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WHY DO SKILLED PEOPLE MIGRATE TO CITIES? A SPATIAL ECONOMETRIC ANALYSIS FOR UNDERSTANDING THE IMPACT OF THE SOCIAL ENVIRONMENT ON THE ATTRACTION OF HUMAN CAPITAL TO CITIES IN TURKEY

Abstract. The main focus of this study is on understanding the importance of social dynamics of cities for attracting human capital to urban regions. The principal research question of the article is "if there is a spatial dependency on neighbouring provinces' social environmental qualities in human capital attraction for Turkey." It is believed that developmental disparities among regions can be overcome with a balanced distribution of human capital. In this article, first the concept and importance of human capital and its evolution throughout economic history are explained in order to emphasize the relationship between development and human capital for urban regions. The literature review consists of migration models developed and used in previous studies and recent literature that together consider human capital and its flow with spatial analysis. A review of migration models helps structure the quantitative models' building blocks, or the concepts to be quantified. Literature that discusses human capital and spatial analysis, at the same time, guides the study in implementing the most appropriate analysis technique. The literature discussed in the paper is focused on human capital migration and urban attractiveness. Its similarity with the current study work is the focus on the relationship between urban environment components and human capital. However, the cited studies lack the "spatial/relational" approach to urban regions which means that the effects of developments in settlements neighbouring the region were ignored. The contribution which we intend to make with the current study is to adapt the spatial econometric analysis to the problem of human capital attraction. Literature review is followed by data used in the empirical part of the study, and brief information on spatial econometric analysis. Next, findings of the empirical spatial econometric analysis of Turkey's 81 urban regions are provided. Overall, the analysis indicated that undergraduate and post-graduate migrants care about the social prosperity of the neighbouring environment of destination province. The last part concludes with an interpretation of empirical study findings and discusses relevant urban and regional policy instruments.

Key words: Human capital, human capital attraction, relational approach, spatial econometrics, Turkey, regional development, spillover Effects.

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1. INTRODUCTION

The success of a regional economy is a chaotic story. Many regional economists and researchers consider dynamism as the word that best describes regional economic success (Arvantidis, Petrakos and Pauleas, 2007). The essential factors that define the dynamism of today's regions are known to be high quality human capital, innovation based on research and development (R&D) (Lucas, 1988; Romer, 1990; Barro, 1991; Becker, 1993; Benhabib and Spiegel, 1994; Hanushek and Kimko, 2000), a stable political environment (Lipset, 1959; Brunetti, 1997), powerful, modern and networked institutions, and improved inter-regional relations (Morgan, 1996, 1997; Evans and Harding, 1997; Jessop, 1998). With human capital defined as one of the building blocks of regional economic dynamism, the analysis of human capital flows between regions should guide policy makers in developing some policies to improve the creative capacities and knowledge assets of regions. However, in the first place, there is the need to conceptualise "region". In human geography, until the middle of the 20th century, geographers tended to define a region as the interaction of human beings and the natural environment in a delimited area. However, the definition of a region began changing in the 1960s and has turned into the concept of "heterogeneous relations" (Murdoch, 2006). In Turkey, investigating the relationship between space and human capital flows is a difficult issue. This is because data production on migration uses a territorial methodology. In other words, in data collection processes administrative and territorial boundaries are taken as data production sets. Data details may disappear among these artificial boundaries. Besides, the artificial boundaries only help produce local or global-scale knowledge. It is not possible to produce knowledge in between those scales. We can determine different geographies by analysing spatial relations grounded in human activity. The methodology of spatial econometric analysis helps us gather some clues on relations beyond artificial provincial boundaries. With the help of this methodology, it is possible to measure the effect of social activity on neighbouring provinces. Again, this perspective allows us to evaluate a region with multiple relations and environments. The empirical findings of the article indicate that neighbouring provinces' social environmental characteristics influence the human capital attraction of a province in Turkey. This means that if we just explore or analyse provinces in their own limited territories, we fail to notice the organic relationships among these provincial boundaries. As planners we have to keep this "multiple relational" approach in mind while conducting an analysis of an urban issue. Therefore, when producing future urban policies, the issue under question should be evaluated using a combined filter of different environments such as the social, economic, natural, etc. Hence, this study is a part of wider research in which different environments are considered in detail. This article discusses only the social environment dimension of this whole.

As a result, this study is built on the interrelation between social environments of urban regions in Turkey and the attraction of human capital to those regions.

In order to emphasise "human capital flows and its attraction to certain places", which is the main consideration of this study, it is necessary to understand the historical evolution of influential thinking on human capital. Since the 13th through to the 20th century, the concept of "human capital" almost reached its most mature form. In the 21st century, the evolutionary economic geography approach has centred this mature conception of "human capital" at the crux of the theory. According to this approach, skilled, educated and creative human power is a requirement for competitiveness. Thus, over the social, economic and technological changes of each historical period the concept of "human capital" was slowly filled in with notions of experience, knowledge, talent, and creativity. In economic formulations, "human capital" moved away from numerical magnitude to something the quality of which formulations began to focus on (Hunt, 2002). According to this study's initial assumption, human capital is the main engine for regional development. Intellectual power is needed in order to create an economically dynamic environment with people possessing entrepreneurial abilities and an environment that is seen as housing innovative industries from various sources (Karlsson *et al.*, 2001). Regions with dense information, unique ideas and competences can be called creative environments (Egan, 1992; Andersson, Quigley and Wilhelmsson, 2005; Faggian and McCann, 2006). These creative environments host academic and cultural activities of various kinds which constitute the most important part of knowledge production, they create opportunities for high levels of communication both within the region and out of the region, and they are in continuous development with the help of cooperative relations inside the regions (Andersson, 1985). People living in an urban environment share their feelings, experiences and the above mentioned kind of explicit knowledge while doing their jobs, working as a group for certain shared objectives, or in undertaking or observing creative artistic events. The fact of being part of such an environment accelerates the diffusion of knowledge, and this relocation and transformation of knowledge multiplies the number of people who learn, teach and produce new ideas. Literature tells us that the prosperity of the social environment in urban regions is highly related with the attraction of human capital to these regions and its accumulation there.

To sum up, for creative environments, the mobility of people who have the capacity to transform tacit knowledge into explicit knowledge is the main issue for regional development. The accumulation of human capital in a region both by being raised in the same region and by attracting them from other regions is a pivotal action to be taken by central, regional, and local authorities. That is why this study's leading question is: "Which properties of the social environment influence the attraction of human capital to urban regions in Turkey?" As stated earlier, this study defines regions from a relational perspective. In this context, answering

the research question is attempted using spatial econometrics which gives hints about the effects of an occasion in an urban area on neighbouring urban areas. Previous studies conducted on human capital have mostly focused on variables that are effective for human capital attraction. However, without spatial spillover effects, this approach is insufficient. Human capital attraction cannot be analysed just by considering the destination region's conditions, as it is a variable which has a propensity to be influenced by the development of neighbouring environments. Therefore, the spatial econometric analysis technique used in this study makes it possible to investigate the ramifications of the developments in neighbouring regions on human capital mobility in destination regions.

2. LITERATURE REVIEW

Attractiveness and human capital migration are the two main modules of the conceptual framework for this study. The motive for the dual structure of the study comes from the human capital perspective that many authorities consider as the principle element of regional development. If a regional environment is to be enriched in terms of human capital structure, quality of life instruments should be dealt with. Many studies in literature suggest that regions should concentrate on the enrichment of their environment's quality of life conditions in order to be more powerful academic and cultural bases. Thus, it would be easier to attract human capital – educated and creative people – who are the main agents of development. There is a large literature on modelling human migration. Main categories of migration models in literature are classical labour migration models, human capital models, job search models, and gravity models. Our study is mostly inspired by human capital models of migration, and independent variables used in the study were chosen based on this theory and previous human capital migration studies. Therefore, brief information on the human capital model and related studies developed using this model is given in this section.

The human capital approach in migration theory differs from the classical theory with its ability to take into consideration the migrant's remaining working life while assuming that the migrant will respond to higher incomes. One of the main assumptions in this theory is that the group of both mobile and well-educated graduates is also the group that contributes the highest share to knowledge formation and accumulation (Faggian and McCann, 2009). Put more clearly, when talented and well-educated people move into a region, production capacity increases, competitivity in the labour market rises, and information and innovation begin to be transferred more effectively (Simon, 1998). It is, therefore, crucial to identify the influential factors in the process of migrants'

decision making on destination choices. It has been shown by many studies that cities as living spaces are mostly preferred by well-educated people (Ritsila and Ovaskainen, 2001). Higher pay and improved chances in cities are the major factors stimulating this tendency. Additional factors are listed as opportunities for education and family life (Glaeser, 1998). Sjaastad (1962) was the pioneer of this argument. According to him, when somebody moves to a region, he/she makes an investment. Glaeser (1998) introduced another factor of human capital accumulation in regions. He suggested that the reason for migrating to cities is the chance for migrants to improve knowledge and talents by getting together with other professionals and thus rise in their careers. This leads to a further increase in income (Glaeser, 1998). Additionally, all costs and benefits are included in the human capital approach, many of which were incomplete in the classical approach. The last strength of the human capital approach in migration modelling is its sensitivity to the selective nature of the action which draws attention to the tendency of young, highly educated and skilled people to migrate (Ritsila and Ovekairen, 2001).

The human capital approach has been very inspiring for many migration and urban studies, starting with the work of Jane Jacobs in 1984 and continuing until the present.

Jane Jacobs (1984) used the term "creative people" as a synonym for "human capital" and noted that regional economic development depends on the qualifications of cities to attract creative people. Lucas (1988), inspired by Jane Jacobs, stressed that most knowledge is spilled over in interactions between people accumulated in cities. The importance of human capital has increased with the development of industry specialising in high technology products and services.

Florida (2003) as a contemporary supporter of creative economies argued that the mobile-talented human capital pool is the most important factor for companies to cluster in certain regions and this source of human capital makes them more competitive and creative. In his studies Florida emphasized the importance of the social environment besides economic opportunities. According to Florida (2003), economic reasons are not the only reasons for highly qualified and talented people to move from one place to another. He argued that the diversity of destinations is one of the most important driving forces behind the talented population's movements across borders. For this reason, he defined culturally diverse places as creative centres where creative human capital, innovation and high-tech industry are concentrated. Those places become the centres of growth because of creative people's preference for living there. Florida's methodology was to compare the correlation statistics of cities using different index values representing mostly the social environment. Another important effect of cultural diversity is known in literature as the migrant stock effect which refers to a generation of people who migrated before and are able to provide information to those who follow (Armstrong and Taylor, 2000, pp. 141–165).

Faggian and McCann (2006) studied the influence of the knowledge capacity of regions on their ability to attract young graduates. In their research, they analysed data which showed them the migration patterns of British students with the help of GIS (Geographical Information Systems). Knowledge capacity indicators used in the study were regional labour market indicators, industry structure indicators (employment demand and innovation indices), quality of life indicators, and geographical indicators. One of the results drawn from the study was the positive correlation between attractiveness of a region for the young human capital and some of the characteristics of the regions such as innovative potential, crime rate, the proportion of knowledge workers, and geographical peripherality. Another outcome of the study was the negative correlation between the weakness of the local job market, and the ability of the region to attract the young talented population. In addition, the study proved that having a research institute or a university raises the chance of the region to benefit from young graduates as a talented human resource. However, there is no direct evidence of the relationship between universities and their contributions to innovative activities in regions. They used an econometric analysis methodology in order to understand the effective specialties of regions on human capital flows and they mapped those results. However, "relational aspect of space" is missing in their study, as in others.

There is also a policy dimension for attracting human capital. Coniglio (2008), in his study, assessed the effects of a regional policy to create a well-educated and talented population and then make them contribute to the regional economy by keeping them within the same region. The manner of migration of this talented population at the micro-level forms the core of their study. To define migrants' personal characteristics, the main causes of migration and the distinguishing features of the destinations for the young and educated migrants were the leading questions they posed in the study. One of the main findings of the study was that giving financial support to young graduates who want to attend a post-graduate course or an internship in the region proved useful for retaining a large portion of the population in the same region. Additionally, developing the ties between local economic agents and higher education courses to provide internships for graduates has a positive effect on retaining graduates in the region. According to the results of the analysis, physical distance, availability of direct information of probable destinations and improved quality of life conditions are the most important features for regions to attract young talented population. Another regional characteristic they analysed in the model was the quality of life and the measures used for it were expenditure on fine arts and musical performances, crime statistics, and population density. Results of the survey showed that human capital flows are most influenced by the increase in income per unit of labour relative to national average among these regional characteristics, and higher unemployment rates have discouraging effects on the flows. The analysis also proved that regions

growing faster receive more young talented migrants compared to the national average. In terms of quality of life indicators, crime has a stronger effect on decisions to move out of that region. However, population density has an adverse yet a weaker effect which means that young talented individuals prefer to move into more populated and diverse places. The methodology used in this study was econometric equations, like in the previous ones. Nevertheless, only one region is studied and therefore the relational approach to understand different regions' effects on one another is missing.

Van der Gaagand and Van Wissen (2008), in their study, aimed to contrast and assess the demographic and explanatory ways of estimating internal migration in some European countries. Three groups of indicators were used, labelled demographic, economic and other. Demographic indicators include population, density, migration, and accessibility. Economic indicators consisted of GDP per inhabitant, unemployment rate, employment and housing stock. Distance and contiguity belong to the "other" group.

One of the conclusions of the study was that the demographic model is a suitable option for estimations covering a short period. Then again, explanatory migration models are useful for scenario making. Demographic models are suitable for regions following a more steady development process. However, for regions evolving quickly in terms of their economy and urban characteristics, demographic models do not give satisfying outcomes. This is also true for regions witnessing rapid falls in economic and urban conditions. Explanatory models are also ideal for long-term predictions of migration patterns. This study is quantified with regression models for a cross-country analysis.

Those models and determinants developed in earlier years paved the way for contemporary academic studies on human capital migration. For instance, Faggian and McCann (2009) in their study intended to analyse the relationship between graduate migration for employment and the innovation performances of British regions. They included the regions' characteristics in the analysis, so as to see if the knowledge infrastructure of a region had an effect on the graduates' decisions to move.

According to migration literature, non-material costs of moving are environmental features for economically developed regions. Environmental features include very wide-ranging elements related to the physical, economic, social, and political sides of the general quality of life. Thus, these features cover neglected and idle property, size of new housing developments, population density, degree of urbanisation, crime and other social anomalies affecting public peace, average temperatures, general weather conditions and air quality, recreation, sports and educational opportunities, and infrastructure besides the above stated indicators.

Glaeser and Saiz (2004), in their research, claimed that there is a strong relationship between urban growth and the educated population with evidence from

both Great Britain and the United States. They drew that conclusion by comparing the percentage of college graduate residents and population growth rates in different cities of the two countries. Glaeser and Saiz (2004) also checked for the relationship between other urban amenities and population growth, and found out that some of the features associated with weather conditions and occupational agglomerations in certain sectors are more strongly correlated with growth. After measuring the correlations between the listed independent variables with population growth and human capital, they concluded that human capital is a factor in raising cities' and regions' productivity levels. According to their findings, if qualified people agglomerate in a province, it causes wages and living costs to go up. Additionally, the structure of occupations in a province supports its growth.

The literature discussed above focused on human capital migration and urban attractiveness. Their similarity with the current study is the focus on the relationship between urban environment components and human capital. However, the cited studies lack the spatial/relational approach to urban regions which means that the effects of developments in settlements neighbouring the region were ignored. The contribution we intend to make with the current study is adapting spatial econometric analysis to the problem of human capital attraction.

This is not to suggest that spatial econometric techniques have never been used in urban issues in literature. There are, of course, many studies combining the two, such as Baudino, 2016; LeSage and Pace, 2010; Chen and Zhou, 2017; Liu *et al.*, 2017, etc. Nevertheless, their main focus is not on human capital but some other urban environmental component.

Having summarised the relevant literature and the contribution of the current project, we now turn to the specific literature on Turkey. When we explore Turkish literature based on human capital, migration and spatial analysis, there are two studies on internal migration patterns of Turkey for 20th century. One of them is by Munro (1974) who worked on influential factors of internal migration and tried to understand the relationship between urbanisation and migration using data from the 1960s. He focused on push models of migration in the methodology. The other piece of research conducted in the late 20th century was by Tunalı (1996). He also investigated the same period as Munro, i.e. 1960–70. His main target was "causes of stepwise-remigration" patterns in the period. He found some evidence that young and better educated and skilled people show a higher propensity to re-migrate than the rest of the population which also supports findings in global literature. He the adopted job search and human capital approaches to migration in his study. However, that was a period of urbanisation and flows from rural to urban areas. Therefore, the migration problem area was quite different from the present century's context. One of the more recent studies on Turkey was conducted by Kırdar and Saraçoğlu (2007) in which they analysed the connection between the conver-

gence of income per capita and internal migration for the period 1975–2000. They found a negative impact of migration on convergence among regions that is contrary to the neoclassical approach. That contrasting result was explained by the authors by the volume and qualifications of migrants. Rural-to-urban migration, i.e. low skilled migration, was still dominant in internal flows at the beginning of the 2000s. Thus, the main motivation for migration between regions was economic. Previously, Gezici and Hewings (2004) analysed the same relation and found no significant effect of migration on convergence for the years 1987–1997. After the 2000s, the migration motivations of individuals in Turkey began to diversify (Kırdar and Saraçoğlu, 2007). Two years after their work, Karahasan and Uyar (2009) studied the relationship between educational disparities and income inequalities within Turkey. Their focus was not directly on human capital and development, but on education as the central component of human capital. A similarity of their work with the current study is the spatial dependency perspective introduced with the help of Moran's I values that they calculated in their research. Their data s applied to the years 1997–2006. They analysed Turkey's regional differences in education levels by using three different education categories (primary, secondary, and university). Their variable was the ratio of students to instructors for each category. Additionally, they highlighted the lack of research on social determinants of economic inequalities of regions. Their results for that period showed that there was a spatial dependency for primary and secondary level ratios. However, there was no significant dependency for university level ratios. They also looked for the spatial patterns for the income level of the regions. Nevertheless, they did not examine the direct effects of income levels and education ratios on each other. One of the most recent studies on human capital in Turkey was conducted by Erdem (2016). He used district level data from 2008 and 2012, and measured human capital disparities, their spatial dependency levels, and their change between 2008 and 2012. Maps produced as part of his analysis showed east and west dualism for primary and secondary education degrees of the population. However, the dualism was not clearly visible for tertiary education level. Then again, for the tertiary level of education, there were aggregation centres. His findings showed spatial dependency and aggregation in certain nodes in terms of human capital. He showed that there was a disproportionate allocation of human capital in Turkey, that it is especially accumulated in the western part of the country, around leading metropolitan cities like Istanbul, Ankara, Izmir, Eskişehir, Muğla, etc. His findings also supported the claim that the accumulation of human capital in regions has positive spillover effects. Another human capital oriented study was carried out by Yüceşahin and KC in 2015. They conducted population projections focusing on the changes in the quality of human capital according to three different political progressive future scenarios for Turkey. In their concluding remarks,

they underlined that general development policies should be considered hand in hand with urban and regional development policy and plans. Lastly, there is a study that measures spatial spillover effects of knowledge using R&D firm level data (Çetin *et al.*, 2016).

As it is obvious from the literature discussed above, there are many studies combining human capital flows and econometric analysis, and also a considerable number of studies that combined urban issues and spatial econometric analysis. However, there is not much literature that combines human capital migration and spatial econometric analysis.

3. DATA AND METHODOLOGY

In our empirical study, econometric spatial regression analysis was applied to social environment indicators in order to observe the effects of social environment indicators on the human capital attractiveness of cities in Turkey.

3.1. Data

In order to understand the effects of social environmental variables on human capital attractiveness, eight different indicators (all province based) were used. These are the socio-economic development index[1] (SEGE2011); the proportion of the population staying at their place of birth, which is used as an indication of cultural diversity and migrant stock effect (MIG_S_EFF); cities' rank order changes from 1990 to 2015 (RANKORDER) which indicates each province's population growth among all 81 cities in Turkey; the number of visitors to museums and archaeological sites per 1,000 people which is used as an indication of the involvement of inhabitants with social and cultural performances (VISITORS); the number of exhibitions at galleries by province per 1,000 people which indicates involvement of inhabitants to art performances (EXH_GAL); the number of theatre performances in the 2012–13 season per 1,000 people which is an additional indicator of involvement of inhabitants to social and cultural performances (PERFORM); the number of films shown per 1,000 people in each 81 province which again gives us a clue about citizens' involvement in social and cultural events (PIC_SHOW); and the number of visitors to fairs and conventions per 1,000 people in each 81 province that is the last variable representing the involvement level of citizens in social and cultural events (PART_FAIR) (see Table 1).

[1] Index developed periodically by the Ministry of Development.

Table 1. Variables used in the empirical model

Variables Used in the Empirical Model						
Relevance of the Variable for the Model	**Variable**	**Indicator**	**Date of the indicator**	**Abbreviation in the model**	**Institution that produced raw data**	**Source of the data**
Dependent	Human capital migration	proportion of migrants who hold undergraduate degrees or higher	2015	TRFACULTY	Turkish Statistical Institute	http://www.turkstat.gov.tr/Start.do
Independent	General socio economic development level of the provinces	socio economic development index value	2011	SEGE2011	Strategy and Budget Presidency	https://www.ab.gov.tr/files/ardb/evt/2_turkiye_ab_iliskileri/2_2_adaylik_sureci/2_2_8_diger/tckb_sege_2013.pdf
Independent	Cultural diversity	proportion of population staying at their place of birth	2015	MIG_S_EFF	Turkish Statistical Institute	http://www.turkstat.gov.tr/Start.do
Independent	Population growth	provinces' rank order changes	1990-2015	RANKORDER	Turkish Statistical Institute	http://www.turkstat.gov.tr/Start.do
Independent	Involvement of inhabitants with social and cultural performances	number of visitors to museums and archeological sites per 1000 people	2015	VISITORS	General Directorate of Cultural Heritage and Museums	http://www.turkstat.gov.tr/Start.do
Independent	involvement of inhabitants to art performances	number of exhibitions at galleries by province per 1000 people	2015	EXH_GAL	Turkish Statistical Institute	http://www.turkstat.gov.tr/Start.do
Independent	involvement of inhabitants to social and cultural performances	number of theater performances 1000 people	2013	PERFORM	Turkish Statistical Institute	http://www.turkstat.gov.tr/Start.do
Independent	involvement of inhabitants to social and cultural performances	number of films shown per 1000 people	2015	PIC_SHOW	Turkish Statistical Institute	http://www.turkstat.gov.tr/Start.do
Independent	involvement of inhabitants to social and cultural performances	number of participants to fairs and conventions per 1000 people	2015	PART_FAIR	Turkish Statistical Institute	http://www.turkstat.gov.tr/Start.do

Source: own work.

The above-mentioned independent variables are all suggested by the literature which was reviewed in the previous section. In the relevant literature, a large variety of independent variables were used to represent different environmental specialties of cities such as pay, educational opportunities, family life opportunities, population diversity, knowledge capacity, industry structure, innovative potential, geographical position, expenditure for creational and art performances, job market conditions, presence of research institutions, weather conditions, etc. In the present empirical study – guided by the relevant literature – we concentrated on the quality of social environments using a group of indicators. Furthermore, in literature focused on Turkey, there are useful studies on migration, human capital, and economic inequalities. However, not a single study has been carried out that specifically tried to measure the effects of the social urban environment on human

capital attraction using a relational approach. That is why, for our empirical analysis, we selected variables representing the wealth of the social environment such as a general socio-economic index giving information about the regions' overall development levels (in short SEGE2011 in the empirical part), cultural diversity (MIG_S_EFF), pace of population growth (RANKORDER), involvement levels of inhabitants in social, cultural, and art performances (VISITORS, EXH_GAL, PERFORM, PIC_SHOW, and PART_FAIR) for 81 different provinces in Turkey.

Spatial regression analysis was implemented using those social environment indicators as dependent variables and the regression model was constructed for the independent variable of proportion of migrants who hold undergraduate degrees or higher (TRFACLTY). The proxy for human capital is a difficult issue in this kind of analysis. The concept is expected to include the talent, experience and academic levels of people. However, data restrictions in Turkey do not allow for using such a comprehensive proxy. Migrants to urban areas can be categorised according to their education levels. Another question that should be considered when deciding the proxy for human capital is "which education level represents the most valuable human capital." The answer to it changes according to the developmental rank of the whole economy, educational contents of different levels (which abilities they provide their graduates with), their contributions to the economic conditions of the country, and, of course, to the time period used in the analysis. For the current study, three different levels of education were considered; high school, undergraduate and graduate, and Ph.D.-level educated people. Each of these categories can be meaningful as a proxy for human capital in accordance with the main objective of interest. In this study, each category was tested as dependent variable, the highest values and the most meaningful spatial dependency results were obtained for undergraduate and higher educated migrants. Therefore, regressions were structured upon that proxy of human capital. The following results were, therefore, presented considering the same eight independent variables belonging to social environment effects on the dependent variable as explained above.

All the data except SEGE (which is the latest available index produced by the Ministry of Development periodically) was collected by the Turkish Statistical Institute (TURKSTAT) and these indicators were established on following an examination of human capital migration models and related studies mentioned in the literature review part (see Table 1).

3.2. Methodology

The methodology used in order to assess the relationship between human capital attractiveness and social environmental indicators was to construct a spatial econometric model, and this section provides technical information about the main statistical figures used in the spatial econometric analysis.

A note on what we mean by the word *spatial* here. In spatial models, space is the most important component. Spatial models are built on the idea that "an occurrence in a particular territory has connection with another occurrence in a bordering territory". This is also compatible with Tobler's First Law of Geography that states: "Although there is a total relationship between each existent, adjacent existents have tighter relationships." Spatial econometric models are based on these main ideas and if we use a spatial econometric model in a study, we are not only interested in variables' effects on dependent variables but also their effects on neighbouring locations. In other words the geographical positioning of a place is an important factor in this methodology. Why is it critical or convenient to use a spatial econometric regression in understanding the urban environment's role in attracting human capital for Turkey? First of all, debates on the definition of a region or an urban entity have a long history. How should we imagine and conceptualise a region? Is it a territory somehow limited by boundaries and shall we take it as if every occurrence is happening inside this closed system? Or is it a relational spatial existence in interaction with any other existence near or far? Especially when talking about the mobility of human beings, we cannot approach a region from the former perspective. That is because humans do not just move their corporeal body to a place, but they also bring their living thoughts, experiences, knowledge, culture, and a way of life with them. The destination is also a living environment with social human beings and their attributes. To put it differently, a relational approach (Amin, 2004 and 2007; Jones, 2009; McCann and Ward, 2010; Ward, 2010) is requisite for a mobility study. In Turkey and in many countries, urban statistics are produced from a territorial perspective. For that reason, one of the ways to approach urban issues is to add a viewpoint to urban research by which one can look at an issue from a broader perspective than that of bounded provinces. Here, spatial econometric analysis helps broaden our perspective from province boundaries and gives us the opportunity to comment on their interrelations with neighbours.

The most important figure representing variables' effects on neighbouring locations is spatial autocorrelation, which is also the most prominent part of our analysis. Therefore, spatial autocorrelation will be explained first. The feature to quantify the intensity of the connection between adjacent and remote elements is called spatial autocorrelation. Anselin and Bera (1998) defined spatial autocorrelation as the probability for two close geographical positions having similar distinctive specialties. In other words, it is a mathematical analysis of the likeness of areas and characteristics. This value can be equal to zero or can be negative or positive. A value of zero means there is no relationship, a negative value determines a negative relation, and a positive value means there is a positive relationship between the variables (Viton, 2010).

The second component of the analysis are the spatial weight matrices. Before constructing a spatial model, it is important to determine which territory is the

neighbour of another. This step contains an R R matrix that is rectangular and symmetric in form, including 1s and 0s. Assuming territory A is a neighbour of B, then the value in the matrix for A and B is 1, and if not, the value is 0. There are four main methods for creating this matrix, i.e. rook, distance based, k-nearest, and queen. For our study, each of the results of the four matrices was tested and the highest significant value was obtained from the queen matrix. Therefore, the preferred matrix for this study is the queen relation which means that two territories are determined as neighbours if they have a shared boundary at any direction and of any length (Viton, 2010). The other options for the matrix have additional restrictions. In a queen matrix, spatial interrelation in any direction is admissible. We are studying a country's urban regions internally and we do not have any presumed evidence of a relation between urban regions in terms of human capital attraction. Therefore, the most suitable matrix option for this research is queen, which gives us enough space to control for all the neighbours in each direction without any distance limitation.

The third component is Moran's I value. Moran's I value is used for both analysis for clustering (global Moran's I) and analysis for clusters (local Moran's I), and it is an element of spatial autocorrelation tests. Global spatial autocorrelation is determined by the assessment of a null hypothesis of an arbitrary territory. If this null hypothesis is rejected, then we can claim that there is a spatial clustering of variables and thus we can get more knowledge about the allocation of values than we could from other statistical instruments such as box plots, quintile maps, etc. The main role of spatial autocorrelation's main is to calculate the magnitude of every variable's relation in a territory with a spatially weighted average of variables in bordering territories.

Below is the formulation of Moran's I value:

$$I_t = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}(k)x_{it}x_{jt}}{\sum_{i=1}^{n}\sum_{j=1}^{n} x_{it}x_{jt}}$$

Here w_{ij} refers to the extent that territory i is associated with territory j, and x_{tt} is the difference between variable i and the mean of the variable i at the year t. Finding a value of I bigger than the expected I value means that there is a positive autocorrelation and if it is smaller than the expected I value, then it shows a negative spatial autocorrelation (Çelebioğlu, 2017). Various methods can be used to define autocorrelations. Here, the calculation of permutations is preferred. 999 re-sampled datasets are generated and then I figures are calculated. The result of these calculations is contrasted with current real dataset (Altay and Çelebioğlu, 2015).

The Moran scatter plot is the image of the global Moran's I analysis and in this image, the regression line's slope matches the Moran's I value. An enhanced ver-

sion of the Moran scatter plot is also able to describe the interrelation of a variable at a territory and another variable at a nearby territory which is called the bivariate spatial autocorrelation. Local Moran's Is images are cluster and significance maps.

A spatial autocorrelation analysis is completed by means of composing spatial weights. The evaluation of spatial autocorrelation is applied to ordinary least-squares regression. The maximum likelihood analysis is used to measure spatial error and lag models. (Anselin, Syabri and Kho, 2006; Altay and Çelebioğlu, 2015) are the two main types of spatial regression models.

According to the spatial lag model, the degree of dependent variable "a" at a region "X" is affected by the degree of that same dependent variable at the bordering region "Y". That is a statistical expression of "spatial spillover". For instance, the rate of unemployment in a region may be affected by the rate of unemployment at a bordering region. Here is the formulation:

$$y = \lambda Wy + X\beta + u$$

Where W_y represents spatially lagged dependent variable for weights matrix W, X is explanatory variables's matrix, represents error terms, is for the spatial coefficient. In case there is no spatial interrelation, then equals zero (Çelebioğlu, 2017).

The second kind of spatial model is called the "spatial error model". Here, the calculations of the spatial impact are done by the help of error terms and the formulation is:

$$y = X\beta + u$$
$$u = \rho Wu + \nu$$

Where u represents error terms, ρ is the spatial error coefficient, and ν represents uncorrelated error terms. If there is no correlation, ρ equals zero (Çelebioğlu, 2017).

The model then changes to:

$$y = X\beta + (I - \rho W)^{-1} \nu$$

While using spatial regression models, the procedure starts with the calculation of standard Lagrange multiplier error and Lagrange multiplier lag numbers. If neither of the two tests rejects the null hypothesis, the next step is to proceed with outcomes of the ordinary least squares method. Conversely, if any of them rejects the null hypothesis, then it shows the researcher the direction to continue using a spatial error model or a spatial lag model. As a third outcome, the null hypothesis may be rejected by both of the Lagrange Multiplier tests. In this case, the robustness of statistics should be checked. One will be more meaningful than the other (Anselin, 2005).

4. FINDINGS

The first step for spatial econometric analysis is to put the dependent variable TRFACULTY with eight independent variables listed above through an ordinary least squares (OLS) test. Faggian and McCann (2009) and many of the previous researchers proved that a mobile and educated population affects knowledge production and innovation capacities of provinces positively. Therefore, our analysis dependent variable was chosen to be faculty and higher educated migrants. In addition to that, internal migration studies taking Turkey as the case were mostly concentrated on mass migration numbers (Kırdar and Saraçoğlu, 2007; Gezici and Hewings, 2004) rather than focusing on some specific groups of migrants like we normally do. Therefore, the construction of our model based on the human capital dependent variable makes a distinction for Turkish internal migration studies. The value of R^2 is found to be 0.75. In this model, the multi-collinearity condition number is less than 30 (8.68) (see Table 2).

The results of the OLS test for migrants of undergraduates and higher to the socio-economic development index and participation to fairs in cities are significant at the 1% level, but the number of art performances and changes in rank orders through the years 1990 to 2015 are significant at the 5% level (see Table 2). Yet, although the changes in rank order through the years are significant, the effect of this independent variable on attractiveness is negative and the socio-economic development index and participation in fairs in cities affect the attractiveness of undergraduates and higher to cities positively. This result indicated parallel findings with Glaeser (1998) and Florida (2003) who found that both economic and social environmental factors were effective on the attraction of people to the cities. Glaeser (1998), Faggian and McCann (2006) also emphasized the positive effect of human capital accumulation in regions on attracting additional human capital. In our analysis we found out that participation in fairs was an effective variable in human capital attraction. That resembled Glaeser's findings. That was because fair participants cover a population who has special interest and specialisation in certain business activities coming from different parts of Turkey and sometimes outside Turkey. They were big business events that gathered the professionals and the related consumer society, those events led to information based interactions and new knowledge formations. Faggian and McCann's (2006), identified in their study some additional factors differing from the economic factors like crime rates which represent the social environment of cities. That also supported our findings of social environmental factors on human capital migration. In our OLS model, independent variables like the migration stock effect, the number of visitors to museums and archeological sites, the number of exhibitions at art galleries, the number of films shown in cinemas were all insignificant. Florida's (2003) findings especially showed positive correlation with cultural diversity in human capital attraction. However, in our analysis the variable we used for representing migrant stock effect was found to be insignificant for the human capital attraction potential of Turkish provinces.

Table 2. Results of spatial econometric analysis

Dependent Variable: TRFACULTY	**Coefficients**		
	OLS	**Weighted-OLS**	**Spatial ERROR**
Constant	0.248398 (0.00844)	0.248398 (0.00844)	0.283626 (0.01072)
SEGE2011	0.196918 (0.00009)	0.196918 (0.00009)	0.404693 (0.00000)
MIG_S_EFF	-0.00355239 (0.18780)	-0.00355239 (0.18780)	-0.00274778 (0.22073)
RANKORDER	-0.0083396 (0.03039)	-0.0083396 (0.03039)	-0.00586401 (0.05095)
VISITORS	-2.29698 (0.39000)	-2.29698 (0.39000)	-2.43748 (0.25349)
EXH_GAL	-1.2088 (0.63184)	-2.29698 (0.39000)	-1.5448 (0.42465)
PERFORM	0.32081 (0.03309)	0.32081 (0.03309)	-0.0518068 (0.67838)
PIC_SHOW	-0.025015 (0.76052)	-0.025015 (0.76052)	0.0900463 (0.15771)
PART_FAIR	0.652583 (0.00000)	0652583 (0.00000)	0.50565 (0.00000)
Lambda	-	-	0.728623 (0.00000)
R^2	0.756118	0.756118	0.820674
Adjusted R^2	0.729020	0.729020	-
Jarque-Bera	124.4639 (0.00000)	124.4639 (0.00000)	-
Breusch-Pagan	208.6814 (0.00000)	208.6814 (0.00000)	101.1206 (0.00000)
Moran's I (error)	-	2.1342 (0.03283)	-
Lagrange Multiplier (lag)	-	0.2344 (0.62826)	-
Robust LM (lag)	-	5.1914 (0.02270)	-
Lagrange Multiplier (error)	-	2.7604 (0.09663)	-
Robust LM (error)	-	7.7174 (0.00547)	-
Note: P-values are in brackets.			

Source: own work.

The step following the OLS analysis was the construction of the regression model that measured the volume of spatial effects of the same 8 independent variables belonging to the social environment of cities. Spatial effects were tested once again with the help of the "queen weight matrix".

After the exploration of "Diagnostics for Spatial Dependence" parts in the model results, in the light of Lagrange Multiplier and Robust LM values which were 0.09663 and 0.00547 respectively, the Spatial Error Model was chosen for the next procedure. Those two values showed very high levels of significance. Thus, the spatial error model was applied using the queen weight matrix (see Table 2).

As can be seen in Table 1, spatial dependency was significant for province preferences of undergraduate and above migrants, which was proved by the result of the likelihood ratio situated in diagnostics for the spatial structure part. That test result was significant at 1% level. The lambda value was also significant at 1% level and its coefficient was 0.72, which means there is a high spatial dependency in the model (see Table 2). A coefficient of 0.72 tells us that one unit of change in error terms in a neighbouring province will cause a change of 72% in that province's probability to be preferred by undergraduate and higher graduates. Erdem (2016) also found a spatial dependency for the human capital accumulation for Turkey in his study.

Thus the outcomes of the model constructed to understand the effects of the social environment on human capital attraction in Turkey showed us that spatial dependency is effective for undergraduate and postgraduate degree holders. In other words, undergraduate and higher degree holder migrants care about the social prosperity of the neighbouring environment of the destination province which is also supported by the findings of global literature seeking the relationship between skilled people's agglomeration in cities and urban amenities.

5. CONCLUSION AND POLICY SUGGESTIONS

This research has been motivated by the driving force of urban environments which is human capital. Mobility of human capital is known to increase the potential of producing new knowledge and avoiding the community stuck in social, economic, and environmental bottlenecks. Despite many of the data restrictions both on scale and content, the empirical analysis was conducted using spatial econometric analysis techniques in the interpretation of the model results. That approach to urban issues gave us the strength to see and analyse the relations ongoing among the administrative boundaries. The analyses based on only the provincial level data is somehow restricting the interpretation of the geographies

of cultural, commercial, social, institutional or environmental relatedness. Therefore, the relational approach and spatial analysis techniques as its instrumental assistant may open new windows in producing urban and regional policies.

In the introductory and theoretical sections of the study;

– Region conception of relational approach of the geography,
– a brief review of historical evolution of human capital conception,
– recent literature on human capital, spatial attractiveness, and some relevant spatial econometric models were discussed.

The details of our empirical model and findings were given in the following parts of the study. In summary, according to the structured model in this study, there are three significant independent variables, namely the level of social development index, participation in fairs and conventions, and the rank order changes of the cities from 1990 to 2015. The most effective independent variable on attracting undergraduates and higher to provinces is the level of participation in fairs and conventions in cities. Fairs and conventions are big events that gather people and the cutting edge knowledge and technology in specialised sectors. Therefore, we can comment that as huge platforms of knowledge sharing and spillover, networked and mobile society are the most influential factors for attracting educated and talented human capital in Turkey. Consequently, urban and regional planning policies for provinces in need of human capital should give priority to organising and constructing those kinds of events and infrastructure for sectors that cultivate those kinds of organisations. When we examine the distribution of the rate of participation in fairs and conventions per province, it is clear that cities getting high rates of participation are accumulated mostly in the western part of Turkey and that it follows a similar pattern with overall developmental disparities among the provinces. This shows that big organisations for technology and knowledge accumulation and sharing are carried out mostly in the western part of the country and the benefits arising from such organisations do not spillover to the eastern parts of the country.

Participation in fairs and conventions gives clues about a community's mobility, eagerness to interact with colleagues, willingness to learn more about some specific issues, and openness to new information.

The lambda value in the model for the social environment is very high, which means that province choices of human capital are affected by the level of social environment variables in the neighbouring locations.

In the light of the study findings, social environments of neighbouring provinces in Turkey influence the human capital attraction capacity of one another, in other words, there is a significant spillover effect among the provinces. This finding shows us that development strategies of provinces should not be developed by considering them independently, as if each province is a closed entity with no relation to the rest of the world, but there should be a regional and relational approach in producing urban strategies which also takes into consideration the neighbour-

ing provinces. Although there are institutional organisations like regional development agencies that have been active since 2009, which can coordinate the implementation of this relational approach, they are not effectively operating on such issues. The implementation of regional plans and regional development strategies that are prepared by regional development agencies should be supported.

Such institutional structures that operate above the provincial boundaries should coordinate central, provincial, and local authorities in advancing common strategies, policies, and plans focused on developing social environment factors for urban areas with the help of scientific knowledge. Decision makers should cooperate especially with the sociology, economics, and urban and regional planning departments at universities for developing the social environment of urban areas.

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