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THE RELATION BETWEEN GEOGRAPHICAL PLACE AND INNOVATIVENESS: THE CASE OF TURKEY

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ABSTRACT

A line of argument in the new growth economy discussions is whether specialization or diversification of economic activity on the geographical scale stimulates innovation. This study explores the relation between innovativeness and different types of geographical concentrations in the case of a developing country. The study addresses the discussion through statistical and econometric analyses using variables such as number of patents, new firm entry and exit at the regional level for the period 1995-2001. The results do not confirm that regions with higher levels of related variety or specialization are more innovative, but instead regions with higher levels of variety are found to be more innovative supporting the diversity thesis.

Keywords: *Innovation, geographical concentration, related variety*

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INTRODUCTION

Innovations are neither equally nor randomly distributed on the geographical scale. Although examining the dynamics of the relation between innovativeness and location of firms has long been a subject of theoretical debate, interest in the subject has been mostly stimulated after 90's by the success of global technology places in the formation of new businesses. Geographical location and spatial proximity have been identified as determinants of innovativeness and recent studies particularly focus on the

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effects of spatial proximity on innovativeness, in the form of different types of geographical concentrations. The question behind such studies is "What type of a geographical concentration helps regions to generate innovations?"

In addressing the question, the literature on new growth economics focuses on explaining the effects of different kinds of knowledge externalities on growth resulting from the geographical agglomeration of industries. In this line of literature innovativeness of the region is explained by mechanisms through which knowledge flows in the same location by linking industry location to the processes of knowledge creation, firm entry and firm exit and quality improvement.

The answer of the research question is important particularly for developing countries since there will be clear policy implications in terms of policies directed towards innovation and regions. Therefore it is essential for developing countries to know what type of geographical concentration stimulates innovation in regions and what differentiates the requirements of a developing country from those of a developed country when determining appropriate regional innovation policies. This study aims to contribute to the literature by exploring the issue for the case of a developing country building on prior empirical literature which is mostly focused on developed country cases. The study addresses the discussion through statistical and econometric analyses for the period 1995-2001 using NUTS2 regional data. The econometric analysis investigates the determinants of innovativeness in a number of spatial measures such as degree of related variety, variety and specialization in the region and proximity to core regions. The systematic relation between innovativeness and spatial variables is estimated by panel models where the dependent variables are number of patents, number of firms opened per 10.000 citizen and number of firms closed per 10.000 citizen.

The rest of the paper is arranged as follows: Section 2 reviews different strands of the literature which provide a theoretical basis and empirical evidence for what type of geographical agglomerations lead to innovativeness. Section 3 describes the data and methodology and the econometric approach used in this study. Section 4 shows the results and Section 5 presents some concluding remarks.

THEORETICAL AND EMPIRICAL BACKGROUND

The idea of the relation between innovation and location dates back to Alfred Marshall's notion of industrial regions where long term competitiveness is based on the evolution of localized skills and competencies, which depends

on cooperation as well as competence (Marshall, 1920). Studies on the spatial factors of success in innovativeness require interdisciplinary research from various study areas such as; economics, geography, international business and knowledge management. For instance, the economical base of the studies on innovation is found in the creative destruction theory of Schumpeter where it is emphasized that the main stimulus for economic change is innovation (Schumpeter, 1934). The growing literature enables researchers from different disciplines to find complementary answers. The common theme among these various viewpoints is the notion of spatial proximity which helps firms in obtaining successes in innovativeness that could not be achieved otherwise. Innovation process is highly affected by spatial proximity of firms to knowledge sources and networks.

The theories are further complemented by the literature on new growth economics which focuses on explaining the effects of different kinds of knowledge externalities on growth resulting from the geographical agglomeration of industries. The literature on new growth economics has considered the effects of two kinds of knowledge externalities on growth. The first kind, where knowledge spillovers arise from industry specialization, originates in the work of Marshall (1920), Arrow (1962) and Romer (1986). This kind of effect considers that spillovers occur within industry therefore industries that are regionally specialized benefit most from transmission of knowledge within industry and innovate more. The second type of externalities arises from diversity or variety between complementary industries. Jacobs (1969) argues that it is the exchange of complementary knowledge across diverse firms which yield a greater return to new economic knowledge leading to innovations.

Building on this theoretical base the main aim of this study is to determine which industry composition of geographic concentration influences innovative performance of regions. The study also aims to contribute to the empirical literature by exploring the issue for the case of a developing country building on prior empirical literature which is mostly focused on developed country cases.

The empirical literature is focused on developed country cases both because breakthrough innovation mostly takes place in developed countries and interest in the subject has been mostly stimulated after 90's by the success of global technology places such as; Silicon Valley in US, Cambridge university park in UK, Hsinchu Industrial Park in Taiwan. Empirically, these innovative places have served as laboratories in investigating the nature of innovative activities and identifying common trends and patterns in the

agglomeration of innovation. The success factors in the growing productivity, innovation and new firm formation of two industrial clusters, namely Silicon Valley and Hsinchu Industrial Park, have been pointed out in the study of Porter (1998) as the combination of competition and vertical cooperation among local firms. The geographic concentration of interconnected firms is also supported by interconnected suppliers, downstream channels, customers and manufacturers of complementary products (Porter, 1998). Both districts have high rates of entrepreneurship and success in formation of many small new businesses alongside big technology companies through forward and backward linkages (Saxenian and Hsu, 2001). The degree of interaction and knowledge exchange between firms, research institutes, universities and other actors involved are seen as key elements of success in the innovation process. Besides the studies on clusters, the relation between spatial distribution and agglomerations of innovative activities is studied by Feldman and Audretsch (1996) for the US case, Moreno et al. (2004) and Breschi (1998) for the European case. The pattern of spatial agglomeration of innovative activities is found to be mostly related to the process of knowledge creation and diffusion; studies at the regional level also prove that regions enjoying higher levels of agglomeration economies and knowledge spillovers tend to produce higher numbers of innovation (Glaeser et al., 1992).

In further studies, at the industry level Breschi (1998) states that concentration is relatively lower in most mechanical engineering and industrial equipment sectors and it is relatively higher in most electrical-electronic and chemical-drugs sectors. Breschi (1998, 2000) explains the reasons behind as, the more knowledge is tacit, complex and systemic the more likely it is that geographical proximity plays an important role in capturing the benefits of knowledge spillovers thus pushing towards the spatial clustering of innovative activities. Conversely, the more knowledge is standardized and simple the less spatial proximity is helpful. Mancusi (2003) shows that innovation is more geographically concentrated in the electronics field but less concentrated in the consumer goods and civil engineering field. Similarly Audretsch and Feldman (1996) confirm that knowledge oriented industries have more spatially concentrated innovative activity. They also show that innovation is more concentrated in industries with high ratios of R&D to sales, higher proportions of skilled labor, and where more university research is devoted to research relevant to that industry.

These studies confirm the validity of the knowledge spillovers but do not explain how knowledge spillovers affect the innovation process. Whether spillovers that occur within industries or across industries have a stimulating

effect in the innovation process has been tested empirically by a few studies which have contradictory results. In the study of Feldman and Audretsch (1999), the evidence provided strong support for the diversity thesis but little support for the specialization thesis. Glaeser et al. (1992) state that city-industries grow faster if the industry is diversified, rather than concentrated. In contrast, Henderson et al. (1995) find that concentration facilitates growth in mature capital-intensive industries.

Taking this discussion further, recent studies focus on the effects of various types of geographical concentrations on innovation in order to explain the mechanism of knowledge spillovers in the innovation process. In the studies of Marshall (1920), Arrow (1962) and Romer (1986, 1990) spillovers occur within industry so that industries regionally specialized benefit most from transmission of knowledge within industry. In Jacobs (1969) it is the exchange of complementary knowledge across diverse firms which yields a greater return to new economic knowledge leading to innovations. Besides the two types of agglomerations, specialization and diversity of industries, a third type of agglomeration named as "related variety" has been studied and empirically tested in the recent literature (Boschma and Immarino, 2009, Lazzeretti et.al 2010, Weterings and Boschma, 2006). Related variety means firms in the same region benefit from the diversity of sectors that complement each other. The basic line of argument is that neither diversity nor specialization stimulates innovation. Instead, related variety leads to more effective interactive learning and innovation, because it enables to diversify into new fields while building on the existing knowledge base. In Klepper (2007) empirically it is demonstrated that prior experience in related industries such as coach and bycycle making increased chances of new firms in the new US automobile sector. Boschma and Wenting (2007) showed that new automobile firms in the UK could start in a new industry when the entrepreneur had a background in related sectors and when the firm had been established in a region that was well endowed with related sectors.

Empirically, the relation between related variety and innovativeness is studied by Weterings and Boschma (2006) where innovativeness of software firms is found to be higher in locations with much related variety. In general terms, the recent empirical literature suggests that major innovations are more likely to occur when knowledge spills over between sectors, rather than within the same sector, but the sectors should be related in terms of shared competences.

Results on the effects of related variety, other than on innovativeness, have mostly supported the related variety thesis as well. Frenken and Boschma (2007) have found that urban areas with high related variety have higher growth in terms of GDP in Dutch metropolitan areas. Boschma and Immarino (2009) states that the most competitive regions in Italy have related variety economies. Lazzeretti et.al (2010) has found important signs of how creativity can help find new, unusual relations among apparently distant sectors in Tuscany region. Frenken, et al. (2007) proved that related variety enhances employment growth, while unrelated variety dampens unemployment growth in Netherland regions. Gulcan and Akgungor (2008) have stated that there exists different growth dynamics in related versus unrelated industries in Turkey. Falcıoğlu (2011) has identified related variety as a determinant of productivity in Turkish regions. Martin and Sunley (2006) state that building on related variety might be an effective way to start up new growth paths.

Empirical studies on the main determinants of innovativeness in Turkey have been on factors such as the role of the state (Lenger, 2008), the effect of FDI (Lenger and Taymaz, 2006), size and ownership in SMEs (Üçdoğruk and Taymaz, 2009) and the effect of public R&D loans (Özçelik and Taymaz, 2008) studied at different spatial levels. Concerning the empirical studies on spatial determinants of innovativeness, the main focus has been on studying the effect of interaction of firms in a certain location with each other as well as with other organizations.

The results of the studies 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, firms tend to cluster in regions where there are economies of scale and there are significant linkages between firms. The findings imply that being close to suppliers is important for spatial clustering, thus supporting the importance of networking and inter-firm linkages for spatial clustering of the economic activity (Akgüngör, 2002; Akgüngör and Falcıoğlu, 2005; Falcıoğlu and Akgüngör, 2008).

Concerning the effects on innovativeness, Eraydin and Armatli-Köroğlu (2008) state that firms with larger numbers of global linkages are more innovative than the ones with local and national linkages. Findings of Çetindamar and Gündüz (2008) reveal that Turkish firms have high-collaboration ties with other companies but the existing partnerships have a weak impact on innovation performance. Gülcan et.al (2011) state that two regions having different knowledge bases have different deficiencies in innovative performance even if they are the subsectors of the same sector.

Examining the relation between innovativeness and geographical concentration, findings of Falcıoğlu and Akgüngör (2005) confirm that high tech industries and engineering related industries are more innovative than low tech industries as a result of increasing geographical concentration which may allow high tech industries to utilize the advantages of spatial proximity more intensely than low tech industries do.

Concerning the effects of related variety, two recent studies have proven that related variety has different growth effects; Gülcan and Akgüngör (2008) have proven that there exists different growth dynamics in related versus unrelated industries, Falcıoğlu (2011) has stated that related variety is a determinant of productivity in the case of Turkish manufacturing industry, whereas variety and specialization are not. The findings of these two studies confirm the existing empirical findings supporting the related variety thesis although the existing literature is based on developed country cases. As a further study, building on the existing literature it can be possible to compare and differentiate the mechanism of the innovation process in the case of a developing country. The mechanism behind innovativeness in a developing country can either be explained through a similar path or if not, factors which differentiate the process can be identified. This information could be used to improve innovative potentials of developing regions of developing countries.

Yet, to the best of author's knowledge, no empirical investigations can be found in the literature analyzing the relation between different types of geographical concentrations and innovativeness in Turkey. Therefore the main objective of the paper is to investigate the changing patterns of geographical concentrations in the Turkish manufacturing industry and to identify whether related variety is a significant determinant of innovativeness for the Turkish manufacturing industry.

Based on new growth theories different types of spatial externalities have different effects on innovativeness of regions. To test whether specialization or diversity or related variety promotes innovation in Turkey the following hypotheses are developed.

H1- Innovativeness of regions in Turkey is significantly determined by the existence of geographical concentrations of firms that are endowed with sectors complementary in terms of competencies.

H2- Innovativeness of regions in Turkey is significantly determined by the existence of geographical concentrations of firms that are endowed with sectors diversified in terms of competencies.

H3- Innovativeness of regions in Turkey is significantly determined by the existence of geographical concentrations of firms that are endowed with sectors specialized within a narrow industry base.

There are also significant studies that have examined the effect of distance on innovation, especially the distance from urban centers. Empirically, it has been proven that distance has different effects on different types of innovations, for instance process innovations in more routine manufacturing may occur further out from metropolitan areas or in small more specialized cities (Duranton and Puga, 2003). In a recent study by Shearmur (2010) findings suggest that medium technology firms closer to metropolitan areas are more innovative. Furthermore, radical process innovations in first and second transformation and medium technology sectors, and nonradical process innovations in high technology firms all increase in small urban areas. To test whether proximity to core areas promotes innovation in Turkey the following hypothesis is developed.

H4- Innovativeness of regions in Turkey is significantly determined by their proximity to core regions.

METHOD AND DATA

In order to examine the changing patterns of related variety in the Turkish manufacturing industry, changes in indices of related variety are compared for the years between 1980 and 2000. Statistical analysis is conducted to examine whether there is a significant relation between related variety levels of regions and their innovativeness. Related Variety levels are compared in terms of number of patents, quality certificates, number of firm entry and exits.

To identify the spatial determinants of innovativeness three panel models are estimated. The three dependent variables are; number of patents, number of firms opened per 10.000 citizens and number of firms closed per 10.000 citizens, respectively. Panel models are estimated for the years 1980, 1985, 1990, 1995 and 2000. The cross sectional units are represented by the 26 NUTS2 regions in Turkey.

The independent variables are variables that reflect the three dimensions of geographical concentrations. The data set to measure related variety, variety and regional specialization consists of annual manufacturing industry surveys complied by State Institute of Statistics of Turkey. Manufacturing Industry Technological Innovation Survey conducted by Turkey's State Institute of Statistics does not offer data at the regional or city

level, therefore the data set to examine the innovation activities is based on a specialized data set collected from State Institute of Statistics, Eximbank, Turkish Standards Institute as stated in the study of Pınarcıoğlu (2002).

To assess the impact of complementary sectors and the impact of diversified sectors the indexes measured in Falcıoğlu (2011) which followed the methodology of Frenken et al. (2007) and Boschma, Iammarino (2009) are employed. To measure the effect of related variety, following Frenken et al. (2007) and Boschma, Iammarino (2009) an entropy measure is employed by which the degree of related variety in each region is measured through the weighted sum of the entropy indicator at the three-digit level within each two-digit class. The variable related variety measures the degree of variety within each of the two-digit classes: it is expected that the higher the related variety of sectors in a region the higher will be its innovativeness.

Related variety is measured as follows. All three-digit sectors *i* fall under a two-digit sector S_g, where g=1,…,G. We can derive the two digit shares Pg by summing the three-digit shares pi. Related variety (RELVAR) is then defined as the weighted sum of entropy within each two-digit sector, which is given by:

$$RELVARIETY = \sum_{g=1}^{G} P_g H_g$$

where:

$$H_g = \sum_{i \in s_g} \frac{p_i}{p_g} \log_2 \left(\frac{1}{p_i / p_g} \right)$$

and

$$P_g = \sum_{i \in s_g} p_i$$

To assess the impact of diversified economies, following Frenken et al. (2007) and Boschma, Iammarino (2009), among other factors, the variable VARIETY is employed which measures the degree of industry diversification by means of an entropy measure at the three-digit level. The value of the entropy indicator increases the more diversified the industry profile of a region is. The entropy at the three-digit level in each region is given by (where p_i stands for the share of three-digit sector *i*):

$$VARIETY = \sum_{i=1}^{n} p_i \log_2 \left(\frac{1}{p_i} \right)$$

To assess the impact of specialized sectors, the index measured in Akgüngör and Falcıoğlu (2008) which followed the methodology of Traistaru & Iara, (2002) is used. The variable regional specialization (REGSPE) is employed which measures the Gini coefficient of Regional Specialization and provides a measure of relative specialization. Gini index takes values between zero and one, values close to zero indicate low specialization, and close to one, high specialization.

GINI Index for regional specialization:

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

$$R_i = \frac{s_{ij}^s}{s_i} \; ; \quad \overline{R} = \frac{1}{n} \sum_{i=1}^{n} R_i$$

s_{ij}^s = share of industry *i* in region *j* takes place in total employment of region j,

si =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 (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.

FINDINGS

Findings on the Pattern of Related Variety

The average value of related variety increased at a rate of 23% between 1980 and 2000 (Table 1). Some of the regions such as have experienced considerable increases in their related variety levels, most remarkably those that had been highly specialized in the past like the mining and steel regions such as, Zonguldak and Erzurum. They have been regions with the highest increases due to their low levels of related variety in 1980. Particularly Zonguldak has been an area highly specialized in traditional coal production starting from 1800's and has become a stagnated area after

Table 1: Change in Indices of Related Variety

	1980	1985	1990	1995	2000	1980-2000
İstanbul	1,519	1,522	1,467	1,430	1,496	-2%
Ankara	1,053	1,020	1,111	1,299	1,518	44%
İzmir	1,491	1,542	1,441	1,370	1,588	6%
Bursa	0,992	1,080	1,179	1,330	1,289	30%
Kocaeli	1,041	1,227	1,149	1,450	1,418	36%
Tekirdağ	0,956	0,756	0,989	1,193	1,183	24%
Adana	1,014	1,040	1,126	1,139	1,279	26%
Aydın	0,691	0,790	0,845	0,776	0,715	3%
Antalya	0,444	0,724	0,671	0,673	0,665	50%
Balıkesir	1,080	1,083	1,206	1,282	1,171	8%
Zonguldak	0,309	0,669	0,183	0,458	0,721	133%
Manisa	0,645	0,865	0,804	0,929	0,859	33%
Konya	0,808	0,986	0,948	1,123	1,448	79%
Gaziantep	0,639	0,792	0,824	0,518	0,661	3%
Hatay	0,491	0,797	0,616	0,718	0,706	44%
Kayseri	0,751	0,737	0,744	0,967	1,032	37%
Kırıkkale	0,611	0,623	0,803	0,878	1,156	89%
Samsun	0,664	0,749	0,702	0,934	0,967	46%
Trabzon	0,904	0,879	0,821	0,949	1,013	12%
Malatya	0,605	0,818	0,985	1,098	0,645	7%
Kastamonu	0,437	0,625	0,620	0,664	0,655	50%
Erzurum	0,366	0,474	0,602	0,888	0,894	144%
Şanlıurfa*	1,123	0,859	0,926	0,632	0,223	-80%
Mardin	0,394	0,275	0,344	0,364	0,381	-3%
Ağrı	0,579	0,394	0,537	0,800	0,659	14%
Van	0,862	0,837	0,852	1,125	0,925	7%
Average	**0,787**	**0,852**	**0,865**	**0,961**	**0,972**	**23%**

* Şanlıurfa is one of the regions where problems of statistical secrecy is observed The same explanation was given in Falcıoğlu and Akgüngör (2008). When a region has less than two firms in a sector data are not available and Şanlıurfa is region where industrialization efforts increased only after 80s.

Source: Compiled by the author.

1980s due to decreasing coal production (Tüylüoğlu, Karakaş, 2006). Core regions such as İstanbul, İzmir, Aydın and Gaziantep have rather stable indices. Regions that are neighboring core regions such as Bursa, Kocaeli, Tekirdağ, Kırıkkale, Kastamonu have higher rates of change.

Table 2: Change in Indices of Related Variety of Regional Groups

Regional Groups	1980	1985	1990	1995	2000	1980-2000
İstanbul and Neighboring R.	0,989	1,042	1,081	1,213	1,208	22%
Ankara and Neighboring R.	0,776	0,797	0,872	1,037	1,214	56%
İzmir and Neighboring R.	0,977	1,070	1,074	1,089	1,083	11%
Adana and Neighboring R.	0,668	0,806	0,835	0,921	0,952	43%
Others	0,659	0,662	0,619	0,714	0,655	-1%

Source: Compiled by the author.

In Table 2 it can be observed that although related variety levels of İstanbul, İzmir and their neighboring regions are higher than the average for all years, their related variety levels have increased below the average over time. Whereas, related variety levels of Ankara and Adana and their neighboring regions are lower than the average, their related variety levels have increased above the average over time. It is possible to state that related variety of Turkish manufacturing sector has increased over time in favor of Adana and Ankara regions. It can be observed that there is a changing trend away from the core towards the periphery. Eastern regions have become more diversified in time. This finding should be evaluated with caution because apart from the geographical concentration pattern the observed change could be interpreted more as a result of increasing industrialization efforts in eastern regions after the 80s. In the next stage of the study it is expected that regions with higher levels of related varieties will tend to have higher levels of innovativeness.

Findings on the Regional Groups with Respect to Innovativeness

Comparing the regions in terms of number of firm entry and exit, it can be seen that İstanbul is above the average, but it is on average terms in comparison with the population of the region. Rate of firm entry to exit figures demonstrate that developed regions such as İstanbul, İzmir, Ankara and Eskişehir have higher numbers of firm entry during the period (Table 3).

The results do not statistically confirm that regions with higher levels of related variety have more innovative capacity but it is possible to state that regions with related varieties above average have higher rates of firm entry to exit (Table 3).

Table 3: Firm Entry and Exit Indicators in Relation with Related Variety (1995-2001)

	New Firm Entry	Firm Entry per 10.000 citizen	Firm Exit	Firm Exit per 10.000 citizen	Rate of firm entry to firm exit
İzmir	6.896,0	24,5	3.669,0	13,0	1,9
İstanbul	32.300,0	34,6	14.958,0	16,0	2,2
Kocaeli	759,0	51,9	875,0	59,9	0,9
Bursa	4.524,0	27,2	3.290,0	19,8	1,4
Balıkesir	2.782,0	47,3	1.771,0	30,1	1,6
Tekirdağ	2.291,0	56,4	1.734,0	42,7	1,3
Manisa	2.797,0	38,5	2.207,0	30,3	1,3
Uşak	520,0	28,0	556,0	29,9	0,9
Aydın	2.516,0	49,8	1.290,0	25,5	2,0
Muğla	2.062,0	73,0	1.249,0	44,2	1,7
Denizli	2.159,0	51,6	1.894,0	45,3	1,1
Kastamonu	147,0	14,3	136,0	13,2	1,1

Table 3: Firm Entry and Exit Indicators in Relation with Related Variety (1995-2001), cont.

	New Firm Entry	Firm Entry per 10.000 citizen	Firm Exit	Firm Exit per 10.000 citizen	Rate of firm entry to firm exit
Regions with related varieties above average	**4.979,4**	**41,4**	**2.802,4**	**30,8**	**1,8**
Ankara	8.642,0	23,9	6.340,0	17,6	1,4
Eskişehir	1.654,0	29,3	1.003,0	17,7	1,6
Konya	3.281,0	24,3	3.549,0	26,3	0,9
Adana	3.149,0	22,5	3.216,0	23,0	1,0
Mersin	2.894,0	27,7	2.368,0	22,7	1,2
Kırıkkale	99,0	3,4	158,0	5,4	0,6
Kırşehir	296,0	19,8	434,0	29,0	0,7
Kayseri	1.714,0	23,4	1.689,0	23,0	1,0
Sivas	874,0	20,6	793,0	18,7	1,1
Gümüşhane	211,0	26,6	226,0	28,5	0,9
Amasya	526,0	26,3	520,0	26,0	1,0
Çorum	849,0	26,7	839,0	26,4	1,0
Erzurum	725,0	12,5	976,0	16,8	0,7
Erzincan	401,0	23,0	398,0	22,8	1,0
Hatay	1.823,0	32,7	1.274,0	22,9	1,4
Çankırı	318,0	22,2	337,0	23,5	0,9
Gaziantep	2.206,0	21,1	1.474,0	14,1	1,5
Regions with related varieties below average	**1.744,8**	**22,7**	**1.505,5**	**21,4**	**1,2**
t-test results	0,1177	0,0012	0,1508	0,0276	

Source: Regional data is from the study of Pınarcıoğlu (2002).

Table 4: Innovation Indicators of Regions in Relation with Related Variety (1990-1999)

	Quality Certificate	Standards Certificate	Patent	Number of Firms	Rate of Quality Certificate per number of firms in the region	Rate of Standards Certificate per number of firms in the region	Rate of Patents per number of firms in the region
İstanbul	373,6	16.439,9	747,3	3.736,0	0,1	4,4	0,2
Kocaeli	221,0	589,3	36,8	368,0	0,6	1,6	0,1
Bursa	58,2	1.047,0	58,2	582,0	0,1	1,8	0,1
Eskişehir	29,9	552,5	29,9	149,0	0,2	3,7	0,2
Balıkesir	19,4	533,5	19,4	97,0	0,2	5,5	0,2
Manisa	19,9	377,5	19,9	199,0	0,1	1,9	0,1
Regions with related varieties above average	**120,3**	**3.256,6**	**151,9**	**855,2**	**0,1**	**3,8**	**0,2**
Konya	20,5	821,3	41,1	205,0	0,1	4,0	0,2
Kayseri	15,6	655,2	46,8	156,0	0,1	4,2	0,3
Ankara	130,5	1.044,3	195,8	653,0	0,2	1,6	0,3
Van	2,2	81,4	5,5	11,0	0,2	7,4	0,5
Regions with related varieties below average	**42,22**	**650,55**	**72,29**	**256,25**	**0,2**	**2,5**	**0,3**
t-test results	0,1395	0,1847	0,2758	0,1787			

Source: Regional data is from the study of Pınarcıoğlu (2002).

The results do not statistically confirm that regions with higher levels of related variety are more innovative. The only indicator worth mentioning is that regions with related varieties above average have higher rates of standards certificate per number of firms in the region (Table 4).

Findings on the Spatial Determinants of Innovativeness

The expectation of this study was to determine the relation between geographical concentration patterns and innovativeness of manufacturing industry in Turkey. Indeed the results concerning the effects of different types of geographical agglomerations have proven that different types of geographical concentration patterns have different effects on innovativeness but not in the same way as the literature suggests. The main results are presented in Table 5.

Regional specialization is not statistically significant in explaining innovativeness parallel with the findings of the recent literature. In the studies of Feldman and Audretsch (1999) and Weterings and Boschma (2006), specialization has not been identified as a determinant. Another common finding in the literature was that related variety would be the key determinant in explaining innovativeness, but contrary to the literature instead of related variety, variety is found to be a significant determinant. In the study of Feldman and Audretsch (1999) similar results were found , the evidence provided strong support for the diversity thesis but little support for the specialization thesis, still it should be noted that related variety was not included in their analysis. As suggested by Weterings and Boschma (2006) it is uncertain what kind of an effect different types of varieties have in the innovation process, whether it occurs through knowledge spillovers, entrepreneurial dynamics or labor market mobilities. Therefore this finding contributes to the literature as a finding that should be verified in the light of the ongoing discussions in the literature.

Distance to core regions is found to be a significant factor for all three variables. Number of patents increase as the geographical distance to core areas decreases. Contrary to expectations the relation between distance to core regions and the number of firms opened and closed reveals that as distance to core areas decreases number of firms opened and closed decreases as well. Data set does not allow us to differentiate between different types of innovation but empirically it has been proven that distance has different effects on different types of innovations, for instance in Duranton and Puga (2003) number of minor cost- saving process innovations increase with proximity to smaller specialized cities not to urban areas.

Table 5: Panel estimates of the determinants of innovativeness (n = 23) (random effect)

Dependent Variable	Log(Number of Patents)	Log(Firms Opened per 10.000)	Log(Firms Closed per 10.000)
Constant	2.17 (2,04)	1,35 (3,61)**	1.38 (4,14)*
Log(regional specialization)	-1.057 (-1,39)	0.14 (0,75)	0,28 (1,66)
Log(Geographical Distance)	-0.30 (-5,19)*	0.06 (2,75)***	0.1 (4,66)*
Log(Related Variety)	0.38 (0,62)	0.12 (0,99)	0,027 (0,23)
Log(Variety)	2,11 (3,47)**	1,48 (5,88)*	1.22 (5,46)*
Adjusted R^2	0,75	0,3	0,27
F-Statistics	34,87	13,17	11,71

* Significant at the $\alpha \leq 0.001$ level

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

*** Significant at the $\alpha \leq 0.02$ level

(Numbers in parentheses are t-statistics.)

CONCLUSION

The results obtained in this study open up a new path to the empirical analysis of the determinants of innovativeness, with particular respect to the effects of different dimensions of concentration of economic activity on the geographical scale. The results concerning the effects of different types of geographical concentrations prove that there is a strong need to differentiate between various types of variety.

The results confirm that regions with higher levels of variety are more innovative, contrary to the findings of the recent literature. The results are consistent for the three models in the study but still it can be stated that available innovation data and analysis methods do not allow us to explore all of the determinants of innovativeness.

Since there will be clear policy implications of this debate in terms of policies directed towards innovation and regions in a developing country, further analysis should be directed towards studying the impact of related variety and/or variety within different levels of industrial groups, such as high technology and low technology industries, within different types of regions at different growth stages. Identifying the determinants of related variety and /or variety for different regions and industries would help in deciding how to bring related variety and/or variety into regions and industries through either political or managerial implications. As confirmed in the study of Kuştepeli, Y., Gülcan, Y., and Akgüngör, S. (2013) necessary institutional arrangements and policy actions are unique to each specific region.

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