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ACCESS TO HEALTHCARE, UTILIZATION AND HEALTH OUTCOMES IN TURKEY

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Abstract

This paper examines the link between healthcare access/utilization and health outcomes in Turkey within a spatial framework. Our initial set of findings highlight an overall duality in health indicators which is getting stronger once spatial dimension is included. Specifically we find wider spatial dichotomy for health outcomes relative to access and utilization measures. Finally once we consider unobserved heterogeneity, spatial spillovers and spatial variability; our results pin point a non-robust link between healthcare access/utilization measures and health outcomes which works better among the already developed regions of Turkey. Overall our combined results indicate an ongoing polarization of health-based human capital development which coincides with local variations of the relationship between healthcare access/utilization and outcomes in Turkey.

JEL Classification: I11, I15, R11

Keywords: healthcare, inequalities, spatial dependence, Turkey

ملخص

تناولت هذه الورقة وصـول / اسـتخدام الرعاية الصـحية نتائج في تركيا ضـمن الإطار المكاني. لدينا مجموعة أولية من النتائج تسـلط الضوء على الازدواجية الشاملة في المؤشرات الصحية والتي تزداد قوة بعد اعتبار البعد المكاني. وعلى وجه التحديد نجد انقسام أوسع للنتائج الصحية ذات الصلة لتدابير الوصول والاستفادة. وأخيرا نقوم باعتبار عدم التجانس الغير ملحوظ، والآثار غير المباشرة المكانية والتباين المكاني؛ تشير النتائج لصلة غير قوية بين وصول / استخدام الرعاية الصحية ونتائج التدابير الصحية والتي تعمل على نحو أفضل بين المناطق المتقدمة النمو بالفعل في تركيا. عموما نتائجنا تشير لوجود دلالة عامة للاستقطاب المستمر لتنمية الموارد البشرية القائمة على الصحة وتزامن ذلك مع وجود اختلافات محلية العلاقة بين وصول / استخدام الرعاية الصحية ونتائج ذلك في تركيا.

1. Introduction

Human capital development has been on the agenda of development economics for decades. Not only education but also health is identified as integral parts of the human capital development. Even this has been a neglected area of research among neoclassic models, Ehrlich and Lui (1991) is one of the first to formally use health within a general equilibrium framework; suggesting that aging population and increasing young longevity are both positive determinants of economic growth. Inspired by theoretical contributions, number of studies controlling for the impact of health within empirical models accelerate. For instance, Gallup and Sachs (2001) and Barro (2013) underline the impact of health status within traditional convergence models. Revisiting the early discussions of Barro (1996), Barro (2013) elaborates that initial health acts as a better control within a convergence model; compared to education. Similarly evidence from Aghion et al. (2010) on a set of cross country is in supportive of the view that falling mortality rates explains most of the variation in productivity and economic growth. This finding is also consistent with Bloom et al. (2004) underlining that good health and productivity are interrelated even at the micro-level.[1]

These contributions show that health act as an important factor in understanding cross country income differences; yet still lack in explaining why and how health based human capital development differs between and within different set of countries. Once various dimensions are taken into account, inequalities can evolve from different perspectives. Hamoudi and Sachs (1999) discuss that health and wealth have multi-variate relationship among each other; mostly running over geographical, environmental and evolutionary factors. For instance according to United Nations World Population Prospects (2015) life expectancy at birth is 83.3 years in Japan, but only 60.6 years in Kenya. These countries have per capita income of $ 38,870 and $ 3,060 respectively (World Development Indicators, 2015). Such a comparison gives us clues on cross country differences in health and wealth. Marmot (2005) underlines that these inequalities are directly related with social justice and act as an important factor explaining cross region/country differences. Marmot (2005) lists a number of solid facts that explain causes of health based differences. While these facts include some social determinants such as social gradient, stress, early life, social exclusion, addiction and food; some other economic and labor market oriented factors such as work, unemployment, social support and transportation are also considered.

Not surprisingly studies dealing with inequalities of health based human capital development approach to this equity phenomenon from different perspectives. Revisiting earlier literature Braveman and Tarimo (2002) underline that not only cross country inequalities of health-based human capital development matters; but also within country disparities are getting stronger. One possible explanation goes back to Curtis and Rees (1998), discussing that inequalities in health is actually no coincidence as geography plays a dominant role in observing disparities in health based human capital development. At this stage one notable thing to observe is the specific emphasize on the underdevelopment fact of the less developed and developing countries. For instance, Boutayeb and Helmert (2011) focus on regional and rural/urban disparities in North Africa suggesting sizable variation of health based development differences. On another note similarly Chou and Wang (2009) show some level of club/cluster convergence that takes place in China rather than a nationwide convergence. This pattern is also validated by Fang et al. (2010) mentioning that given continuous rise in economic growth in China; regional structure worsens in terms of health equity. Meanwhile on the side of regional policies impact on health based equality is complicated and seems to be subject to development phase of countries. For instance while Zhang and Kanbur (2005) underline the continuum of health inequalities even after the reform process in China, Lopez-Casasnovas et

[1] It is also possible to approach the link between health and economic well-being from different perspectives. See Costa and Steckel (1997) for a discussion on a non-linear link between health and economic growth.

al. (2005) remark that impact of policies and reforms are mostly positive on the regional health equality in Spain.

Unequal access to healthcare and the resulting adverse health outcomes are at the top of pressing issues in public health. Health and health outcomes heavily rely on the differences on the differences in geographical access to healthcare as health outcomes and illnesses are unequally distributed across space and time. This study aims at discussing the spatial origins of healthcare access, utilization and development in Turkey. Given different attempts to restructure the Turkish Health System (Social Security Unification etc.) after 1990s, the so-called 2003 transformation (the Health Transformation Program -HTP) is discussed to be politically motivated given the sizable budget of the Ministry of Health. Even though this paper does not attempt to directly focus on the reflections of the transformation, our research design will inevitably give insight on the regional extent of policy measures. That is, discussions on the impact of transformation are on the agenda of policy makers and social scientists evolving around the question of quality and equity of healthcare services. However issue of equity is mostly challenged around the disparities among different income groups and comparing individuals that are with and without healthcare coverage in Turkey. We further discuss that regional disparities are also vital in examining the post 2003 transformations' influence on different segments of the society.

This paper will continue as follows; section 2 defines the data sources and summarizes the methodological approach of the paper, section 3 gives the combined results of the exploratory data analysis. Section 4 contains results of the empirical models and finally the paper concludes.

2. Methodology and Data

2.1 Data

In order to apprehend the spatial pattern of health-based human capital development in Turkey we use province level NUTS 3 data.[2] Our data comes from Ministry of Health Care Statistical Yearbooks provided by Turkish Statistics Office (TurkStat) and covers the 2009-2014 period.

In line with the central objective, we group our healthcare indicators into three major categories; (i) potential healthcare accessibility, (ii) healthcare utilization (revealed accessibility) and (iii) health outcomes. Potential accessibility refers to the ability to receive care whereas revealed accessibility or utilization refers to the actual delivery of healthcare during which patients come into contact with healthcare system Joseph and Phillips (1984). In order to measure the extent of the healthcare potential accessibility we use the number of general practitioners and specialists per 100,000 population (gptp and specptp respectively). While the former measure proxies the primary healthcare potential accessibility, second represents the secondary healthcare accessibility. Meanwhile we use primary and secondary (includes tertiary healthcare visits) healthcare visits (phcvpc and sthcvpc respectively) to control for the regional healthcare utilization. Finally in order to assess the province level healthcare status and outcomes we use infant mortality (death under one year of age-imr1) and under five mortality rates (imr5).[3] It should be noted that child mortality does not necessarily cover the overall health status of regions. However periodical data on different dimensions of public health status is not available at NUTS 3 level for Turkey. Given this limitation, we discuss that child mortality is the best proxy that can be considered in order to control for regional differences in health development in Turkey. Moreover we back our judgment on the applicability of child mortality as a good indicator of regional health status differences by

[2] NUTS is the abbreviation for Nomenclature of Units for Territorial Statistics (Nomenclature des unit's territoriales statistiques). See table 1 for NUTS classification of Turkey.

[3] Our data set covers the 81 settlements (provinces) for the 2009-2014 period. Only for the primary healthcare visits we are unable to obtain regional data for the pre 2012 period.

arguing its relationship with life expectancy at birth which is a commonly used measure in cross section and intra country studies.[4] It would not be naive to expect a connection between life expectancy at birth and child mortality if health based human capital development is regarded from a development perspective. According to World Development Indicators (World Bank) less developed regions of the globe mostly suffer from high mortality rates which are associated with lower life expectancy at birth. For instance for Sub-Saharan African Countries under 5 mortality rate and infant mortality rates are 174 and 87.[5] Considering life expectancy at birth Sub-Saharan African region has an average of 49 years. Similarly Low Income Countries (LIC-according to WB classification) have under 5 mortality rate and infant mortality rates of 185 and 86 respectively. Life expectancy at birth is around 49 years for LIC. On the other hand for upper middle income (UMI) countries under 5 mortality rate and infant mortality rates are 54 and 28; while life expectancy at birth is 66. Finally considering high income countries (HIC), under 5 mortality rate and infant mortality rates are 17 and 7 respectively. For this wealthiest set of countries average life expectancy at birth is 75 years.[6]

While this classification allows us to see different dimensions of healthcare services, it fails in controlling for the impact of geographical accessibility. Revisiting recent discussions of New Economic Geography (NEG) we transform our potential accessibility and utilization indicators into geographical accessibility measures by implementing the market potential approach of Harris (1954).[7] Our point is that regional accessibility is not only a function of its own territory, but also fed by the accessibility of its proximity. We consider the healthcare geographical accessibility at provincial level as given in equation 1, which is a positive function of the health-based human capital development of any province and a negative function of the physical proximity. H measures the province based healthcare indicator (demand/supply in NEG framework, accessibility/utilization in the current framework) of any region, D represents the physical distance between any pair of province.[8] That is, the Healthcare Geographical Access Index (HGA) measures the healthcare potential (geographical access) of a province as a distance weighted sum of the healthcare level of all other provinces in its proximity.[9]

$$HGA_i = \frac{H_i}{D_{ij}} \qquad (1)$$

2.2 Spatial concentration and regional disparities

In order to better apprehend regional inequalities in health based human capital development, we start by a set of usual inequality analyses. Standard deviation (sigma convergence), coefficient of variation and min/max ratios are calculated to assess the overall behavior of the distribution. Next, we divert our attention on the locality of inequalities and implement a set of spatial analyses. First in order to compare the tradeoff among within and between inequalities following Bourguignon (1979), we implement the Theil decomposition. Equation 2 is the Theil Index, where the first part and second part measures the between and within inequalities respectively. The idea is that even regions at aggregated levels (i.e. NUTS 1 and NUTS 2) may

[4] See Barro (1996), Barro (2013), Aghion et al. (2010) and Lopez-Casasnovas et al. (2005) for details

[5] Mortality rates are represented per 1,000 lives birth. All summary measures represent the 1960-2015 averages.

[6] In case of using individual data TurkStat provides better measures to consider individual and aggregate health status. At this stage since we use aggregate regional data we postpone a detailed discussion on the measurement of health outcomes and leave this for a subsequent research.

[7] See Redding and Schott (2003) and Redding and Venables (2004) for the formal NEG model.

[8] We use motorway distances to measure the physical proximity. Data is obtained from Ministry of Transportation. Another possible way to consider the distance is to use the travel time distances. However at current stage we do not have reliable data on travel time; moreover it is also less likely to control for the quality of infrastructure and road-networks at the regional scale (especially with a time dimension).

[9] Note that we also consider the accessibility issues within the same province. In case i=j, we use the Head and Mayer (2006) approximation for internal distance as $D_i = 0.66/\sqrt{Area_i/\prod}$.

have similar healthcare patterns, it is possible to observe a relatively dissimilar distribution at the more local level (i.e. NUTS 3).[10]

$$T = \sum_{i=1}^{n} y_i log\left(\frac{y_i}{x_i}\right) + \sum_{g=1}^{n} Y_g T_g \quad (2)$$

After having seen the level of locality we focus on the spatial clustering behavior; which we believe gives hints on the persistence of spatial disparities. As discussed by Combes et al. (2008) spatial auto-correlation measures (i.e. Moran's I, Geary's C etc.) will serve to assess the extent of spatial concentration, which in a way inhibits spatial inequalities. Note that while the Theil Index gives clues on the locality of inequalities, still it does not explain spatial ties and dependence. We claim that this pattern will visualize the extent of the spatial concentration thus inequalities. We prefer two commonly used spatial statistics in order to observe the spatial concentration of healthcare services. Following Anselin and Getis (1992); Anselin (1996) we will start by considering the spatial dependence and spillovers via conventional spatial auto-correlation analysis. Equation 3 and 4 are the Moran's I and Geary's C test statistics respectively, both with the null hypothesis of spatial randomness.[11] The former measures the deviations from the sample mean while the latter considers the variations from each pair of locations. In both cases n is the number of cross-sections and s is the summation of the all elements of the weight matrix (w).

$$I = \frac{n}{s} \frac{\sum_i \sum_j w_{ij}(x_i - \bar{x})(x_j - \bar{x})}{\sum_i (x_i - \bar{x})^2} \quad (3)$$

$$C = \frac{(n-1)(\sum_i \sum_j w_{ij}(x_i - x_j)^2}{2(\sum_i \sum_j w_{ij})(x_i - \bar{x})^2} \quad (4)$$

In order to take into account different dimensions of spatial association we perform the spatial analysis by using three different specifications. (i) a contiguity weight matrix, (ii) an inverse distance weight matrix and (iii) a threshold distance weight matrix. Our stand point is similar to Monastiriotis (2009), that the way locality is identified may have impact on the strength of the spatial dependence. Equation 5 is the contiguity weight matrix assigning 1 to adjacent regions and 0 otherwise. Contiguity weight matrices have the shortfall of neglecting the possible spatial ties that may prevail in the second and even third order adjacency. Even it is possible to increase the order of a weight matrix then the problem will be the exogenous identification of the order without any prior assumption on the shape of the geography. Meanwhile equation 6 is an inverse distance weight matrix, which identifies a local link between each cross section under concern. Finally as given in equation 7 we construct a threshold distance weight matrix that assigns a value of 1 to each region in a given great circle or 0 otherwise. Our rule for determining the threshold distance is based on the k-nearest neighbor; that is we define $d(ij)$ which is the great circle distance between centroids of regions i and j and $D_i(k)$ is the fourth, sixth and eights order smallest distance between regions i and j such that each regions is going to have 4, 6 and 8 neighbors respectively.

[10] In our analysis we use the NUTS 2 aggregation in order to observe the distinction among between and within inequalities.

[11] Moranâ€™s I lie between -1 and +1, where â€“ and + values represents negative and positive spatial auto-correlation; 0 represents spatial randomness. Meanwhile for Gearyâ€™s C values lower than 1 represents increasing positive spatial autocorrelation and values higher than 1 represents increasing negative spatial auto-correlation. For Gearyâ€™s C 1 represents the spatial randomness.

$$w_{i,j} = \begin{Bmatrix} w = 0 & if\ i = j \\ w = 0 & if\ i, j\ non-neighbor \\ w = 1 & if\ i, j\ neighbor \end{Bmatrix} \quad (5)$$

$$w_{i,j} = \frac{1}{d_{i,j}^{n}} \quad (6)$$

$$w_{i,j} = \begin{Bmatrix} w = 0 & if \quad i = j \\ w = 0 & if \quad d_{i,j} > D_i(k) \\ w = 1 & if \quad d_{i,j} \quad D_i(k) \end{Bmatrix} \quad (7)$$

2.3 Spatial heterogeneity, persistence and mobility

Even spatial autoregressive behavior and its persistence can be important; another important dimension of the spatial analysis is the extent of the spatial heterogeneity. Overall spatial dependence detected by the global spatial autocorrelation analysis may have different local realizations, which in turn create distinct spatial regimes among the geography. Once spatial heterogeneities are classified, it is also possible trace the mobility among a distribution where grids are determined by the existing spatial regimes. Anselin (1995) and Anselin (1996) discuss the decomposability of the Moran's I by considering the Local Indicator of Spatial Association (LISA). LISA statistic given in equation 8 measures the local variations of the global spatial dependence. Regardless of the identified global spatial autocorrelation LISA values at regional scale is allowed to vary being negative, positive or insignificant (spatially random). Anselin (1995) considered four different spatial regimes at the local level. In case of positive spatial dependence, two different clusters can be observed. If values with above the average are clustered together a hot spot of High-High (H-H) is formed; or if values below the average are clustered together a cold spot of Low-Low (L-L) is formed. For the identification of local negative spatial association two outlier regimes are offered: Low-High (L-H) outliers with below average values in close proximity to above average values; High-Low (H-L) outliers with above average values in close proximity to below average values.

$$I_i = (x_i - \bar{x}) \sum_j w_{ij} (x_j - \bar{x}) \quad (8)$$

Even LISA analysis identifies the existence of different spatial regimes, it does not explain the persistence of the inequalities. That is, we do not directly observe mobility between spatial regimes by just focusing on the geographical instabilities. This problem can be solved within the distributional dynamics approach of Quah (1996) which stands as a reaction to the traditional neoclassic convergence framework. As formalized in Rey (2001), the Markov Transition approach in Quah (1996) can be augmented and transformed into a Spatial Markov Framework.[12] Following Rey (2001) we define the states of Markov analysis originating from the LISA classifications.[13] Each spatial regime represents a state that can be traced to measure the probability of moving from one to the other. In addition to the probabilities, we identify four different types of mobility between the spatial regimes as given in table 1: Type 0 is the stability of for a province and its neighbor, Type I is the mobility of a province and the stability of its neighbor, Type II is the stability of the province and the mobility of the neighbor, Type

[12] Also see Rey (2014) for a recent discussion on incorporating geography within Markov Chain analysis.

[13] See Rey (2001) for different variants of spatial markov analysis. Another different approach is to use a spatial lag markov which is similar to the spatial conditioning approach of Quah (1996). That said, we do not perform the spatial lag markov analysis within this study as it does not directly fit into the structure constructed, which aims at diverting the attention towards spatial heterogeneities and persistence issues.

IIIA is the mobility of the province and the neighbor to the same direction, Type IIIB is the mobility of the province and the neighbor to different directions. $F_{0,t}$, $F_{I,t}$, $F_{II,t}$, $F_{IIIA,t}$, $F_{IIIB,t}$ each represents the number of transitions that experienced a mobility in the period t to t+1. Given that there are n observations; $n = F_{0,t} + F_{I,t} + F_{II,t} + F_{IIIA,t} + F_{IIIB,t}$.[14]

While observing the transition probability matrix and the summary indices given in table 2 is informative, we also use a number of indices to summarize the stability and mobility between spatial regimes defined above. Cohesion index ($C_t = \frac{F_{IIIA,t}}{n}$) and augmented cohesion index ($C_t^* = \frac{F_{IIIA,t} + F_{0,t}}{n}$) will be used, both indicating the stability of the distribution. We also consider the Flux Ratio which is simply $(1 - CohesionIndex)$.

2.4 Modeling strategy

Given different ways to identify regional inequalities and spatial concentration, we finally divert the focus towards constructing a design that helps in discussing the impact of healthcare accessibility and utilization on health outcomes in Turkey. Given the space-time dimension of the data we estimate different variants of cross section and panel models. We first estimate cross section models for beginning and ending years of the sample. Next we take into account unobserved cross section heterogeneity via fixed effect panel models. Note that for sake of comparability we also estimate random effect panel models. While both give clues on the overall structure we also decide to incorporate the impact of spatial dependence as regional health-based human capital development can be subject to substantial level of spatial spillovers. Equation 9 and 10 are the panel versions of our models which we further augment by incorporating spatial dependence. We begin with the Spatial Lag Model (SAR) that considers the impact of the spatial lag of health outcomes (equation 9). Next Spatial Error Model (SEM) that assumes the spillover of common shocks is employed (equation 10).[15] In both specifications; HO is the related health outcome variable, H is the related healthcare access and utilization measures and finally X contains a number of control variables that we believe may have influence on regional health outcome differences.[16] In order to discuss urbanization versus congestion effect we use population density. Meanwhile we control for the impact of public inclusion at the regional scale by using per capita public expenditures. Revisiting the possible negative impact of nature and geographical properties we include altitude of each province (only in the cross sectional models). Next in order to control for impact of education based human capital differences we use regional illiteracy rates. Finally we include the net migration growth rate of each province, which we believe contains information on the attractiveness of each region.

$$HO_{i,t} = a + bH_{i,t} + \rho WHO_{i,t} + \gamma X_{i,t} + \varepsilon_{i,t} \quad (9)$$

$$HO_{i,t} = a + bH_{i,t} + \gamma X_{i,t} + W\lambda\varepsilon_{i,t} \quad (10)$$

Our final discussion is on the stability of the first set of parameter estimates that explains the causal relationship between healthcare access/utilization and health outcomes in Turkey. Our concern is that even though results of the first set of models (global models) controls for the

[14] Please note that table 1 does not take into account the local significance. It can be augmented by also introducing the local insignificant regions and question whether there are chances for these provinces to become significant and belong to a spatial regime.

[15] Note that we also take into account the spatial spillovers of the independent variables via Spatial Durbin Models. These results are available upon request

[16] There are inevitably different factors that will affect regional health outcome, specifically mortality rates of Turkish regions. At this stage our choice of control are mostly shaped by regional data availabilities.

existence of the spatial spillovers, they may fail in controlling for the spatial variability and non-stationarity. This yields a set of generalized results obtained from a global model; however it is equally likely to have more than a number of mechanisms and relations, all of which can be better identified with the help of a local model. Considering the remarks of Ali et al. (2007), we claim that any policy that originates from the positive spillovers and externalities at the global scale may be unsuccessful and more importantly unproductive if it does not consider the possible variability of the local variations among different spatial regimes.

In order to overcome the possible biases of focusing on global models we consider Geographically Weighted Regression (GWR) model. GWR approach enables us to control for spatial non-stationarity and allows in detecting spatial variability of the impact of healthcare access and utilization on the health outcomes. Inspired by the discussions of Brunsdon et al. (1998), Fotheringham and Brunsdon (1999) and Fotheringham et al. (2002), we augment the spatial models to incorporate the possibility of the spatial varying coefficient estimates for the different healthcare indicators via a Geographically Weighted Regression (GWR) analysis. Our intuition is that, impact of the healthcare accessibility and utilization does not necessarily be stable across space; rather may tend to vary both in size and in magnitude across the geography of Turkey. In order to formally identify this effect we estimate a GWR model as given in equation 11. u and v represents the coordinates of the i^{th} province in space. GWR model spatially weights the observations through space where weights represent the neighboring effect in a given bandwidth.[17] Note that following Nakaya et al. (2005) and Nakaya et al. (2014) we will perform the spatial stability test of on the related variables as to check whether the GWR estimates gives significant variability for coefficient estimates. This test simply subtracts the information criterion of the local model from the global one. A negative value of the test result signals the dominance of the GWR model over the global models, as it indicates lower variance of the selected GWR model.

$$HO_i = \alpha_i(u_i, v_i) + \rho_i(u_i, v_i)H_i + \gamma_i(u_i, v_i)X_{i,t} + \varepsilon_i \qquad (11)$$

3. Exploratory Data Analysis

3.1 Regional inequalities and spatial dependence

In order to have a deeper insight on equity of health-based human capital development in Turkey, we refer to a number of usual inequality measures. We report the 2009 and 2014 comparison in Table 3.[18] These preliminary observations indicate the rise in accessibility and utilization of healthcare services. In a way this is reflected to the health outcomes as well; both infant as well as under 5 mortality rates are in a declining trend. However once we divert our attention on the equality of healthcare access/utilization and outcomes we end up with contradictory findings. First not the least standard deviation and min-max ratios do not follow a uniform pattern. Other than accessibility for secondary health care services we report rising inequalities for all accessibility and utilization indicators. On contrary for health outcome indicators we observe rising inequalities for infant mortality rates but a fall in inequalities for under 5 mortality rates. All these results prevent us to make a generalization. However once we control for sample size and focus on coefficient of variation we observe that both healthcare accessibility and utilization witness a slight improvement in terms of variation. However evidence strongly suggests that health outcomes' dispersion is becoming more unequal in this short time interval. Considering early findings on the rising accessibility and utilization both

[17] Bandwidth selection is a vital step of the GWR analysis. The usual Akaike Information Criteria (AIC), Bayesian Information Criterion (BIC) and Cross Validation (CV) are used for bandwidth selection. Moreover, as discussed by Fotheringham et al. (2002) GWR estimations allow for identification of the optimal bandwidth as fixed or adaptive. As most of the time fixed Kernel creates high variance depending on the size of the data, following Fotheringham et al. (2002) we will implement the adaptive Kernel approach in our GWR analysis.

[18] Note that as number of primary healthcare visits at province level is not reported prior to 2012, we use 2012 data rather than 2009 throughout the study.

for primary and secondary healthcare services; these results are in supportive of short period of improvement matched by more equity for healthcare service access and utilization. On the other hand even there seems to be an average rise in the level of health outcomes, our preliminary findings strongly suggests that this pattern is not shared equally among the geography of Turkey. These first set of results are early signals for a loss of connection between healthcare access/utilization and health outcomes.

Next in order to assess the locality of inequalities we implement Theil decomposition analysis. Table 4 gives the results. In line with the initial set of results from coefficient of variation; healthcare access and utilization seems to realize an improvement (limited) in the form of declining variation. However, once again health outcomes are getting more unequal based on the Theil Index calculations. More importantly for the locality of inequalities, results given in table 4 show that source of healthcare inequalities is the between regional inequalities rather than the within imbalances. That is, overall structure of the NUTS 2 regions are so divergent that any local imbalance observed within these sub-regions are degraded by the overall between inequalities. That said, it is remarkable to note that within inequalities are rising for both accessibility and utilization indicators; closing the gap among between and within inequalities. On contrary for health outcomes we continue to report the dominance of between inequalities. Note that these findings reminds us once more on the falling ties between healthcare access/utilization and health outcomes. Also it is remarkable to note that dominance of between inequalities does not impede the local variations and instabilities; rather signals the ongoing heterogeneous structure of the overall Turkish geography.

While the initial set of analysis gives hints on the path of regional healthcare equity, it can be further improved by including discussions on the extent of spatial ties. Spatial dependence does not only show the level of local/spatial links among regions but also show the clustering potential of the overall geography, which we believe contains additional information on the roots of the inequalities. In order to understand this pattern we calculate spatial autocorrelation measures of Moran's I and Geary's C. Overall results given in table 5 indicate the significance of spatial spillovers. Regardless of the chosen weight matrix healthcare access, utilization and outcomes have a spatially correlated pattern during the selected sample years.[19] It is true that size of the spatial dependence is prone to the weight matrix specification. That is, we report higher spatial dependence for contiguity and neighbor based threshold weight matrices. We discuss that all these differences in the size of the spatial dependence is connected with the level of locality of the spatial dependence. In a way allowing for higher orders and/or distance for spatial dependence enables us to observe rising spatial connectivity. Note that this finding is in line with the Theil analysis underlining the rising connectivity within NUTS 2 regions and accelerating dissimilarities between NUTS 2 regions.[20] We underline a non-uniform pattern for access and utilization considering the evolution of spatial dependence. For instance, while we report falling spatial dependence for primary healthcare access and utilization for secondary healthcare access and utilization spatial ties are getting marginally stronger. On the other hand for all of the health outcome indicators we do observe rising spatial dependence, which is significantly stronger compared to the relative increase in secondary healthcare access and utilization. This finding is consistent with the observed acceleration of inequalities in health outcomes. Revisiting Combes et al. (2008) this finding validates the concerns on the link between rising spatial concentration and inequalities, giving clues on the existing level of regional healthcare heterogeneities. More importantly in line with the first set of findings path

[19] We perform the same set of analysis for the individual sample years. Results with similar findings are available from the authors upon request.

[20] At this stage we delay a more detailed discussion on the locality of spatial dependence, which we handle in more details in the next sub-section.

of spatial dependence show rising concentration for health outcomes which is sizable compared to other healthcare indicators.

3.2 Spatial regimes and mobility

Given significant amount of spatial dependence as well as the geographical non-randomness of healthcare inequalities, investigating the local variations of spatial dependence stands crucial. We discuss that existence of spatial regimes should not be neglected as local variations make regional issues more sophisticated. For instance a mechanism defined in the western Turkey may not be that suitable for some Far East geographies, if geographical structures are dissimilar. In turn modeling of a structural link between access/utilization and health outcomes become much more challenging since local realizations will be potentially different compared to average generalizations.

In order to assess the extent of spatial dissimilarities and detect different spatial regimes, LISA analysis is implemented.[21] We report the LISA cluster maps for all healthcare indicators for 2009 and 2014. Figure 1 to 6 give the comparisons. In general spatial pattern is in favor of a duality; leaving eastern territory less developed compared to western Turkey. This general finding is consistent with our knowledge on regional disparities in Turkey.[22] That said, LISA maps contain additional important information that would help one to better understand the evolution of disparities. First vital finding is related with primary healthcare accessibility indicator; that in line with the decrescent global spatial correlation, we observe rising spatial randomness in our local analysis. The cluster of less developed regions in the far east, as well as the developed region cluster in the north almost disappears in the given time interval. In contrast we do not observe a similar pattern for secondary healthcare accessibility, which in both years gives a clear dual structure. More interestingly, even primary healthcare accessibility has a weakening spatial pattern at local level; utilization of primary healthcare services gives strong spatial stability and duality. For both years under consideration there prevails sizable spatial clustering behavior; with less developed regions and high developed regions located among eastern and western geography respectively. This pattern is comparable with utilization of secondary healthcare services up to a level. Even cluster of less developed regions among the eastern territory share a common pattern for primary and secondary healthcare, when we consider secondary healthcare utilization of developed regions we identify a shift from west to north and partially center geography of Turkey. Finally as we divert our attention on the health outcomes, results indicate sizable spatial duality regardless of the selected indicators. First eastern and specifically south-eastern geography of Turkey suffers drastically from death of children under the age of 1. Note that number of regions within high and low infant mortality clusters accumulates from 2009 to 2014; once again signaling the stability of the distribution and rising heterogeneity of health outcomes. Second the findings are much or less similar for under 5 mortality rates, signaling once again the healthcare based development duality for Turkish regions. Moreover it is noticeable that for both outcome indicators number of regions acting as outliers are negligible; pointing out the extent of the dichotomy.

While LISA cluster maps are informative for examining the spatial pattern of clusters and outliers, it can be developed further by taking into account the persistence of the heterogeneities. We apply the framework developed by Rey (2001) and offer a distributional dynamics approach in which states of the distribution is determined by spatial regimes highlighted in the LISA analysis. Our central objective is to trace the possible mobility from

[21] We use inverse distance weight matrix for LISA calculations. We also calculate the LISA scores by using different weight matrices. Even strength of the global measure is significantly prone to weight matrix specification, local spatial analysis yield mostly comparable results. These additional results can be supplied by the authors upon request

[22] See Filiztekin (1998) and Dogruel and Dogruel (2003) for details of regional inequalities in Turkey.

one spatial regime to other and to assess a region's likelihood to change the healthcare status.[23] Transition probability matrices and a summary of the results based on these matrices are also given in table 6 and 7. These combined results underline the overall persistence of inequalities with the exception of primary healthcare access. Note that we detect the lowest Type 0 mobility for the primary healthcare access, which is also supported by the relatively lower cohesion index. To be more specific, we identify that there is 43% probability for regions within the Low-Low cluster to move to a better primary healthcare access, whether individually or together with its neighbor. This probability is only 5% for the secondary healthcare access measure. This finding is consistent with the exploratory analysis done so far. Revisiting the LISA cluster maps, we report drastic fall in the number of local units within the low healthcare status cluster. Although LISA maps take into account local significance we discuss that these two patterns together underline the improvement of primary healthcare access in terms of equity issue. This finding is consistent with the low cohesion (stability) and high flux (mobility) that is reported in table 7. Keeping in mind this low stability, it is interesting to note that other access and utilization indicators show sizable stability compared to health outcomes. This finding seems to contradict with the analysis done so far, however a careful interpretation of the transition probabilities tells us the opposite. Considering the healthcare status; the probability that any region within the low infant mortality cluster to move to a higher the infant mortality rate is 14%. Same probability is 16% for mortality rate under 5 years of ages. More importantly for a region in the Low-High regime, we observe that there is combined probability of 42% and 19% to move to a High-Low and High-High regime for infant mortality and under 5 mortality rates respectively. This indicates the possible worsening of the distribution for some specific regions. Mobility highlighted by the flux index does not take into account the fact that some regions are moving towards the far end of the spatial distribution with lower health development. Given these contradictory findings from indices and transition probabilities, we discuss that summary results of the LISA analysis should be interpreted carefully by focusing more on the individual transition probabilities within the distribution. Respectively these spatial Markov analyses show that despite some improvements in access of healthcare, still there is no significant sign on a more equal health outcome distribution.

3.3 Geographical accessibility and spatial stability

Findings so far use various measures of health-based human capital development, yet none of them takes into account the geographical proximity. As discussed in the previous section we create a distance weighted healthcare indicator for each of the healthcare access and utilization measures on the grounds that healthcare access and utilization of any region is not only influenced from its local conditions but also affected from proximity. That is, any access and utilization volume of a region is a positive function of the geographical accessibility of other regions. The distance is going to have a negative influence in any case, since proximity will act as a discount factor decreasing the impact of access and utilization from other regions.

At this stage rather than replicating all set of initial analyses we decide to focus on spatial dimension of geographical accessibility. Table 8 give the spatial auto-correlation test results for distance weighted accessibility indicators for 2009 and 2014.[24] Results show that spatial dependence accumulates when distance and spatial proximity is considered. In all cases both Moran's I and Geary's C statistics rises as geographical accessibility is considered. This signals rising disparities and widening clustering behavior. Note that using distance weighted access

[23] Following Rey(2001) we disregard the local significance in the transition probability calculations. Our reasoning is two-fold; first mobility from a significant spatial regime to a insignificant one does not yield information on the stability of the distribution. Rather it gives idea on the change in the spatial randomness of the distribution at the local level. Second from a practical view, focusing only on the significant spatial units decreases the number of observations that can be traced within the short time interval. As discussed in Rey (2001) this would impede the strength of the LISA Markov Analysis.

[24] Only results obtained from inverse distance weight matrix are reported. We end up with much or less similar results with other weight matrix specifications. These results are available upon request.

and utilization measures does not change our comments on historical evolution of spatial dependence. Rather it influences the overall magnitude of spatial dependence. We claim that considering accessibility and utilization of the proximity seems to increase the clustering behavior. This finding signals that inequalities and stability are both rising as NEG framework is incorporated to our analysis.

In order to deepen our knowledge on the roots of these spatial ties, we also replicate the spatial markov analysis.[25] Our results confirm the rising spatial clustering and stabilities. Both stability observed in the transition probability matrices (table 9) as well as the defined mobility types (table 10) suggest persistent and increasing stability in favor of greater disparities. Note that the high flux/mobility we observe for primary healthcare accessibility is no longer present. The probability of moving to any form of greater healthcare access at primary level is now around 12%, which is significantly lower than its previous level of 43%. Meanwhile for healthcare utilization, downgrading probabilities from High-Low to Low-Low regimes are now higher. The probability of moving from a High-Low to a Low-Low spatial regime is 13% and 15% for primary and secondary healthcare utilization respectively, signaling the possible downgrading within the distribution.

4. Empirical Models

Our first set of exploratory results show that Turkey is going through a period in which link between access/utilization and health outcomes loosens; in terms of equity. Still we identify that once spatial ties and mobility is considered not only health outcomes but also healthcare access and utilization show substantial level of inequalities creating a dichotomy. It is true that source of the inequalities are connected with the overall regional duality issue in Turkey, however investigating the internal dynamics of recent episode still contains sizable information for policy makers.[26] In order to model the overall relationship between health outcomes and access/utilization measures we estimate two set of models. We first control for possible spatial spillovers and then asses the spatial variability of the link between healthcare access and outcomes in Turkey.

4.1 Spatial dependence

One of our central hypotheses is that, regions with higher access and utilization for healthcare services should have better health outcomes and therefore health based human capital development. We discuss that such a relationship should hold even spatial links are also considered. We introduce two set of spatial models. First we estimate cross section spatial models for the beginning and ending years of our sample. Next, in order to consider various dimensions of the unobserved patterns we estimate spatial panel models with fixed and random effects. In both cases we put forward different assumptions on the source of the spatial dependence (i.e. Spatial Lag Model, Spatial Error Model). For each specification we also consider a number of regional properties of Turkish provinces. Population density, public expenditures per capita, illiteracy rate, migration growth and finally altitude levels are used as control variables.[27]

Our first set of results from the cross section models in table 11 underline that spatial dependence works over the omitted variables. In none of the SAR models we report significant spatial spillovers over health outcomes. Regarding the impact of access and utilization, spatial

[25] Please note that we do not report the LISA cluster maps for the geographical accessibility indicators. Rather we prefer to focus on the stability of the distribution by tracing the mobility of moving from one spatial regime to the other. Still all LISA maps for geographical accessibility indicators are available upon request.

[26] See Gezici and Hewings (2004) and Gezici and Hewings (2007) for spatial dimension of regional inequalities in Turkey.

[27] Note that altitude is only used within the cross section models. Also we are not using the distance weighted versions of our access and utilization indicators for two reasons. First we end up with fairly similar results once these geographical accessibility indicators are considered. Second we do not see a direct reason to use this distance weighted indicators as our spatial models use a weight matrix that already considers inverse distance to link provinces.

cross sectional models indicate a negative relationship in most of the instances especially for SEM in 2014. This finding is consistent with the view that improvement in the access and utilization of healthcare services has direct and negative effect (by decreasing mortality rates) on health outcomes. However we have to note that type of healthcare service (primary/secondary) and health outcome considered matters. For instance both in 2009 and 2014 we do not find any influence of primary healthcare access on infant mortality rates. More interestingly observed influence of primary healthcare access on under 5 mortality rates disappears in 2014. On contrary for secondary healthcare access we identify an increasing influence on both of the health outcomes measures from 2009 to 2014. The same pattern prevails for the utilization measures. While utilization of primary healthcare services are more important for under 5 mortality rates in 2009, in 2014 we find substantial increase of its impact on both infant and under 5 mortality rates. Note that healthcare utilization for secondary healthcare services is a strong determinant of both health outcome measures regardless of the investigated year. One final comment on these initial set of results is related to the regional controls; interestingly enough out of the selected variables it is the education variable (illiteracy ratio) that significantly and persistently explains the regional healthcare status pattern.

Our results give valuable information on the relationship between access/utilization and outcomes of healthcare; however suffer from the failure to control for the unavoidable unobserved heterogeneity. Therefore we further estimate a set of spatial panel models to overcome this issue. For the sake of comparability we employ fixed effect models to control for the unobserved time invariant heterogeneities and the random effect models to see the robustness and sensitivity of our results. First of all unlike the cross section spatial models, results in table 12 report significant spatial spillovers in both SAR and SEM specifications. However for the fixed effect models, we do not find any significant relationship between healthcare access/utilization and outcomes. For the random effect models, there is marginally a significant relationship between some of the selected access and utilization measures. That said, we approach results of the random effect models with caution as it has inability to directly consider the time invariant unobserved heterogeneity; which we believe is significantly present for the Turkish case. Note that results on the control variables are much or less identical with the cross section models.

To sum up, our results give us contradictory findings. Even it is possible to discuss an association between healthcare access/utilization and outcomes of Turkish regions, it seems difficult to consider this as a causal transmission once different dimensions of regional heterogeneities are considered. Even though result coming from panel models already control for spatial dependence and unobserved heterogeneities, still they do not take into account the possible spatial variability. However defined mechanisms may have sizable spatial instabilities; causing results of panel and cross section models to act as global, failing to explain local variations of the discussed relationship between access/utilization and health outcomes in Turkey.

4.2 Spatial heterogeneity

While our previous analyses control for the existence of spatial dependence, spatial instabilities are mostly neglected. Even we have reason for believing in the existence of distinct spatial regimes (from LISA analysis), we could not control for this by using conventional spatial models. To overcome this issue we construct a different spatial framework in order to assess the local heterogeneity issue. Rather than a panel structure we estimate GWR models for individual years in our sample and follow the spatial varying relationship between access/utilization indicators and health outcomes in Turkey.[28] Our concern is that, mechanisms

[28] We report only results for the beginning and ending years of our sample. Results of all individual years are available upon request.

defined in the previous empirical models may have regional instabilities. We mean, even there may evolve a causal link in general, still some different mechanisms can be present across the territory of Turkey.[29] Such cases are difficult to control for by only using control variables for the social and economic structure of different geographies.

Results of the GWR models are given in table 13. Note that we only report the variability of the access and utilization indicators. Regardless of the health outcomes first vital finding is the rise in the spatial variability that can be directly observed from the widening range of the distribution for each coefficient estimate. It is true that for a number of variables our difference criterion (diff), given in the last column of table 13 suggests lack of significant variability. Nevertheless the common trend is in favor of rising spatial heterogeneity. Starting with models explaining spatial distribution of infant mortality rates, we observe highest variability for primary healthcare access which witnesses a drastic rise in spatial variability from 2009 to 2014. Note that in 2014 while there are even some set of regions that seems to lose the link between primary healthcare access and infant mortality rates, mechanism turns out to be just the reverse for some other locations, which is not in line with our expectations. This pattern albeit not as strong as the access measure is also present for primary healthcare utilization; as the link between primary healthcare utilization and infant mortality rates turns out to be positive in some selected locations. Next, once we focus on under 5 mortality rates, we end up with much or less comparable results with respect to infant mortality rates. Spatial variability is increasing, but relatively lower in both years compared to infant mortality rates. Suggesting that there are higher local instabilities once infant mortality rates are tried to be explained by regional access and utilization of healthcare services.

Finally in order to better understand the geography of the variability we group the impact of each access/utilization measure among four equal classes. Tables 14 and 15 gives the results for 2009 and 2014 respectively. Each cell represents the share of provinces within a NUTS 1 region. Q1 and Q4 represent the groups that we detect highest and lowest impact of healthcare access/utilization on outcomes respectively. Our aim is to observe the roots of spatial variability. In 2009 our results show that NUTS 1 regions among the western geography are mostly composed of provinces in which the expected relationship between access/utilization and health outcomes holds. Meaning that rising access and utilization of healthcare services decreases the infant and under 5 mortality rates strongly in these western locations. On contrary NUTS 1 regions among the eastern geography are mostly composed of provinces with lack of relationship between access/utilization and health outcomes. Emphasizing that a change in the primary and secondary healthcare access and utilization has relatively lower impact on health outcomes compared to western geography of Turkey. For instance considering both outcome measures, all of the provinces in TR1 and TR2 regions locate in the first group (Q1) and benefit from sound relationship between access/utilization and outcomes. However most of the provinces in eastern NUTS 1 regions (i.e. TRA and TRB) suffer from the weakening of the defined mechanisms. One remarkable exception of this pattern is the primary healthcare utilization measure; as it seems that impact of primary healthcare visits on health outcomes works well among the less developed eastern regions of Turkish territory. On the other hand results for 2014 contain minor differences. For instance we observe falling impact for developed regions such as TR1 and TR2; rising impact for TRA and TRB. An overall assessment of this pattern makes us think that strength of the relationship between healthcare access/utilization and health outcomes tend to shift geographically as we move from 2009 to 2014. That said, still there tends to exist sizable differences in GWR estimate results still in favor of the developed westerns regions. We discuss that these results underline the existence

[29] Frohlich et al. (2006) discuss the Canadian experience and underline that policy tools directed to channels that affect the overall inequalities can also have sizable influence to combat against health disparities among different segments of the society.

of a spatiotemporal behavior for the GWR results. That is, impact of healthcare access/utilization on health outcomes does not only vary across space, but also through time.

Lower access and utilization in major healthcare services among the eastern geography and detecting lower impact in these locations make GWR results even more sophisticated. At this stage we discuss that loss of ties among the less developed regions can be evaluated via two separate channels. First it could be argued that investing more in access and utilization is not a priority for these less developed regions. Instead other socio-economic conditions (i.e. education, social inclusion, security etc.) can act as barriers for rising health-based human capital development. Second it could also be argued that significant link between access/utilization and health outcomes among the western regions is not a coincidence. Further measures to stimulate more access and utilization to healthcare services should be taken for these less developed regions. While results of this research do not directly explain this issue, in both cases our results underline the failure of global policy implementations with lack of awareness of local conditions. We discuss that further effort is needed in order to better apprehend the locality of global policy implementations.

5. Conclusion

Health based human capital development as well as spatial disparities in access and utilization of healthcare services are crucial discussions for Turkey. Given sizable changes in health and social security system during the last decades; attention on equality of health-based human capital development is expected to receive more attention in order to understand whether implemented policies have influence on regional health based human capital disparities. As a contribution to open up and deepen this debate we carry out a set of spatial analysis considering different dimensions of health-based human capital development. We start by exploring the geography of Turkey via a number of spatial data analyses. Next we construct conventional spatial models which test the relationship between access/utilization and health outcomes in Turkey. Finally we augment our specification by incorporating the context of spatial variability, which we believe will further open up new question to social scientist working on healthcare equity issue especially for developing world.

Our initial set of findings indicates an overall improvement in access/utilization of healthcare services. This improvement is matched by decreasing mortality rates suggesting a similar improvement in health outcomes of Turkish regions. That said, this pattern has not been shared equally. Based on different measures we underline that health outcomes are getting spatially more unequal and clustered compared to healthcare access/utilization. Additionally even within inequalities are rising for access/utilization of healthcare services, still it is the between inequalities that explains most of the spatial variation of health-based human capital development.

These first set of analyses make us think on a fall among the ties between access/utilization and health outcomes especially considering the equity issue. However still these analyses do not explain the geography of development and/or heterogeneities both might give rise to the evolution of spatial regimes. Our spatial heterogeneity analysis (LISA) validates this concern; as a clear dual structure exists for almost all of the healthcare indicators. More remarkably distribution of spatial regimes is prone to sizable stability; suggesting that the probability of moving from one spatial regime to the other is extremely low. It is notable that not only health outcomes but also healthcare access and utilization show sizable stability. In general it is less likely to observe a mass movement of regions from one spatial regime to the other, making health conditions significantly better. It is also remarkable that, replicating the spatial analysis (both global as well as local ones) by using geographical access measures give us rising stability and more rigid spatial disparity. In nearly all cases both spatial autocorrelation analysis

as well as transition analysis of spatial regimes gives us evidence on a more unequal distribution.

Considering the sizable variation of health indicators; our final set of analyses aim at testing the possible causal framework between healthcare access/utilization and health outcomes in Turkey. Remembering the early sceptic findings that discuss the loss of ties between access/utilization and health outcomes, our empirical evidence from different variants of spatial models show that impact of primary and secondary healthcare access/utilization measures losses their influence on health outcomes once spatial spillovers, regional unobserved heterogeneity and a number of regional factors are considered. However once we focus on possible spatial instabilities we end up with contradictory findings. There are some regions in which expected relationship between healthcare access/utilization holds compared to some other locations in which no significant relationship is detected. More importantly our results show that it is actually western regions with already better initial conditions that benefit from the relationship between healthcare access/utilization and health outcomes. On the other hand for less developed eastern regions a similar connection between access/utilization and health outcomes cannot be reported.

To sum up, our findings underline that spatial heterogeneity and significant level of variability is shaping the structure of different spatial regimes in terms of healthcare access/utilization and health outcomes in Turkey. Given some progress in healthcare services some level of improvement is observed in health outcomes. Even efficiency may be sustained up to a level, equity of healthcare services and outcomes is a failure. Rising disparities of health outcomes is beyond the observed disparities in access/utilization. It is remarkable that even some progress is sustained for primary healthcare services' dispersion; it is very less likely to detect a causal impact on any of the health outcome measures considered. However there are exceptions. Specific regions in western geography are able to create a sound link between access/utilization and health outcomes, which cannot be seen for less developed eastern regions. These findings show that regional policies and their implications are getting sophisticated among geographies suffering from substantial level of spatial duality and heterogeneity. We believe results of this research will open up new questions for policy makers to discuss more flexible regional policies that take into account local factors and structures.

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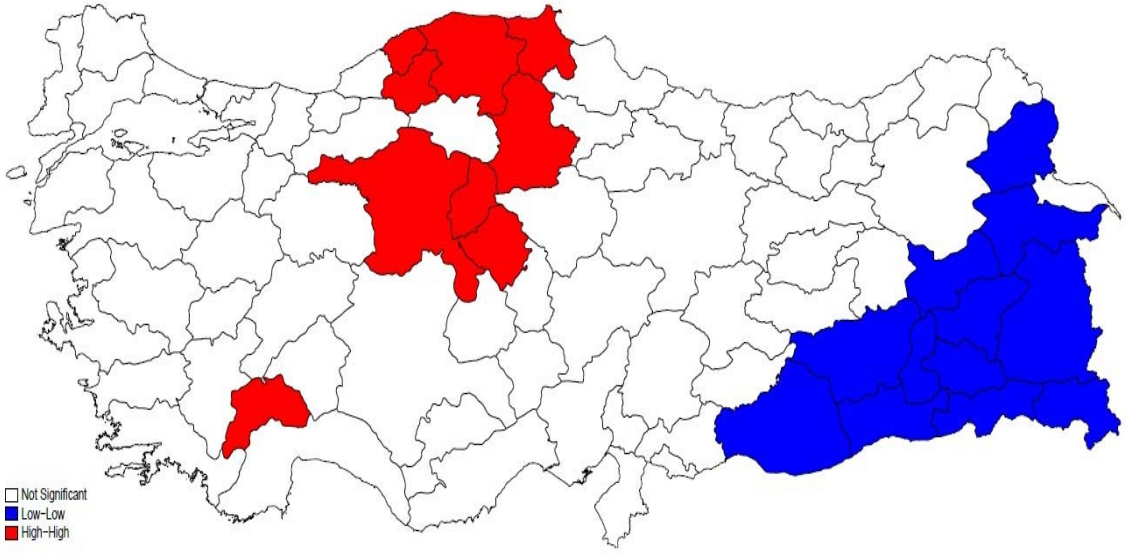
Figure 1: Spatial Autocorrelation Decomposition: Primary Healthcare Accesibility

(a) 2009



(b) 2014

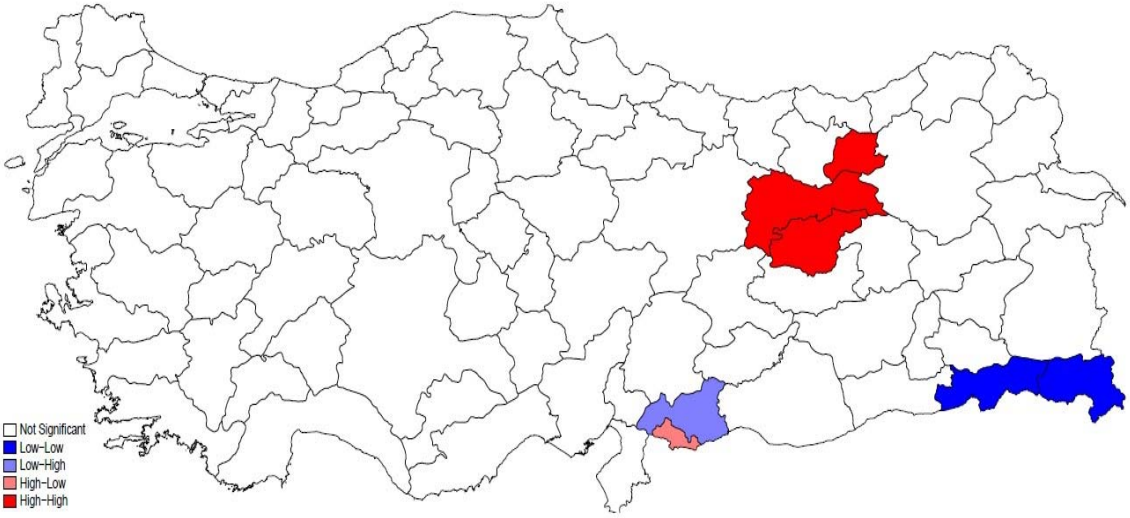
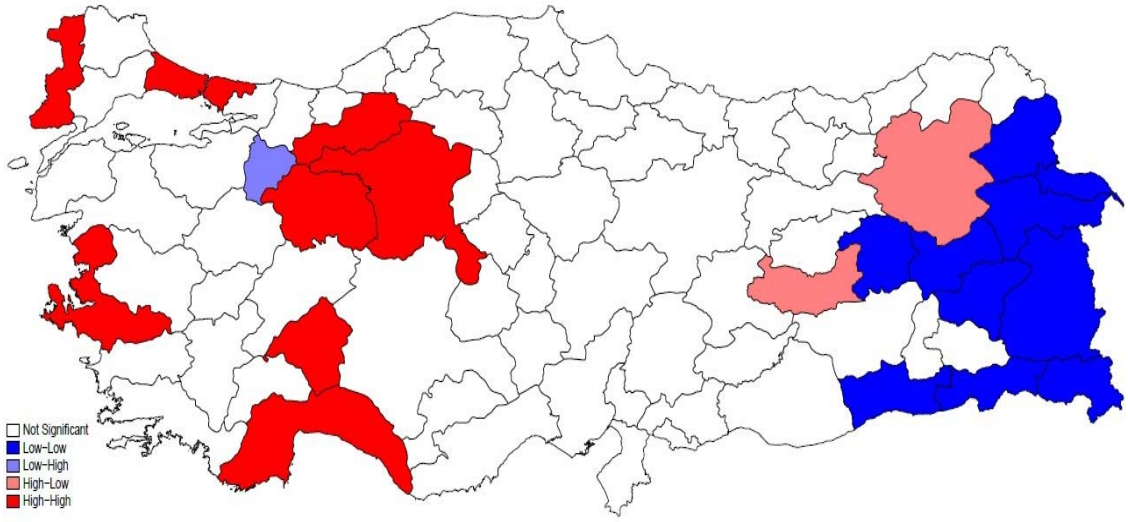


Figure 2: Spatial Autocorrelation Decomposition: Secondary Healthcare Accesibility

(a) 2009



(b) 2014

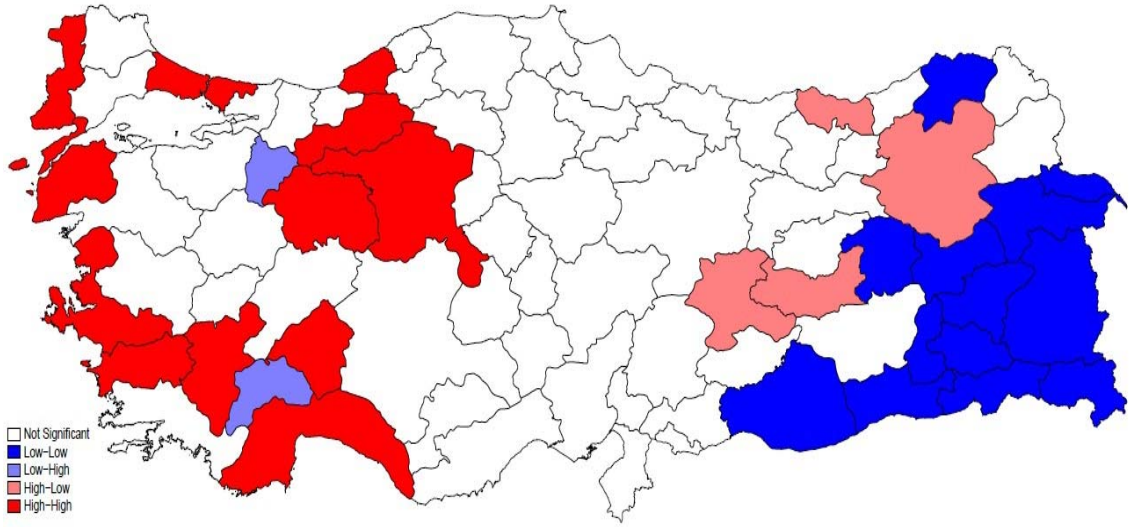
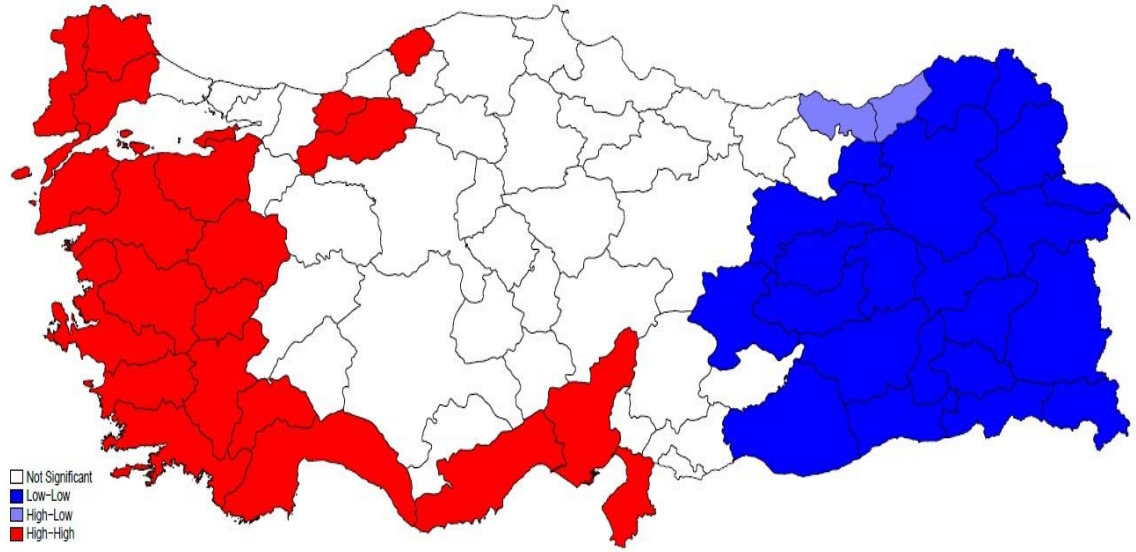


Figure 3: Spatial Autocorrelation Decomposition: Primary Healthcare Utilization

(a) 2012



(b) 2014

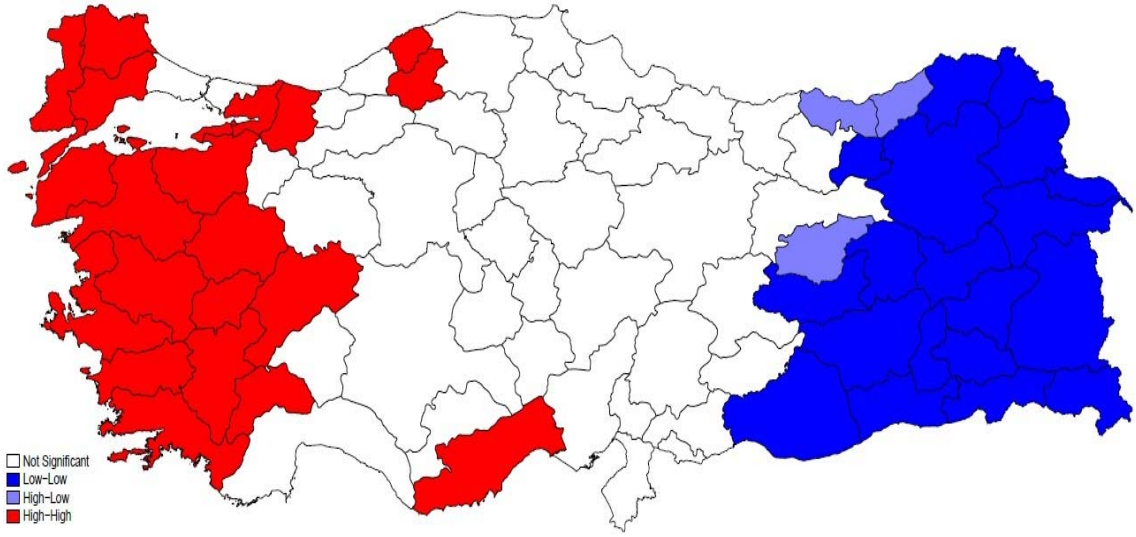
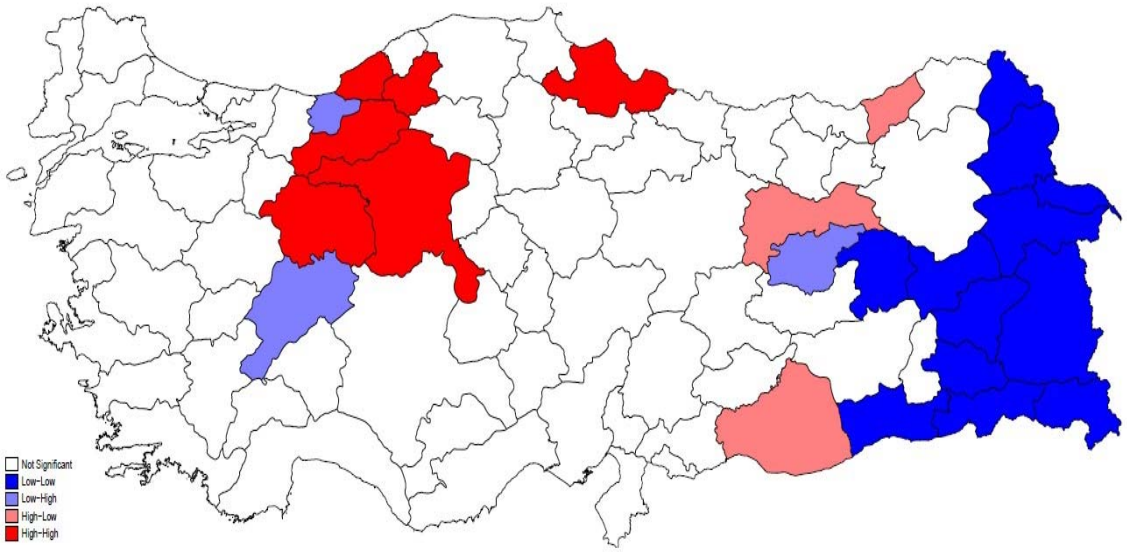


Figure 4: Spatial Autocorrelation Decomposition: Secondary Healthcare Utilization

(a) 2009



(b) 2014

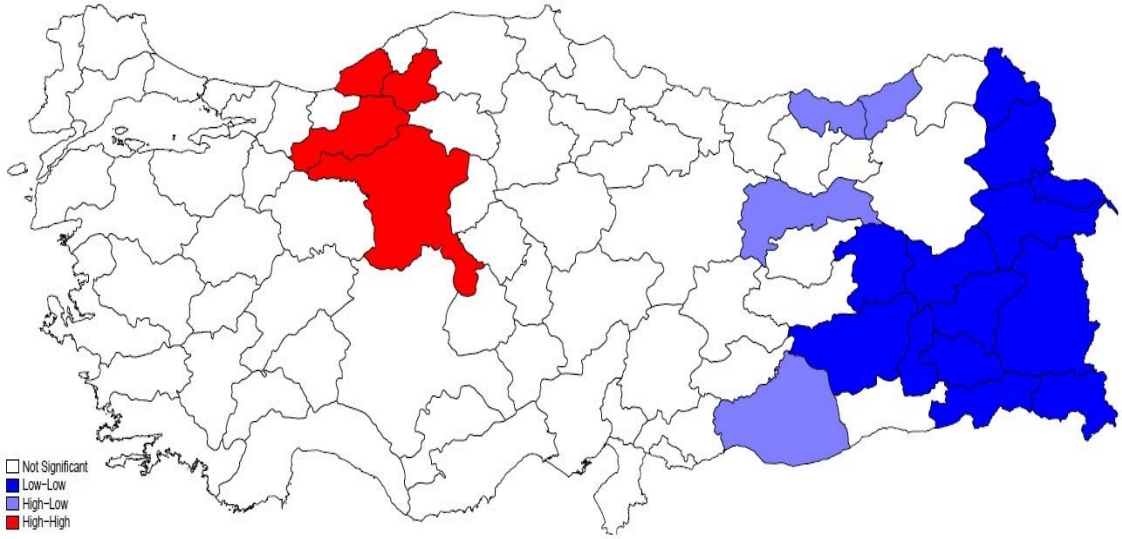
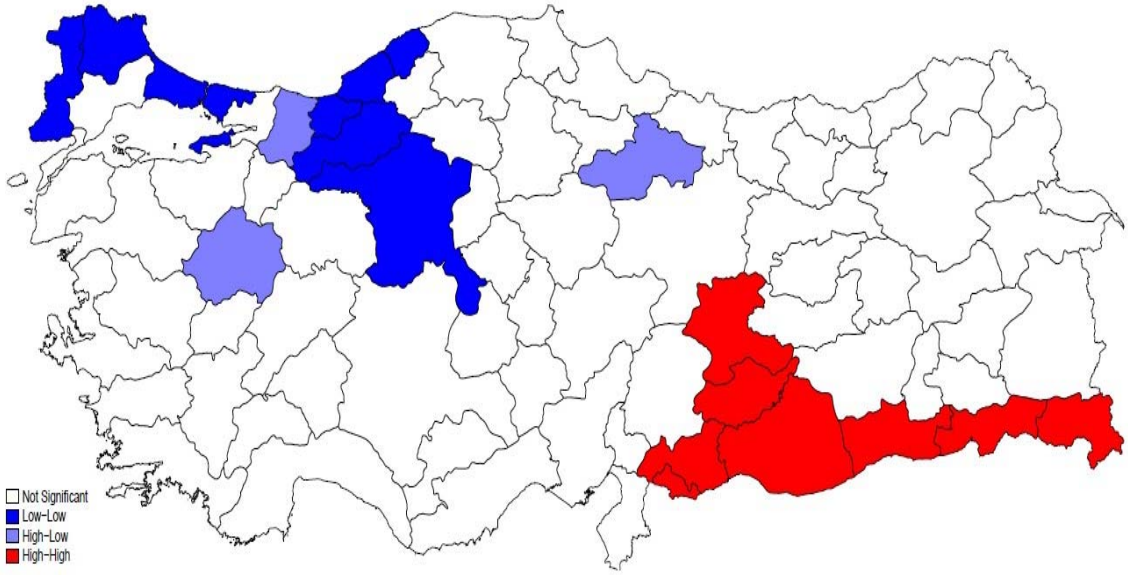


Figure 5: Spatial Autocorrelation Decomposition: Health Outcome A (Infant Mortality Rate)

(a) 2009



(b) 2014

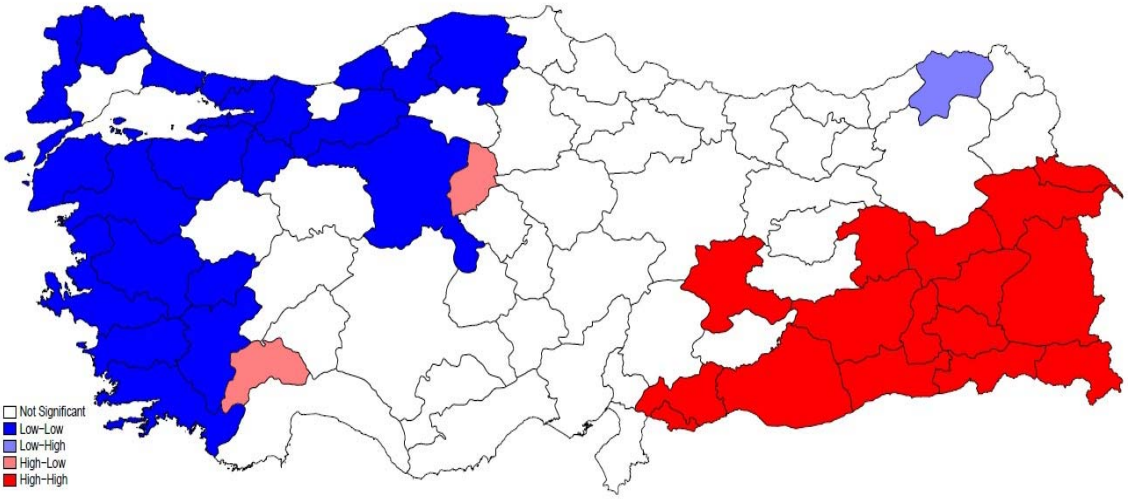
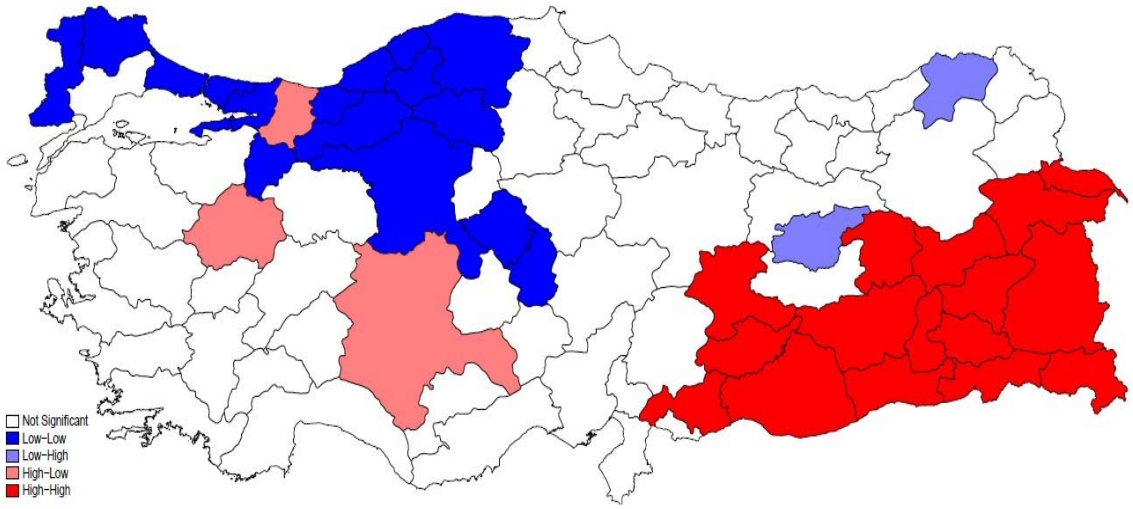


Figure 6: Spatial Autocorrelation Decomposition: Health Outcome B (Under 5 Mortality Rate)

(a) 2009



(b) 2014

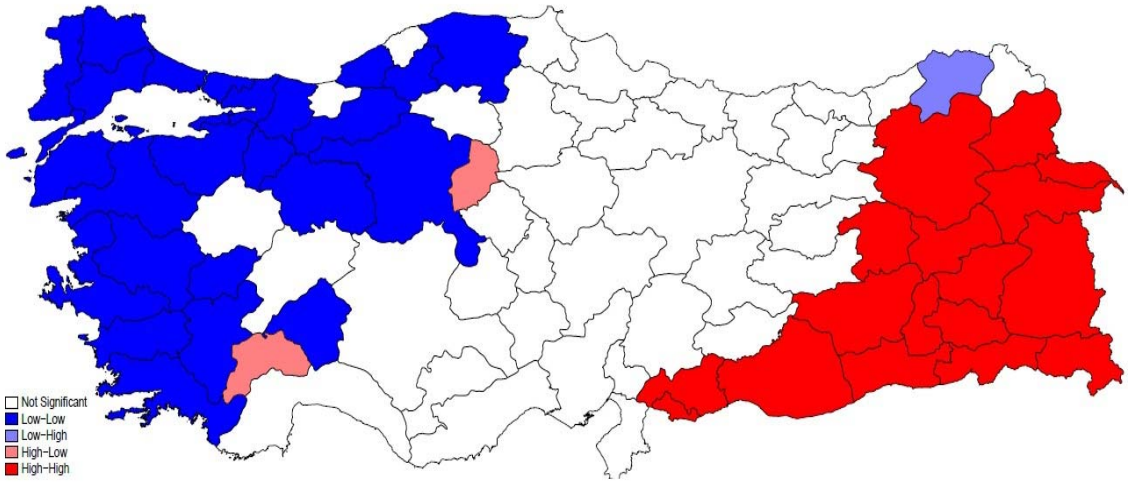


Table 1: NUTS Classification of Turkey

NUTS-1	NUTS-2	NUTS-3
Istanbul Region (TR1)	Istanbul Subregion (TR10)	Istanbul Province (TR100)
West Marmara Region (TR2)	TekirdaÄŸ Subregion (TR21)	Tekirda Province (TR211)
		Edirne Province (TR212)
		Klareli Province (TR213)
	BalÄ±kesir Subregion (TR22)	Balkesir Province (TR221)
		Ãanakkale Province (TR222)
Aegean Region (TR3)	Izmir Subregion (TR31)	Äzmir Province (TR310)
	AydÄ±n Subregion (TR32)	AydÄn Province (TR321)
		Denizli Province (TR322)
		Mula Province (TR323)
	Manisa Subregion (TR33)	Manisa Province (TR331)
		Afyonkarahisar Province (TR332)
		KÃahya Province (TR333)
		UŸak Province (TR334)
East Marmara Region (TR4)	Bursa Subregion (TR41)	Bursa Province (TR411)
		EskiÅŸehir Province (TR412)
		Bilecik Province (TR413)
	Kocaeli Subregion (TR42)	Kocaeli Province (TR421)
		Sakarya Province (TR422)
		DÃ Province (TR423)
		Bolu Province (TR424)
		Yalova Province (TR425)
West Anatolia Region (TR5)	Ankara Subregion (TR51)	Ankara Province (TR510)
	Konya Subregion (TR52)	Konya Province (TR521)
		Karaman Province (TR522)
Mediterranean Region (TR6)	Antalya Subregion (TR61)	Antalya Province (TR611)
		Isparta Province (TR612)
		Burdur Province (TR613)
	Adana Subregion (TR62)	Adana Province (TR621)
		Mersin Province (TR622)
	Hatay Subregion (TR63)	Hatay Province (TR631)
		Kahramanmara Province (TR632)
		Osmaniye Province (TR633)
Central Anatolia Region (TR7)	KÄ±rÄ±kkale Subregion (TR71)	Kkkale Province (TR711)
		Aksaray Province (TR712)
		NiÄŸde Province (TR713)
		NevÅŸehir Province (TR714)
		KÄrŸehir Province (TR715)
	Kayseri Subregion (TR72)	Kayseri Province (TR721)
		Sivas Province (TR722)
		Yozgat Province (TR723)
West Black Sea Region (TR8)	Zonguldak Subregion (TR81)	Zonguldak Province (TR811)
		Karab Province (TR812)
		Bartn Province (TR813)
	Kastamonu Subregion (TR82)	Kastamonu Province (TR821)
		Ãank Province (TR822)
		Sinop Province (TR823)
	Samsun Subregion (TR83)	Samsun Province (TR831)
		Tokat Province (TR832)
		Ãorum Province (TR833)
		Amasya Province (TR834)
East Black Sea Region (TR9)	Trabzon Subregion (TR90)	Trabzon Province (TR901)
		Ordu Province (TR902)
		Giresun Province (TR903)
		Rize Province (TR904)
		Artvin Province (TR905)
		GÃmÃhane Province (TR906)
Northeast Anatolia Region (TRA)	Erzurum Subregion (TRA1)	Erzurum Province (TRA11)
		Erzincan Province (TRA12)
		Bayburt Province (TRA13)
	AÄŸrÄ± Subregion (TRA2)	AÄŸrÄ± Province (TRA21)
		Kars Province (TRA22)
		IÄŸdÄ±r Province (TRA23)
		Ardahan Province (TRA24)
Central East Anatolia Region (TRB)	Malatya Subregion (TRB1)	Malatya Province (TRB11)
		ElazÄ±ÄŸ Province (TRB12)
		BingÃ¶l Province (TRB13)
		Tunceli Province (TRB14)
	Van Subregion (TRB2)	Van Province (TRB21)
		MuÅŸ Province (TRB22)
		Bitlis Province (TRB23)
		HakkÃ¢ri Province (TRB24)
Southeast Anatolia Region (TRC)	Gaziantep Subregion (TRC1)	Gaziantep Province (TRC11)
		AdÄ±yaman Province (TRC12)

NUTS-1	NUTS-2	NUTS-3
		Kilis Province (TRC13)
	ÅžanlÄ±urfa Subregion (TRC2)	ÅžanlÄ±urfa Province (TRC21)
		DiyarbakÄ±r Province (TRC22)
	Mardin Subregion (TRC3)	Mardin Province (TRC31)
		Batman Province (TRC32)
		ÅžÄ±rnak Province (TRC33)
		Siirt Province (TRC34)

Source: TurkStat

Table 2: Classification of LISA Cluster Transitions

	Low-Low	Low-High	High-Low	High-High
Low-Low	0	II	I	IIIA
Low-High	II	0	IIIB	I
High-Low	I	IIIB	0	II
High-High	IIIA	I	II	0

Source: Rey (2001)

Table 3: Descriptive Statistics

	Mean		Std. Dev.		CoV		Min-Max	
	2009	2014	2009	2014	2009	2014	2009	2014
gpptp	52.10	55.48	7.58	7.78	0.15	0.14	0.48	0.41
specptp	62.82	76.64	24.59	27.35	0.39	0.36	0.17	0.19
phcvpc	2.94	2.79	0.92	0.78	0.31	0.28	0.09	0.15
sthcvpc	4.23	5.38	0.70	0.81	0.16	0.15	0.46	0.44
imr1	13.77	10.99	3.27	3.40	0.24	0.31	0.38	0.20
imr5	17.49	13.18	4.83	4.09	0.28	0.31	0.30	0.25

Table 4: Theil Index Decomposition

	2009			2014		
	Theil Index	Within (%)	Between (%)	Theil Index	Within (%)	Between (%)
gpptp	0.011	30.26	69.83	0.010	57.51	42.49
specptp	0.064	35.79	64.21	0.059	40.41	59.59
phcvpc	0.053	20.33	79.65	0.043	21.39	78.61
sthcvpc	0.013	48.46	51.54	0.011	55.83	44.17
imr1	0.028	44.72	55.28	0.044	29.86	70.16
imr5	0.036	30.95	69.05	0.045	25.18	74.84

Table 5: Global Spatial Autocorrelation Test Results (I)

	Moran's I			Geary's C		
	Inverse Distance	Contiguity (n=1)	k-nearest (k=5)	Inverse Distance	Contiguity (n=1)	k-nearest (k=5)
gpptp 2009	0.125***	0.499***	0.428***	0.850***	0.485***	0.530***
	(8.373)	(7.144)	(6.764)	(-8.116)	(-6.752)	(-6.905)
gptp 2014	0.034***	0.299***	0.235***	0.964**	0.664***	0.756***
	(2.814)	(4.344)	(3.787)	(-1.990)	(-4.434)	(-3.597)
specptp 2009	0.061***	0.117**	0.167***	0.924***	0.875 *	0.743 ***
	(4.754)	(1.919)	(2.922)	(-2.963)	(-1.331)	(-3.247)
specptp 2014	0.082***	0.168***	0.222***	0.900***	0.816**	0.716***
	(5.807)	(2.554)	(3.653)	(-4.862)	(-2.274)	(-4.004)
phcvpc 2012	0.312***	0.693***	0.680***	0.650***	0.290***	0.303***
	(19.719)	(9.834)	(10.603)	(-19.233)	(-9.396)	(-10.320)
phcvpc 2014	0.297***	0.653***	0.620***	0.669***	0.327***	0.368***
	(18.875)	(9.286)	(9.698)	(-17.903)	(-8.838)	(-9.302)
sthcvpc 2009	0.027***	0.239***	0.167***	0.943***	0.714***	0.778***
	(2.394)	(3.512)	(2.752)	(-3.095)	(-3.746)	(-3.259)
sthcvpc 2014	0.059***	0.190***	0.255***	0.921***	0.746***	0.710***
	(4.360)	(2.837)	(4.124)	(-4.094)	(-3.260)	(-4.204)
imr1 2009	0.065***	0.311***	0.216***	0.925***	0.679***	0.754***
	(4.711)	(4.507)	(3.501)	(-4.143)	(-4.257)	(-3.639)
imr1 2014	0.212***	0.558***	0.418***	0.776***	0.361***	0.532***
	(13.916)	(8.120)	(6.744)	(-10.520)	(-7.713)	(-6.492)
imr5 2009	0.172***	0.524***	0.454***	0.803***	0.450***	0.526***
	(11.247)	(7.510)	(7.179)	(-10.394)	(-7.126)	(-6.911)
imr5 2014	0.250***	0.632***	0.508***	0.729***	0.309***	0.447***
	(16.066)	(9.053)	(8.047)	(-13.920)	(-8.803)	(-7.978)

Notes: ***, **, * indicate significance at 10%, 5%, 1% respectively. z-scores are in ( )

Table 6: Transition Probabilities: Spatial Markov Framework for LISA(I)

		Low-Low	Low-High	High-Low	High-High
gpptp	Low-Low	0.56	0.26	0.12	0.05
	Low-High	0.33	0.50	0.02	0.13
	High-Low	0.15	0.03	0.53	0.24
	High-High	0.09	0.10	0.10	0.68
specptp	Low-Low	0.95	0.02	0.03	0.00
	Low-High	0.02	0.90	0.00	0.06
	High-Low	0.06	0.00	0.86	0.02
	High-High	0.00	0.05	0.00	0.92
phcvpc	Low-Low	0.94	0.00	0.04	0.00
	Low-High	0.04	0.80	0.00	0.08
	High-Low	0.00	0.00	0.60	0.10
	High-High	0.00	0.04	0.02	0.89
sthcvpc	Low-Low	0.85	0.07	0.05	0.02
	Low-High	0.04	0.79	0.00	0.16
	High-Low	0.09	0.02	0.67	0.17
	High-High	0.00	0.12	0.07	0.79
imr1	Low-Low	0.86	0.05	0.08	0.01
	Low-High	0.09	0.46	0.05	0.37
	High-Low	0.38	0.03	0.52	0.02
	High-High	0.01	0.12	0.01	0.83
imr5	Low-Low	0.84	0.04	0.11	0.01
	Low-High	0.07	0.70	0.00	0.19
	High-Low	0.48	0.00	0.44	0.02
	High-High	0.02	0.06	0.00	0.89

Table 7: Transition Types and Indices for LISA (I)

	Type 0	Type I	Type II	Type IIIA	Type IIIB	Cohesion	Flux
gpptp	0.595	0.123	0.227	0.044	0.010	0.640	0.360
specptp	0.938	0.047	0.015	0.000	0.000	0.938	0.062
phcvpc	0.932	0.043	0.025	0.000	0.000	0.932	0.068
sthcvpc	0.807	0.111	0.074	0.005	0.002	0.812	0.188
imr1	0.763	0.183	0.074	0.005	0.012	0.768	0.232
imr5	0.805	0.158	0.030	0.007	0.000	0.812	0.188

Table 8: Global Spatial Autocorrelation Test Results (II)

	2009		2014	
	Moran's I	Geary's C	Moran's I	Geary's C
ma_gpptp	0.221***	0.757***	0.167***	0.803***
	(14.220)	(-13.171)	(10.957)	(-10.477)
ma_specptp	0.303***	0.686***	0.32***	0.667***
	(19.276)	(-16.597)	(20.285)	(-17.745)
ma_phcvp	0.344***	0.644***	0.334***	0.653***
	(21.742)	(-18.985)	(21.164)	(-18.534)
ma_sthcvpc	0.201***	0.775***	0.222***	0.759***
	(13.006)	(-12.006)	(14.337)	(-12.673)

Notes: ***, **, * indicate significance at 10%, 5%, 1% respectively. z-scores are in ( )

Table 9: Transition Probabilities: Spatial Markov Framework for LISA(II)

		Low-Low	Low-High	High-Low	High-High
ma_gpptp	Low-Low	0.878	0.081	0.024	0.016
	Low-High	0.150	0.838	0.000	0.013
	High-Low	0.077	0.000	0.538	0.385
	High-High	0.000	0.000	0.021	0.979
		Low-Low	Low-High	High-Low	High-High
ma_specptp	Low-Low	0.962	0.019	0.019	0.000
	Low-High	0.000	0.962	0.000	0.038
	High-Low	0.000	0.000	1.000	0.000
	High-High	0.000	0.051	0.013	0.937
		Low-Low	Low-High	High-Low	High-High
ma_phcvpc	Low-Low	0.945	0.037	0.018	0.000
	Low-High	0.031	0.948	0.000	0.021
	High-Low	0.130	0.000	0.783	0.087
	High-High	0.000	0.000	0.017	0.983
		Low-Low	Low-High	High-Low	High-High
ma_sthcvpc	Low-Low	0.924	0.023	0.046	0.008
	Low-High	0.025	0.937	0.000	0.038
	High-Low	0.154	0.000	0.769	0.077
	High-High	0.006	0.012	0.006	0.976

Table 10: Transition Types and Indices for LISA (II)

	Type 0	Type I	Type II	Type IIIA	Type IIIB	Cohesion	Flux
ma_gpptp	0.906	0.012	0.077	0.005	0.000	0.911	0.089
ma_specptp	0.951	0.037	0.012	0.000	0.000	0.951	0.049
ma_phcvpc	0.953	0.017	0.030	0.000	0.000	0.953	0.047
ma_sthcvpc	0.938	0.037	0.020	0.005	0.000	0.943	0.057

Table 11: Spatial Cross Section Models

Dependent Variable	Infant Mortality Rate				Under 5 Mortality Rate				Infant Mortality Rate				Under 5 Mortality Rate			
Panel A:ML 2009																
Practitioners per 100K population	-0.255				-0.496**				-0.267				-0.544***			
	(0.222)				(0.201)				(0.210)				(0.192)			
Specialists per 100K population		-0.101				-0.189**				-0.080				-0.160*		
		(0.097)				(0.089)				(0.096)				(0.088)		
Primary healthcare visits			-0.145				-0.224**				-0.124				-0.210**	
			(0.09)				(0.092)				(0.091)				(-0.085)	
Secondary healthcare visits				-0.339**				-0.450***				-0.337**				-0.420***
				(0.159)				(0.144)				(0.155)				(0.139)
Population density	0.027	0.065*	0.066*	0.033	0.022	0.095***	0.079**	0.048	0.015	0.051	0.064*	0.021	0.008	0.076**	0.076**	0.033
	(0.043)	(0.036)	(0.035)	(0.036)	(0.039)	(0.033)	(0.033)	(0.033)	(0.042)	(0.037)	(0.035)	(0.036)	(0.038)	(0.035)	(0.033)	(0.033)
Altitude	0.027	0.035**	0.017	0.027	0.036**	0.051***	0.024	0.039**	0.023	0.028	0.015	0.022	0.027*	0.041**	0.021	0.032**
	(0.018)	(0.017)	(0.018)	(0.017)	(0.016)	(0.016)	(0.017)	(0.015)	(0.017)	(0.017)	(0.017)	(0.016)	(0.015)	(0.016)	(0.016)	(0.015)
Public Expenditures	-0.043	-0.029	-0.440***	-0.022	0.002	0.028	-0.460***	0.027	-0.038	-0.032	-0.395**	-0.020	-0.005	0.023	-0.429***	0.025
	(0.081)	(0.083)	(0.136)	(0.080)	(0.073)	(0.076)	(0.128)	(0.073)	(0.080)	(0.082)	(0.132)	(0.079)	(0.074)	(0.075)	(0.124)	(0.072)
Illiteracy Rate	0.152*	0.171**	-0.027	0.184**	0.265***	0.306***	0.0002	0.339***	0.164*	0.189**	-0.000	0.198**	0.254***	0.310***	0.016	0.341***
	(0.082)	(0.076)	(0.091)	(0.070)	(0.075)	(0.069)	(0.086)	(0.063)	(0.087)	(0.085)	(0.086)	(0.078)	(0.079)	(0.083)	(0.080)	(0.075)
Net Migration rate	0.001	0.002	-0.003	0.002	0.000	0.001	-0.004	0.002	0.001	0.001	-0.002	0.002	0.000	0.001	-0.003	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
ρ	-0.005	-0.011	0.009	-0.009	-0.014	-0.024**	0.003	-0.021**								
	(0.012)	(0.011)	(0.013)	(0.011)	(0.010)	(0.009)	(0.012)	(0.009)								
λ									0.091**	0.095**	0.083*	0.098**	0.075	0.146***	0.075	0.144***
									(0.043)	(0.041)	(0.048)	(0.039)	(0.052)	(0.009)	(0.052)	(0.011)
R-Squared	0.22	0.21	0.31	0.24	0.49	0.49	0.46	0.52	0.23	0.21	0.27	0.25	0.48	0.43	0.42	0.47
Number of Obs.	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81
Panel B: ML 2014																
Practitioners per 100K population	0.149				0.033				0.085				-0.029			
	(0.218)				(0.211)				(0.204)				(0.195)			
Specialists per 100K population		-0.248**				-0.245***				-0.232**				-0.226**		
		(0.097)				(0.093)				(0.094)				(0.089)		
Primary healthcare visits			-0.265**				-0.290***				-0.195*				-0.232**	
			(0.116)				(0.111)				(0.107)				(0.103)	
Secondary healthcare visits				-0.468**				-0.532***				-0.415 **				-0.483***
				(0.188)				(0.179)				(0.176)				(0.165)
Population density	0.109**	0.109***	0.066*	0.096***	0.095**	0.108***	0.062*	0.095***	0.090**	0.104**	0.067*	0.088**	0.074*	0.100***	0.059*	0.086**
	(0.045)	(0.037)	(0.038)	(0.036)	(0.043)	(0.035)	(0.036)	(0.034)	(0.043)	(0.037)	(0.037)	(0.036)	(0.041)	(0.035)	(0.035)	(0.034)
Altitude	0.044**	0.037**	0.0191	0.027	0.048**	0.045**	0.025	0.033*	0.031	0.029*	0.018	0.021	0.033*	0.034**	0.020	0.025
	(0.020)	(0.018)	(0.020)	(0.019)	(0.019)	(0.017)	(0.019)	(0.018)	(0.019)	(0.017)	(0.019)	(0.021)	(0.018)	(0.016)	(0.018)	(0.017)
Public Expenditures	-0.108	-0.103	-0.157*	-0.153*	-0.117	-0.106	-0.164**	-0.161**	-0.088	-0.078	-0.114	-0.120	-0.091	-0.083	-0.126	-0.131*
	(0.086)	(0.082)	(0.084)	(0.083)	(0.083)	(0.079)	(0.081)	(0.079)	(0.081)	(0.079)	(0.080)	(0.079)	(0.078)	(0.075)	(0.076)	(0.074)

Dependent Variable	Infant Mortality Rate				Under 5 Mortality Rate				Infant Mortality Rate				Under 5 Mortality Rate			
Illiteracy Rate	0.293***	0.181**	0.144	0.238***	0.313***	0.210***	0.159*	0.260***	0.208**	0.117	0.147*	0.184**	0.205**	0.119	0.139*	0.182**
	(0.073)	(0.079)	(0.092)	(0.071)	(0.070)	(0.076)	(0.088)	(0.068)	(0.082)	(0.086)	(0.087)	(0.079)	(0.080)	(0.084)	(0.083)	(0.075)
Net Migration Rate	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.002	-0.001	-0.001	-0.001	-0.002	-0.001	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
ρ	-0.007	0.001	0.012	0.005	-0.014	-0.008	0.002	-0.003								
	(0.014)	(0.013)	(0.015)	(0.013)	(0.012)	(0.012)	(0.013)	(0.012)								
λ									0.120***	0.115***	0.100**	0.114***	0.141***	0.136***	0.115***	0.130***
									(0.027)	(0.030)	(0.039)	(0.031)	(0.012)	(0.016)	(0.030)	(0.020)
R-Squared	0.37	0.41	0.41	0.41	0.42	0.47	0.47	0.48	0.23	0.28	0.30	0.28	0.24	0.29	0.33	0.31
Number of Obs.	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81

Notes: ***, ** and * represents significance at 10%, 5% and 1% respectively. Std. errors in ( )

Table 12: Spatial Panel Models

Dependent Variable	imr 1				imr 5				imr 1				imr 5			
Panel A: 2009-2014 Fixed Effect																
Practitioners per 100K population	0.178				0.153				0.201				0.164			
	(0.134)				(0.104)				(0.150)				(0.115)			
Specialists per 100K population		-0.113				-0.094				-0.137				-0.130		
		(0.132)				(0.110)				(0.139)				(0.116)		
Primary healthcare visits			0.155				0.140				0.143				0.144	
			(0.099)				(0.090)				(0.101)				(0.092)	
Secondary healthcare visits				0.139				0.068				0.099				0.022
				(0.091)				(0.068)				(0.095)				(0.070)
Population density	.399	0.267	3.091**	0.187	-0.068	-0.185	1.858	-0.188	0.287	0.160	3.050*	0.150	-0.174	-0.287	1.687	-0.235
	(0.401)	(0.385)	(1.530)	(0.413)	(0.339)	(0.326)	(1.294)	(0.347)	(0.416)	(0.405)	(1.617)	0.428	(0.347)	(0.338)	(1.281)	(0.360)
Public Expenditures	-0.010	0.005	0.046	-0.023	-0.0217	-0.008	0.033	-0.023	-0.047	-0.029	0.033	-0.055	-0.057*	-0.039	0.030	-0.054
	(0.042)	(0.041)	(.095)	(0.044)	(0.034)	(0.036)	(0.078)	(0.037)	(0.044)	(0.043)	(0.100)	(0.046)	(0.034)	(0.035)	(0.077)	(0.037)
Illiteracy Rate	0.209***	0.179***	1.611***	0.217***	0.225***	0.200***	1.681***	0.221***	0.288***	0.254***	1.842***	0.285***	0.306***	0.273***	1.757***	0.296***
	(0.048)	(0.055)	(0.507)	(0.052)	(0.048)	(0.052)	(0.456)	(0.050)	(0.055)	(0.057)	(0.537)	(0.059)	(0.049)	(0.050)	(0.377)	(0.051)
Net Migration Rate	-0.000	-0.0007	-0.001	-0.0005	0.0001	0.0001	-0.000	0.0002	-0.0009	-0.001	-0.001	-0.0008	0.00003	0.000	0.000	0.0000
	(0.001)	(0.001)	(0.002)	(0.001)	(0.0009)	(0.0009)	(0.001)	(0.0009)	(0.001)	(0.001)	(0.002)	(0.001)	(0.0009)	(0.001)	(0.001)	(0.001)
ρ	0.483***	0.450***	0.331*	0.485***	0.407***	0.383***	0.075	0.423***								
	(0.096)	(0.0940)	(0.191)	(0.094)	(0.119)	(0.117)	(0.279)	(0.115)								
λ									0.502***	0.473***	0.347	0.498***	0.389***	0.372**	-0.177	0.397**
									(0.094)	(0.096)	(0.230)	(0.104)	(0.149)	(0.145)	(0.379)	(0.154)
R-Squared	0.02	0.08	0.01	0.11	0.28	0.22	0.04	0.20	0.08	0.23	0.02	0.19	0.20	0.16	0.05	0.18
Obs.	486	486	243	486	486	486	243	486	486	486	243	486	486	486	243	486
Panel B: 2009-2014 Random Effect																
Practitioners per 100K population	0.020				0.025				0.012				0.015			
	(0.143)				(0.111)				(0.040)				(0.129)			
Specialists per 100K population		-0.114*				-0.135**				-0.108*				-0.141**		
		(0.060)				(0.057)				(0.061)				(0.0596)		
Primary healthcare visits			-0.083				-0.116*				-0.120				-0.156**	
			(0.068)				(0.066)				(0.077)				(0.078)	
Secondary healthcare visits				0.011				-0.037				-0.060				-0.114
				(0.085)				(0.065)				(0.094)				(0.075)
Population density	0.034	0.042*	0.047*	0.032	0.029	0.039	0.043		0.040	0.048**	0.048*	0.039	0.035	0.046*	0.044	0.033
	(0.028)	(0.024)	(0.024)	(0.024)	(0.027)	(0.025)	(0.024)	(0.024)	(0.030)	(0.025)	(0.028)	(0.024)	(0.027)	(0.025)	(0.028)	(0.024)
Public Expenditures	-0.024	-0.014	-0.131**	-0.024	-0.007	0.004	-0.106*	-0.002	-0.076*	-0.063	-0.144**	-0.070	-0.058	-0.044	-0.116	-0.045

Dependent Variable	**imr 1**				**imr 5**				**imr 1**				**imr 5**			
	(0.040)	(0.041)	(0.068)	(0.042)	(0.033)	(0.035)	(0.058)	(0.035)	(0.042)	(0.043)	(0.072)	(0.044)	(0.036)	(0.037)	(0.063)	(0.037)
Illiteracy Rate	0.177***	0.149***	0.124*	0.177***	0.226***	0.196***	0.156**	0.220***	0.252***	0.225***	0.165**	0.242***	0.321***	0.289***	0.220***	0.304***
	(0.039)	(0.041)	(0.065)	(0.041)	(0.041)	(0.042)	(0.062)	(-0.0007)	(0.042)	(0.041)	(0.077)	(0.042)	(0.040)	(0.040)	(0.075)	(0.039)
Net Migration Rate	-0.001	-0.001	-0.002	-0.001	-0.0006	-0.0006	-0.001		-0.001	-0.001	-0.002	-0.001	-0.0006	-0.0007	-0.001	-0.0008
	(0.001)	(0.001)	(0.001)	(0.001)	(0.0008)	(0.0008)	(0.001)		(0.001)	(0.001)	(0.001)	(0.001)	(0.0009)	(0.0009)	(0.001)	(-0.0009)
ρ	0.507***	0.502***	0.705***	0.508***	0.480***	0.475***	0.732***	0.470***								
	(0.089)	(0.088)	(0.070)	(0.087)	(0.100)	(0.099)	(0.0727)	(0.099)								
λ									0.509***	0.498***	0.653***	0.511***	0.425***	0.421***	0.646***	0.431***
									(0.084)	(0.087)	(0.092)	(0.081)	(0.124)	(0.123)	(0.114)	(0.115)
R-Squared	0.29	0.31	0.34	0.29	0.41	0.44	0.44	0.42	0.30	0.31	0.31	0.31	0.41	0.44	0.40	0.44
Obs.	486	486	243	486	486	486	243	486	486	486	243	486	486	486	243	486

Notes: ***, ** and * represents significance at 10%, 5% and 1% respectively. Std. errors in ( )

Table 13: GWR Models: Spatial Variability of Coefficient Estimates

y: Infant Mortality Rate	Min.	Max.	Range	Lwr	Median	Upper	Diff
Practitioners per 100K population_2009	-0.610	-0.002	0.608	-0.560	-0.393	-0.069	-7.989
Specialists per 100K population_2009	-0.121	-0.025	0.095	-0.110	-0.088	-0.052	-3.237
Primary healthcare visits_2012	-0.138	-0.038	0.100	-0.127	-0.077	-0.046	-0.702
Secondary healthcare visits_2009	-0.375	-0.285	0.090	-0.353	-0.334	-0.303	1.511
Practitioners per 100K population_2014	-0.072	0.880	0.952	0.109	0.201	0.504	-36.488
Specialists per 100K population_2014	-0.269	-0.110	0.158	-0.189	-0.172	-0.140	1.423
Primary healthcare visits_2014	-0.142	0.322	0.464	-0.118	0.010	0.122	0.598
Secondary healthcare visits_2014	-0.598	-0.010	0.587	-0.532	-0.322	-0.198	-0.447
y: Under 5 Mortality Rate							
	Min.	Max.	Range	Lwr	Median	Upper	Diff
Practitioners per 100K population_2009	-0.676	-0.362	0.313	-0.667	-0.625	-0.432	-8.886
Specialists per 100K population_2009	-0.181	-0.109	0.071	-0.161	-0.129	-0.120	-6.124
Primary healthcare visits_2012	-0.138	-0.038	0.1	-0.127	-0.077	-0.046	-0.702
Secondary healthcare visits_2009	-0.506	-0.334	0.172	-0.473	-0.434	-0.367	0.737
Practitioners per 100K population_2014	-0.178	0.740	0.918	-0.020	0.058	0.363	-40.090
Specialists per 100K population_2014	-0.262	-0.105	0.157	-0.219	-0.201	-0.122	1.455
Primary healthcare visits_2014	-0.178	0.283	0.462	-0.164	-0.028	0.116	-0.280
Secondary healthcare visits_2014	-0.639	-0.102	0.536	-0.606	-0.448	-0.306	-0.169

Table 14: Geographical Evolution of GWR Results (2009)

	y: Infant Mortality Rate	gpptp		specptp				phcvpc				shcvpc				
		Q1	Q2	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q3	Q4	Q1	Q2	Q3	Q4
TR 1	Istanbul Region	1.000	0.000	1.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	1.000	1.000	0.000	0.000	0.000
TR 2	West Marmara Region	1.000	0.000	1.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	1.000	1.000	0.000	0.000	0.000
TR 3	Aegean Region	0.875	0.125	0.875	0.125	0.000	0.000	0.500	0.500	0.000	0.000	0.000	1.000	1.000	0.000	0.000	0.000
TR 4	East Marmara Region	0.875	0.125	0.875	0.125	0.000	0.000	0.875	0.125	0.000	0.000	0.375	0.625	0.625	0.375	0.000	0.000
TR 5	West Anatolia Region	0.000	1.000	0.000	1.000	0.000	0.000	0.000	0.667	0.000	0.000	1.000	0.000	0.000	1.000	0.000	0.000
TR 6	Mediterranean Region	0.000	0.500	0.000	0.500	0.500	0.000	0.000	0.375	0.000	0.500	0.250	0.250	0.125	0.625	0.250	0.000
TR 7	Central Anatolia Region	0.000	0.500	0.000	0.500	0.500	0.000	0.000	0.500	0.000	0.250	0.750	0.000	0.000	0.625	0.250	0.125
TR 8	West Black Sea Region	0.000	0.700	0.000	0.700	0.300	0.000	0.300	0.600	0.200	0.200	0.600	0.000	0.000	0.400	0.400	0.200
TR 9	East Black Sea Region	0.000	0.000	0.000	0.000	0.333	0.667	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000
TR A	Northeast Anatolia Region	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000
TR B	Central East Anatolia Region	0.000	0.000	0.000	0.000	0.250	0.750	0.000	0.000	0.625	0.375	0.000	0.000	0.000	0.000	0.375	0.625
TR C	Southeast Anatolia Region	0.000	0.000	0.000	0.000	0.556	0.444	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	1.000	0.000

	y: Under 5 Mortality Rate	gpptp		specptp				phcvpc				shcvpc				
		Q1	Q2	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q3	Q4	Q1	Q2	Q3	Q4
TR 1	Istanbul Region	1.000	0.000	1.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	1.000	1.000	0.000	0.000	0.000
TR 2	West Marmara Region	1.000	0.000	1.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	1.000	1.000	0.000	0.000	0.000
TR 3	Aegean Region	0.375	0.625	0.375	0.625	0.000	0.000	0.875	0.125	0.000	0.000	1.000	0.000	1.000	0.000	0.000	0.000
TR 4	East Marmara Region	1.000	0.000	1.000	0.000	0.000	0.000	0.750	0.250	0.000	0.000	0.000	1.000	0.625	0.375	0.000	0.000
TR 5	West Anatolia Region	0.000	1.000	0.000	1.000	0.000	0.000	0.000	0.667	0.000	0.000	0.667	0.333	0.000	1.000	0.000	0.000
TR 6	Mediterranean Region	0.000	0.500	0.000	0.500	0.500	0.000	0.000	0.375	0.000	0.500	0.500	0.000	0.125	0.500	0.375	0.000
TR 7	Central Anatolia Region	0.000	0.500	0.000	0.500	0.500	0.000	0.000	0.375	0.000	0.375	0.500	0.125	0.000	0.625	0.375	0.000
TR 8	West Black Sea Region	0.300	0.400	0.300	0.400	0.300	0.000	0.100	0.800	0.000	0.300	0.200	0.500	0.000	0.500	0.500	0.000
TR 9	East Black Sea Region	0.000	0.000	0.000	0.000	0.333	0.667	0.000	0.167	0.667	0.333	0.000	0.000	0.000	0.000	0.167	0.833
TR A	Northeast Anatolia Region	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000
TR B	Central East Anatolia Region	0.000	0.000	0.000	0.000	0.375	0.625	0.000	0.000	0.750	0.250	0.000	0.000	0.000	0.000	0.250	0.750
TR C	Southeast Anatolia Region	0.000	0.000	0.000	0.000	0.444	0.556	0.000	0.000	0.333	0.667	0.000	0.000	0.000	0.000	0.667	0.333

Table 15: Geographical Evolution of GWR Results (2014)

	y: Infant Mortality Rate	gpptp				specptp				phcvpc				shcvpc			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
TR 1	Istanbul Region	0.000	1.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	1.000	0.000	1.000	0.000	0.000	0.000
TR 2	West Marmara Region	0.000	1.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.800	0.200	0.000	1.000	0.000	0.000	0.000
TR 3	Aegean Region	0.000	0.125	0.875	0.000	0.000	0.000	0.500	0.500	0.000	0.500	0.500	0.000	0.375	0.625	0.000	0.000
TR 4	East Marmara Region	0.500	0.500	0.000	0.000	0.000	0.000	0.375	0.625	0.000	0.000	0.625	0.375	0.750	0.250	0.000	0.000
TR 5	West Anatolia Region	0.333	0.000	0.333	0.333	0.000	0.000	0.000	1.000	0.000	0.000	0.000	1.000	0.000	0.667	0.000	0.333
TR 6	Mediterranean Region	0.000	0.000	0.375	0.625	0.125	0.250	0.125	0.500	0.000	0.125	0.750	0.125	0.000	0.250	0.125	0.625
TR 7	Central Anatolia Region	0.000	0.000	0.125	0.875	0.375	0.125	0.375	0.125	0.000	0.125	0.125	0.750	0.000	0.500	0.500	0.000
TR 8	West Black Sea Region	0.500	0.000	0.100	0.400	0.500	0.000	0.100	0.400	0.000	0.000	0.200	0.800	0.500	0.500	0.000	0.000
TR 9	East Black Sea Region	0.333	0.333	0.167	0.167	1.000	0.000	0.000	0.000	0.667	0.333	0.000	0.000	0.000	0.000	1.000	0.000
TR A	Northeast Anatolia Region	0.714	0.143	0.143	0.000	0.571	0.429	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000
TR B	Central East Anatolia Region	0.375	0.250	0.250	0.125	0.125	0.875	0.000	0.000	0.625	0.375	0.000	0.000	0.000	0.000	0.250	0.750
TR C	Southeast Anatolia Region	0.000	0.444	0.333	0.222	0.000	0.778	0.222	0.000	0.444	0.556	0.000	0.000	0.000	0.000	0.000	1.000

	y: 5 Mortality Rate	gpptp				specptp				phcvpc				shcvpc			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
TR 1	Istanbul Region	0.000	1.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000	1.000	0.000	0.000	0.000
TR 2	West Marmara Region	0.000	1.000	0.000	0.000	0.000	0.000	0.800	0.200	0.000	0.800	0.200	0.000	1.000	0.000	0.000	0.000
TR 3	Aegean Region	0.000	0.125	0.875	0.000	0.000	0.000	0.500	0.500	0.000	0.500	0.500	0.000	0.250	0.750	0.000	0.000
TR 4	East Marmara Region	0.375	0.625	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.750	0.250	0.750	0.250	0.000	0.000
TR 5	West Anatolia Region	0.333	0.000	0.333	0.333	0.000	0.000	0.667	0.333	0.000	0.000	0.000	1.000	0.000	0.667	0.333	0.000
TR 6	Mediterranean Region	0.000	0.000	0.375	0.625	0.125	0.375	0.125	0.375	0.000	0.125	0.625	0.250	0.000	0.375	0.000	0.625
TR 7	Central Anatolia Region	0.000	0.000	0.125	0.875	0.375	0.000	0.625	0.000	0.000	0.125	0.125	0.750	0.000	0.500	0.250	0.250
TR 8	West Black Sea Region	0.400	0.100	0.100	0.400	0.300	0.100	0.300	0.300	0.000	0.000	0.200	0.800	0.600	0.300	0.100	0.000
TR 9	East Black Sea Region	0.333	0.167	0.333	0.167	1.000	0.000	0.000	0.000	0.667	0.333	0.000	0.000	0.000	0.000	1.000	0.000
TR A	Northeast Anatolia Region	0.714	0.143	0.143	0.000	0.429	0.571	0.000	0.000	0.857	0.143	0.000	0.000	0.000	0.000	1.000	0.000
TR B	Central East Anatolia Region	0.500	0.125	0.250	0.125	0.375	0.625	0.000	0.000	0.625	0.375	0.000	0.000	0.000	0.000	0.375	0.625
TR C	Southeast Anatolia Region	0.111	0.444	0.222	0.222	0.111	0.778	0.111	0.000	0.556	0.444	0.000	0.000	0.000	0.000	0.000	1.000