A SECTORAL ANALYSIS OF SPATIAL REGIONAL EMPLOYMENT DYNAMICS OF TURKISH PROVINCES

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Abstract

This paper aims to analyze how the concentration of sectoral employment across Turkish provinces has changed between 1985 and 2000. First, a beta convergence analysis of the provincial employment rates for manufacturing, agriculture and services sectors are performed by employing a seemingly unrelated regression model (SUR). Then this model is extended in order to capture the spatial aspects of the employment dynamics, where spatial dependence is handled in alternative ways. In the second part of the paper, on the other hand, spatial variations in the relationships are examined with geographically weighted regression (GWR) to reveal some geographical variations in the results.

Keywords: Sectoral employment dynamics, spatial analysis, GWR, Turkey.

I. INTRODUCTION

The persistent disparities in aggregate growth and the large differences in wealth of Eastern and Western regions has been the main concern of the policy makers in Turkey. Even though the issue of regional differences and economic development of Turkish economy have been investigated, there is limited empirical evidence regarding the regional employment dynamics of Turkey. Empirical research on employment in Turkey mainly focuses on the effects of trade liberalization on labour participation (Boratav et al. (1994), Filiztekin (1999), Uygur (1996), Senses (1997)). Altiok (1998) examined the characteristic nature of growth and ongoing crisis in Turkish economy. Another strand of the employment studies examines the female labour force participation in Turkey (Tunali (1997), Özar and Senesen (1998) and Tansel (2002)).

Employment growth equations have generally been employed in order to investigate employment dynamics across economies or regions ignoring the spatial dimension of the issue. However, there are close economic links between the regions and/ or provinces leading to interdependencies between regional economies through the access to common markets.

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Moreover, these regions often have similar industrial composition and production technologies. Accordingly, employment in region/province may depend to some extent on continued employment in another region/province. Any possible shock that could affect one region/province may affect other regions/provinces that produce similar goods for the consumption at the common marketplace. Alternatively, a shock to a producer in one region/province may affect suppliers of intermediate goods in the neighboring area. Therefore, if there is substantial spatial correlations among regions, its ignorance may result in biased and inconsistent estimates of the employment dynamics. Thus, incorporating spatial effects into the analysis may impact significantly on any estimated convergence effects.[1]

This paper aims to analyze how the concentration of sectoral employment across 67 Turkish provinces[2] has changed between 1985 and 2000. In the first part of the paper a beta convergence analysis of the provincial employment rates for three sectors, namely manufacturing, agriculture and services, are performed by employing a seemingly unrelated regression model (SUR), where cross-sectoral employment interactions are allowed. Then this model is extended in order to capture the spatial aspects of the employment dynamics, where spatial dependence is handled in alternative ways. Thus both provincial and sectoral differences are tried to be captured by the model. In the second part of the paper, on the other hand, spatial variations in the relationships are examined with geographically weighted regression (GWR) to reveal some geographical variations in the results. This approach produces local parameter values for each region/province in the data set rather than simply estimating global coefficient values over the whole data set. The paper is organized as follows: Section 2 offers a brief overview of the labour market developments in Turkey in 1990s. Econometric methodology is summarized in Section 3. Section 4 presents the empicial results. Finally Section 5 concludes.

II. LABOUR MARKET DEVELOPMENTS IN TURKEY

Even though the Turkish population growth rate declined over the last decade, Turkey still has by far the highest average annual population growth rate among the OECD countries with a 1.5 per cent population growth rate in 2000. Even though the employment growth rates averaged only

[1] See for example, Glendon and Vigdor (2003), Desmet and Fafchamps (2004) for the importance of spatiality in employment dynamics.
[2] From 1990 onwards the number of provinces has been increased from 67 to 81. But the original 67 provinces have been included in our analysis, as the data relating to new provinces do not cover the time period under consideration

1.81 per cent in the time period 1990-2000, the working-age population (15 to 64) growth rate was even higher, 2.52 per cent.[3] In early 1970s Turkey had one of the highest employment rates among the OECD countries, whereas in 2000 the Turkish employment rate fell below 50 per cent and the lowest one among the OECD countries. The decline in employment rates indicates that a significant part of the Turkish labour supply resources are underutilized. The low participation and employment rates can be attributed not only to demographic problems and entry problems in the labour market but also to low growth rates, recession and structural shifts resulting in lay-offs and matching problems.

Until the 1980s, Turkey has implemented an import substitution policy for economic growth. From the early 1980s onwards there has been a change in the industrialisation strategy towards an export-led growth regime via an orthodox structural adjustment program , aiming the integration of the country into the global economy. Even though export growth increased in post-1980 period, there has been a decrease in the growth rate of employment compared with the import-substitution period, with a drastic decline in real wages.[4] Before 1980 both wages and employment generally moved together. However this parallel movement has been reversed after 1980s without any significant improvement in the employment growth. In order to justify the repression of wages, it was argued that greater openness would eventually lead to an increase in employment and real wages. However employment and real wage increases have never been achieved. With the liberalization of capital movements, government was able to increase its spending with help of foreign capital entries prior to 1989 elections. Thus after 1990, increases in real wages were recorded. Onaran (1999) argues that wage demands of the trade unions were found acceptable by the employers for two reasons: First, an increase in public spending indicated an increase in domestic demand. Second, there has been a decline in non-labour input costs due to the appreciation of the domestic currency so that wages could be increased without undermining profits. However, with the 1994 financial crisis exchange rate has depreciated sharply with large interest rate rises, reducing the real wage gains of post-1989 period.

Overall, the suppressed real wages and increased labour market flexibility have not encouraged high employment growth rates in the post-1980 period. Compared to the import-substitution

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[3] Various issues of OECD Employment Outlook and OECD Historical Statistics.

[4] See Onaran and Stockhammer (2005),Voyvoda and Yeldan (2001), Onaran (2000) andTaymaz (1999) for a review of labour market developments in Turkey.

period, a lower rate of growth in employment was recorded even though there has been an increase in export growth in post-1980 period. The poor employment creation capacity of the Turkish economy in a period of downward flexibility of real wages points to structural problems of the economy. The strategy of export promotion that is based on wage suppression has not been successful in stimulating new investments which may be due to the volatility of growth and, consequently, employment growth has been weak in the absence of industrial restructuring. Figure 1 and 2 which present the provincial employment levels in 1985 and 2000, respectively, suggest that welfare disparities between west and east Turkey, exhibit themselves in employment figures as well. Because, Western provinces have high employment levels compared to the Eastern provinces, both in 1985 and 2000.

Figure 1: Provincial Employment in 1985

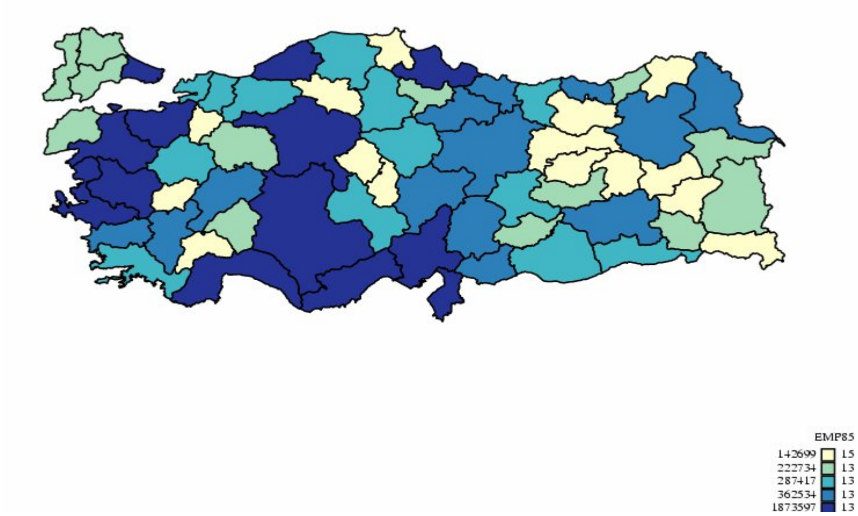
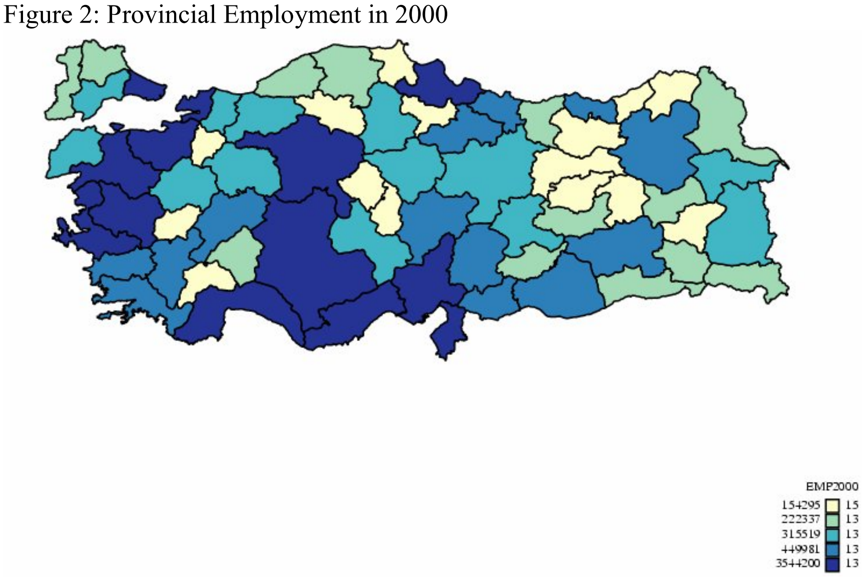


Figure 2: Provincial Employment in 2000



The poor employment creation capacity of Turkish economy may be responsible for almost stable sectoral employment shares for the time period under consideration. During that period total employment increased by 25 per cent, even though there has been a reduction in 1997. Traditionally, the bulk of Turkish population has been engaged in agricultural activities, which is reflected by a high agricultural employment share, around 53 per cent on average per annum for the time period under consideration. However, the share of agricultural employment decreased from 58 per cent in 1985 to 48 per cent in 2000. The other important sources of employment are manufacturing and community, social and personal services, 11.64 and 12.13 per cent on average per annum, respectively. There has been a considerable increase in the employment share of services sector from 6 per cent in 1985 to 17 per cent in 2000, whereas the employment shares of other sectors have remained steady. Thus, it can be argued that unemployed labour in the agricultural sector, might have found employment opportunities in the services sector. Moreover, it appears that agriculture still remains the most important source of employment and the large fluctuations point to its cushioning role for jobless workers, even though its share in total employment has decreased. Considering the extremely volatile economic growth, together with an unstable financial system this volatility impacts on expectations in terms of investment and employment, the dominance and relative stability in terms of employment in agriculture indicates that Turkey is still in a transition phase towards an industrial and service economy.

III. METHODOLGY

Spatial Analysis

Neoclassical theory claims that in a constant returns to scale framework without spatial externalities inter-regional mobility of capital and labour is expected to bring an even distribution of economic activity, and hence employment. The issue of employment dynamics at sub-national level has attracted a lot of attention in recent years. A large number of studies have been devoted to investigating the determinants of employment at different territorial levels especially for the European Union countries and for the USA. (Among others, see for example Marelli (2000, 2004), Boeri and Terrel (2002), Perugini and Signorelli (2004), Desmet and Fafchamps (2005, 2006)). Beta convergence analysis has generally been employed in order to investigate convergence across economies or regions using cross-sectional data, implementing the following equation:

$$\log\left(E_{it}/E_{i0}\right) = \alpha + \delta \log E_{i0} + u_i \qquad \textbf{(1)}$$

Where E_{it} denotes employment level at time t (=1, 2, …, N), E_{i0} denotes employment at some initial time 0; α is the intercept term, which may incorporate any rate of technological progress; u is random error term distributed iid($0,\sigma^2$), which may represent random shocks to technology or tastes. A negative value of δ signifies the beta convergence and convergence rate is calculated using the following formula[5]:

$$\beta = -[\ln[1-\delta]]/N$$

However, this approach assumes that all regions or economies under consideration have the same steady state income path. But this is a highly restrictive assumption and may induce significant heterogeneity bias in estimates of convergence coefficient.

In empirical literature two alternative approaches have been introduced to correct the heterogeneity bias associated with the traditional cross-section analysis. The first is to employ time series analysis to investigate the rates of convergence by looking for common stochastic trends in the individual regional time series data. But this approach is applicable only if long time series data is available at the regional level as well as national level. Alternatively, control variables that can proxy or capture the differences in the paths of steady state incomes of regions, such as rates of accumulation of physical capital, net migration rates, differences in industrial structure, can be included in the traditional cross-section estimates. However, to obtain long time series data as well as reliable proxy data is a difficult task especially for a developing country such as Turkey.

Another dimension of the convergence analysis is that the regional employment growth may follow a spatial pattern. It is important to investigate the spatial patterns that may indicate the spillover effects among regions. Even though the neoclassical model assumes perfect mobility of factors of production between economies, there may be significant adjustment costs or barriers to mobility for labour and possibly for capital. In cases where regions produce similar goods for consumption in the global market, when the demand for the certain product changes, employment changes tend to occur in several neigbouring regions. Alternatively, a shock to a producer in one region may affect suppliers of intermediate goods in the surrounding regions. (Glendon and Vigdor (2003)). Moreover, when regions pursue their own growth promoting policies, there may be spillover effects from that regions to the adjacent regions which may affect employment. Cheshire and Gordon (1998) points that economic rents from research and development and other

5 See for example Salai-Martin (1996) for a detailed description of estimation methods.

sources may more likely to accrue locally, where regions are more self-contained. Moreover, Fagerberg *et al*. (1996) claim that rates of technological diffusion may follow a spatial pattern as regions may have different capacities to create or absorb new technologies. Thus, incorporating spatial effects into the analysis may impact significantly on any estimated convergence effects.

Spatial dependence can be handled in beta convergence in alternative ways:[6] The first approach, spatial error model, assumes that the spatial dependence operates through the error process, where any random shock follow a spatial pattern, so that shocks are correlated across adjacent regional economies, such that the error term in equation (1) may reveal a significant degree of spatial covariance, which can be represented as follows:

$$\log(E_{it}/E_{i0}) = \alpha + \delta \log E_{i0} + u_i$$

$$u_i = \rho W u_i + \varepsilon_i \qquad \textbf{(2)}$$

where ρ is the spatial error coefficient, ε_i is a white noise error component and *W* is a spatial weighting matrix. *W* may be constructed using information on physical distance between pairwise combinations of economies in the sample or may be defined such that element $w_{ij} = 1$ if *i* and *j* are physically adjacent and 0 otherwise.

Alternatively, spatial lag model examines the extent to which regional growth rates depend on the growth rates of adjacent regions, conditioning on the level of initial income:

$$\log(E_{it}/E_{i0}) = \alpha + \delta \log E_{i0} + \rho W \log(E_{it}/E_{i0}) + u_i \qquad \textbf{(3)}$$

where *ρ* denotes the spatial autoregressive parameter.

Moreover, the spatial cross-regressive model allows any spatial spillovers to be reflected in the initial levels of income as follows:

$$\log(E_{it}/E_{i0}) = \alpha + \delta \log E_{i0} + \tau W \log E_{i0} + u_i \qquad \textbf{(4)}$$

where τ represents the spatial spillovers.

Geographically Weighted Regression

Another way to investigate the spatial dependence in coefficient estimates across study areas composed of regions and/or provinces is to estimate a geographically weighted regression (GWR) model. This approach produces local parameter values for each region/province in the data set rather than simply estimating global coefficient values over the whole data set.

6 For a detailed analysis of spatial econometric techniques and methods please see Anselin (1988) and Henley (2003).

An ordinary linear regression model can be expressed as

$$Y_i = \alpha_0 + \sum_{k=1}^{p} \alpha_k X_{ik} + \varepsilon_i \,, \qquad i=1,...,n. \tag{5}$$

Where the dependent variable Y is represented as a linear combination of explanatory variables X_k , k=1,…,p; and ε_i are independent normally distributed error terms with zero mean and constant variance. Usually the ordinary least squares (OLS) method is employed to estimate the regression parameters, which can be expressed in the matrix form as follows:

$$\hat{\alpha} = \left(X^T X\right)^{-1} X^T Y$$

Even though the parameters in equation (5) are assumed to be same across the study area, this may not be true as different locations may have different parameters. GWR, on the other hand, extends the OLS regression model in equation (5) by assigning weights to observations which are functions of the distance between the region for which the coefficient estimates are required and all other regions. Thus the parameter estimates become specific to location i (Fotheringham et al. 1997b). The GWR model can be expressed as

$$Y_i = \alpha_{i0} + \sum_{k=1}^{p} \alpha_{ik} X_{ik} + \varepsilon_i \tag{6}$$

Then the parameter vector at location i is estimated as :

$$\hat{\alpha}_i = \left(X^T W_i X\right)^{-1} X^T W_i Y \,, \qquad i=1,\dots,n.$$

Where W_i is an n-by-n local spatial weights matrix, whose off-diagonal elements are zero and whose diagonal elements are the weights of each observation. In estimating the parameters in the GWR equation, it is important to choose a criterion to decide on the weighting matrix, which will represent the importance of each observation among locations. A common way to choose a weighting matrix at location i is to exclude observations that are further than a specified distance. This is equivalent to setting a zero weight on observation j if the distance from i to j is greater than a threshold distance d,

$W_{ij}=1$ if $d_{ij} \leq d$,

$W_{ij}=0$ if $d_{ij} > d$,

For i,j=1,…,n.

In order to overcome the discontinuity problem that the above equation exhibits, Fotheringham et al. (1997a, b) specify W_{ij} as a continuous and decreasing function of d_{ij}. The most commonly used weighting function is the Gausian function:

$$W_{ij} = \exp(\eta d_{ij}^2), \qquad i=1,\ldots,n.$$

Where η is a nonnegative distance decay parameter.

IV. EMPIRICAL RESULTS

In this section sectoral employment dynamics have been considered for three sectors, namely agriculture, manufacturing and services sectors. However, rather than estimating a single employment dynamics equation for each sector, a system estimation approach, seemingly unrelated regression (SUR), is preferred in the belief that error terms might be correlated across equations due to the omission of variables. Moreover, SUR[7] provides parameter estimates that are asymptotically more efficient than ordinary least squares estimates because of the correlation between contemporaneous disturbances across equations. Accordingly, a three equation system is estimated by SUR corresponding to each of the equations (1), (2), (3) and (4), the first of which could be expressed as follows:

$$\begin{aligned}
\log(EAGR_{it}/EAGR_{t0}) &= \alpha + \delta_{11}\log EAGR_{i0} + u_{1i} \\
\log(EMAN_{it}/EMAN_{t0}) &= \alpha + \delta_{21}\log MAN_{i0} + u_{2i} \\
\log(ESER_{it}/ESER_{t0}) &= \alpha + \delta_{31}\log ESER_{i0} + u_{3i}
\end{aligned} \qquad \textbf{(7)}$$

Where EAGR, EMAN and ESER denote employment in agricultural, manifacturing and services sectors, respectively. Moreover, in order to capture any interaction effect among the sectors considered here, an alternative model has also been considered for each of the specifications, the one corresponding to equation (1) can be expressed as follows:

$$\begin{aligned}
\log(EAGR_{it}/EAGR_{t0}) &= \alpha + \delta_{11}\log EAGR_{i0} + \delta_{12}\log EMAN_{i0} + \delta_{13}\log ESER_{i0} + u_{1i} \\
\log(EMAN_{it}/EMAN_{t0}) &= \alpha + \delta_{21}\log EAGR_{i0} + \delta_{22}\log EMAN_{i0} + \delta_{23}\log ESER_{i0} + u_{2i} \\
\log(ESER_{it}/ESER_{t0}) &= \alpha + \delta_{31}\log EAGR_{i0} + \delta_{32}\log EMAN_{i0} + \delta_{33}\log ESER_{i0} + u_{3i}
\end{aligned} \qquad \textbf{(8)}$$

Where changes in employment dynamics in each sector are conditioned not only on that sector's initial employment level, but also on other sectors' initial employment levels. In order to capture the effects of labour policy changes on the employment dynamics, these systems of equations are estimated for two periods: for 1985-2000 and 1990-2000. Estimation results are presented in Tables 1 to 6, where $\overline{R}^2$ is the adjusted coefficient of determination, AIC is the Akaike

[7] See Zellner (1962).

Information Criterion, Schwartz is the Schwartz Criterion and β is the corresponding convergence rate.

It appears from Tables 1 and 2, where employment dynamics equations for agricultural sector for time periods 1985-2000 and 1990-2000, respectively, are presented, that spatial error model with sectoral interaction terms has been chosen by the model selection criteria for both time periods. Even though a divergent trend is implied by the base model, when sectoal interactions are taken into account a convergent trend is observed. For both models spatial error term is statistically significant, implying that the traditional beta convergence model is misspecified. When the sectoral interactions are considered, it emerges that services sector employment in 1985 has a positive effect on agricultural employment changes for the period 1985-2000, whereas, employment in manufactring sector contributed to the employment rate improvements in the period 1990-2000.

Employment dynamics equations estimates for the manufacturing sector are presented in Tables 2 and 3. Model selection criteria indicated the selection of the spatial error model. Even though employment in services sector has a statistically significant positive effect on the improvement of employment rates of manufacturing sector, it appears that sectoral interaction does not contribute to the determination of the manufactural employment rate, for 1985-2000 period. However, for 1990-2000 period, the model selection criteria indicates that sectoral interactions play a role in determing the manufactural employment dynamics, even though interaction terms are statistcally insignificant. For both periods, there is a convergent trend in manufacturing employment rate, in spite of a marginally significant beta convergent coefficient for the spatial error model for 1990-2000.

Even though the models without the interaction terms indicate convergence for 1985-2000 period for services sector employment rates, interaction models indicates a divergent trend (Tables 5 and 6). Model selection criteria choose spatial error model with sectoral interaction terms where negative effects from the base year agricultural and manufacturing employment levels are observed. Similarly spatial error model with interaction terms is choosen by the model selection criteria, which indicates a divergent trend 1990-2000 period employment dynamics. But in this model a positive effect from the base year agricultural employment level and a negative effect from the base year manufacturing employment level is observed.

Table 1: Beta Convergence of Provincial Agricultural Employment Rates (1985-2000)

	OLS		SPATIAL ERROR		SPATIAL LAG		SPATIAL CROSS REGRESSIVE	
	Base	Interaction	Base	Interaction	Base	Interaction	Base	Interaction
Constant	0.999* (0.000)	1.125* (0.000)	1.067* (0.000)	1.154* (0.000)	0.989* (0.000)	1.147* (0.000)	0.988* (0.000)	1.149* (0.000)
$Logeagr_0$	0.0009 (0.994)	-0.067* (0.000)	-0.012 (0.25)	-0.067* (0.000)	0.001 (0.920)	-0.075* (0.000)	0.002 (0.870)	-0.075* (0.000)
$Logeman_0$		-0.026*** (0.010)		-0.018 (0.159)		-0.026*** (0.09)		-0.026*** (0.096)
$Logeserv_0$		0.0822* (0.000)		0.067* (0.000)		0.084* (0.000)		0.084* (0.000)
ρ			0.224* (0.000)	0.221* (0.000)	0.0003 (0.887)	0.002 (0.266)		
τ							-0.00008 (0.843)	0.0003 (0.301)
$\overline{R}^2$	0.07	0.41	0.48	0.60	0.09	0.29	0.09	0.43
AIC	78.52	-86.26	-92.91	-95.12	-76.48	-84.26	-76.55	-84.49
Schwartz	-78.86	-86.95	-93.43	-95.99	-77.00	-85.13	-77.08	-85.36
β	- 0.0001	0.0041	0.0007	0.0041	- 0.0001	0.0045	-0.0001	0.0045
Values in parentheses are the p - values and (*), (**), (***) denote significance at 1%, 5% and 10% respectively.								

Table 2: Beta Convergence of Provincial Agricultural Employment Rates (1990-2000)

	OLS		SPATIAL ERROR		SPATIAL LAG		SPATIAL CROSS REGRESSIVE	
	Base	Interaction	Base	Interaction	Base	Interaction	Base	Interaction
Constant	-0.353 (0.285)	-0.181 (0.549)	-0.115 (0.611)	-0.040 (0.860)	-0.083 (0.736)	-0.074 (0.758)	-0.319 (0.361)	-0.110 (0.717)
$Logeagr_0$	0.063 (0.314)	-0.124*** (0.070)	0.017 (0.685)	-0.116** (0.027)	0.017 (0.717)	-0.0419 (0.458)	0.053 (0.437)	-0.159** (0.031)
$Logeman_0$		0.108*** (0.010)		0.160* (0.000)		0.0370 (0.333)		0.110* (0.015)
$Logeserv_0$		0.077 (0.341)		-0.013 (0.827)		0.031 (0.635)		0.088 (0.275)
ρ			0.276* (0.000)	0.258* (0.000)	0.268* (0.000)	0.239* (0.000)		
τ							0.0006 (0.699)	0.0018 (0.218)
$\overline{R}^2$	0.08	0.36	0.57	0.64	0.48	0.60	0.015	0.39
AIC	6.775	-2.417	-12.54	-16.13	-10.82	-13.84	8.708	-0.996
Schwartz	6.079	-3.112	-13.41	-17.00	-11.69	-14.71	7.839	-1.865
β	- 0.0059	0.0106	- 0.0016	0.0100	- 0.0016	0.0037	-0.0050	0.0134
Values in parentheses are the p - values and (*), (**), (***) denote significance at 1%, 5% and 10% respectively.								

Table 3: Beta Convergence of Provincial Manufactural Employment Rates (1985-2000)

	OLS		SPATIAL ERROR		SPATIAL LAG		SPATIAL CROSS REGRESSIVE	
	Base	Interaction	Base	Interaction	Base	Interaction	Base	Interaction
Constant	1.082* (0.000)	1.185* (0.000)	1.117* (0.000)	1.156* (0.000)	1.066* (0.000)	1.224* (0.000)	1.075* (0.000)	1.236* (0.000)
$Logeagr_0$		-0.054*** (0.069)		-0.029 (0.172)		-0.069** (0.031)		-0.070** (0.029)
$Logeman_0$	-0.014 (0.112)	-0.069* (0.000)	-0.022* (0.000)	-0.086* (0.000)	-0.014*** (0.010)	-0.068* (0.010)	-0.015*** (0.098)	-0.074* (0.006)
$Logeserv_0$		0.101* (0.008)		0.094* (0.000)		0.104* (0.006)		0.108* (0.004)
ρ			0.246* (0.000)	0.243* (0.000)	0.002 (0.355)	0.003 (0.227)		
τ							0.0004 (0.529)	0.0009 (0.213)
$\overline{R}^2$	0.06	0.20	0.56	0.59	0.09	0.24	0.09	0.24
AIC	-55.690	-55.032	-75.220	-72.005	-53.751	-53.442	-53.822	-53.642
Schwartz	-56.038	-55.7278	-75.742	-72.875	-54.272	-54.312	-54.344	-54.511
B	0.0009	0.0042	0.0014	0.0052	0.0009	0.0041	0.0009	0.0045
Values in parentheses are the p - values and (*), (**), (***) denote significance at 1%, 5% and 10% respectively.								

Table 4: Beta Convergence of Provincial Manufactural Employment Rates (1990-2000)

	OLS		SPATIAL ERROR		SPATIAL LAG		SPATIAL CROSS REGRESSIVE	
	Base	Interaction	Base	Interaction	Base	Interaction	Base	Interaction
Constant	-0.551* (0.000)	-0.402 (0.302)	-0.373* (0.000)	-0.648** (0.025)	-0.133 (0.259)	-0.544*** (0.074)	-0.585* (0.000)	-0.324 (0.412)
$Logeagr_0$		-0.061 (0.491)		0.0066 (0.920)		0.025 (0.716)		-0.096 (0.310)
$Logeman_0$	0.127* (0.000)	0.118** (0.045)	0.084* (0.000)	0.069 (0.116)	0.030 (0.267)	-0.025 (0.610)	0.118* (0.000)	0.110*** (0.063)
$Logeserv_0$		0.045 (0.666)		0.066 (0.393)		0.114 (0.165)		0.062 (0.552)
ρ			0.238* (0.000)	0.243* (0.000)	0.180* (0.000)	0.191* (0.000)		
τ							0.003 (0.187)	0.0025 (0.300)
$\overline{R}^2$	0.25	0.29	0.57	0.62	0.52	0.58	0.18	0.32
AIC	12.624	12.393	-1.206	-3.008	2.332	-0.065	13.832	14.007
Schwartz	11.929	11.698	-2.076	-3.877	1.462	-0.935	12.962	13.138
B	-0.0123	-0.0114	-0.0073	-0.0065	-0.0028	0.0022	-0.0114	-0.0106
Values in parentheses are the p - values and (*), (**), (***) denote significance at 1%, 5% and 10% respectively.								

Table 5: Beta Convergence of Provincial Service Sector Employment Rates (1985-2000)

	OLS		SPATIAL ERROR		SPATIAL LAG		SPATIAL CROSS REGRESSIVE	
	Base	Interaction	Base	Interaction	Base	Interaction	Base	Interaction
Constant	1.708* (0.000)	1.981* (0.000)	1.617* (0.000)	1.874* (0.000)	1.695* (0.000)	2.005* (0.000)	1.710* (0.000)	1.998* (0.000)
$Logeagr_0$		-0.110* (0.000)		-0.080* (0.000)		-0.120* (0.000)		-0.115* (0.000)
$Logeman_0$		-0.159* (0.000)		-0.142* (0.000)		-0.157* (0.000)		-0.159* (0.000)
$Logeserv_0$	- 0.136* (0.000)	0.100* (0.000)	- 0.113* (0.000)	0.071** (0.02)	- 0.136* (0.000)	0.102* (0.000)	-0.134* (0.000)	0.102* (0.007)
ρ			0.257* (0.000)	0.287* (0.000)	0.001 (0.567)	0.0023 (0.398)		
τ							-0.0004 (0.631)	0.0003 (0.674)
$\overline{R}^2$	0.54	0.72	0.77	0.81	0.55	0.73	0.55	0.73
AIC	-83.03	-55.56	-64.26	-64.31	-43.99	-53.68	-44.75	-53.62
Schwartz	-83.38	-56.26	-64.78	-65.18	-44.52	-54.55	-44.75	-54.49
β	0.0080	-0.0066	0.0067	-0.0046	0.0080	-0.0067	0.0079	-0.0067
Values in parentheses are the p - values and (*), (**), (***) denote significance at 1%, 5% and 10% respectively.								

Table 6: Beta Convergence of Provincial Service Sector Employment Rates (1990-2000)

	OLS		SPATIAL ERROR		SPATIAL LAG		SPATIAL CROSS REGRESSIVE	
	Base	Interaction	Base	Interaction	Base	Interaction	Base	Interaction
Constant	-0.026 (0.896)	-0.355 (0.283)	-0.051 (0.757)	-0.387 (0.176)	-0.022 (0.902)	-0.266 (0.384)	-0.084 (0.695)	-0.318 (0.342)
$Logeagr_0$		0.022 (0.762)		0.062 (0.342)		0.001 (0.983)		0.0061 (0.939)
$Logeman_0$		-0.102** (0.041)		-0.077*** (0.077)		-0.064 (0.177)		-0.102** (0.041)
$Logeserv_0$	0.033 (0.448)	0.176** (0.048)	0.038 (0.290)	0.113 (0.146)	0.017 (0.674)	0.129 (0.120)	0.039 (0.416)	0.181** (0.042)
ρ			0.236* (0.000)	0.239* (0.000)	0.102* (0.000)	0.100* (0.000)		
τ							0.0013 (0.705)	0.0011 (0.547)
$\overline{R}^2$	0.08	0.18	0.36	0.40	0.26	0.32	0.02	0.20
AIC	4.618	2.787	-3.271	-3.524	1.161	0.259	6.395	4.710
Schwartz	3.922	2.092	-4.141	-4.393	0.291	-0.610	5.526	3.841
β	- 0.0031	-0.0176	- 0.0035	-0.0109	- 0.0016	-0.0126	-0.0036	-0.0182
Values in parentheses are the p - values and (*), (**), (***) denote significance at 1%, 5% and 10% respectively.								

Overall, beta convergence is apperant in agricultural employment dynamics for both 1985-2000 and 1990-2000 periods. Whereas a divergent trend is observed for the employment dynamics in the services sector for both periods. For manufacturing sector employment rates, on the other hand, a convergent trend is observed for 1985-2000 period, in contrast to a divergent trend for 1990-2000 period. Moreover, model selection criteria indicates the selection of spatial error model for all regression, suggesting the misspecification of the traditional beta convergence models. Additionally, sectoral interactions in employment dynamics equations are found to be significant in affecting the sectoral employment performance, with the exception of manufacturing employment for 1985-2000 period.

Next, GWR analysis is performed in order to explore further the sectoral employment dynamics. Tables 7 and 8 provide the summary statistics for models estimated by employing GWR, for time period 1985-2000 and 1990-2000, respectively. In Tables 7 and 8, F denotes the test statistics from the ANOVA analysis which tests the null hypotesis of no improvement by GWR estimation over the global OLS. It appears from Tables 7 and 8 that, GWR model has significant improvement over the global OLS model for all models. Additionally, model selection criteria indicates the selection of interaction models for all models except, manufacturing employment equation for 1985-2000 period and services employment equation for 1990-2000 period. Rather than providing the parameter estimates, the density functions of beta coefficients are presented for the selected models for each sector, in Figures 3 to 8. When the density plots of the convergence rates are examined, it appears that clustering of employment is more apparent in 1985-2000 period compared to 1990-2000 period, suggesting an improvement in the structural instability of the employment dynamics.

Table 7: Summary Statistics for GWR Estimates

	1985-2000 Period		1990-2000 Period	
	Base Model	Interaction Model	Base Model	Interaction Model
Agriculture	AIC=-231.72	AIC= -295.92	AIC=-75.12	AIC=-102.71
	$\bar{R}^2$=0.25	$\bar{R}^2$=0.31	$\bar{R}^2$=0.46	$\bar{R}^2$=0.26
	F=3.50	F =1.86	F=3.48	F =1.82 F_3
Manufacturing	AIC=-245.53	AIC=-225.72	AIC=-74.76	AIC=-68.37
	$\bar{R}^2$=0.44	$\bar{R}^2$=0.55	$\bar{R}^2$=0.19	$\bar{R}^2$=0.17
	F=5.63	F=5.03	F=2.35	F=1.75
Services	AIC=-239.41	AIC=-249.59	AIC=-92.91	AIC=-89.96
	$\bar{R}^2$=0.68	$\bar{R}^2$=0.86	$\bar{R}^2$=0.014	$\bar{R}^2$=0.042
	F=14.49	F=6.11	F=2.16	F=1.60

Figure 3: Density Plots of Log EAGR parameter for Agricultural Employment GWR Model 1985-2000

Base Model | Interaction Model

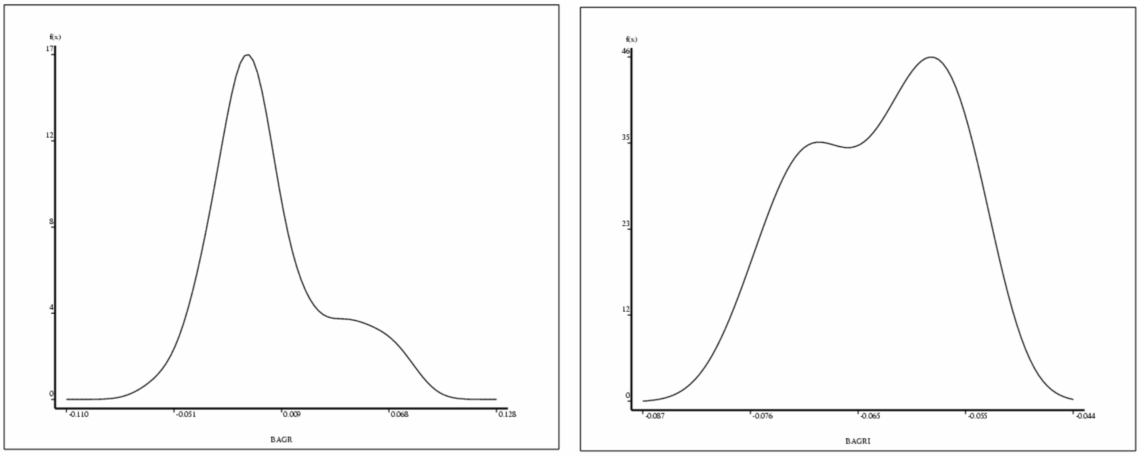


Figure 4: Density Plots of LogEMAN parameter for Manufacturing Employment GWR Model 1985-2000

Base Model | Interaction Model

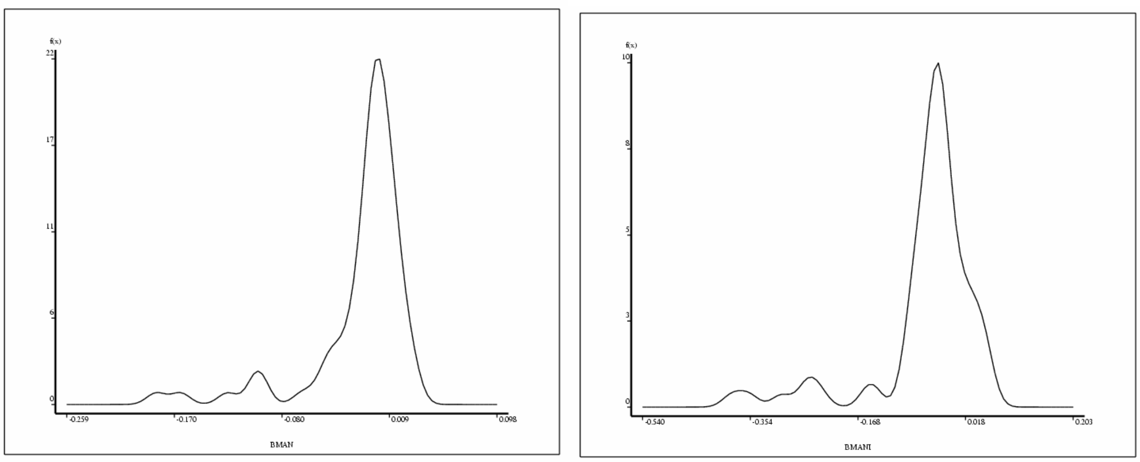


Figure 5: Density Plots of LogESER parameter for Services Employment GWR Model 1985-2000

Base Model | Interaction Model

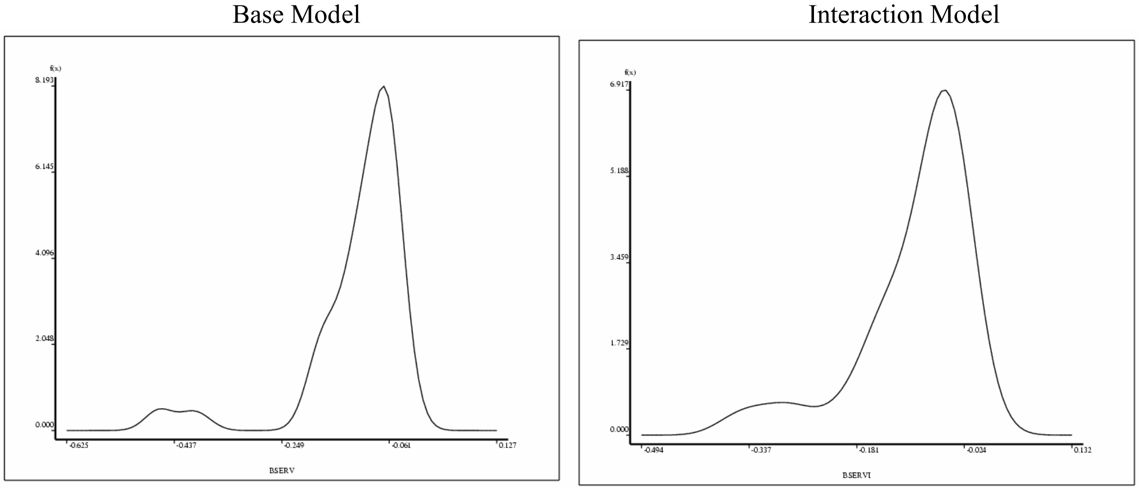
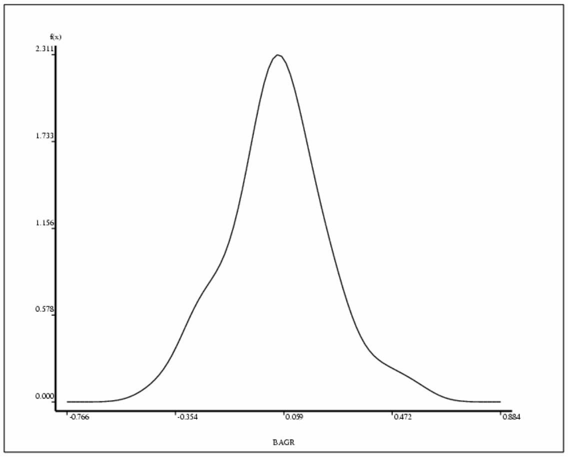


Figure 6: Density Plots of Log EAGR parameter for Agricultural Employment GWR Model 1990-2000

Base Model | Interaction Model



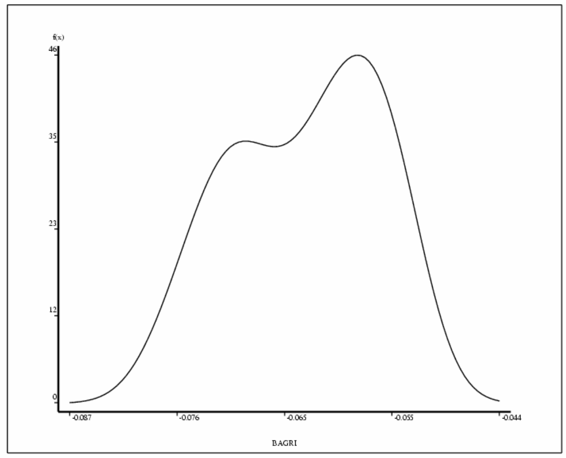
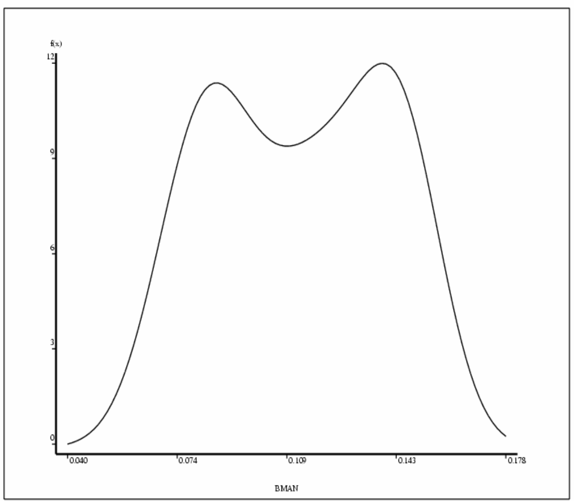


Figure 7: Density Plots of LogEMAN parameter for Manufacturing Employment GWR Model 1990-2000

Base Model | Interaction Model



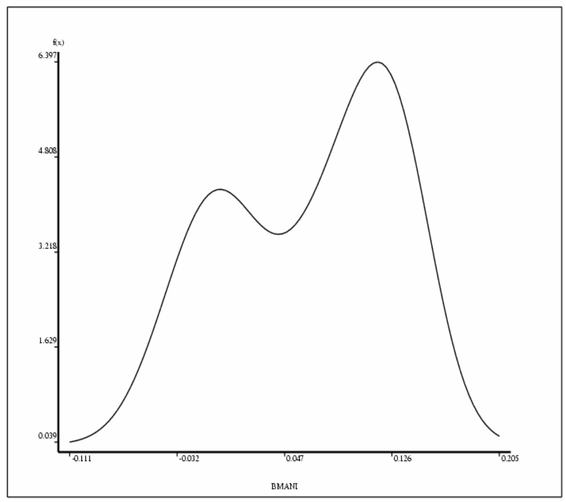
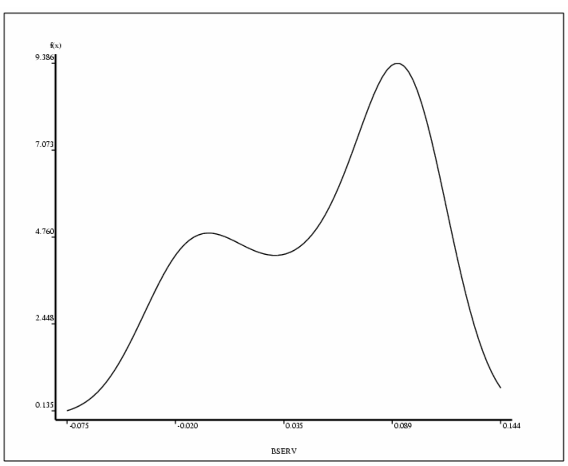


Figure 8: Density Plots of LogESER parameter for Services Employment GWR Model 1990-2000

Base Model | Interaction Model



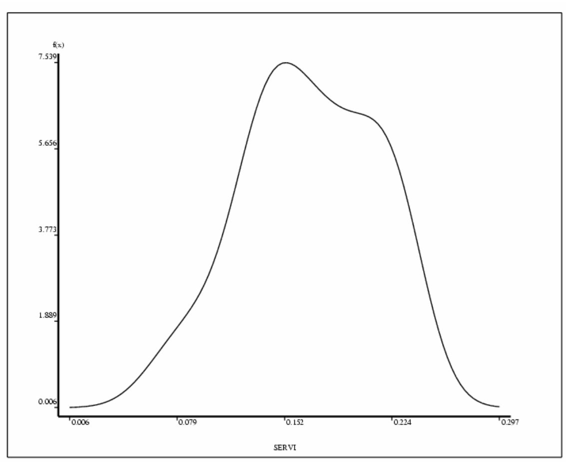


Figure 9: Spatial Distribution of the Convergence Parameter for Agricultural Employment

1985-2000 1990-2000

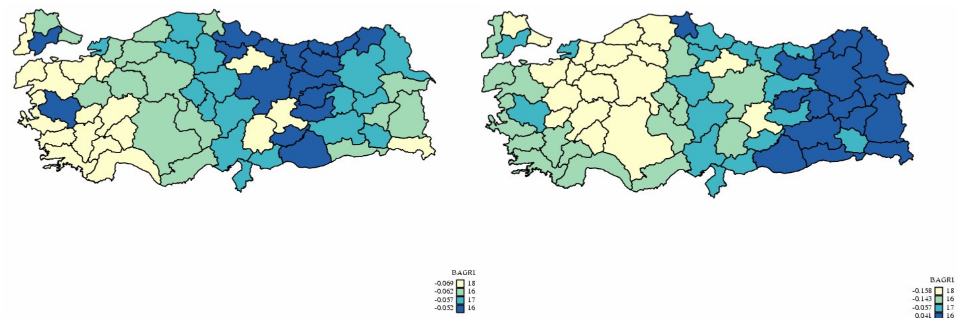


Figure 10: Spatial Distribution of the Convergence Parameter for Manufacturing Employment

1985-2000 1990-2000

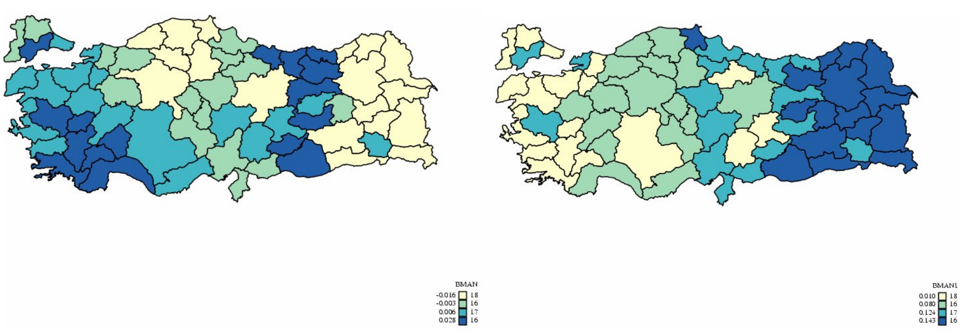
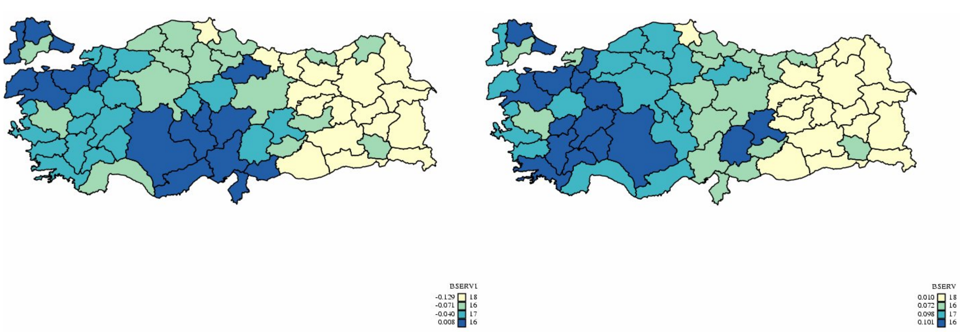


Figure 11: Spatial Distribution of the Convergence Parameter for Service Sector Employment

1985-2000 1990-2000



Moreover, mappings of GWR parameter estimates of the models confirm the belief that structural differences between the provinces are sustained. The banded East-West pattern is even more pronounced in the mapped values of estimates for 1990-2000 period. When employment in agricultural sector is concerned, it appears that Eastern and Southeastern provinces have comparatively lower speeds of convergence, compared to Western provinces for both time periods. This could be due to the fact that harsh weather conditions, lack of arable land in these provinces may limit employment opportunities in the agricultural sector. Whereas for sevice sector employment the reverse situation prevails. Considering limited employment opportunities in agricultural and manufacturing sectors in East and Southeast Turkey, employment in services sector present itself as a natural solution. Turkish government implements development plans for these provinces based on private investment incentives and government investment expenditures to promote and enhance productive private investment and employment along with an increase in productivity. One of the components of the development plans has been high wages for public employees, which might have contributed to the service sector employment increases. For manufacturing sector employment, on the other hand, Eastern provinces have higher speeds of convergence in 1985-2000 period, but lower speeds of convergence for 1990-2000 period, compared to Western provinces. This difference in the manufacturing sector employment dynamics can be attributed to the relative success of development plans which appear to reduce the gap in manufactiuring employment levels between Eastern and Western Turkey.[8]

V. CONCLUSION

The aim of this study is to examine how the concentration of sectoral employment across Turkish provinces has changed between 1985 and 2000. First, a beta convergence analysis of the provincial employment rates for three sectors. Then this model is extended in order to capture the spatial aspects of the employment dynamics, where spatial dependence is handled in alternative ways. Thus both provincial and sectoral differences are tried to be captured by the model. Even though beta convergence (divergent) trend is apperant in agricultural (services sector) employment for both 1985-2000 and 1990-2000 periods, mixed results are obtained for manufacturing sector employment. Moreover, model selection criteria indicates the selection of spatial error model for all regression, suggesting the misspecification of the traditional beta convergence models. Additionally, sectoral interactions in employment dynamics equations are found to be significant in affecting the sectoral employment performance, with the exception of manufacturing employment for 1985-2000 period.

In the second part of the paper, on the other hand, spatial variations in the relationships are examined with geographically weighted regression (GWR). Empirical findings indicate that GWR models have significant improvements over the global OLS model for all models. Moreover, mappings of GWR parameter estimates of the models confirm the belief that structural differences between the provinces are sustained.

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[8] For an analysis of regional policy effects on economic convergence in Turkey, please see Yildirim (2005).

References

Altiok M. 1998. 1980 sonrasi Turkiye'de sermaye birikimi ve kriz. *METU Studies in Development* **25(2)**: 245- 276.

Anselin L. 1988. *Spatial Econometrics: Methods and Models.* Dordrecht: Kluwer.

Boeri T, Terrel K. 2002. Institutional determinants of labor reallocation in transition. *Journal of Economic Perspectives* **16:** 51-76

Boratav K, Türel O, Yeldan E. 1994. Distributional dynamics in Turkey under structural adjustment of the 1980's. *New Perspectives on Turkey* **11**: 43-69.

Cheshire PC, Gordon I.R. 1998. Territorial competition: some lessons for policy. *The Annals of Regional Science* **32:** 321-346.

Crandall MS, Weber BA. 2004. Trickling Down: Does Local job Growth Reduce Poverty?. Mimeo: Oregon State University.

Desmet K, Fafchamps M. 2005. Changes in the spatial concentration of employment across U.S. counties: A sectoral analysis 1972-2000. *Journal of Economic Geography* **5**: 261-84.

Desmet K, Fafchamps M. 2006. Employment concentration across U.S. counties. *Regional Science and Urban Economics*: forthcoming.

Fagerberg J, Verspagen B, Marjolein C. 1996. Technology, growth and unemployment across European regions. *Regional Studies* **31:** 457-466.

Filiztekin A. 1999. Growth and dynamics of productivity in Turkish manufacturing. Mimeo: Koc University.

Fotheringham AS, Charlton ME, Brunsdon C. 1997a. Two techniques for exploring nonstationarity in geographical data. *Geographical Systems* **4**: 59-82.

Fotheringham AS, Charlton ME, Brunsdon C. 1997b. Measuring spatial variations in relationships with geographically weighted regression. in *Recent Developments in Spatial Analysis*, Fisher M M, Getis A (eds). Springer: Berlin, Heidelberg, New York: 60-85.

Glendon PS, Vigdor JL. 2003. Thy neighbor's job: geography and labour market dynamics. *Regional Science ans Urban Economics* **33**: 663-693.

Henley A. 2003. On regional growth convergence in Great Britain. *The University of Wales Research Paper*: 2003-3.

Marelli E. 2000. Convergence and asymmetries in the dynamics of employment: the case of European regions. *Jahrbuch fur Regionalwissenschaft/Rev. Reg. Res*: 20.

Marelli E. 2004. Evolution of employment structures and regional specialization in the EU. *Economic Systems* : 28.

Perugini C, Signorelli M. 2004. Employment performance and convergence in the European countries and regions. *The European Journal of Comparative Economics* **1(2)**: 243-278.

OECD Employment Outlook: Various Issues.

OECD Historical Statistics: Various Issues.

Onaran Ö, Stockhammer E. 2005. Two different export-oriented growth strategies: distribution and accumulation a la Turca and a la South Korea. *Emerging Markets Finance and Trade* **41(1)**: 65-89.

Onaran Ö. 2000. Labor market flexibility during structural adjustment in Turkey. *ITU Discussion papers in Management Engineering*,: 00/1.

Onaran Ö. 1999. The wage setting mechanism in private manufacturing industry and its effect on the flexibility of the labor market in Turkey. *ITU Discussion papers in Management Engineering:* 99/5.

Özar S, Günlük-Senesen G. 1998. Determinants of female (non) participation in the urban labor force in Turkey. *METU Studies in Development* **25(2)**: 311-328.

Salai-Martin X. 1996. Regional cohesion: Evidence and theories of regional growth and convergence. *European Economic Review* **40:**1325-1352.

State Institute of Statistics of Turkey. Yearbooks: Various Issues.

Şenses F. 1997. Structural adjustment policies and employment in Turkey. *New Perspectives on Turkey* **15**: 65-93.

Tansel A. 2002. Economic development and female labor force participation in Turkey: time-series evidence and cross-province estimates. Middle East Technical University, ERC Working Papers in Economics: 01/05.

Taymaz E. 1999. Trade liberalization and employment generation: the experience of Turkey in the 1980s", in *Turkey: Economic Reforms, Living Standards, and Social Welfare Study*, Ana Revenga (ed):Vol II Technical Papers, Washington, D.C.: World Bank.

Tunali I. 1997. To work or not to work: an examination of female labor force participation rates in urban Turkey. Mimeo: Koç University.

Uygur E. 1996. Export policies and export performance: the case of Turkey. Mimeo: Ankara University.

Voyvoda E, Yeldan E. 2001. Patterns of productivity growth and the wage cycle in Turkish manufacturing. *International Review of Applied Economics* 15(4): 375-396.

Yildirim J. 2005. Regional Policy and Economic Convergence in Turkey: A Spatial Data Analysis. 18th European Advanced Studies Institute in Regional Science, Lodz-Krakow-Poland., 1-10 July 2005.

Zellner A. 1962. An Efficient Method of Estimating Seemingly Unrelated Regressions

and Tests for Aggregation Bias. *Journal of American Statistical Association* 57(298): 348–368.