistics is equal to 0.86 and 0.82, respectively. The Moran scatter plot shows that provinces are clustered in two large groups (the central-northern and southern cluster) (Figures 2 and 3).

<< Insert Figure 2-3 about here>>

It seems plausible that the aforementioned recent regulation of Italian labour markets has led to a reduction of the nation-wide unemployment rate without any significant effects on the unemployment differentiation across provinces. Moreover, the flexibility of the labour market has allowed some northern provinces to achieve almost full employment, while the provinces in the South have only modestly decreased their unemployment rates.

Given the persistent dispersion of spatial unemployment rates, it is likely that there are, in general, structural regional employment rate differences, even though the significant decline in the nation-wide maximum and minimum values of unemployment rates – which are rather evident between 1998 and 2003 – suggests that both structural equilibrium and disequilibrium explanations of unemployment differences may be valid.

In the last years, the absolute value of unemployment rates has been decreasing, but there were still structural differences in unemployment rates between northern and southern regions (or provinces); the North and South are characterized by high and low unemployment rates, respectively.

In the light of these considerations, one may wonder why southern provinces show only a weak tendency towards northern provinces. Perhaps in the South, people may obtain some benefits from remaining in high unemployment regions. Next, provinces in the North appear to attain also a stronger employment growth than southern provinces. To shed more light on these questions, an

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[3] For details, see e.g., D.Lgs. 196/1997 ('*Pacchetto Treu*'); D.Lgs. 469/1997; D.Lgs. 181/2000; L. 388/2000; and D.Lgs. 276/2003 (Biagi Law).

[4] In the years 1993, 1998 and 2003 the provinces with lower unemployment rates are: Cuneo, Bolzano and Lecco, respectively, i.e., provinces of the North of Italy. In the same years the provinces with high unemployment rates are: Naples, Enna and Reggio Calabria, i.e., provinces of the South of Italy.

empirical model, including equilibrium and disequilibrium variables, would need to be developed to investigate these issues.

The novel aspect of our analysis, compared to previous Italian analyses, consists both in using an applied model that includes equilibrium and disequilibrium factors, and in verifying the existence of spatial spillover effects to explain the unemployment differences among these regions in Italy.

In the literature, there is a clear evidence of spillover on growth and localization activities (see, e.g., Lopez-Bazo et al. 1999 and Rey and Montouri 1999); but in regard to the labour market, there are relatively few analyses. For example, Molho (1995) reports evidence of significant spillover effects in adjustments to local demand shocks in 280 Local Labour Areas for Great Britain. Niebuhr (2003) emphasizes the importance of spatial interaction with respect to regional labour markets in Europe. Aragon et al. (2003) finds that a disequilibrium unemployment in one hinterland of Midi-Pyrenée propagates very quickly outwards to its neighbours. And Lopez-Bazo et al. (2002) show that spatial effects might be proxies for different interactions across labour markets in Spain.

From a statistical point of view, at this level of dissaggregation (i.e., provincial data) one cannot ignore the spatial effects on the estimated parameters of a model. Actually, it is necessary to take into account spatial autocorrelation effects in the data to obtain efficient standard errors of parameters and to make a statistically reliable inference. Furthermore, the interactions across provincial labour markets, as measured by spatially lagged dependent variables (or some other explanatory variables) or by autocorrelated error terms, might explain the differences in unemployment rates. As argued by Fingleton (1999) and dall'Erba and Le Gallo (2005), spatial autocorrelation may act as a proxy of some omitted variables. In Section 4 the data and the estimated models for the Italian regions will be presented.

4. Models and Data on Unemployment in Italian Provinces

As argued above, the explanations of unemployment disparities in Italian regions may be clustered into equilibrium and disequilibrium variables. Following the findings from the literature and considering the dualistic and persistent geographical structure of Italian unemployment disparities, it is thus necessary to develop a model including equilibrium and disequilibrium variables, as well as spatial effects. In order to meet this challenge, data from different sources have been used: *U*, *E*, *Eman*, *Eser*, *Eagr*, *Malp* and *Femp* from ISTAT, Italian Survey on Labour Force (1993, 1998a, 2003a); *Hous* from ISTAT, Census of Population (1991, 2001); *Hcap* from Ministry of Education (1998, 2003); *Young* and *Old* from ISTAT, demographic statistics (1998b, 2003b); *Dens* and *Mig* from ISTAT, Territorial Indicators (1999, 2002).

In order to explore both the significance of spatial clusters of high or low unemployment and the explanatory factors of unemployment, our starting point is a cross-sectional regression model on regional unemployment without spatial effects. In particular, the following general theoretical model is used as a starting point:

$$U^t = \beta_o + \beta_1 EC_1^t + \beta_2 EC_2^t + \beta_3 Eman^t + \beta_4 Eagr^t + \beta_5 Eser^t + \beta_6 Hous^t + \beta_7 Femp^t + \beta_8 Malp^t +$$
$$+\beta_9 Hcap^t + \beta_{10} Young^t + \beta_{11} Old^t + \beta_{12} Mig^t + \beta_{13} Dens^t + \varepsilon \tag{1}$$

where U is the vector of differences between the unemployment rate in each province in year t (i.e., 1998 and 2003) and the nation-wide unemployment; EC_1 is the mean variation in provincial employment over the last four years (i.e., from 1993 to 1997 or 1998 to 2002 if the analysis concerns the years 1998 or 2003, respectively) as a proxy for a structural disequilibrium variable; EC_2 is the variation in provincial employment in the last year (i.e., from 1997 to 1998 for the year 1998 and from 2002 to 2003 for the year 2003) as a proxy for a short-time disequilibrium variable. The other variables are proxies for market, mobility and demographic equilibrium variables, respectively, while ε is a vector of residuals.

The equilibrium variables are: share of employment in the manufacturing sector over total provincial employment (*Eman*); share of employment in the agricultural sector over total provincial employment (*Eagr*); share of employment in the service sector over total provincial employment (*Eser*); number of vacant (non-occupied) houses over the total number of available houses (*Hous*); number of students that have at least started high school over working age population (*Hcap*); female labour force over total females at working age (*Femp*); male labour force over males at working age (*Malp*); population of 15-29 years old over total population (*Young*); population over 65 years over total population (*Old*); net migration balance (*Mig*) and population density (*Dens*).

The equilibrium variables *Eman*, *Eagr and Eser* are proxies for the provincial economic structure, though it is not always clear which sign these control variables should have. Clearly, intuitively, provinces specializing in a declining economic sector such as agriculture might show higher structural unemployment rates than provinces specializing in modern sectors such as manufacturing or services (Elhorst 2003).

Next, the variable *Hous* is a proxy for economic and social barriers, viz. a proxy for a mobility equilibrium variable. The housing market which has a lower proportion of occupied housing should have cheaper housing prices and a higher chance of finding a dwelling compared to provinces which have a high proportion of occupied housing. We may expect a negative coefficient for this variable, the reason being that workers are not available to move from area i with a high number of vacancies to area j with a low number of vacancies (see Bradley and Taylor 1994; Molho 1995).

The variables *Femp*, *Malp*, *Hcap*, *Young*, *Old*, and *Mig* are proxies for demographic equilibrium variables. According to most empirical studies , the sign of the coefficients of variables *Femp* and *Malp* should be negative (see, e.g., Elhorst 2003), *Hcap* and *Young* are proxies for the demographic structure of young people. The former, more specifically, is a proxy for the schooling level of population; the expected sign of the coefficient is negative, viz. if a high share of young people attends highschool, then their participation in the labour market will be delayed with an indirect and positive effect on unemployment rate. With respect to the share of the young population, the expected sign of the coefficient of *Young* is positive; usually higher unemployment rates characterize young cohorts. Similarly, a high share of old population should produce a positive

effect (i.e., a negative sign of the parameter) on unemployment (see, e.g., Molho 1995; López et al. 2005; Elhorst 1995).

The sign of the coefficient of *Mig* is not clear, because it may cause an increase in both the demand and supply side of labour (see, e.g., Elhorst 2003).

Finally, the *Dens* variable is a proxy for consumer and producer amenities; the sign of its coefficient is not unambiguous, because, on the one hand, a high density may increase the efficiency of matching workers to jobs, but on the other hand, it may increase the time spent by workers to collect information about vacancies on the job market (Taylor and Bradley 1997; Patridge and Rickman 1995; López et al. 2005).

In the estimation of model (1) we followed a general empirical strategy according to Hendry's methodology (see, e.g., Spanos 1988). We distinguish between the theoretical model (i.e., the mathematical formulation of the theory), in our application (see model (1) and the statistical model written in terms of observable random variables. Generally, if the assumptions of the statistical model are tested and not rejected, this indicates that the postulated probabilistic structure is appropriate for the data. If not, an alternative model, which has a more appropriate informative structure, must be chosen. In other words, we should try to maximize the 'statistical adequacy' of the theoretical model.

Since in our case the probabilistic structure postulated by model (1) was not appropriate to the data base, different statistical models were estimated in order to identify the most adequate one. The empirical findings, discussed in the next section, were obtained in the light of this empirical strategy.

Moreover, if the spatial dependence effects are significant but ignored, the OLS regression of equation (1) will provide a biased estimation of the parameters in the case of spatial lag dependence, while it provides unbiased and inefficient estimates in the case of spatial error dependence. The spatial interaction between economic phenomena introduces the concept of spatial autocorrelation, which is linked to the territorial shape of the observed phenomena and to the connections between observations. Measures of spatial autocorrelation take into account the dependence between observations by a spatial weights matrix **W**. For a set of N observations the spatial matrix **W** is an N x N matrix with diagonal elements equal to 0; the other elements w_{ij} represent the intensity of the effect of territorial area i on territorial area j (see Anselin and Bera 1998). The matrix defines the structure and the intensity of spatial effects, and it may be either a contiguity matrix or a matrix based on a distance decay function. In the literature, there are very few formal guidelines and suggestions on the choice of the most adequate spatial weights (for details, see Anselin 1988, 2002; Anselin and Bera 1998; Leenders 2002; Dietz 2002). Here, we use a rook contiguity matrix that is row-standardized, i.e., a binary spatial weight such that $w_{ij}^s = w_{ij} / \sum w_{ij}$ if the provinces i and j are contiguous (i.e., share a border), and $w_{ij} = 0$ otherwise. Although also other matrices could be used, in our view the contiguity matrix is the most appropriate to describe the spatial interactions of labour markets in Italy, and to catch the morphological and geographical structure of Italian provinces. Moreover, as the statistical units are territorial areas and not, for

example, single points (e.g., families, firms, etc.), a generic distance matrix is less useful (see, Anselin 1988)[5].

The most general model, including spatial dependence effects, is the following:

$$U = \rho WU + \beta X - \delta WX + (I - \lambda W)^{-1}\xi, \qquad (2)$$

where X is an $(n \times k)$ matrix of observations on the k independent variables (in our application the equilibrium and disequilibrium variables); ρ is the spatial autocorrelation coefficient and measures the *spillover* effects: in other words, $\rho \neq 0$ implies that unemployment in province i depends directly on unemployment in other neighbouring provinces. Moreover, in order to capture spillover effects connected to the explanatory variables, their spatial lags could be encapsulated by the coefficient δ.

We know that model (2) cannot be estimated directly; in the course of time, different specification strategies have been performed in order to take account of spatial dependence (see, e.g., Anselin and Rey 1991; Florax and Folmer 1992; Anselin et al. 1996; Florax et al. 2003).

Here, in order to explore the spatial interaction of the geographical distribution of unemployment, we follow the robust specification strategy which uses the robust LM test to detect the spatial effects (see Anselin et al. 1996 and also Florax et al. (2003)). Moreover, we do not ignore the theoretical arguments on the basis of which model (1) was performed (see Fingleton and Lopez-Bazo 2006). The robust specification strategy aims to test the statistical significance of λ and ρ, departing from a model without spatial effects using a separate robust LM test. We test then whether λ and ρ are equal to 0; if neither are equal to 0, we could choose between a spatial error or a spatial lag model, on the basis of the largest robust LM statistics. If only λ (or ρ) is significant, a spatial error (or spatial lag) model could be estimated.

The empirical findings, discussed in the next section, were obtained in the light of the aforementioned empirical and operational estimation strategies.

5. Empirical Findings for Provincial Italian Unemployment

The previous section has identified – on the basis of theory and the availability of data – some relevant variables that explain the regional disparities of unemployment rates in Italy. Clearly, it is not expected that all variables of model (1) (i.e, the variables included in the general model to be estimated) would be required in an adequate statistical model. According to Spanos (1988: 117), the problem "*arises as to how to coalesce the relevant theoretical and sample information in the specification of statistical models*". In other words, we need to identify an estimable model – with a theoretical basis – that is bound up with an adequate statistical model.

In fact, in our case the estimation of model (1) has produced relevant statistical problems like heteroskedasticity and multicollinarity. Hence, these problems had to be solved by using both the

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[5] With regard to the provinces of the two islands Sardinia and Sicily, the contiguity has been considered inside each island.

logarithm of variables and combined independent variables. Specifically, we substituted the variables *Femp* and *Malp* for the ratio of female labour force over male labour force (*FM*); young and old variables for the ratio between young and old population (*YO*). Moreover, we did not include in the statistical model the variables *Eser*, *Hcap* and *Mig*, because they caused a severe multicollinearity.

The estimable statistical model used for our final estimation is now:

$$U^t = \beta_o + \beta_1 EC_1^t + \beta_2 EC_2^t + \beta_3 Eman^t + \beta_4 Eagr^t + \beta_5 Hous^t + \beta_6 FM^t + \beta_7 YO^t + \beta_8 Dens^t + \varepsilon \qquad (3)$$

We first estimated a cross-sectional model without spatial effects. The OLS estimations obtained for 1998 and 2003 are shown in columns 1 and 2 of Table 2[6].

In 1998, all coefficients of the independent variables – except *Eagr, Hous* and *Dens* – appear to be statistically significant. In 2003, in addition to the previous variables, the EC_1 variable appears to be also insignificant. In 1998 and 2003 moreover, the robust LM test on omitted spatially lagged dependent variables appears to give a significant value equal to 21.02 and 34.52, respectively. The significant values of the robust LM test indicate that $\rho \neq 0$; so, a spatial lag model has to be estimated[7].

The estimations of our spatial lag regression model are shown in columns 3-5 of Table 2. The estimations related to 1998 show a consistent and significant spatial effect explaining the differentials of regional unemployment. The coefficient of the variable WU is rather large ($\rho = 0.63$). The positive value of ρ implies that unemployment in province i depends directly on the unemployment in other neighbouring provinces. Moreover, the unemployment differences are explained by the short-run change in employment. The coefficient of the variable EC_2 implies that unemployment in one area depends strongly on the change in employment (in the same area) in the last previous year. In contrast, the variation of employment in the medium run (i.e., EC_1) does not produce any effect on unemployment. In other words, the effect of the change in employment is dissipated over the years – as the coefficient of EC_1 shows – and produces effects only in the short run, as confirmed by the coefficient of EC_2.

In particular, the negative expected sign of EC_2 means that a unit marginal increase in employment from 1997 to 1998 has a more than proportional decreasing effect on the unemployment differentials. The effect on unemployment connected to the labour demand is

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[6] As it is plausible hypothesis that some endogeneity problems could affect model (3), here the independency among explanatory variables has been assumed rather than tested due to the lack of suitable instrumental variables at provincial level.

[7] It is useful to note that, as the Moran scatter plot indicated a polarization of unemployment, we also investigated on spatial heterogeneity effects, i.e. the other possible spatial effect (as known, the spatial effects are distinguished in spatial dependence and spatial heterogeneity). Spatial heterogeneity "*may show up in terms of spatial heteroskedasticity or spatially varying parameters*" (de Graaff et al. 2001, p. 259). With respect to the last case, as heteroskedasticity was not present, we estimated a spatial regime model, one regarding the north-central regions and one for the southern ones. The Chow test on structural stability of individual coefficients indicates that almost all coefficients are the same in both regimes. In 1998, there is a significant difference in the relation between *U* and *YO* in each of the regimes, while in 2003, only the relation between *U* and E_{man} and *YO*, respectively, is different in both regimes. On the basis of these results, we did not futher take account of spatial heterogeneity effects.

highlighted by the coefficient of *Eman*, which has a negative sign; it is strongly significant and equal to 0.55, in contrast to the coefficient of *Eagr* that is not significant.

Finally, the empirical findings show that demographic and amenity variables (*YO*, *Hous* and *Dens*) do not influence the explanation of unemployment differentials. It is now interesting to examine the negative sign of the coefficient of *FM*. As *FM* is a combined variable, it may be interesting to discover whether the effect is mainly connected to female or male participation. To this end, we decompose the coefficient of the variable in the following way:

$$\hat{\beta}_6 = \frac{\partial LnU}{\partial Ln(FLF/MLF)} \; ceteris \; paribus$$

then we can write

$$\frac{1}{\hat{\beta}_6} = \frac{\partial Ln(FLF/MLF)}{\partial LnU} = \frac{\partial}{\partial LnU}(LnFLF - LnMLF)$$

Now we define the elasticity of unemployment with respect to the variable FLF and MFL as:

$$\beta_F = \frac{\partial LnU}{\partial Ln \; FLF} \; and \; \beta_M = \frac{\partial LnU}{\partial Ln \; MLF}$$

so we have

$$\frac{1}{\hat{\beta}_6} = \frac{1}{\beta_F} - \frac{1}{\beta_M},$$

and consequently:

$$\hat{\beta}_6 = \frac{\beta_F * \beta_M}{\beta_M - \beta_F}.$$

Finally, we may conclude that

$$\hat{\beta}_6 > 0 \; if \; \beta_F < \beta_M \; and \; \hat{\beta}_6 < 0 \; if \; \beta_F > \beta_M.$$

As in our analysis $\hat{\beta}_6 < 0$, we may state that the effect connected to female participation is stronger than that of male participation. In fact, the correlation coefficient between unemployment rate and either female and male participation is -0.80 and -0.56, respectively. More specifically, a gender analysis of descriptive statistics shows that the behaviour of female participation is more linked to the dynamics of the labour market; in other words, in the provinces where the unemployment rate is high, the female participation is low. In fact, in the South of Italy, where the unemployment is higher than in the North, the female labour participation is 37.0% against 52.0% in the provinces of the North.

This behaviour of women in the South of Italy, as argued by Saraceno (2005), is most plausibly caused by the lack of an appropriate private and public service supporting social cohesion and emancipation. Moreover, the low probability to find a job in the South discourages the participation in the labour market or to look for a job.

The estimates of the spatial lag model for 1998 show that the spatial autocorrelation was here eliminated, as shown by the Likelihood Ratio (LR) and LM test on lag dependency and autoregressive spatial errors, respectively.

Regarding the year 2003, the estimates in column 4 of Table 2 show that all coefficients of independent variables – except EC_1, *Hous* and *Dens* – are statistically significant; furthermore, the spatial effect of the unemployment variable is almost equal to the value of 1998 ($\rho = 0.61$). In contrast to 1998, this model does not eliminate the spatial dependence; in fact, the diagnostic for spatial dependence highlights the presence of spatial correlation in the residual term. Therefore, a spatial error model with a dependent lagged variable should be estimated. But as the diagnostic spatial dependence test started from OLS estimates (see Table 2, column 2), and forced us to use spatial lagged dependent variables, we may hypothesize that the presence of spatial autocorrelation in the residual term is a misspecification problem due to omitted systematic variables (see Fingleton and López-Bazo 2006). So, the spatially lagged independent variable *Eman* is included in model (2) as a control variable. This choice is based on both the statistical feature of the variable (i.e., a quite high value of Moran-I) and economic reasons. In fact, it is plausible to hypothesize that the manufacturing employment in a given province has a positive effect on unemployment in the neighbouring provinces[8].

The inclusion of W*Eman* in model (2) permitted us to eliminate the spatial error dependence. This variable presents a highly significant coefficient and is equal to -0.22; this indicates that unemployment in this province is sensitive to employment in contiguous provinces. In other words, this new model points at a double contiguity effect, viz. one due to the unemployment of neighbouring provinces ($\rho = 0.45$), and the other one connected to the demand side, viz. the coefficient of employment in the manufacturing sector in neighbouring provinces. Furthermore, the negative sign of the coefficient of *WEman* may be conceived of as an indicator of inter-provincial mobility[9]. As a rule of thumb, the level of manufacturing employment of neighbouring provinces has a positive effect on the labour force by stimulating the commuting among contiguous provinces. But as the mobility is a short-run phenomenon, it does not serve to change the geographical shape of unemployment differentials.

The short-run change of employment (EC_2) – even though it has lost a little bit of its explanatory power in comparison to 1998 – represents the main determinant of unemployment differences.

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[8] We followed also another empirical strategy. We estimated a spatial lag model with all lagged and unlagged explanatory variables. Next, we eliminated those variables which parameters were both insignificant and with an unexpected sign. This strategy led us to a spatial lag model including only the spatially lagged explanatory variables of EC_2, E_{man} and *HOU*; but only WE_{man} reported a significant coefficient. Furthermore, this model presented a larger AIC value than the model reported in Table 2, column 5; so, we decided to choose the most parsimonious model with a smaller AIC.

[9] Indeed, manufacturing employment in the neighbouring provinces can be thought to have both a positive and negative effect on unemployment in a given province. It will depend on the strength of the positive (cooperation) and the negative (competition) externalities. We would like to thank an anonymous referee for this suggestion and interpretation.

The parameter of *Eman* maintains its negative and significant coefficient. In contrast to 1998, the coefficient of *Eagr*, though not strongly, contributes to reduce the provincial differences of unemployment. In comparison to 1998, the significant and positive coefficient of the provincial structure of population is noteworthy. In particular, by decomposing the parameter $\hat{\beta}_7$ like $\hat{\beta}_6$, we can argue that the effect of the share of population over 65 is stronger than the share of the young population. In other words, the differentials of unemployment are more sensitive to the relative variation of the population over 65 years old; therefore, provinces with a high share of old people have experienced a lower unemployment rate, in agreement with the official demographic statistics.

Finally, labour participation shows a significant negative coefficient and its power is stronger than 1998.

For both years, the major conclusion that we can draw from our estimates is that unemployment differentials in Italian provinces have an explanation in terms of both disequilibrium and equilibrium factors. In 1998, the provincial unemployment differentials are mainly explained by a disequilibrium factor (short-run change in employment) and weakly by equilibrium factors such as the share of employment manufacturing and the share of the female labour force. In contrast, in 2003, although the disequilibrium factor maintains its strong power in the explanation of unemployment differences, more equilibrium variables contribute to highlight the geographical shape of unemployment.

Finally, by using spatial models we may highlight that the spatial effects matter to explain the geographical distribution of unemployment, and hence they cannot be neglected in the analysis of regional unemployment differences. Indeed, in our case the spatial effects, mainly represented by spatial dependence, point at a polarization of unemployment rate. In other words, the unemployment rate of each individual province is more similar to the unemployment rate of neighbouring provinces than to the average unemployment rate. This result is in agreement with recent debates on labour markets of European regions (see, e.g. Overman and Puga 2002; Puga 2002). The question is of course, why this has happened. Our results led us to hypothesis the unemployment polarization is predominantly driven by labour demand rather than supply. As supported by official statistical data, the driving force on the demand side is the 'clustering activity'; i.e., the concentration of manufacturing activities that are highly efficient in the northern provinces compared to the southern ones. This in turn causes a higher labour demand in the north provinces and, actually, lower unemployment rates and vice versa.

6. Conclusions

The main aim of this paper was to investigate the provincial unemployment differences in the labour market in Italy by using a proper statistical model. We adopted a general empirical strategy on the basis of both a theoretical model and the probabilistic structure of spatial data.

A cross-sectional analysis using spatial econometrics model, for 1998 and 2003, was next performed to investigate the effectiveness of the new Italian regulation, in support of labour market flexibility, at the beginning and some years later after it came in effect.

The empirical model includes spatial dependence effects, and both equilibrium and disequilibrium factors. The most adequate statistical model for both years appears to be the spatial lag model. The regional differences in unemployment are strictly related to disequilibrium factors rather than to equilibrium variables. This result, already highlighted by previously undertaken Italian research (see, e.g., Amendola et al. 1999; Amendola et al. 2004) leads us to the conclusion that the differentials of unemployment which have characterized the Italian labour market are mainly due to the labour demand.

The analysis shows that the strength of the new regulation of the Italian labour market was higher at the beginning of its application (i.e., in 1998), creating new jobs and prompting less rigid local labour markets. In 2003, the positive (but lower) effect of the employment growth compensates for the low labour market participation and the older composition of the population. Both these factors have usually a favourable effect on unemployment rates by favouring its decline. Specifically, low female participation in the provinces characterized by high unemployment rates and the older composition of population in the northern provinces have mitigated the polarisation of provincial unemployment rates.

The polarisation of unemployment rates has been demonstrated by the positive spatial autocorrelation characterizing local labour markets in both years; in other words, local labour markets with high or low values of unemployment tend to cluster in space. Actually, Italian provincial unemployment rates are characterized by a neighbouring effect, which is significant notwithstanding the fact that regional characteristics were controlled.

The spatial-geographic distribution of unemployment appears to be similar in the two years under consideration; in other words, the cluster of central-northern provinces is clearly distinguished from the cluster of southern provinces for both years. We call the presence of these joint characteristics, in time and space, 'spatial persistency'.

The major policy implications that we can draw out from the statistical analysis is that the new regulation of the nineties for the Italian labour market has produced positive effects on unemployment; and this effect has been stronger in 1998 than in 2003. But, notwithstanding the increase of employment, the geographical unemployment differences remain high, as highlighted by the official statistics.

According to the new economic geography, the polarized structure of unemployment rates may reflect the agglomeration of economic activities. Specifically, in a country like Italy characterized by a wage setting at the national level and a low labour mobility (see Faini 1999; Jimeno and Bentolila 1998), the clustering of activities is related to differences in unemployment rates and increasing wage gaps (Puga 1999, 2002). Therefore, a proper understanding of the *spatial persistency* of unemployment becomes crucial to investigate the polarization of labour demand. Moreover, the polarization effect on the demand- and supply-side should encourage policy makers

to identify and develop appropriate national policies to facilitate the integration between heterogeneous regions within a country.

Further, the high unemployment disparities of unemployment rates within Italy questions the effectiveness of European development policies, in general, and of policies targeted at Objective 1 and 2 regions. The findings suggest that Objective 1 and 2 programme incentives have not been successful in coping with regional inequalities (see Boldrin and Canova 2001; Bondonio and Greebaum 2006; Puga 2002, Rodríguez-Pose and Fratesi 2004). We may plausibly argue that the national and European policies have supported the clustering of economic activities as driving forces of polarisation of unemployment; on the other hand, they have prevented a further divergence rather to foster a cohesion process.

The spatial persistency of unemployment and the delays in employment growth may suggest to policy makers a shaggy path to reshape unemployment differentials. More specifically, if in the long-run, structural change actions are not undertaken to foster labour interregional mobility and a more flexible wage setting, the short-run effect connected with the decrease in unemployment will be dissipated (Overman and Puga 2002).

In conclusion, our results and considerations argue in favour of a critical rethinking and reshaping of Italian and European policies keeping in mind that any regional policy in an open space-economy acts in both region i and in its neighbourhood. Policies should pay more attention to specific regional features in order to balance the trade-off between economic advantages of agglomeration effects, linked to economic integration and the inequalities generated.

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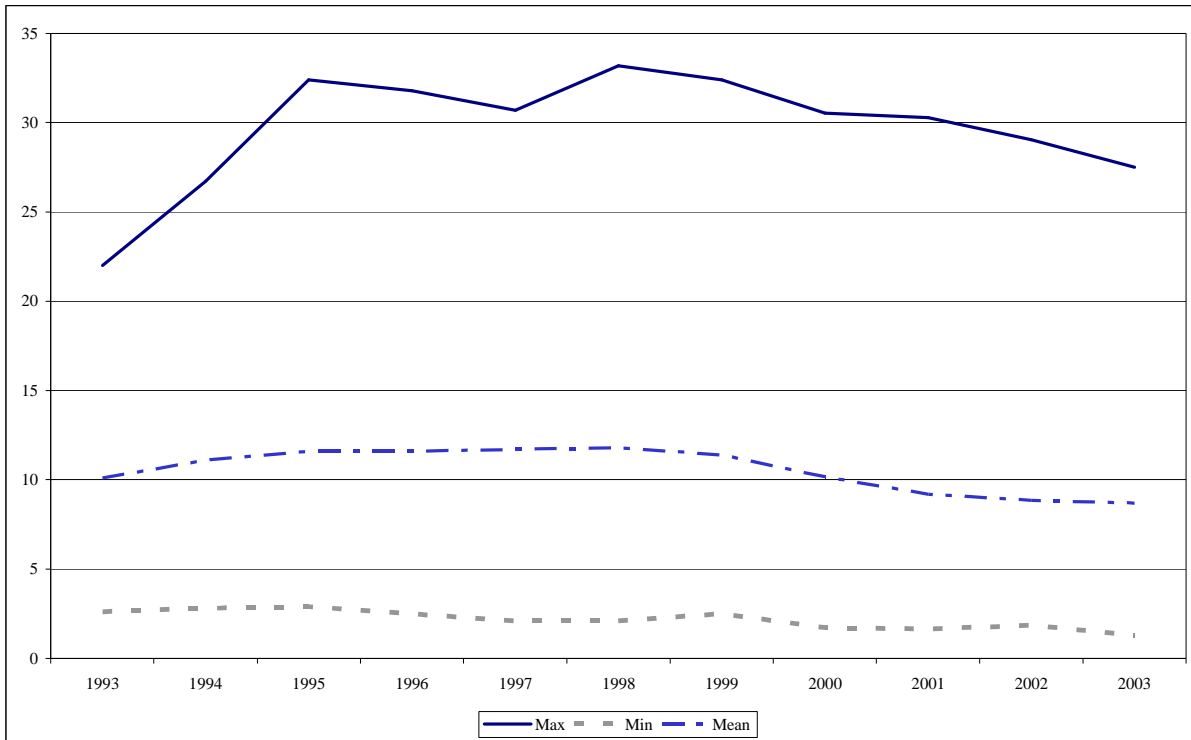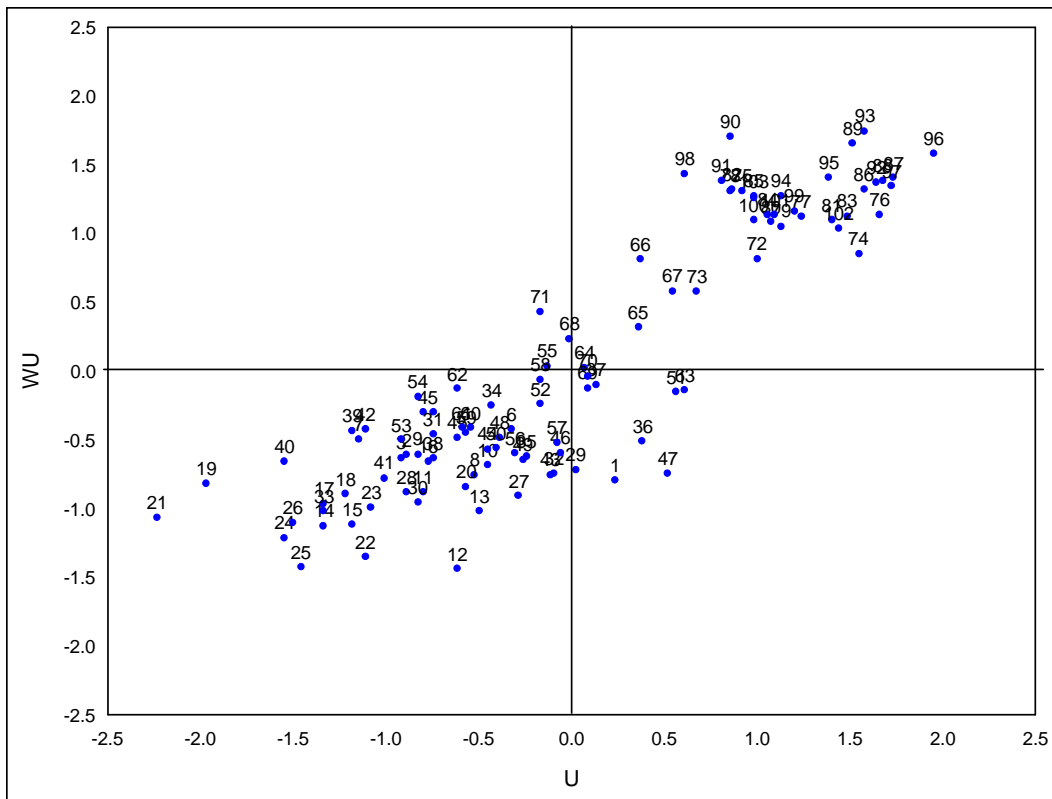
Figure 1. Trend of Italian unemployment rates
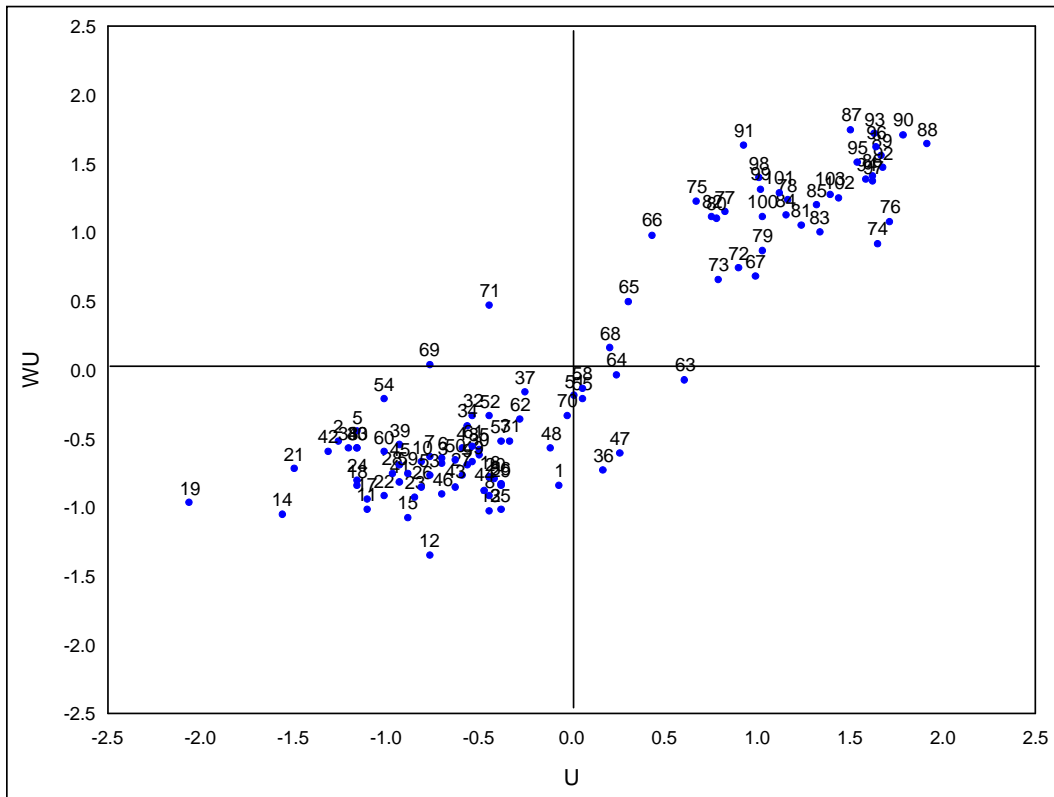

Figure 2. Moran scatter plot of U for 1998

Figure 3. Moran scatter plot of U for 2003

Table 1. Unemployment rate in Italy over time

	National Unemployment Rate	S.D	CV	Min	Max
1993	10.0	5.361	0.536	2.6	22.0
1998	11.4	7.598	0.669	2.1	33.2
2003	8.5	6.894	0.808	1.3	27.5

Table 2. Regression results

Variable	OLS		MLE		
	1998	2003	1998	2003	
	Col 1	Col 2	Col 3	Col 4	Col5
Constant	-2.2852	-2.1308	-1.4151	-1.2080	-1.0754
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0002)
WU	-	-	0.6248	0.6089	0.4496
			(0.0000)	(0.0000)	(0.0000)
EC_1	1.6050	0.4260	0.6721	-1.1060	-0.7659
	(0.0809)	(0.8710)	(0.3023)	(0.5520)	(0.6764)
EC_2	-2.2419	-2.7194	-2.4327	-1.7291	-2.2417
	(0.0983)	(0.0621)	(0.0109)	(0.0914)	(0.0277)
E_{agr}	0.0205	-0.0139	-0.0688	-0.0856	-0.0792
	(0.7426)	(0.8395)	(0.1216)	(0.0784)	(0.0990)
E_{man}	-1.0446	-1.2313	-0.5522	-0.6155	-0.5023
	(0.0000)	('0.0000)	(0.0000)	(0.0000)	(0.0003)
HOU	0.1513	-0.0116	0.1045	0.0158	-0.0237
	(0.1817)	(0.9254)	(0.1955)	(0.8581)	(0.7860)
FM	-1.0689	-1.5193	-0.4762	-0.6764	-0.6103
	(0.0017)	(0.0000)	(0.0521)	(0.0085)	(0.0172)
YO	0.3185	0.5557	0.0827	0.2387	0.3091
	(0.0525)	(0.0008)	(0.4794)	(0.0443)	(0.0094)
DEN	0.1036	-0.0691	0.0800	-0.0380	-0.0472
	(-0.1665)	(0.3669)	(0.1309)	(0.4824)	(0.3779)
WE_{man}	-	-	-	-	-0.2181
					(0.0023)
R^2	0.7103	0.7576	0.7919	0.8295	0.8537
LIK	-38.9945	-45.4710	-14.7479	-20.6721	-16.3125
AIC	95.9891	108.942	49.4958	61.3443	54.6251
Condition Number	29.2976	28.5232	-	-	-
LR Test-LAG	-	-	48.4932	49.5976	18.6263
			(0.0000)	(0.0000)	(0.0000)
LM-ERR	-	-	0.0056	4.3214	1.9321
			(0.9405)	(0.0376)	(0.1645)
Robust LM-LAG	21.0243	34.5178	-	-	-
	(0.0000)	(0.0000)			
Robust LM-ERR	0.3958	4.8713	-	-	-
	(0.5293)	(0.0273)			

Appendix: List of Provinces

Province	Province	Province	Province
1 Torino	27 Venezia	53 Arezzo	79 Foggia
2 Vercelli	28 Padova	54 Siena	80 Bari
3 Novara	29 Rovigo	55 Grosseto	81 Taranto
4 Cuneo	30 Udine	56 Prato	82 Brindisi
5 Asti	31 Gorizia	57 Perugia	83 Lecce
6 Alessandria	32 Trieste	58 Terni	84 Potenza
7 Biella	33 Pordenone	59 Pesaro e Urbino	85 Matera
8 Verbano-Cusio-Ossola	34 Imperia	60 Ancona	86 Cosenza
9 Aosta	35 Savona	61 Macerata	87 Catanzaro
10 Varese	36 Genova	62 Ascoli Piceno	88 Reggio Calabria
11 Como	37 La Spezia	63 Viterbo	89 Crotone
12 Sondrio	38 Piacenza	64 Rieti	90 Vibo Valentia
13 Milano	39 Parma	65 Roma	91 Trapani
14 Bergamo	40 Reggio Emilia	66 Latina	92 Palermo
15 Brescia	41 Modena	67 Frosinone	93 Messina
16 Pavia	42 Bologna	68 L'Aquila	94 Agrigento
17 Cremona	43 Ferrara	69 Teramo	95 Caltanissetta
18 Mantova	44 Ravenna	70 Pescara	96 Enna
19 Lecco	45 Forlì-Cesena	71 Chieti	97 Catania
20 Lodi	46 Rimini	72 Campobasso	98 Ragusa
21 Bolzano-Bozen	47 Massa Carrara	73 Isernia	99 Siracusa
22 Trento	48 Lucca	74 Caserta	100 Sassari
23 Verona	49 Pistoia	75 Benevento	101 Nuoro
24 Vicenza	50 Firenze	76 Napoli	102 Cagliari
25 Belluno	51 Livorno	77 Avellino	103 Oristano
26 Treviso	52 Pisa	78 Salerno	