

**SPATIAL DETERMINANTS OF REGIONAL PRODUCTIVITY IN
TURKISH MANUFACTURING INDUSTRY: AN ANALYSIS FOR THE REGIONS OF
TURKEY**

-ABSTRACT-

Pınar Falcıoğlu, Phd

Işık University

Faculty of Economics and Administrative Sciences

Department of Management, Şile, İstanbul, TURKEY

Phone: ++ 90-216-7121460/7218; Fax: ++ 90-212-286 7775

E-mail: pinarf@isikun.edu.tr

Key words: *regional specialization, regional productivity, new economic geography.*

Discussions of this paper are based on arguments from the new economic geography literature suggesting that agglomeration economies enhance productivity and productive regions grow more rapidly as a result (Rosenthal, Strange, 2004). Although previous studies done on Turkish regions do not mention the relation between regional productivity and regional specialization in a direct way, based on their findings it can be stated that economic activity in Turkey is mainly localized in major metropolitan areas as well as a set of emerging regions (Eraydın, 2002; Falcıoğlu and Akgüngör, 2008; Öz, 2001; TÜSİAD/DPT, 2005). The aim of this paper is to complement the findings of the studies on reasons of regional productivity differences in Turkey's manufacturing industry by exploring the spatial determinants of productivity of Turkish regions.

This paper addresses the discussion by an econometric analysis investigating the determinants of spatial variation in a number of measures of regional productivity, including measures such as regional specialization index, average wage, output per employee, value added per employee and proximity to core regions. Study uses NUTS2 regional data for Turkey to analyze the determinants of spatial variations in productivity. The main finding of the study is that regional specialization level is not a significant determinant in determining productivity of Turkish regions which does not support the predictions of New Economic Geography Theory. On the other hand, being close to core regions is found to be a significant determinant in explaining regional productivity supporting the predictions of New Economic Geography Theory.

JEL Classification: L60, R10, R11, R12, R15.

References:

1. Eraydın, A. (2002). Yeni Sanayi Odakları: Yerel Kalkınmanın Yeniden Kavramlaştırılması. Ankara: ODTÜ Mimarlık Fakültesi Basım İşbirliği.
2. Falcıoğlu P. and Akgüngör, S. (2008). "Regional Specialization and Industrial Concentration Patterns in the Turkish Manufacturing Industry: An Assessment for the 1980-2000 period.". European Planning Studies 16 (2), 303-323.
3. Öz, Ö. (2002). Geographic Clusters and International Competitiveness: Evidence From Turkey". METU, Ankara.
4. Rosenthal S. and W.C. Strange, (2004). Evidence on the nature and sources of agglomeration economies. In: V. Henderson and J. Thisse, Editors, *Handbook of Urban and Regional Economics*, vol. 4.
5. TÜSİAD/DPT (2005). Türkiye'de Bölgesel Gelişme Politikaları: Sektör, Bölge Yığılımları. Tüsiad Büyüme Stratejileri Dizisi No: 4 Tüsad-T/2002-09/408.

SPATIAL DETERMINANTS OF REGIONAL PRODUCTIVITY IN TURKISH MANUFACTURING INDUSTRY: AN ANALYSIS FOR THE REGIONS OF TURKEY

1. INTRODUCTION

The phenomenon of reasons of regional productivity has always been the focus of interest due to the persistent presence of interregional inequalities almost in every country and groups of countries, such as in the EU countries. Recent studies focus on a rather neglected aspect of regional productivity; the spatial dynamics of regional productivity across regions and reasons for such productivity differences. A new theory developed by Krugman (1991) led the way to exploring spatial aspects of regional productivity differences through a new perspective. New economic geography theory mainly suggests that agglomeration economies enhance productivity and productive regions grow more rapidly as a result (Rosenthal, Strange, 2004).

Exploring the spatial reasons of regional productivity in Turkey has become significantly important after Turkey became a candidate country. The persistence of spatial dualism in Turkey as well as some of the EU member countries makes it necessary to explore the spatial reasons of productivity differences between regions. Reasons of regional productivity differences have long been an issue in Turkey. Although there have been earlier studies, emphasis on the spatial dimension has generally been neglected (Gezici and Hewings, 2007).

Studies that explore spatial dimension of Turkish manufacturing industry mainly focus on the reasons of location choice of agglomeration of industries in certain regions. These studies mention that although the manufacturing industry is located mainly in four major metropolitan areas which make up nearly 73% of the total manufacturing labor force, there is also a set of emerging regions that are characterized by local internationally competitive production systems, such as Çorum, Denizli and Gaziantep (Eraydın, 2002). Öz (2002) identifies and elaborates on the performance of the towel/bathrobe cluster in Denizli and furniture cluster in Ankara. Eraydın (2002) points out the significance of Bursa, Denizli, Gaziantep districts as well as several production centers in Anatolia regarding their potential to integrate with global markets. Falcıoğlu P. and Akgüngör, S. (2008) study the reasons of agglomeration in Turkey at the regional level and state that economies of scale is a significant factor in the location choice of industries in Turkey. SPO (2003) defines the main tendencies

in the spatial distribution of industry in Turkey. Spatially, industry spreads to nearby cities from traditional cities of İstanbul, Ankara, İzmir and Adana and industries become concentrated in cities such as Kocaeli, Sakarya, Tekirdağ, Manisa, Mersin which are neighbor to traditional cities. Cities like Zonguldak and Kırıkkale which are characterized with heavy public investment are losing their industrial strength and some cities in Anatolia such as Çorum, Kahramanmaraş, Denizli, Gaziantep, depending on their own capacities and by specializing on certain sectors have developed as new emerging regions (SPO, 2003).

Another group of study on spatial regional differences in Turkey mainly focus on the issue of convergence of regions. Gezici and Hewings (2004) reveal the persistence of a spatial dualism between east and west from the past until the present and find no evidence for convergence across regions in Turkey from 1980 to 1997. Moreover, a high level of the spatial dependence was revealed. The level of regional GDP per capita growth was highly related to the neighbors and disparities are still obvious between the east and west of Turkey. In another study by Gezici and Hewings (2007) the results indicate that overall inequalities are decreasing; however spatial dependence is becoming more dominant. The Theil Index indicates that interregional inequalities are increasing while intraregional inequalities are declining for all spatial partitions from 1980 to 1997. In other convergence studies, results mainly suggest that the majority of provinces tend to move toward low productivity levels while few moves toward high productivity levels and these two groups form convergence clubs. Three industrialized regions (İstanbul, İzmir and Adana) show a persistent spatial pattern of high labor productivity during the period of 1975-1990 (Temel, Tansel , Albersen, 1999). In a similar study this time conducted for the long-run tendencies of productivity at the sectoral level it is found that in the long run again two convergence clubs are likely to emerge - one for the agricultural and another for the highly industrialized provinces. The study concludes that the reason might be that the regions with high productivity levels are employing more capital per worker than regions with low productivity levels but this hypothesis needs to be confirmed empirically for Turkey (Temel, Tansel, Gungör, 2007).

The major objective of the study is complement the findings of the studies on the spatial determinants of productivity differences between Turkish regions identified above by exploring the spatial determinants of productivity differences between Turkish regions based on the assumptions of New Economic Geography theory.

2. THEORETICAL FRAMEWORK

In the distant past the creation of wealth largely depended on local availability of natural resources. However as the economy evolved, wealth creation came to depend on physical assets such as equipment, finance availabilities of markets. In recent theoretical work the existence of well-developed markets for consumer goods, industrial goods and factors of production became a central theme since they help make densely concentrated regions attractive places to live and work. The theoretical base of this strand of the literature lies in the urban theory analysis of city formation. Henderson (1974) argues that there is a trade – off between economies of agglomeration of industries specific to that city and general diseconomies such as costs related to commuting and high rents which do not depend on structure of the local industry. On the other hand the growth literature suggests a cumulative process wherein interregional disparities are inevitable and will increase between core and peripheral regions (Hirshman, 1958; Myrdal, 1970).

In the New Economic Geography literature it is generally examined if productivity is higher in regions with larger concentrations of industry and it is generally found that, controlling for observable cost and other differences across regions, firms are attracted to locations with large concentrations of firms in their industry and appear to be more productive in these locations. Agglomeration economies enhance productivity and productive regions grow more rapidly as a result (Rosenthal, Strange, 2004). Therefore, based on the predictions of New Economic Geography the following hypothesis is proposed;

- Productivity of Turkish regions is significantly determined by the existence of large concentrations of firms that are specialized in specific industries in regions.

Following the logic of Krugman(1991) and Venables (1996) the spatial concentration of economic activities is a result of increasing returns to scale and agglomeration may raise the productivity of firms if it expands local demand for their goods, either through market size effects or input-output linkages between industries. Krugman (1991) also focuses on the role that density plays in reducing transport costs between suppliers and customers (Paluzie, Pols,

Tirado, 2000 ; Glaeser, 2000). Therefore, based on the predictions of New Economic Geography the following hypothesis is proposed;

- Productivity of Turkish regions is significantly determined by the existence of scale economies in the region.

One of the propositions of New Economic Geography theory is that market potential raises local factor prices meaning that a location whose access to major markets and suppliers is not impeded by large trade costs will tend to reward its factors with higher wages and land rentals (Head and Mayer, 2004). Even without perfect competition in more productive locations wages will be higher (Glaeser and Mare, 2001 ; Wheaton and Lewis, 2002). The key prediction is that firms are willing to pay workers higher wages in regions that are close to large consumer markets since firms in these regions are able to deliver goods to market at low transport cost. Therefore, based on the predictions of New Economic Geography two more hypotheses are proposed;

- Productivity of Turkish regions is significantly determined by their proximity to core regions.
- Productivity of Turkish regions is significantly determined by the average wage that regions pay.

3. DATA AND METHOD

The data consists of annual manufacturing industry surveys compiled by State Institute of Statistics of Turkey and arranged for NUTS 2 regions. The period covers the years between 1980 and 2000.

The systematic relation between regional productivity and spatial variables is estimated by four panel models where in the first two estimations the dependent variable is output per labor and in the last two estimations the dependent variable is value added per labor. A fixed effect panel model is estimated for the years 1980, 1985, 1990, 1995 and 2000. The cross sectional units are represented by the NUTS2 regions in Turkey.

The first two panel models employ output per labor (OL) of each region as the dependent variable. This is calculated as the region's total output divided by the employment in region.

The last two panel models employ value added per labor (VA) of each region as the dependent variable. This is calculated as the region's total value added divided by the employment in region.

The effect of level of regional specialization is captured with the variable RSP. Although there are several measures of specialization in the literature such as the Herfindahl Index, Dissimilarity Index and the Krugman Index Gini coefficient of Regional Specialization, which provides a measure of relative specialization is employed in this analysis. Regional specialization is defined as the distribution of the shares of an industry i in total manufacturing in a specific region j compared to a norm. Istanbul region is said to be specialized in the textile industry if this industry has a high share in the employment of manufacturing of Istanbul region. The production structure of a region is called "highly specialized" if a small number of industries are responsible for a large share of the production. GINI index takes values between zero and one, values close to zero indicate low specialization, and close to one, high specialization.

Regional specialization is measured by GINI index as demonstrated below:

GINI Index for regional specialization:

$$GINI_j^s = \left(\frac{2}{n^2 \bar{R}} \right) \left[\sum_{i=1}^n \lambda_i |R_i - \bar{R}| \right]$$

$$R_i = \frac{s_{ij}^s}{s_i}; \bar{R} = \frac{1}{n} \sum_{i=1}^n R_i; s_{ij}^s = \text{share of industry } i \text{ in region } j \text{ takes place in total employment of}$$

region j , s_i = share of employment in industry i takes place in total employment. n : number of regions.

λ_i indicates the position of the industry i in the ranking of R_i in descending order.

In order to provide an index of geographical peripherality a distance variable, given as DIST, is used which measures the distance in kilometers from the major urban center to the closest of the four national core regions in Turkey, namely İstanbul, İzmir, Ankara and Adana.

The effect of level of economies of scale is captured with the variable average firm size (AS). This is measured as the ratio of employment in region to number of firms in the region.

The effect of level of economies of scale is captured with the variable average wage (AW). This is measured as the ratio of total wage paid in region to employment in the region.

In Panel Models 2 and 4 the variable Capital Intensity per worker (CI) is included which is measured as the ratio of additional fixed capital expenditures of the region to employment in the region.

For the choice between linear and nonlinear specifications we apply likelihood ratio (LR) test and reject the hypothesis that the linear model is a more effective predictor than the log linear model. Since the model employs cross sectional data, heteroskedasticity test is applied and the standard deviation of the forecasted coefficients is corrected using the method developed by White (1980). The results of the econometric models are presented in Table 1 and 2.

4. FINDINGS

Table 1: Panel estimates of the determinants of regional productivity (n=26) Dependent variable= log(OL)

Variables	Panel Model 1	Panel Model 2
Constant	4.324 (9.150)*	2.791 (4.163)*
Log(AW)	0.9904 (6.520)*	1.035 (9.988)*
Log(DIST)	-0.267 (-5.194)*	-0.154 (-2.560)**
Log(RSP)	0.280 (1.875)	0.218 (1.128)
Log(AS)	-0.102 (-1.317)	-0.087 (-1.030)
Log(CI)	-	0.174 (5.194)*
Adj R ²	0.471	0.57
F-Statistics	25.21841	29.689

* Significant at the $\alpha \leq 0.0005$ level

** Significant at the $\alpha \leq 0.01$ level

(Numbers in parentheses are t-statistics.)

Table 2: Panel estimates of the determinants of regional productivity (n=26) Dependent variable= log(VA)

Variables	Panel Model 3	Panel Model 4
Constant	3.284 (4.909)*	1.928 (2.2595)
Log(AW)	1.118 (8.616)*	1.184 (8.974)*
Log(DIST)	-0.359 (-6.252)*	-0.2766 (3.602)**
Log(RSP)	-0.040 (-0.191)	-0.1103 (-0.443)
Log(AS)	-0.154 (-3.399)**	-0.137 (-1.2711)
Log(CI)	-	0.1376 (3.231)**
Adj R ²	0.44	0.34
F-Statistics	22.235	17.55

* Significant at the $\alpha \leq 0.0005$ level

** Significant at the $\alpha \leq 0.01$ level

(Numbers in parentheses are t-statistics.)

In terms of output per labor, panel model 1 predicts that spatial variables of average wage (AW) and distance to core regions (DIST) are significant in explaining regional productivity supporting hypotheses 3 and 4. The Regional Specialization (RSP) and Average Firm Size (AS) variables are not statistically significant in explaining the reasons of regional productivity. We therefore reject hypotheses 1 and 2.

In terms of value added per labor, results obtained in Panel model 3 are quite similar with the findings of Model 1. Again, variables of average wage (AW) and distance to core regions (DIST) are significant in explaining regional productivity differences supporting hypotheses 3 and 4. Although this time Average Firm Size (AS) implies that there is a significant opposite relation between productivity and economies of scale. The Regional Specialization (RSP) variable is not statistically significant in explaining the reasons of regional productivity. We therefore reject hypotheses 1.

The result obtained about the variable average firm size (employment/ firm size) as a proxy for economies of scale was unexpected. Taking only employment as a measure of economies of scale may not be able to assess the ability of a region to exploit market power. Average firm size of capital intensive and high technology regions may have caused such a result. Previous empirical study of Temel, Tansel, Gungör (2007) had also proved that there is high productivity/low productivity as well as high technology/low technology industries convergence clubs, therefore exploring whether there is a relation between capital intensive regions and productive regions could be a good measure in explaining the unexpected result.

When the variable capital intensity per worker (CI) is added to the analysis, both in terms of output per labor and value added per labor, panel model 2 and 4 predicts that spatial variables of average wage (AW), distance to core regions (DIST) and Capital intensity (CI) are significant in explaining regional productivity supporting hypotheses 3 and 4. The Regional Specialization (RSP) and Average Firm Size (AS) variables are not statistically significant in explaining the reasons of regional productivity. We therefore reject hypotheses 1 and 2.

REFERENCES

Eraydın, A. (2002). *Yeni Sanayi Odakları: Yerel Kalkınmanın Yeniden Kavramlaştırılması*. Ankara: ODTÜ Mimarlık Fakültesi Basım İşbirliği.

Falcıoğlu P. and Akgüngör, S. (2008). "Regional Specialization and Industrial Concentration Patterns in the Turkish Manufacturing Industry: An Assessment for the 1980-2000 period.". *European Planning Studies* 16 (2), 303-323.

Gezici F., Hewings GJD. (2004) "Regional Convergence and The Economic Performance of Peripheral Areas In Turkey" - Review of Urban & Regional Development Studies.

Gezici F. (2007) "Spatial Analysis of Regional Inequalities in Turkey", *European Planning Studies*, 15(3), 384-403.

Glaeser, E. (2000). "The New Economics of Urban and Regional Growth", (in: Clark, G.L., M.P. Feldman, M.S. Gertler -Eds., *The Oxford Handbook of Economic Geography*.) Oxford: Oxford University Press, 83-98.

Glaeser, E.L & Mare, D.C, (2001). "Cities and Skills", *Journal of Labor Economics*, University of Chicago Press 19 (2), 316-42.

Henderson, J.V. (1974). "The Sizes and Types of Cities", *American Economic Review* 64, 640-656.

Hirschman, A. (1958). *The Strategy of Economic Development*. New Haven: Yale University Press.

Krugman, P. (1991). *Geography and Trade*, MIT Press, Cambridge, Ma.

Myrdal, G. (1970). *The Challenge of World Poverty: A World Anti-Poverty Program in Outline*. New York: Vintage Books.

Öz, Ö. (2002). *Geographic Clusters and International Competitiveness: Evidence from Turkey*". METU, Ankara.

Paluzie, E., Pons, J., Tirado, D.A. (2001). "Regional Integration and Specialization Patterns in Spain", *Regional Studies* 35(4), 285-296.

Rosenthal S. and W.C. Strange, Evidence on the nature and sources of agglomeration economies. In: V. Henderson and J. Thisse, Editors, *Handbook of Urban and Regional Economics*, vol. 4 (2004).

Temel, T., Tansel, A., & P. Albersen (1999). Convergence and spatial patterns in labor productivity: Nonparametric estimations for Turkey. *Journal of Regional Analysis and Policy*, 29(1):3-19.

Temel, T., Tansel A. , Gungor, N., (2005), “ Convergence Of Sectoral Productivity In Turkish Provinces: Markov Chains Model” *International Journal of Applied Econometrics and Quantitative Studies* Vol.2.

TUSIAD/DPT (2005). Türkiye’de Bölgesel Gelişme Politikaları: Sektör, Bölge Yığılımları. Tüsiad Büyüme Stratejileri Dizisi No: 4 Tüsad-T/2002-09/408.

Venables, A.J. (1996). “Equilibrium Locations of Vertically Linked Industries”, *International Economic Review* 37, 341-360.

Wheaton, W.C., Lewis, M.J. (2002).”Urban Wages and Labor Market Agglomeration”, *Journal of Urban Economics* 51(3), 542-562.