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EUROPEAN INTEGRATION AND REGIONAL SPECIALIZATION PATTERNS IN TURKEY'S MANUFACTURING INDUSTRY

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EUROPEAN INTEGRATION AND REGIONAL SPECIALIZATION PATTERNS IN TURKEY'S MANUFACTURING INDUSTRY[1]

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Key words: *regional specialization, geographical concentration, economic integration, geographical economics*

ABSTRACT

The dynamics of industrial agglomeration across the regions and the reasons for such agglomeration have been the focus of interest particularly in exploring the effects of economic integration of regions on the spatial distribution of economic activity. In this context, following the predictions of the literature on economic geography, Turkey's integration with the European Union as a candidate member is a likely cause of changes in economic dispersion of the economic activity over the years. The major objective of the study is to complement the findings of the studies on industrial agglomeration in Turkey's manufacturing industry by exploring whether specialization and concentration patterns have changed over time and to expose the driving forces of geographic concentration in Turkey's manufacturing industry, particularly during Turkey's economic integration process with the European Union under the customs union established in 1996.

Industrial concentration and regional specialization are measured by GINI index for NUTS 2 regions at the 2-digit level for the years between 1992 and 2001. To investigate which variables determine industry concentration, the systematic relation between the characteristics of the industry and geographical concentration is tested. A regression equation is estimated, where the dependent variable is GINI concentration index and the independent variables are the variables that represent the characteristics of the sectors.

The major finding of the study is that Turkey's manufacturing industry has a tendency for regional specialization. Increase in the average value for regional specialization supports the prediction developed by Krugman that regions become more specialized with regional integration. But there is no evidence for increased industrial concentration in Turkish manufacturing industry, contrary to the expectations. As for the answer to which variables determine industry concentration, the analysis supports the hypothesis that the firms tend to cluster in regions where there are economies of scale and there are significant linkages between firms, supporting the predictions of new trade theory and economic geography.

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

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EUROPEAN INTEGRATION AND REGIONAL SPECIALIZATION PATTERNS IN TURKEY'S MANUFACTURING INDUSTRY

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1. INTRODUCTION

The phenomenon of industrial agglomeration has been the focus of interest particularly in exploring the effects of economic integration of regions on the spatial distribution of economic activity. Expansion of the European Union into becoming 25 members as well as the dynamic effects of North American Free Trade Association on the economics of industrial location has been a topic widely discussed particularly in the geographical economics literature (Krugman, 1991; Fujita, Krugman and Venebles, 1999). The focus of the stream of research is to question the effect of economic integration on the spatial structure of economic activity in terms of specialization of the regions and geographical concentration of the industries, with particular emphasis on introducing new models in the international trade, economic geography and trade theory (Traistaru, Nijkamp, Longh, 2003; Suedekum, 2004; Paluzie, Pons and Tirado, 2001; Peterson, 2000)). The emphasis has been in exploring the dynamics of industrial agglomeration across the regions and questioning the reasons for such agglomeration.

Following the predictions of the literature on economic geography, Turkey's integration with the European Union as a candidate member is a likely cause of changes in economic dispersion of the economic activity over the years. Studies that focus on manufacturing clusters in Turkey reveal that firms are localized in major metropolitan areas as well as a set of emerging regions and that these four regions make up nearly 73% of the total manufacturing labor force (Eraydin, 2002). There is also a set of emerging regions that are characterized by local internationally competitive production systems, such as Çorum, Denizli and Gaziantep (Eraydin, 2002; DPT, 1998). Öz (2002) identifies and elaborates on the performance of the towel/bathrobe cluster in Denizli and furniture cluster in Ankara. Eraydin (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.

Another attempt that focuses on identifying the industry clusters in Turkey is the "Competitive Advantage of Turkey" (CAT) project, in association and consultancy with Center for Middle East Competitive Strategy (1999).[4] The identified industry clusters in the first phase of the project are, tourism industry (focusing on Sultanahment cluster, Fethiye cluster and Kuşadası cluster), textile and ready wear sector (focusing on undergarment cluster and ready wear cluster in Çorlu), construction and household sector (focusing on ceramics cluster and construction cluster) and information technologies clusters in Ankara and Istanbul.

Using the 1990 and 1996 input-output tables of Turkish Economy (State Institute of Statistics), Akgüngör, Kumral and Lenger (2003) and Akgüngör (2005) identifies industry cluster templates in Turkey among which engineering and textile are the largest templates with respect to the number of establishments and employment. Majority of the manufacturing employment is located in Istanbul, Izmir, Ankara/Kırıkkale and Çukurova districts, covering roughly 70% of the total manufacturing labor force. These four major manufacturing centers are localities that have been able to integrate into the global economy. Akgüngör (2005) points out the importance of newly developing centers near the periphery of Ankara as well, such as Çorum, Kayseri, Konya, Samsun and Eskişehir.

The major objective of the study is complement the findings of the studies on industrial agglomeration in Turkey's manufacturing industry identified above by exploring whether specialization and concentration patterns have changed over time, particularly during Turkey's economic integration

[4] For further information, see, http://www.competitiveturkey.org

process with the European Union under the customs union established in 1996. More specifically, the paper aims to answer the following research questions:

- How specialized are Turkey's regions?
- Has economic integration with the European Union affected the geographical concentration of industry in Turkey?
- What are the driving forces of geographic concentration in Turkey's manufacturing industry?

2. THEORETICAL FRAMEWORK

Competitiveness of a region's economy is closely related to existence of groups of firms clustered together with close interdependencies. The underlying idea is that competitive advantage lies outside the boundaries of firms and that interaction across firms and institutions affect regions' economic performance through diffusion of technology, transfer of innovation, skills and knowledge. This idea dates back to Alfred Marshall's notion of industrial regions where he contends that industries tend to cluster in distinct geographical districts and that knowledge is the most powerful engine of production (Marshall, 1949). The most important component of the Marshallian theory is that long term competitiveness is based on the evolution of localized skills and competencies, which depends on cooperation as well as competence (Andersen, 1996). Marshallian theory marks the groundwork for further analytical framework that highlights the changing perspective from resource based development to a development approach that is based on knowledge resources.

Agglomeration of industries creates scale economies, increased specialization, division of labor and greater access to information that creates opportunities for innovation. Schumpeter further elaborates the significance of clusters in creating revolutionary technology through shared knowledge where he emphasizes that the main stimulus for fundamental economic change is innovation (Schumpeter, 1934). Schumpeter discusses the potential of innovations in creating basis for a whole series of adaptive decisions and points that the main stimulus for fundamental economic change is innovation.

Evolving out of Fordism and mass production, Piore and Sabel (1984) placed a new focus on the literature on industrial location. Acknowledging the emergence of virtuous networks among rival firms in Italy's Emila-Romagna region, Piore and Sabel demonstrates the merits of vertically disintegrated and local production. Piore and Sabel highlight the importance of flexible specialization as the developmental stage succeeding Fordism or mass-production. It is further contended that the difference between Marshallian model and the network model that is developed by Piore and Sabel is "trust" (Bergman and Feser, 1999).

Post Schumpeterian researchers further complement to the discussion of geographic dispersion of industrial activity (Dahmen, 1970; Myrdal, 1957; Hirschman, 1958). Dahman's idea of development blocks, Hirschman's discussion on inducement of investment decisions through backward and forward linkages and Perroux's growth pole theories emphasize the importance of inter firm linkages in the development process. The theories are further complemented by recent evolutionary economics that are pioneered by Nelson and Winter (1989) and literature on industrial dynamics that focus on dynamic models that demonstrate the role of linkages between suppliers and users of products in promoting innovation (Andersen, 1998).

Literature on learning regions puts emphasis on the importance of increasing the firms' capacity to innovate and creative base in achieving and sustaining competitive advantage (Cooke, 1996; Asheim, 1994; Park, 1996). It is contended that competitiveness depends on a locally networked economic system that is integrated to the global economy (Cooke, 1988). Eraydın (2002) states that the main difference between localized concentration of small firms/industrial districts and industry clusters lies

in the firms' ability to integrate to international markets and be able to integrate into the international production network.

Another stream of literature that focuses on merits of industrial clusters is strategic management literature. The literature elaborates on conditions of competitive advantage and contends that local environment is a principle determinant for sustainable competitiveness (Porter, 1999). Porter, in his book "The Competitive Advantage of Nations" have popularized the concept of industry clusters and proposed a model that provides conditions for a firm to be internationally competitive (Porter, 1990). Porter's diamond framework reveals that competitive advantage is highest where the local environment is dynamic and challenging, where trading patterns, regional institutions and mechanisms foster inter industry networking, exchange of information, knowledge sharing and technology transfer.

The impact of economic integration on geographical clustering of economic activity has been an important topic both the mainstream economics and geographical sciences. Each discipline has different methods in explaining the effects of economic integration on the spatial dynamics of the industry. The neoclassical international trade theory looks at regions from the perspective of mainstream economics within which reduction in trade barriers stimulates trade and this positively contributes to welfare. The neoclassical model focuses on the effects of factor endowments in explaining the location of economic activity across the regions. Regions are dimensionless points in space and interaction between these dimensionless points determine the field of international economics and in particular trade theory (Brakman and Garretsen, 2003). Once geography is introduced, the countries and regions are no longer dimensionless points and factors of production have to make location decisions depending on spatial location of regions where transportation costs, agglomeration rents, economies of scale become variables of particular importance in explaining regional concentration and specialization patterns.

New trade theory has evolved due to differences between the predictions of free trade theory and real world trade flows. One difference was due to the observation that trade was growing fastest between industrial countries with similar endowments of production factors and similar economies. Trade flows in many industries showed no specific and clear advantage on factor endowments for any country and trade consisted mostly of similar goods. Contrary to standard international trade theory, the new trade theory emphasizes increasing returns and imperfect competition. The core model developed by Krugman is a general equilibrium model with a market structure that is consistent with increasing returns to scale and explicitly includes transportation costs and location decisions of mobile factors of production (Krugman, 1991; Fujita, Krugman and Venables, 1999).

Economic integration is an important topic both in the mainstream economics and new trade theory as well as geographical sciences. New economic geography or geographical economics offer a useful starting point that aims to connect the viewpoints of the economists and geographers (Brülhart, 1998; Venables, 1996). In new economic geography, the location becomes endogenous and the key determinants of geographical advantages are ease of interaction among economic agents, consumers, suppliers and various sources of information and technology. Based on ideas such as beneficial externalities, knowledge spillovers, labor market pooling effects, linkages between buyers and sellers, geographical economics offers a theoretical foundation for the reasons of spatial clustering (Peterson, 2000).

Existing literature on international trade and geographical economics predict possible increase in the geographical concentration of industries as a result of trade liberalization. Changes in the spatial distribution lead to the concentration of distinct industries in distinct regions and regional specialization as well. Following the predictions of Krugman hypothesis, regions will become specialized and economic activity will become more geographically concentrated. (Krugman, 1991). We therefore propose hypothesis 1 as:

Hypothesis 1: Turkey and European Union economic integration has affected the spatial distribution of Turkey's manufacturing industry firms. Regional concentration and regional specialization have increased over time.

Another aim of the study is to investigate what factors determine industrial concentration. There are several theoretical explanations to examine these phenomena, including theories on international trade as well as geographical economics (Paluzie, Pons, Tirado, 2001). The first explanation is the theory that is based on comparative advantage of regions, developed by Ricardo. According to Ricardo's theory, a country or region specialize on producing goods that it has the most advantage. Comparative advantage arises from differences in relative technology between countries. The only factor of production is labor and comparative advantage rises as a result of technological differences between regions (Bayraktutan, 2003). Ricardo's model incorporates labor as the only one factor of production. The model assumes that productivity of labor varies across countries which cause differences in technology between nations. The higher the labor productivity differences between regions, the hypothesis of equal distribution of industry among regions is rejected and we are likely to accept the hypothesis of regional differences of industry concentration. The second hypothesis therefore reflects the theory developed by Ricardo which states that industrial concentration is shaped in relation with the regional differences in labor productivity.

Hypothesis 2: As the productivity differences between regions increase industrial concentration increases (Ricardo Model)

Another explanation developed by Hecksher-Ohlin complements the Ricardo's model. Hecksher-Ohlin model assumes that capital and labor are the only two production factors and allows for the assumption of different factor-proportions both across and within industries. It is therefore proposed that countries or regions specialize based on factors which they are relatively abundant (Suedekum, 2004). To capture the Hecksher-Ohlin model, we follow the approach that is proposed by Amiti (1999) as demonstrated in Paluzie, Pons and Tirado (2001) and focus on labor factor endowment. We therefore propose the following hypothesis:

Hypothesis 3: As the differences of labor endowments across the regions increase, industrial concentration increases (Hecksher-Ohlin Model).

New trade theory of the 1980s have emerged as a result questioning the assumptions of standard international trade theory that is firmly based on a neoclassical world with formalized static equilibrium with constant returns to scale and perfect competition. The focus of new trade theory is on issues that neoclassical trade theories have neglected and questions the assumptions of imperfect competition and increasing returns to scale. The core model that is developed by Krugman is a general equilibrium model with a market structure that is consistent with increasing returns to scale that explicitly includes transportation costs and location decisions of mobile factors of production (Fujita, Krugman and Venables, 1999). One part of the theory predicts that scale economies cause firms to cluster in certain regions. Following Paluzie, Pons and Tirado (1999), we capture the new trade theory effects by stating that regional concentration is determined with the existence of scale economies and develop Hypothesis 4.

Hypothesis 4: As the differences in existence of scale economies across the regions increase, industrial concentration increases. (New Trade Theory)

In geographical economics, location becomes endogenous and combination of firm specific increasing returns and transport costs implies that firms are no longer indifferent as to the location of their production. In addition to the predictions of the new trade theory under the assumptions of increasing returns to scale and factor mobility, positive externalities created by synergies across the economic units (consumer, supplier, firm, institutions) as a result of forward and backward linkages, firms tend to cluster in the same geography. Vertical structures of production with possibility of up and downstream industries predict agglomeration under the "new economic geography" or "geographical

economics" theory (Krugman 1991; Fujita, Krugman and Venables, 1999). Hypothesis below predicts the arguments of geographical economics.

Hypothesis 5: As the existence of horizontal and vertical linkages increase between the firms across the regions, industrial concentration increases. (New Economic Geography / Geographical Economics Theory)

3. DATA AND METHOD

The data consists of annual manufacturing industry surveys complied by State Institute of Statistics of Turkey and arranged for NUTS 2 regions at the 2-digit level. The period covers the years between 1992 and 2001. Industrial concentration and regional specialization are measured by GINI index as demonstrated below:

GINI Index for regional specialization:

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

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

GINI Index for industrial concentration:

$$GINI_i^c = \frac{2}{m^2\overline{C}}\left[\sum_{j=1}^{m}\lambda_j\left|C_j - \overline{C}\right|\right]$$

$C_j = \frac{s_{ij}^c}{s_j}$; $\overline{C} = \frac{1}{m}\sum_{j=1}^{m} C_j$; s_{ij}^c = share of industry i in region j takes place in total employment of i, s_j = share of employment of j region takes place in total employment.

As explained above, there are four main explanations that focus on what determines industrial concentration[5]. According to the first explanation regional specialization of industry is directly related with the concentration of production factors and technological accumulation in the region (Ricardo's approach). In the model developed by Ricardo, the variable TF measures the technological differences of industry groups across the regions (Haaland, 1999; Paluzie, Pols and Tirado, 2001). In the equation, VA_{ij} measures value added of industry i at region j, E_{ij} measures employment of industry i at region j, c denotes number of regions and n denotes number of industries.

$$TF_i = \sqrt{\frac{1}{n}\sum_j\left[\frac{\frac{VA_{ij}}{E_{ij}}}{\frac{1}{c}\sum_j\frac{VA_{ij}}{E_{ij}}} - \frac{\sum_i\frac{VA_{ij}}{E_{ij}}}{\frac{1}{c}\sum_j\sum_i\frac{VA_{ij}}{E_{ij}}}\right]^2}$$

According to Heckscher-Ohlin theory, regions where capital is abundant specialize on capital based products while regions where labor is abundant specialize on labor based products. Following Paluzie, Pols and Tirado (2001), we measure the labor intensity of the with HO variable as shown below. HO is defined as labor costs divided by value added at factor cost. A high value of HO coefficient developed by Amiti (1999) means that the labor use in the industry deviates from the average. We expect that

[5] The following variables and arguments follow closely those developed in Paluzie, Pons and Tirado (2001).

those industries which differ substantially from the mean are most geographically concentrated. If LC_{ij} denotes labor cost of industry i at region j, VA_{ij} denotes value added of industry i at region j, the index that measures differences in labor use across industries is defined as follows:

$$HO_i = \left[\frac{\sum_j LC_{ij}}{\sum_j VA_{ij}} - \frac{\sum_j \sum_i LC_{ij}}{\sum_j \sum_i VA_{ij}} \right]^2$$

New trade theory predicts that a demand bias in favor of a particular good creates a large home market for this good and scale economies. The theory predicts that scale economies cause firms to cluster in certain regions and measured by the SCALE variable, where E_{ij} denotes employment of industry i at region j and NF_{ij} denotes number of firms in industry i at region j.

$$SCALE_i = \frac{\sum_j E_{ij}}{\sum_j NF_{ij}}$$

Finally, economic geography literature points out the importance of local markets and horizontal and vertical production relations between firms. If vertical integration between firms is higher in an industry, that industry will tend to concentrate in one area. The EG coefficient developed with this purpose is defined as below, where X_{ij} denotes output of industry i at region j and VA_{ij} denotes value added of industry i at region j. High value of EG index means that vertical integration is also high for the mentioned industry.

$$EG_i = \frac{\sum_j (X_{ij} - VA_{ij})}{\sum_j X_{ij}}$$

4. FINDINGS

The average value of GINI coefficient of regional specialization increased between the 1992-2001 period (Table 1). Increase in the average value supports the prediction developed by Krugman as stated in Hypothesis 1 that regions become more specialized with regional integration. The term covers the period after 1996, during which Turkey established a Customs Union with the EU but it is not possible to state how much of this increase in specialization is due to Turkey and EU economic integration. There is, however, a sign of a tendency of increase in specialization of the regions.

Table 1: Gini indices of regional specialization (NUTS II Regions)

	1992	Rank	1995	Rank	1998	Rank	2001	Rank
Adana	0,762	13	0,725	18	0,712	19	0,659	20
Ağrı	0,483	24	0,481	24	0,477	25	0,557	25
Ankara	0,716	18	0,778	11	0,722	18	0,741	16
Antalya	0,818	7	0,792	10	0,832	8	0,794	12
Aydın	0,771	11	0,776	12	0,773	13	0,757	14
Balıkesir	0,875	4	0,914	2	0,856	4	0,867	5
Bursa	0,672	21	0,598	21	0,563	22	0,565	24
Erzurum	0,716	19	0,763	13	0,842	6	0,809	10
Gaziantep	0,780	10	0,848	8	0,855	5	0,903	2

Hatay	0,906	2	0,854	7	0,786	10	0,859	6
İstanbul	0,491	23	0,527	23	0,481	24	0,496	26
İzmir	0,482	25	0,459	25	0,455	26	0,579	23
Kastamonu	0,724	17	0,753	17	0,800	9	0,814	9
Kayseri	0,870	5	0,817	9	0,780	11	0,827	8
Kırıkkale	0,818	8	0,754	15	0,746	16	0,807	11
Kocaeli	0,707	20	0,684	19	0,728	17	0,744	15
Konya	0,763	12	0,855	6	0,775	12	0,784	13
Malatya	0,747	15	0,863	4	0,884	2	0,870	4
Manisa	0,755	14	0,759	14	0,767	14	0,700	18
Mardin	0,415	26	0,416	26	0,488	23	0,655	21
Samsun	0,885	3	0,860	5	0,835	7	0,834	7
Şanlıurfa	0,730	16	0,754	16	0,710	20	0,719	17
Tekirdağ	0,792	9	0,629	20	0,707	21	0,639	22
Trabzon	0,945	1	0,940	1	0,951	1	0,954	1
Van	0,573	22	0,566	22	0,750	15	0,679	19
Zonguldak	0,851	6	0,870	3	0,867	3	0,871	3
Average	0,733		0,732	% change: -%0.14	0,736	% change: %0.544	0,749	% change: %1.736

The NUTS II region with highest specialization coefficient is Trabzon. Trabzon region's GINI coefficient has increased over time as well. Following Trabzon, the NUTS II regions with next highest GINI are Hatay and Samsun in 1992, Balıkesir and Zonguldak in 1995, Malatya and Zonguldak in 1998 and Gaziantep and Zonguldak in 2001.

Inspection of location coefficients of the industries reveal that industry code 15 (manufacture of food products and beverages) (LQ=5.95) is highest for Trabzon in 2001[6]. The two digit codes of other industries that are located in highly specialized regions indicated above are 27 in Hatay (manufacture of basic metals), 16 in Samsun (manufacture of tobacco products), 15 in Balıkesir (manufacture of food products and beverages), 27 in Zonguldak (manufacture of basic metals), 16 in Malatya (manufacture of tobacco products) and 17 in Gaziantep (manufacture of textiles) (Table 2).

[6] Location quotient (LQ) is a measure of the industry's concentration in an area relative to the rest of the Nation. LQ=[(Industry's local employment)/(Total local employment)]/[(Industry's national employment/Total national employment)]. A location quotient greater than 1 means that the cluster employs a greater share of the local workforce than it does Nationally. LQ value greater than 1.25 is considered to be an initial evidence of regional specialization (for further information, see, "Business Clusters in the UK" A report for the Department of Trade and Industry by a consortium led by Trends Business Research)

Table 2: Location Quotients

Nuts 2 Regions	İstanbul	Balıkesir	Zonguldak	Manisa	Konya	Gaziantep	Hatay	Kayseri	Kırıkkale	Samsun	Trabzon	Ankara	Malatya	Kastamonu	Erzurum	Şanlıurfa	Mardin	Ağrı	Van	İzmir	Bursa	Kocaeli	Tekirdağ	Adana	Ayrın	Antalya
15	0,37	4,07	0,23	1,84	3,13	0,63	0,65	0,73	1,29	2,11	5,95	0,93	1,65	1,91	4,49	2,16	0,61	5,30	4,21	1,10	0,70	0,88	0,97	0,93	0,29	1,36
16	0,29	0,81	0,00	0,00	0,00	0,00	0,00	0,00	0,00	11,70	1,64	0,00	6,00	0,00	0,00	0,00	0,00	0,00	7,22	6,57	0,00	0,08	0,00	1,44	0,00	0,00
17	0,75	0,11	0,03	0,62	0,24	3,79	1,98	1,41	0,66	0,27	0,03	0,27	2,07	0,40	0,21	1,31	0,00	0,00	0,52	0,35	1,48	0,37	1,87	1,47	2,58	2,07
18	1,93	0,19	0,49	0,26	0,01	0,18	0,03	0,10	0,14	0,39	0,04	0,39	0,26	2,23	0,23	1,10	0,00	0,10	0,45	1,16	0,67	0,18	1,32	0,91	1,68	0,53
19	2,04	1,56	0,00	1,19	0,80	0,76	0,05	0,15	0,00	0,92	0,17	0,70	0,26	0,00	5,85	0,00	0,00	10,08	7,16	1,09	0,22	0,02	1,67	0,00	0,07	0,00
20	0,15	1,79	2,42	1,52	0,25	1,00	0,09	0,55	0,00	2,32	3,75	1,39	0,00	5,36	0,68	0,00	0,00	0,00	0,00	0,56	0,80	3,31	0,57	1,22	0,26	5,40
21	0,99	2,07	1,77	0,93	1,26	0,53	0,49	0,29	0,08	0,75	0,94	0,10	0,21	5,27	0,00	0,00	0,00	0,00	0,00	1,42	0,79	1,91	0,69	1,71	0,69	0,00
22	2,10	0,00	0,00	0,26	0,42	0,04	0,00	0,00	0,00	0,00	0,20	4,21	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,98	0,41	0,12	0,54	0,07	0,07	0,43
23	0,27	0,00	0,00	0,00	0,00	0,00	0,00	0,00	13,44	0,00	0,00	0,00	0,00	0,00	0,00	0,00	46,56	0,00	0,00	3,66	0,24	3,99	0,14	0,80	0,09	0,00
24	1,38	1,69	0,00	1,01	0,19	0,04	0,49	0,38	0,85	1,18	0,12	0,54	0,02	0,29	0,21	0,00	0,45	0,00	0,06	1,56	0,25	2,00	0,58	2,12	0,41	0,82
25	1,07	0,24	0,13	0,59	1,07	1,40	0,24	0,69	1,38	0,30	0,17	0,50	0,51	0,10	0,00	0,43	2,82	0,00	0,00	1,14	1,08	2,75	0,50	0,97	0,21	0,66
26	0,46	1,89	1,25	3,34	0,80	0,35	0,32	0,61	1,06	2,66	0,61	1,05	0,56	1,15	2,15	2,95	7,19	1,48	0,60	0,79	1,17	1,19	0,83	1,33	1,37	1,97
27	0,44	0,05	13,89	0,29	3,03	0,07	6,81	0,49	2,37	1,05	0,17	0,68	2,66	0,00	0,08	0,17	0,00	0,32	0,00	1,03	0,80	1,56	0,14	0,18	0,44	0,52
28	1,26	0,25	0,14	1,21	0,95	0,11	0,39	1,15	0,23	0,06	0,09	2,28	0,17	0,28	0,15	0,00	0,42	0,00	0,00	0,86	0,99	1,84	0,39	0,83	0,25	0,38
29	0,96	0,27	0,03	0,90	1,91	0,12	1,14	1,68	3,94	0,76	0,07	3,02	0,05	1,39	0,85	0,12	0,00	0,00	0,00	0,86	1,02	0,96	1,05	0,53	0,22	0,32
30	1,54	0,00	0,00	0,00	1,27	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	6,63	0,00	0,00	0,00	0,00	0,00	0,00
31	1,63	0,98	0,05	0,59	0,02	0,02	0,00	1,34	0,00	0,09	0,03	1,32	0,69	0,00	0,00	2,50	0,00	0,00	0,00	0,86	0,62	1,92	0,95	0,09	0,39	0,09
32	1,87	0,04	0,00	4,98	0,00	0,00	0,00	0,00	0,00	0,00	0,00	4,06	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,11	0,02	0,05	1,31	0,03	0,03	0,00
33	1,47	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,42	0,00	5,80	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,62	0,50	0,17	0,28	0,45	0,38	0,00
34	0,79	0,16	0,00	0,54	0,96	0,06	0,01	0,07	0,85	0,16	0,08	0,97	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,19	2,93	1,99	0,17	0,86	0,13	0,11
35	0,76	0,36	0,70	0,39	0,12	0,00	0,00	6,35	0,00	0,00	0,07	3,65	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,47	1,96	1,44	0,00	0,00	0,00	0,00
36	1,40	0,46	0,47	0,17	0,42	0,06	0,03	7,42	0,03	0,44	0,61	1,40	0,05	0,10	0,24	0,00	0,31	0,00	0,00	0,50	1,18	0,50	0,38	0,80	0,26	0,09

Table 3 demonstrates industry concentration. Contrary to the expectation, the average value of GINI concentration coefficient did not increase over time. Industries with highest GINI concentration indices are 19 (tanning, dressing of leather; luggage, handbags, footwear), 27 (manufacture of basic metals), 31 (manufacture of electrical machinery and apparatus n.e.c.). Additionally in 1995, we observe 18 (manufacture of wearing apparel; dressing and dyeing of fur) and in 1998 we observe 34 (manufacture of motor vehicles, trailers and semi-trailers) as industries with high concentration. In general, leather industry (19), basic metals (27) and engineering related and medium level high technology industries (31 and 34) are most geographically concentrated industries across the country.

Table 3 also reveals that industries such as 30 (manufacture of office, accounting and computing machinery), 32 (manufacture of radio, TV, communication equipment, apparatus) and 33 (manufacture of medical, precision, optical instruments, watches, clocks) have lower than average concentration coefficients. As demonstrated in Table 4, GINI value of high tech industries generally have deteriorated over time. Table 4 also demonstrates that sectors defined as middle level technology such as 31 (manufacture of electrical machinery and apparatus n.e.c.) and 34 (manufacture of motor vehicles, trailers and semi-trailers), have the highest geographical concentrations for all years and have increased over time.[7] These industries can be regarded and named as engineering related sectors as well (Akgüngör, 2005). Akgüngör 2005 also demonstrates that engineering related activities make up the largest cluster template in Turkish manufacturing industry in terms of number of sectors and employment.

Table 3: Gini index of geographical concentration of industries

Industry	1992	Rank	1995	Rank	1998	Rank	2001	Rank
15	0,571	20	0,607	20	0,637	20	0,610	20
16	0,767	9	0,811	7	0,804	7	0,680	16
17	0,745	11	0,783	9	0,787	8	0,772	7
18	0,818	7	0,912	2	0,820	5	0,753	10
19	0,901	1	0,918	1	0,849	2	0,861	4
20	0,824	6	0,798	8	0,730	12	0,782	6
21	0,733	13	0,685	17	0,672	18	0,700	15
22	0,827	5	0,702	16	0,782	9	0,751	11
23	0,750	10	0,625	19	0,709	16	0,678	17
24	0,776	8	0,731	12	0,709	15	0,747	12
25	0,741	12	0,765	10	0,668	19	0,678	18
26	0,495	21	0,529	21	0,557	21	0,513	21
27	0,881	2	0,878	3	0,837	4	0,884	1
28	0,726	14	0,730	13	0,710	14	0,759	9
29	0,707	17	0,680	18	0,690	17	0,704	14
30	0,369	22	0,363	22	0,295	22	0,365	22
31	0,863	3	0,861	5	0,845	3	0,863	3
32	0,709	16	0,711	15	0,764	11	0,761	8
33	0,626	19	0,734	11	0,724	13	0,634	19
34	0,856	4	0,874	4	0,873	1	0,877	2
35	0,671	18	0,714	14	0,817	6	0,707	13
36	0,720	15	0,815	6	0,766	10	0,791	5
Average	0,731		0,737		0,729		0,721	

[7] For the definition and classification of industries according to technology level, see, OECD, Science, Technology and Industry Scoreboard, 2003. ((http://www1.oecd.org/publications/e-book/92-2003-04-1-7294/)

The industries with whose ISIC codes are 15 (manufacture of food products and beverages), 16 (manufacture of tobacco products), 17 (manufacture of textiles), 18 (manufacture of wearing apparel; dressing and dyeing of fur), 19 (tanning, dressing of leather; luggage, handbags, footwear), 20 (manufacture of wood and of products of wood and cork), 21 (manufacture of paper and paper products), 22 (publishing, printing and reproduction of recorded media), 36 (manufacture of furniture; manufacturing n.e.c.) and 37 (recycling) are defined as low-tech industries (OECD, 2003). Table 4 reveals that GINI coefficients of low-tech sectors, particularly the ones with ISIC codes 15-18 and 22, 23 have decreased over time.

Table 4: Percent change in Gini index of concentration of industries

Industry	Change during the 1992-1995 period (%)	Change during the 1995-1998 period (%)	Change during the 1998-2001 period (%)
15	6,305	4,942	-4,239
16	5,737	-0,863	-15,423
17	5,101	0,511	-1,906
18	11,491	-10,088	-8,171
19	1,887	-7,516	1,413
20	-3,155	-8,521	7,123
21	-6,548	-1,898	4,167
22	-15,115	11,396	-3,964
23	-16,667	13,440	-4,372
24	-5,799	-3,010	5,360
25	3,239	-12,680	1,497
26	6,869	5,293	-7,899
27	-0,341	-4,670	5,615
28	0,551	-2,740	6,901
29	-3,819	1,471	2,029
30	-1,626	-18,733	**23,729**
31	-0,232	-1,858	2,130
32	0,282	7,454	-0,393
33	**17,252**	-1,362	-12,431
34	2,103	-0,114	0,458
35	6,408	**14,426**	-13,464
36	13,194	-6,012	3,264

In summary, we observe that concentration of the engineering-related industries in Turkey have improved over time. Another point is that 17 (manufacture of textiles), 18 (manufacture of wearing apparel; dressing and dyeing of fur) (labor based industries) and 19 (tanning, dressing of leather; luggage, handbags, footwear) (resource based industries), the GINI coefficient of concentration have decreased over time, particularly after 1995. It is therefore possible to state that regional concentration of Turkey's manufacturing sector have changed in favor of engineering related sectors against labor based and resource based sectors.

A finding that is parallel to the findings demonstrated above also predicts that highpoint industries in cities where regional specialization is intensive should have high concentration coefficients as well. However, among the four industries, only 27 (manufacture of basic metals) is an industry that is highly concentrated with a location quotient that is greater than 1.25 (Hatay and Zonguldak).

Another focus of the study is to investigate which variables determine industry concentration. Following the discussion presented in Paluzie, Pons and Tirado (2001) that is summarized in the

method section, we test the systematic relation between the characteristics of the industry and geographical concentration. A regression equation is estimated, where the dependent variable is GINI concentration index and the independent variables are the variables defined in the method section that represent the characteristics of the sectors.

The model is estimated for the years 1992, 1995, 1998, 2001. 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 a method developed by White (White's test for heteroskedasticity).

The results of the econometric model are given in Table 5. TF variable is not significant and we therefore reject hypothesis 2. Ricardo's model is not a valid explanation of industry concentration in Turkey. Similarly, the HO variable is not significant and therefore we reject the HO model that is depicted in hypothesis 3.

Table 5: Estimates of the determinants of geographical concentration of industries (n=22)

Variables	1992	1995	1998	2001
Constant	-0.326*** (-2.010)	-0.482** (-2.215)	-0.075 (-0.514)	-0.305* (-2.229)
Log (TF)	-0.013 (0.396)	0.008 (0.846)	-0.049** (-2.781)	0.029 (0.599)
Log (HO)	0.003 (0.437)	-0.016 (0.292)	0.051* (4.683)	0.001 (0.053)
Log (SCALE)	0.076** (2.165)	0.089* (4.085)	0.098* (3.697)	0.027 (0.593)
Log (EG)	0.453** (2.887)	0.659* (3.258)	0.389* (3.553)	0.377*** (1.852)
Adj R2	0.25	0.50	0.58	0.22
F- Statistics (4,17)	2.76	6.19	8.33	2.51

* Significant at the $\alpha \leq 0.01$ level
** Significant at the $\alpha \leq 0.05$ level
*** Significant at the $\alpha \leq 0.10$ level

Among the descriptive variables, SCALE variable that measures the average amount of firm employment in the sector is found significant and as expected, for all years except 2001. Findings show that the sectors with high economies of scales have high geographical concentrations, meaning that the big firms operating in the same sector tend to concentrate in the same region. We therefore do not reject hypothesis 4 and state that industrial concentration and scale economies have parallels and we expect industries subject to high scale economies to be more geographically concentrated, because this kind of industry needs fewer plants to satisfy demand (Paluzie, Pons and Tirado, 2001).

EG variable is significant for all years supports the hypotheses of new trade theory and new economic geography (Hypothesis 5). EG variable measures the intensity of the input-output linkages between firms. Firms, which have more intensive horizontal integration, tend to agglomerate in the same geography and use the advantage of spatial proximity in this way. The higher the percentage shares of intermediate goods purchased from firms operating in the same sector, the higher the tendency of firms to cluster in the same geography.

5. CONCLUSION

The major finding of the study is that Turkey's manufacturing industry has a tendency for regional specialization but there is no evidence for increased industrial concentration in Turkish manufacturing industry between 1992-2001. Turkey and European Union integration with the customs union may have affected the geographical distribution of the manufacturing industry. However, available data and analysis methods do not allow us to explore how much of this increase in specialization is due to increased economic integration. There is, however, a sign of a tendency of increase in specialization of the regions.

Examining the composition of the industries across the regions and specialization patterns reveal that concentration of the engineering-related industries in Turkey has improved over time. Data shows that regional specialization trend is towards middle level technology industries and ICT (information and communication technology) industries and away from labor and resource based low and middle tech industries.

The results indicate that a significant determinant of the economic geography of Turkey is the presence of backward and forward linkages between firms within the manufacturing sector. The analysis supports the hypothesis that the firms tend to cluster in regions where there are economies of scale and there are significant linkages between firms, supporting that predictions of new trade theory and economic geography. The findings imply that being close to suppliers is important for spatial clustering, thus supporting the importance networking and inter-firm linkages in for spatial clustering of the economic activity. The findings should be elaborated further to explore highpoint industries across the regions and investigate the growth potential for successful and competitive industry clusters.

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Appendix 1:

ISIC Rev 3 Industry Codes

15 - Manufacture of food products and beverages
16 - Manufacture of tobacco products
17 - Manufacture of textiles
18 - Manufacture of wearing apparel; dressing and dyeing of fur
19 - Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
20 - Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
21 - Manufacture of paper and paper products
22 - Publishing, printing and reproduction of recorded media
23 - Manufacture of coke, refined petroleum products and nuclear fuel
24 - Manufacture of chemicals and chemical products
25 - Manufacture of rubber and plastics products
26 - Manufacture of other non-metallic mineral products
27 - Manufacture of basic metals
28 - Manufacture of fabricated metal products, except machinery and equipment
29 - Manufacture of machinery and equipment n.e.c.
30 - Manufacture of office, accounting and computing machinery
31 - Manufacture of electrical machinery and apparatus n.e.c.
32 - Manufacture of radio, television and communication equipment and apparatus
33 - Manufacture of medical, precision and optical instruments, watches and clocks
34 - Manufacture of motor vehicles, trailers and semi-trailers
35 - Manufacture of other transport equipment
36 - Manufacture of furniture; manufacturing n.e.c.
37 - Recycling

Appendix 2:
Classification of Industries Based on Technology (OECD)

High-technology industries	ISIC Rev 3 Code
Aircraft and spacecraft	353
Pharmaceuticals	2423
Office, accounting and computing machinery	30
Radio, TV and communication equipment	32
Medical, precision and optical instruments	33
Medium-high-technology industries	
Electrical machinery and apparatus, n.e.c.	31
Motor vehicles, trailers and semi-trailers	34
Chemicals excluding pharmaceuticals	24 excl. 2423
Railroad equipment and transport equipment, n.e.c.	352 + 359
Machinery and equipment, n.e.c.	29
Medium-low-technology industries	
Building and repairing of ships and boats	351
Rubber and plastics products	25
Coke, refined petroleum products and nuclear fuel	23
Other non-metallic mineral products	26
Basic metals and fabricated metal products	27-28
Low-technology industries	
Manufacturing, n.e.c.; Recycling	36-37
Wood, pulp, paper, paper products, printing and publishing	20-22
Food products, beverages and tobacco	15-16
Textiles, textile products, leather and footwear	17-19
Total manufacturing	15-37

Source: OECD (2003), Science, Technology and Industry Scoreboard, Paris: OECD.
(http://www1.oecd.org/publications/e-book/92-2003-04-1-7294/)