DOI: 10.26650/JGEOG2024-1417358

COĞRAFYA DERGİSİ
JOURNAL OF GEOGRAPHY
2024, (48)

https://iupress.istanbul.edu.tr/en/journal/jgeography/home

Investigation of the Relationship between Women Indicators and Socio-Economic Development Index using Spatial Econometrics Models

Kadın Göstergeleri ve Sosyo-ekonomik Gelişmişlik Endeksi Arasındaki İlişkinin Mekansal Ekonometrik Modeller Aracılığıyla İncelenmesi

Lale GÖRGÜLÜ[1], Çağla GÖRGÜLÜ[1]

[1]İzmir Institute of Technology, Faculty of Architecture, Urban Planning, İzmir, Türkiye

ORCID: L.G. 0000-0002-7376-6520; Ç.G. 0000-0002-3261-5013

ABSTRACT
The aim of this study was to investigate the relationship between socioeconomic development (SEGE) scores at the provincial level and women's indicators in Türkiye. The research questions include whether there is a relationship between women's indicators and SEGE scores, how the indicators affect SEGE scores, which indicators have a greater impact on SEGE, and how to determine the geographical distribution of the most effective indicators. The dataset for this study includes the socioeconomic development index scores of provinces and indicators related to women. The methods used in this study are correlation analysis, regression analysis, and spatial analyses (including spatial autoregressive and spatial error models, Moran's I and Lagrange multiplier diagnostics). The study's results indicate a negative significant relationship between the number of births of women aged 20-39 years and the proportion of agriculture in GDP. Conversely, there is a positive significant relationship between the indicator of compulsory insured women and SEGE scores. This study highlights the effects of women indicators on SEGE and contributes to the realisation of Sustainable Development Goals (SDGs) 5.5 and 10.2, which aim to provide gender equality and inclusion of women in socioeconomic life. The findings can guide the development of women-based strategies and policies for sustainable development.
Keywords: Socio-economic Development Index (SEGE), Women indicators, Spatial econometrics

ÖZ
Bu çalışma, Türkiye'de il düzeyindeki sosyo-ekonomik gelişmişlik skorları ile kadın göstergeleri arasındaki ilişkiyi araştırmayı amaçlamaktadır. Bu amaçla kadın göstergeleri ile Sosyo-ekonomik Gelişmişlik Endeksi (SEGE) il skorları arasında ilişki olup olmadığı, göstergelerin SEGE skorlarını nasıl etkilediği, hangi göstergelerin SEGE üzerinde daha fazla etkisi olduğu, en etkili göstergelerin coğrafi dağılımının nasıl olduğu araştırma soruları olarak belirlenmiştir. İllerin Sosyo-ekonomik Gelişmişlik Endeksi skorları ve kadın göstergeleri çalışmanın veri setidir. Bu çalışmada korelasyon analizi, regresyon analizi ve mekansal analiz yöntemleri (mekansal otoregresif ve mekansal hata modelleri, Moran's I ve Lagrange çarpanı teşhisi) kullanılmıştır. Çalışmanın sonuçları, 20-39 yaş arası kadınların doğum sayısına ilişkin göstergelerin ve tarımın GSYH içindeki payının SEGE skorları ile negatif anlamlı bir ilişkiye sahip olduğunu, zorunlu sigortalı kadın göstergesinin ise SEGE skorları ile pozitif anlamlı bir ilişkiye sahip olduğunu ortaya koymaktadır. Bu çalışma, kadın göstergelerinin SEGE skorları üzerindeki etkilerini vurgulamaktadır. Toplumsal cinsiyet eşitliğini ve kadınların sosyo-ekonomik hayata dahil edilmesini sağlamak amacıyla 5.5 ve 10.2 sayılı Sürdürülebilir Kalkınma İlkeleri'ne dikkat çekmektedir. Sürdürülebilir kalkınmayı sağlamak için kadın odaklı stratejilerin ve politikaların yönlendirilmesine katkıda bulunmaktadır.
Anahtar kelimeler: Sosyo-ekonomik Gelişmişlik Endeksi (SEGE), Kadın göstergeleri, Mekansal ekonometri

Submitted/Başvuru: 10.01.2024 • **Revision Requested/Revizyon Talebi:** 22.02.2024 • **Last Revision Received/Son Revizyon:** 08.05.2024 • **Accepted/Kabul:** 23.05.2024 • **Online Published/Çevrimiçi Yayın:** xx.xx.2024

Corresponding author/Sorumlu yazar: Lale GÖRGÜLÜ / lalegorgulu@pers365.iyte.edu.tr

Citation/Atıf: Görgülü, L., Görgülü, Ç. (2024). Investigation of the relationship between women indicators and socio-economic development index using spatial econometrics models. *Cografya Dergisi, 48*, 155-174. https://doi.org/10.26650/JGEOG2024-1417358

1. INTRODUCTION

Cities have varying social and economic characteristics. In Türkiye, the Socio-Economic Development Index (SEGE) is calculated at two levels to guide strategies, policies, and implementations. Socio-economic development is measured by multiple indicators. The undeniable social roles of women in different fields also affect socioeconomic development levels. National development plans and their programmes emphasise the importance of women's roles in enterprise, the labour force, and welfare (Ministry of Family and Social Policies, 2014). Women are key subjects for sustainable development. SDG 5.5 states that women should have equal opportunities for participation and leadership in decision-making processes in political, economic, and social life. SDG 10.2 advocates for the empowerment and inclusion of all individuals in social, economic, and political aspects regardless of age, gender, disability, or ethnicity, by 2030. The perception and roles of women in society have a significant impact on social and economic structures. According to TurkStat's Labour Force Statistics for 2023, the labour force participation rate for women is 35.5%, while that for men is 71.4%. In 2020, the unemployment rate for women was 15%, which is higher than the rate for men at 12.3% (TurkStat, Labour Force Statistics, 2023). Recent studies have highlighted key indicators for women's empowerment (Abaidoo, 2023), the economic and social effects of women (Gurenko, 2023), and poverty reduction (Gebre, 2020).

In the literature, various studies have been conducted on socioeconomic development, gender equality, and women's indices. However, the relationship between the existing socioeconomic development index and women's indicators has not been explored. This study proposes new gender-based indicators of socioeconomic development. This study investigates the relationship between indicators of women and the Socioeconomic Development Index (SEGE) to contribute to poverty reduction, sustainability, and gender equality in economic and social life.

The purpose of this study is to analyse the statistical and spatial relationships between indicators of women and socioeconomic development. This study demonstrates how women indicators affect the socioeconomic development of provinces in Türkiye. In Türkiye, Ministry of Industry and Technology calculates socioeconomic development scores (SEGE) through statistical analyses and comparison based on various parameters. Furthermore, an investigation into the contributions of women to the social, economic, and political development of countries is necessary. For instance, TurkStat has analysed statistics related to women since 2012. In line with this, women's statistics are used in this study. These women indicators are excluded in the SEGE. This study puts forward that the SEGE should include women indicators to promote higher levels of socioeconomic development.

This study focuses on the following research questions: Is there a relationship between women indicators and SEGE scores? How do indicators affect SEGE scores? Which indicators have a greater impact on SEGE? How can we determine the geographical distribution of the most effective indicators?

The dataset for this study covers 81 provinces of Türkiye. SEGE scores and some gender-based indicators were obtained from TurkStat, the Ministry of Development, the Ministry of Industry and Technology, and the Turkish Employment Agency (İşkur) for 2014. The main method used is regression analysis, which is supported by descriptive statistics and maps.

The rest of the study is organised in this way: Section 2 presents the theoretical and empirical literature. Section 3 describes the data and methods used. The next section represents the empirical results of the study. Finally, the results of the study will be evaluated in the conclusion.

2. Literature Review

The literature on indicators of women and the socioeconomic development index has been investigated both theoretically and empirically.

2.1. Theoretical Literature

There is an ongoing debate regarding the role of women in everyday life, particularly in relation to their unpaid work in the home, such as caring for children. This work is often unregistered (Ministry of Family and Social Policies, 2014), and as a result, women's contributions to social and economic life are frequently overlooked. Furthermore, women face discrimination in both their professional and personal lives. The economic sector and unemployment rates have been used to justify this issue (Ministry of Family and Social Policies, 2014). Women's earnings differ from men's due to the prevalence of low-wage and temporary jobs that are deemed suitable for women. TurkStat has produced gender statistics to provide equality between females and males in society, consolidate the role of women in socio-economic

development, and produce and thrive national and international policies (TurkStat, 2022). In line with this aim, TurkStat published the first publication in 1995. The first statistic included women statistics from 1927 to 1992. Following the emphasis on women's contribution to socio-economic development, TurkStat, universities, and other public institutions conducted further research. TurkStat subsequently published the Gender Statistics Data Set on their website. To prevent discrimination due to gender and negative indicators of resource allocation, on the other hand, to upgrade the social and economic position of women, some indicators have been published since 2012 (TurkStat, 2022). The "Gender Statistics Publication" highlighted Sustainable Development Indicators Goal 5, which achieves gender equality and empower all women (TurkStat, 2022).

In addition, gender-related indices are used to determine the importance of women. Generally, these indices are created by comparing women and men (Deniz and Hobikoğlu, 2012). These index studies emphasise inequalities between women and men. Examples of such indices include the Gender Gap Index, Gender Inequality Index, and Gender-Related Development Index (GDI), which are developed using indicators from the Human Development Index (HDI). The Gender Empowerment Measure (GEM), Gender Inequality in Education, and Gender Inequality in Economic Activity compare women's and men's indicators in terms of economics, politics, and education (Deniz and Hobikoğlu, 2012). women's labour in both house and other fields is generally not reflected. The project, which was coordinated by the Ministry of Family and Social Policies General Directorate of The Status of Women, is the first project about analysis of this subject. The project is based on three surveys, such as Household Labour Force Survey, the Earnings Structure Survey, and the Time Use Survey (Ministry of Family and Social Policies, 2014). These surveys were obtained from TurkStat, and the Ministry of Family and Social Policies General Directorate of The Status of Women were evaluated in terms of gender equality.

In the statistical research, it is obvious that there is social and economic discrimination between women and men in Türkiye. According to some data obtained from TurkStat, the youth unemployment rate for persons by sex which includes 2014-2020, women's youth unemployment rates tend to increase (TurkStat, Household Labour Force Survey, 2023). For example, women's youth unemployment rate in 2014 was 20.4%, while the rate increased to 30.3% in 2020 (TurkStat, Household Labour Force Survey, 2023). In addition, the women's employment rate is 30.3%. In contrast, the male employment rate is 65.3% in 2023. Additionally, Woman Statistic 2022, published by Turkstat, reveals that women play a significant role in housework, and Family Structure Research 2021 shows that women are responsible for childcare (94,4%), laundry and dishwashing (85,6%), cooking, daily tidying, and cleaning of the house (85,4%). The statistical indicators claim that women are restricted in their roles in both the labour force and social life and are often left in the background. The TurkStat report recommends new policies to address adverse indicators and improve the socioeconomic status of women. Additionally, the report presents findings from the Türkiye Family Structure Research on women in the workforce. According to the Türkiye Family Structure Research (2021), it facilitates women's participation in social activities through employment.

According to statistical research, some women indicators are as follows:

- Women Giving Birth Between the Ages of 20 and 39 According to the Place of Residence Dec. refers to the number of women who are giving birth during this age period.
- Women Aged 18 and Over Who Can Read and Write gives the number of literate women.
- Women Aged 18 and Over who have Graduated from High School and Equivalent Vocational Schools refers to women who have degrees at the high school level and equivalent vocational schools.
- Women who Graduated from a College or Faculty at the Age of 18 and over denotes women who have a degree in college or faculty.
- Women who Graduated with a Master's degree (Including 5 or 6-Year Faculties) at the Age of 22 and Older represent women who have a master's degree.
- Women with a Doctoral Degree Aged 22 and Older refers to women who have a doctoral degree.
- The average age of marriage of a women is the average age at marriage of couples getting married first in a given year. This variable shows the women's mean age at first marriage.
- Women with Compulsory Insurance refers to women who have compulsory insurance.
- Number Of Trainees in Vocational Training Courses refers to women who take vocational training courses.
- Number of Trainees in Entrepreneurship Training Programme refers to women who take entrepreneurship training courses.
- Number of Trainees in On-Job Training refers to women who take on-job training courses.

- Registered Labour Force represents the number of women who participate in the registered labour force.
- Registered Unemployees denote the number of unemployed women.

According to statistical research, some demographic and economic indicators are as follows:

- Variable of Household refers to one person or group of persons with or without a family relationship who live in the same dwelling.
- The proportion of agriculture in GDP represents the ratio of the agriculture sector to Gross Domestic Product (GDP).
- The proportion of industry in GDP represents the ratio of the industry sector to Gross Domestic Product (GDP).
- The proportion of service in GDP represents the ratio of the service sector to Gross Domestic Product (GDP).

2.2. Empirical Literature

In the literature, there are many empirical studies on socioeconomic development (Table 1).

Şener and Demirdirek (2014) conducted a study in the context of the United Nations Joint Programme on Women-Friendly Cities 2006, which was applied in some provinces of Türkiye. The study emphasised the importance of gender-sensitive data as a milestone for a women-friendly approach and offered that social development policies at the local administration level could be developed accordingly.

Tunç (2018) focussed on gender inequality. She studied income level and the level of human development. The aim of this study was to demonstrate the impact of gender inequality on human development levels. Tunç (2018) conducted a study using least squares and cross-sectional analysis methods based on income groups in various countries. The dependent variable in her study was the level of human development.

Özdemir and Altıparmak (2005) examined social and economic variables. The authors analysed three factors: health, education, and enrolment rate, as well as two economic variables, financial indicators, and manufacturing industry indicators, using factor analysis.

Gül and Çevik (2014) developed an index for the provinces of Türkiye using 49 indicators and basic component analysis. They produced two indices and analysed their spatial distributions.

Sakarya and İbişoğlu (2015) investigated whether there is a relationship between the 2011 socioeconomic development index (SEGE) and examined indicators using geographically weighted regression.

Çetin and Sevüktekin (2016) focussed on regional differences and sustainability, investigating socio-economic development according to indicators from the World Bank, the Organisation for Economic Co-Operation and Development (OECD), and the United Nations (UN). Çetin and Sevüktekin highlighted spatial relationships and used the GeoDa and R-INLA packages to conduct their analyses.

Table 1. Empirical literature review

Author(s)	Place of Study	Period	Method(s)	Results
Gül and Çevik (2014)	All provinces of Türkiye	2010-2012	Component analysis and compare existing indices	They evaluated changes in levels of financial development over two years. Thus, they offer new financial and investment policies.
Tunç (2018)	99 countries	2015	methods of least squares analysis and cross-sectional analysis	Their results show that women play a significant role in development. They emphasise relationship between gender inequality and development.
Çetin and Sevüktekin (2016)	All provinces of Türkiye	2015	descriptive methods, Moran's I, and LISA analyses using GeoDa and R-INLA packages	They investigated the socioeconomic development of different regions spatially. They put forward that there are differences between the western and eastern parts of Türkiye. However, clustered provinces have homogeneity.
Sakarya and İbişoğlu (2015)	All provinces of Türkiye	2011	geographically weighted regression using GIS	They put forward that economic indicators explain the higher development scores in developed provinces and that the rate at which social indicators explain the higher development scores in underdeveloped provinces.
Ministry of Development (2017)	All provinces of Türkiye	2014	Basic component analysis	Scores and levels of socioeconomic development for each province were determined, and the ministry evaluated the presence conditions of the provinces according to their indices.
Şener and Demirdirek (2014)	Some plot provinces of Türkiye	2006-2014	survey, in-depth interviews, and analyses	They evaluated existing indices and offered action plans for gender-sensitive studies.

SEGE (Socio-economic Development Index), a report presented by the Ministry of Development in Türkiye, serves as the main study as the provincial level indices become the dependent variable in this research. This study investigates the role and effect of women on the Socioeconomic Development Index (SEGE) in Türkiye.

This study offers new indicators for SEGE, as it has never been studied in a gender-based context before. Some indicators related to women correlate with SEGE. These indicators can guide social and economic strategies and policies for sustainable development and gender equality.

3. MATERIALS AND METHODS

Geographical characteristics influence human activities, economic activities, and the distribution or choice of settlements. Geography is a discipline with multiple branches, including human geography and economic geography (Wikipedia, Human geography). Human geography examines the impacts of the geographical environment on human life and vice versa. Additionally, human geography encompasses economic geography, given that economic activities ultimately encompass human activities. Furthermore, spatial econometrics investigates the relationship between variables related to human activities and geographical location. Therefore, spatial econometrics models are the main method of this research. The field of spatial econometrics originated in the 1970s because of the need for sub-country data in regional econometric models. Spatial econometrics employs a set of techniques that account for explicit spatial effects, including spatial interaction and structure. Spatial integration refers to spatial autocorrelation, whereas spatial structure refers to spatial heterogeneity (Anselin, 2003; Paelinck and Klaassen, 1979; Anselin, 1988a). Spatial econometrics has traditionally been used in applied econometrics, but it is now being applied not only in location- and geography-based fields such as regional, urban, and real estate economics but also in labour, public and environmental economics.

The study utilised secondary data. First, a dataset was compiled (See Appendix Table S1). Existing provincial 2017 SEGE scores were acquired. The 52 variables in the 2017 SEGE present data from 2014 (Ministry of Industry and Technology Website). Among the 52 variables, there are three variables related to women: age-specific fertility rate (15-49 aged women), average daily earnings of women, and proportion of literate women. In addition, the share of agricultural production value in Türkiye is one of the existing variables of SEGE. Women's indicators and other indicators proposed in this research, which are not included in the 52 SEGE indicators, were obtained at the provincial level for 2014. The age-specific fertility rate, proportion of literate women, and share of agricultural production value in GDP are included in regression analysis with different units from those existing in SEGE. The collected data were converted into rates by dividing the population of each province. This study utilised demographic and economic indicators, and

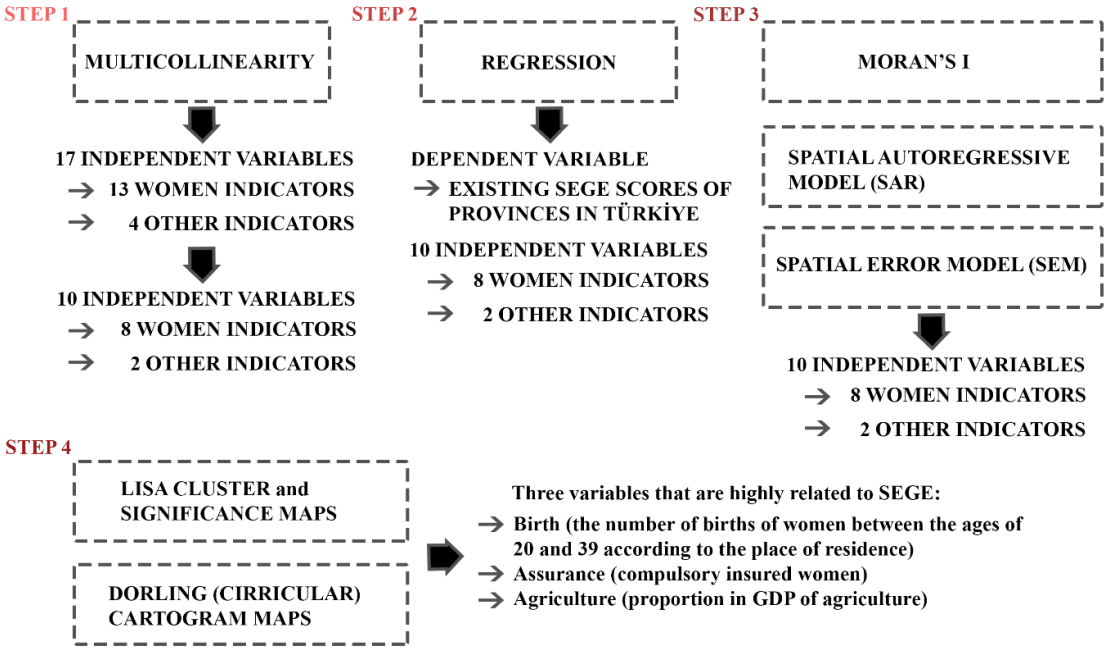


Fig 1. Method flow chart

Table 2. Data definition table

Variables	The types of Variables	Definition	Unit	Data sources
SEGE_score	Dependent	Socio-economic Index	Percentage	Ministry of Industry and Technology, 2014
Agriculture	Independent	Portion in GDP of Agriculture	Per thousand	TurkStat, 2014
Assurance	Independent	Compulsory-Insured Women	Rate (divided by the population of the province)	TurkStat, 2014
Birth	Independent	Number of Births of Women Between the Ages of 20 and 39 According to the Place of Residence	Rate (divided by the population of the province)	TurkStat, 2014
Entrepreneur_training	Independent	Number of Trainees in Entrepreneurship Training Programme	Rate (divided by the population of the province)	Turkish Employment Agency (İşkur), 2014
High_school	Independent	Women Aged 18 and Over who have Graduated from High School and Equivalent Vocational Schools	Rate (divided by the population of the province)	TurkStat, 2014
Household	Independent	Size of the Household	Number	TurkStat, 2014
Industry	Independent	Portion in GDP of Industry	Per thousand	TurkStat, 2014
Labour_force	Independent	Registered Labour Force	Rate (divided by the population of the province)	Turkish Employment Agency (İşkur), 2014
Literacy	Independent	A Woman Aged 18 and Over Who Has Literacy	Rate (divided by the population of the province)	TurkStat, 2014
Marriage_age	Independent	Average Age of Marriage of a Woman	Number	TurkStat, 2014
Master	Independent	Female Graduate of the Master's Degree (Including 5 Or 6-Year Faculties) Aged 22 and Over	Rate (divided by the population of the province)	TurkStat, 2014
Onjob_training	Independent	Number of Trainees on Job Training	Rate (divided by the population of the province)	Turkish Employment Agency (İşkur), 2014
PhD	Independent	A Woman with a Doctoral Degree Aged 22 and Older	Rate (divided by the population of the province)	TurkStat, 2014
Service	Independent	Portion in the GDP of Service	Per thousand	TurkStat, 2014
Vocational_training	Independent	Number Of Trainees in Vocational Training Courses	Rate (divided by the population of the province)	Turkish Employment Agency (İşkur), 2014
University	Independent	Female Graduates Of a College Or Faculty Aged 18 and Over	Rate (divided by the population of the province)	TurkStat, 2014
Unemployeds	Independent	Registered Unemployeds	Rate (divided by the population of the province)	Turkish Employment Agency (İşkur), 2014

indicators related to women, as independent variables, while SEGE scores were used as the dependent variable. The main methods employed in the study included descriptive statistics, correlation analysis for the independent variables, regression analysis, spatial analysis (Moran's I), and cartogram mapping (Fig 1).

Table 2 provides a data definition table that explains the types of variables, their scopes, units, and data sources. All variables refer to data from 2014. Marriage age and household are measured in numbers, while agriculture, industry, and service are measured in per thousand. The SEGE score is measured in percentage. The remaining variables are presented as ratios, as they are divided by populating each province (Table 2).

3.1. Descriptive Statistics

Maps illustrating SEGE scores of provinces for 2017 were prepared using the GeoDa programme (Fig 2). A darker colour indicates a higher socio-economic development score. It can be observed that Ankara and Istanbul have the highest SEGE scores.

3.2. Correlation Analysis for Independent Variables (Multicollinearity)

If independent variables are correlated, the estimated coefficient may be misleading (Duran, 2023). To determine which variables are correlated, a correlation analysis was performed between the independent variables. One of the independent variables that exceeds the threshold is eliminated. Variables above 0.7 or below -0.7 are accepted as highly correlated. For this study, 18 variables were identified. Seventeen variables are independent.

Table 3. Correlation matrix

CORRELATION MATRIX	Agriculture	Assurance	Birth	Entrepreneur_training	High_school	Household	Industry	Labour_force	Literacy	Marrige_age	Master	Onjob_training	Phd	Service	Vocational_training	University	Unemployeds
Agriculture	1	-0.258625	0.143776	0.088356	-0.24575	0.100542	-0.5446	-0.228277	-0.18902	-0.52553	-0.1288	0.011133	-0.17722	-0.11862	0.135921	-0.197199	-0.19247
Assurance	-0.258625	1	-0.65209	0.285081	0.821411	-0.66573	0.513925	0.537158	0.787552	0.692583	0.72244	0.101172	0.587755	-0.33341	-0.04523	0.854165	0.408714
Birth	0.143776	-0.65209	1	-0.38467	-0.79251	0.847678	-0.3576	-0.636838	-0.87685	-0.68937	-0.41777	-0.37346	-0.36824	0.24552	-0.11006	-0.695153	-0.52928
Entrepreneur_training	0.088356	0.285081	-0.38467	1	0.273074	-0.31795	0.075123	0.438705	0.376193	0.151872	0.032704	0.370405	0.029245	-0.14405	0.389622	0.219602	0.361546
High_school	-0.24575	0.821411	-0.79251	0.273074	1	-0.756138	0.447129	0.62483	0.809168	0.706791	0.711964	0.14723	0.600689	-0.29367	-0.025502	0.935715	0.512376
Household	0.100542	-0.66573	0.847678	-0.31795	-0.75614	1	-0.40302	-0.529315	-0.84634	-0.72098	-0.47303	-0.28567	-0.38482	0.339329	-0.068003	-0.690155	-0.4076
Industry	-0.544597	0.513925	-0.3576	0.075123	0.447129	-0.403019	1	0.282841	0.510805	0.430206	0.273787	0.04048	0.311302	-0.73181	-0.174375	0.411759	0.230854
Labour_force	-0.228277	0.537158	-0.63684	0.438705	0.62483	-0.529315	0.282841	1	0.529037	0.534634	0.227857	0.47165	0.152336	-0.17799	0.226481	0.513832	0.953074
Literacy	-0.189022	0.787552	-0.87685	0.376193	0.809168	-0.846343	0.510805	0.529037	1	0.726694	0.54489	0.304306	0.511778	-0.37511	-0.008219	0.760023	0.417838
Marrige_age	-0.525525	0.692583	-0.68937	0.151872	0.706791	-0.720977	0.430206	0.534634	0.726694	1	0.495394	0.083353	0.423131	-0.04712	-0.001661	0.660191	0.436272
Master	-0.128801	0.72244	-0.41777	0.032704	0.711964	-0.473026	0.273787	0.227857	0.54489	0.495394	1	-0.09301	0.703205	-0.17382	-0.120398	0.843574	0.169937
Onjob_training	0.011133	0.101172	-0.37346	0.370405	0.14723	-0.285669	0.04048	0.47165	0.304306	0.083353	-0.09301	1	-0.09478	-0.06254	0.241211	0.04298	0.443744
Phd	-0.177221	0.587755	-0.36824	0.029245	0.600689	-0.384815	0.311302	0.152336	0.511778	0.423131	0.703205	-0.09478	1	-0.15257	-0.22202	0.693232	0.085428
Service	-0.118621	-0.333411	0.24552	-0.14405	-0.29367	0.339329	-0.73181	-0.177986	-0.37511	-0.04712	-0.17382	-0.06254	-0.15257	1	0.067806	-0.276773	-0.15568
Vocational_training	0.135921	-0.04523	-0.11006	0.389622	-0.0255	-0.068003	-0.17438	0.226481	-0.00822	-0.00166	-0.1204	0.241211	-0.22202	0.067806	1	-0.104323	0.188575
University	-0.197199	0.854165	-0.69515	0.219602	0.935715	-0.690155	0.411759	0.513832	0.760023	0.660191	0.843574	0.04298	0.693232	-0.27677	-0.104323	1	0.427513
Unemployeds	-0.192471	0.408714	-0.52928	0.361546	0.512376	-0.407598	0.230854	0.953074	0.417838	0.436272	0.169937	0.443744	0.085428	-0.15568	0.188575	0.427513	1

After multicollinearity, 10 independent variables are preferred. These are Birth, Marrige_age, Vocational_training, Entrepreneur_training, Onjob_training, Phd, Labour_force, Assurance, Agriculture, and Industry (Table 3).

3.3. Regression Analysis

Spatial regression models include spatial lag and spatial error models. Spatial lag is used to evaluate the existence and strength of spatial interaction. Regression analysis was performed in RStudio. We refer to the following regression equation (1) to answer the research questions:

$$SEGE\_score_i = Birth_i + Marriage\_age_i + Vocational\_training_i + Entrepreneur\_training_i + Onjob\_training_i + Phd_i + Labour\_force_i + Assurance_i + Agriculture_i + Industry_i \quad (1)$$

i: provinces i: 1,……81

3.4. Spatial Analyses (Moran's I, SEM, SAR)

According to Tobler's first law of geography in 1969, everything is related to everything else, but closer objects are more related (Duran, 2023). Moran introduced Moran's I statistic in 1948. Moran's I is a specification test for spatial autocorrelation (Anselin, 2003). It is a commonly used indicator of global spatial autocorrelation. It became popular with the classic work on spatial autocorrelation by Cliff and Ord in the 1973s. This is a cross-product statistic between a variable and its spatial lag, and it refers to deviations from its mean (GeoDa Website, 5a). It is a two-dimensional analogue of a test for univariate time series correlation (Anselin, 2003; Cliff and Ord, 1973). Moran's I is the best local test, and it presents better performance than other tests used in simulation experiments. If Moran's I value is close to 1, there is a positive significant relationship. If Moran's I value is close to 1, there is a negative significant relationship. When Moran's I value becomes 0, there is no autocorrelation. According to Anselin (1996), the Moran scatterplot consists of a plot with the spatially lagged variable on the y-axis and the original variable on the x-axis (GeoDa website, 5a). The slope of the line in the scatterplot is equal to Moran's I. The scatterplot contains four quadrants. If the line runs from the lower left quadrant to the upper right quadrant, this direction indicates positive spatial autocorrelation (similar values at neighbouring locations) (GeoDa Website, 5a). Positive spatial autocorrelation also indicates high-high and low-low spatial autocorrelation. However, if the line runs from the lower right to the upper left quadrant, it corresponds to a negative spatial autocorrelation (dissimilar values at neighbouring locations). In other words,

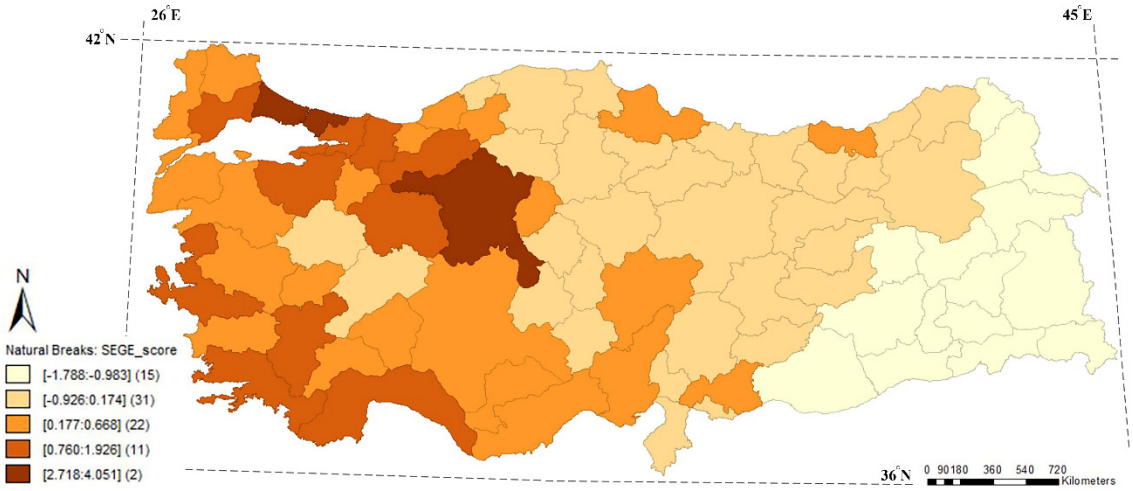


Fig 2. Geographical distribution of SEGE scores

negative spatial autocorrelation also refers to high-low and low-high spatial autocorrelation (GeoDa website, 5a).

Another specification test is LM. The LM test was suggested by Burridge (1980) for the estimation of the model under the null. LM also provides a distinction between a spatial error and a spatial lag alternative (Anselin, 2003). Moran's I is slightly better than the LM test in small samples, but the performances of the LM test and Moran's I do not distinguish from each other in larger samples (Anselin, 2003).

The spatial error model is defined as nuisance dependence (Anselin, 2003). The spatial error model is applied for correcting of potentially biassing effect of the spatial autocorrelation. SEM stands for Spatial Error Models and stands for Spatial Autoregressive Model. SAR works with spatial data and creates and manages spatial weighting matrices.

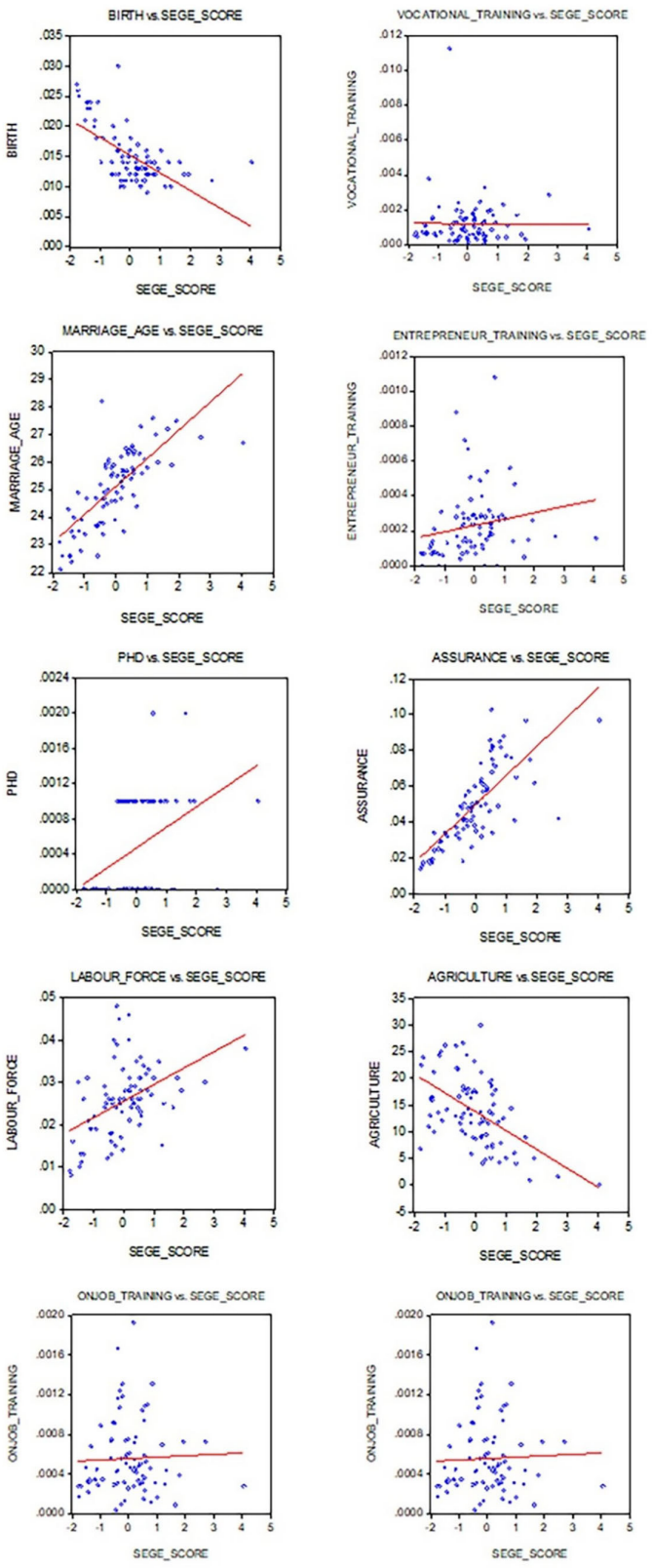
3.5. Cartogram Map

In academic geography research, area cartograms, which are a type of thematic map, are important visualisation tools. Area cartograms use dimension and distance according to a variable instead of the dimension and distance of the earth's surface (Şahin and Şahin, 2019). In other words, area cartograms are a combination of statistical data and geographical areas. Cartogram is an example of a non-linear optimisation problem (GeoDa Website, 3a). The cartogram map replaces the original layout with geometric shapes, such as circles, rectangles, and hexagons. There are many variations in the cartogram. Area cartograms can be classified as contiguous, non-contiguous, dorling (circular), and rectangular cartograms (Şahin and Şahin, 2019; Dent et al., 2009; Van Kreveld and Speckmann, 2007; Nusrat, Alam, Scheidegger and Kobourov, 2018; Tyner, 2010). The circular cartogram, which was developed by Dorling, shows each element on the map in the form of a circle so that they do not overlap each other. It preserves neither spatial appearance nor topology. This makes it easier to compare and interpret the data distribution on the cartogram (Şahin and Şahin, 2019). The cartogram map differs from a standard choropleth map in that it is proportional to the value of the variable for the location, whereas a standard choropleth map here reflects the size of the polygon corresponding to the area of the location in question (GeoDa Website, 3a). GeoDa works with a circular cartogram, which represents the area units and proportional values observed at that location. The cartogram map in GeoDa shows the proportional value observed in areal units, based on the size and colour of the circles. In this study, bubbles in the cartogram maps refer to the provinces of Türkiye. The colour of the bubbles refers to SEGE, and the size of the bubble denotes independent variables. Dark blue represents low SEGE scores, and red represents the most developed provinces in terms of social and economic. If the size of the bubbles is larger, the value of the indicators is high.

4. RESULTS

Regression analysis showed that birth (number of births of women aged 20-39 by place of residence), insurance (women with compulsory insurance), and agriculture (share of agriculture in GDP) are highly correlated with the SEGE score (Table 4). Briefly, the indicator of birth is significant at 0.05%, while assurance and agriculture are significant at 0.001%. The indicator of birth has a negative coefficient value. This shows that there is

a negative relationship with SEGE. A high birth rate results in low sociocultural and economic potential. Assurance refers to women who have compulsory insurance. Women's labour with assurance has a positive effect on SEGE. Unfortunately, SEGE scores are low in provinces where women work without insurance. On the other hand, agriculture has a negative effect on SEGE. This explains the fact that unqualified and temporary labourers work in agriculture. In addition, the geographical distribution of these indicators is visualised in GeoDa (See Appendix Fig S1-S3).



Graphic 1. Scatter plots

Table 4. Regression results

Residuals:				
Min	**1Q**	**Median**	**3Q**	**Max**
-0.90007	-0.27495	-0.05909	0.19960	2.27757
Variables	**Coefficient**	**Standard Error**	**T-Tests (t-Value)**	**p-Value (Pr(>|t|))**
Birth	-5.54E+01	2.37E+01	-2.335	0.022410 *
Marriage_age	8.20E-02	8.89E-02	0.923	0.359106
Vocational_training	4.78E+01	5.21E+01	0.917	0.362242
Entrepreneur_training	7.40E+01	4.02E+02	0.184	0.854277
Onjob_training	-2.88E+02	2.11E+02	-1.366	0.176184
Phd	-1.06E+02	1.46E+02	-0.722	0.472920
Labour_force	-9.00E+00	1.10E+01	-0.815	0.417736
Assurance	2.12E+01	5.19E+00	4.086	0.000115 ***
Agriculture	-4.80E-02	1.39E-02	-3.445	0.000968 ***
Industry	6.52E-03	8.53E-03	0.765	0.447077

Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**

Residual standard error: 0.5467 on 70 degrees of freedom

F-statistic: 19.76 on 10 and 70 DF

p-value: < 2.2e-16

Table 5. Heteroscedasticity and normality tests

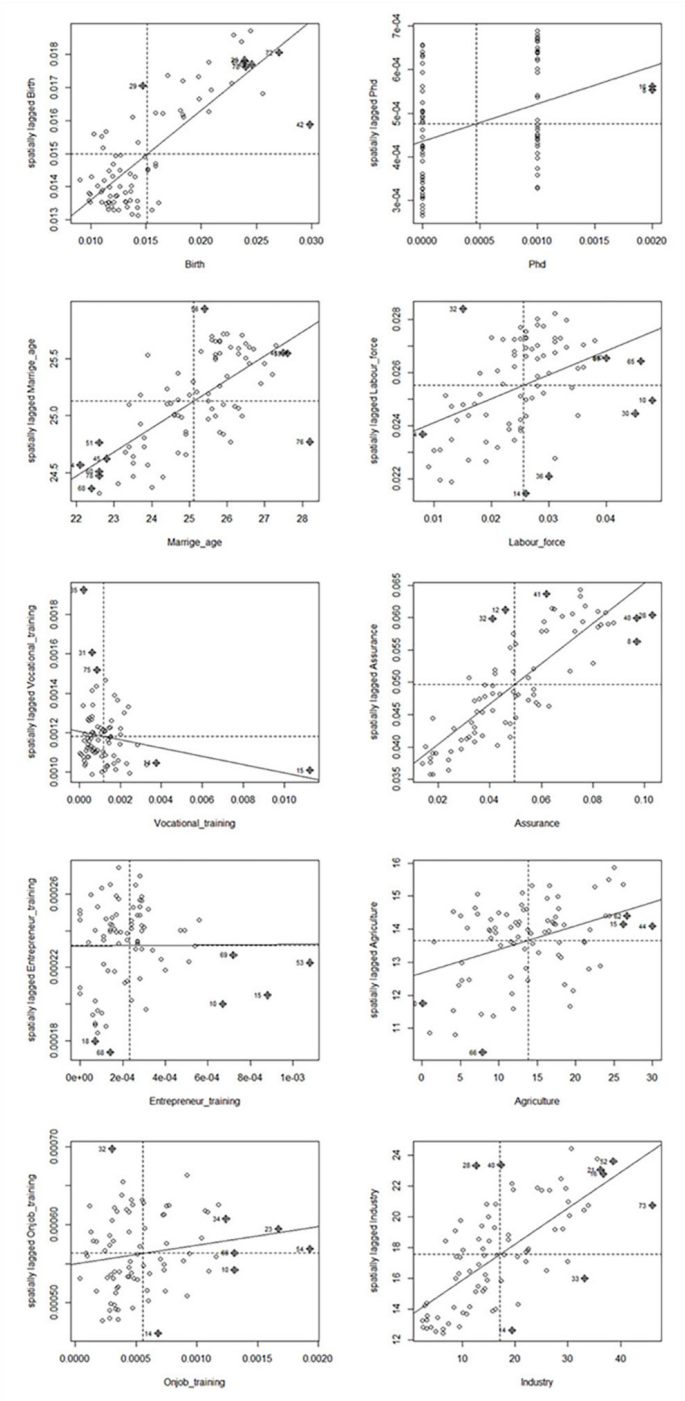
REGRESSION DIAGNOSTICS			
MULTICOLLINEARITY CONDITION NUMBER	167.479246		
TEST ON NORMALITY OF ERRORS			
TEST	DF	VALUE	PROB
Jarque-Bera	2	112.0454	0
DIAGNOSTICS FOR HETEROSKEDASTICITY			
RANDOM COEFFICIENTS			
TEST	DF	VALUE	PROB
Breusch-Pagan test	10	52.7123	0
Koenker-Bassett test	10	15.5735	0.11251
SPECIFICATION ROBUST TEST			
TEST	DF	VALUE	PROB
White	65	78.213	0.12588

Table 6. Moran's I statistics

Data	**Moran I statistic**	**P-value**
Birth	0.2709995918	< 2.2e-16
Marriage_age	0.2095496367	< 2.2e-16
Vocational_training	-0.0210447559	0.76
Entrepreneur_training	0.0007937842	0.2029
Onjob_training	0.0239053941	0.013
Phd	0.0863685246	1.463E-09
Labour_force	0.0894077360	3.844E-10
Assurance	0.3120649643	< 2.2e-16
Agriculture	0.0709854915	2.549E-07
Industry	0.2341304512	< 2.2e-16

Spatial Weight Matrix: Inverse Distance

Scatter plots illustrate the relationship between each variable and SEGE scores (Graphic 1). It is clearly seen that women giving birth between the ages of 20 and 39 according to the place of residence and proportion of agriculture in GDP have a negative relationship with SEGE scores, whereas women with compulsory insurance have a positive relationship with SEGE scores at the provincial level.



Graphic 2. Moran's I plots

Traditionally, heterogeneity can be included in the random coefficient model. Testing for spatial error dependence and heteroskedastic error variance can be based on the Lagrange Multiplier approach (Anselin, 1988). No problems of heteroscedasticity or normality were found (Table 5).

The results of Moran's I spatial dependency test are shown below (Graphic 2). The spatial analysis was performed using a spatial weight matrix (inverse distance) in RStudio. According to the values of Moran's I, birth, marriage age, assurance, and industry have relatively positive significant spatial autocorrelation since these values are closer to 1 than the other variables (Table 6).

Lagrange multiplier diagnostics for spatial dependence were assessed using RStudio (Table 7). SARMA was significant at 0.01%. Therefore, we can say that spatial lag dependence and spatial error dependence are valid.

Table 7. Lagrange Multiplier Diagnostics for spatial dependence

Lagrange multiplier diagnostics	Spatial Weight Matrix: Inverse Distance	P-value
Spatial Error Dependence-LM Test (Lmerr)	0.7277	0.3936
Spatial Lag Dependence-LM Test (LMlag)	9.0129	0.002681
Spatial Error Dependence Sub-spatial Lag -Locally robust LM test (RLMerr)	2.5513	0.1102
Spatial Lag Dependence Sub-Spatial Error- Locally robust LM test (RLMlag)	10.836	0.0009952
SARMA	11.564	0.003082

The spatial autoregressive model (SAR) was performed in RStudio. Its type is lag, and its spatial weight matrix is the inverse distance. Coefficients refer to the asymptotic standard errors (Table 8).

The spatial error model (SEM) has an error type. Coefficients refer to the asymptotic standard errors (Table 9). The table shows the lambda value, LR test value, and p-value.

Additionally, GeoDa was used to illustrate significance maps that display locations with a significant local statistic, as well as LISA (Local Indicators of Spatial Association) (univariate) cluster maps for three variables that are highly related to SEGE (GeoDa Website, 6a).

Because of regression and Moran's I, in GeoDa, the LISA cluster and significant maps were illustrated with queen weighted for three significant variables. These variables are birth (the number of births of women between the ages of 20 and 39

Table 8. SAR results

Residuals:				
Min	**1Q**	**Median**	**3Q**	**Max**
-0.838838	-0.232823	-0.091498	0.230314	2.100987
Variables	**Coefficient**	**Standard Error**	**z-Value**	**p-Value (Pr(>|z|))**
Birth	-4.373E+01	2.06E+01	-2.1182	0.03416
Marriage_age	3.492E-02	7.74E-02	0.4514	0.65169
Vocational_training	4.82E+01	4.52E+01	1.0656	0.28658
Entrepreneur_training	1.00E+02	3.49E+02	0.2869	0.77421
Onjob_training	-4.16E+02	1.84E+02	-2.2628	0.02365
Phd	-8.92E+01	1.27E+02	-0.7028	0.48220
Labour_force	1.55E-01	9.64E+00	0.0161	0.98719
Assurance	1.46E+01	4.61E+00	3.1689	0.00153
Agriculture	-5.75E-02	1.21E-02	-4.7427	2.11E-06
Industry	-7.13E-03	7.60E-03	-0.9386	0.34795

Rho: 0.80337, **LR test value:** 8.9062, **p-value:** 0.0028421
Asymptotic standard error: 0.12907
Log likelihood: -55.66122 for lag model
ML residual variance (sigma squared): 0.22492, **(sigma:** 0.47425**)**
LM test for residual autocorrelation
test value: 0.46945, **p-value:** 0.49324

Table 9. SEM results

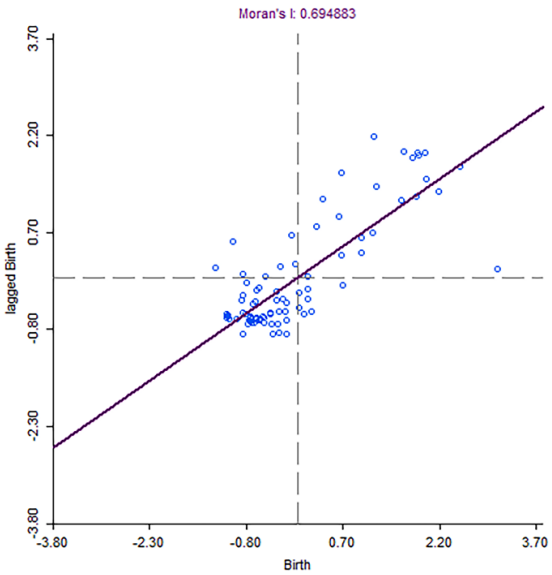
Residuals:				
Min	**1Q**	**Median**	**3Q**	**Max**
-0.824105	-0.273297	-0.063396	0.187382	2.221290
Variables	**Coefficient**	**Standard Error**	**z-Value**	**p-Value (Pr(>|z|))**
Birth	-5.11E+01	2.24E+01	-2.2833	0.0224140
Marriage_age	6.65E-02	8.04E-02	0.8264	0.4085607
Vocational_training	6.21E+01	4.63E+01	1.3398	0.1803072
Entrepreneur_training	-4.75E+01	3.59E+02	-0.1321	0.8948782
Onjob_training	-3.25E+02	1.90E+02	-1.7106	0.0871614
Phd	-8.19E+01	1.29E+02	-0.6345	0.5257477
Labour_force	-3.19E+00	1.00E+01	-0.3175	0.7508388
Assurance	1.87E+01	4.90E+00	3.816	0.0001356
Agriculture	-5.54E-02	1.27E-02	-4.3639	1.28E-05
Industry	-1.42E-03	8.08E-03	-0.1752	0.8609256

Lambda: 0.77062, **LR test value:** 2.1865, **p-value:** 0.13923
Asymptotic standard error: 0.15669
Log likelihood: -59.02107 for error model
ML residual variance (sigma squared): 0.24528, **(sigma:** 0.49525**)**

according to the place of residence), assurance (compulsory insured women), and agriculture (proportion in GDP of agriculture). LISA provides a statistic with an assessment of significance for each location (GeoDa Website, 6a).

Moran's I value for birth is 0.69 (Graphic 3). This means that there is a positive spatial autocorrelation. In other words, provinces with a high number of women giving birth between the ages of 20 and 39 are geographically grouped together, with those with a low number of such women situated in close proximity to each other.

A high number of women giving birth is defined as a value that is above the average. The LISA cluster map shows that high values are located in the southeast of Türkiye (Fig 3). In the southeast of Türkiye, 15 provinces are clustered together. In the northern and western parts of Türkiye, 16 provinces demonstrate spatial autocorrelation. The small number of women giving birth between the ages of 20 and 39 years are grouped together. This clustering indicates the influence of geographic factors on the age at which women give birth.



Graphic 3. Moran's I plot for birth

The LISA significance map justifies that the level of significance increases in the southeast of Türkiye (Fig 4). There is a significant correlation between the high number of women giving birth in the southeast and their geographical location. Furthermore, provinces in the western part of Türkiye exhibited a notable correlation with their geographic locations at the 0.05 significance level.

Women's empowerment is a key indicator of socioeconomic development. Insurance for working women varies according to several factors, such as cultural norms, educational attainment, and awareness in the local context. Moran's I value for assurance is 0.72 (Graphic 4). This means that there is a significant positive spatial autocorrelation.

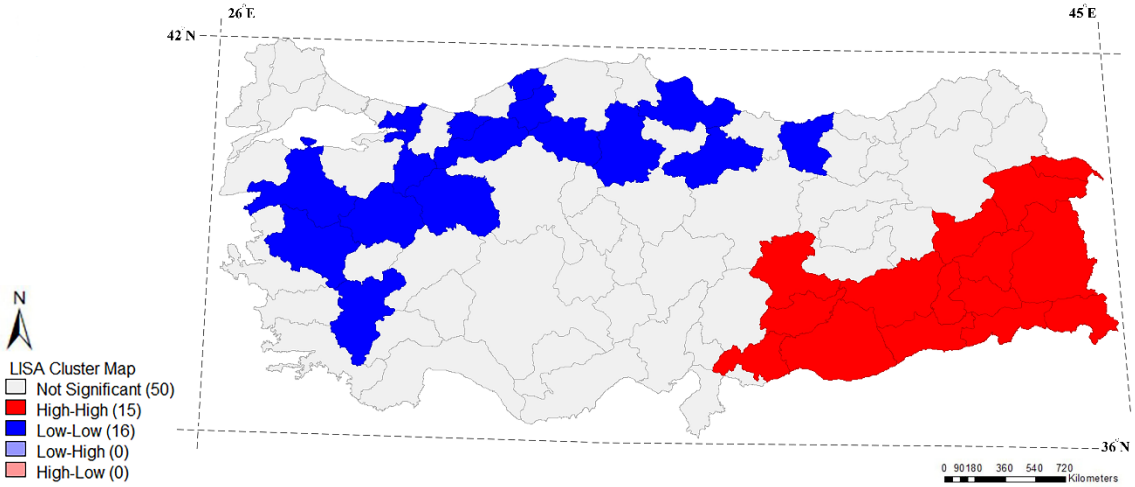


Fig 3. LISA cluster map for birth

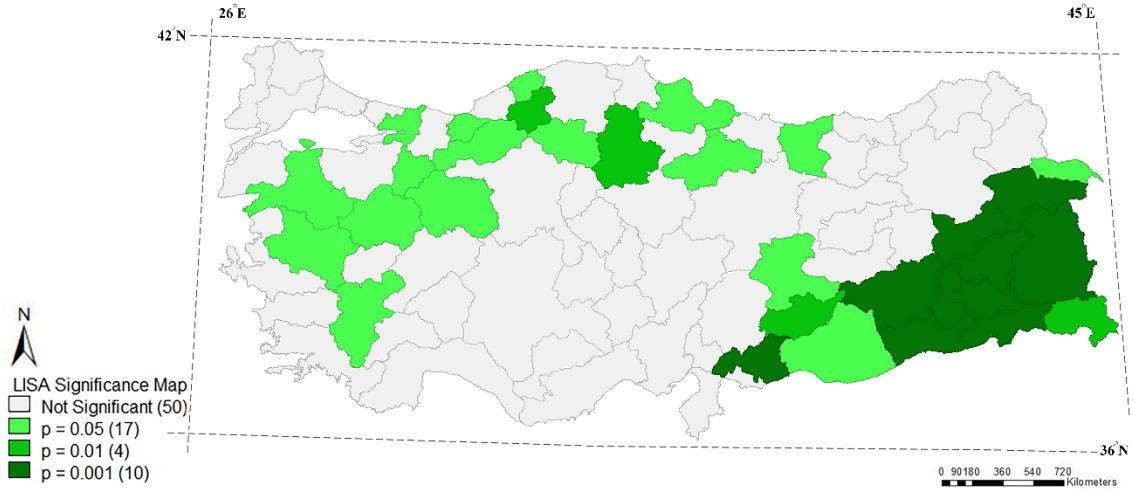
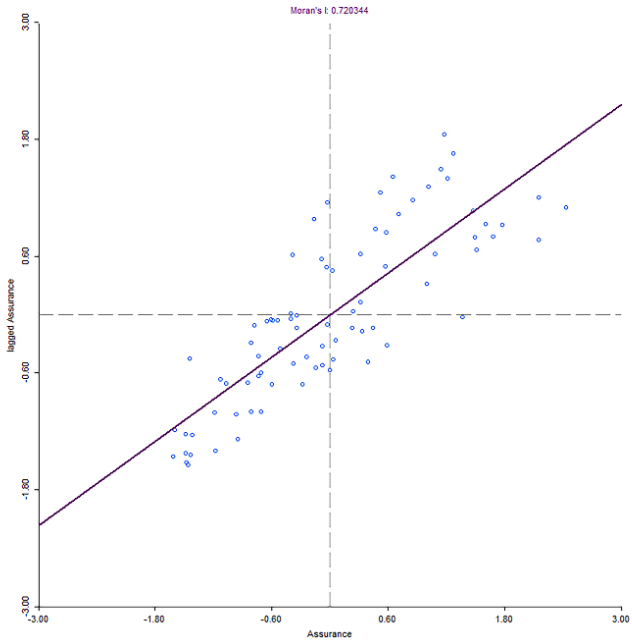


Fig 4. LISA significance map for birth



Graphic 4. Moran's I plot for assurance

The geographical correlation indicates that assurance variables with high values are surrounded by high values in the west of Türkiye. Conversely, low-low values are situated in the eastern region of Türkiye (Fig 5). This means that the socioeconomic characteristics of geographical locations impact women's employment with insurance. For example, the level of education attained, economic activities based on geographic characteristics, working conditions, and the attitudes towards women all affect women's assurance in their working lives.

The significance map shows that the most significant values are mostly in the east of Türkiye (Fig 6). This highlights the variability in women's assurance based on their geographical location. The assurance variable demonstrates a significant spatial autocorrelation.

The eastern regions of Türkiye are suitable for agricultural production. The share of agriculture in GDP is a variable of socioeconomic development. It is concentrated in the eastern

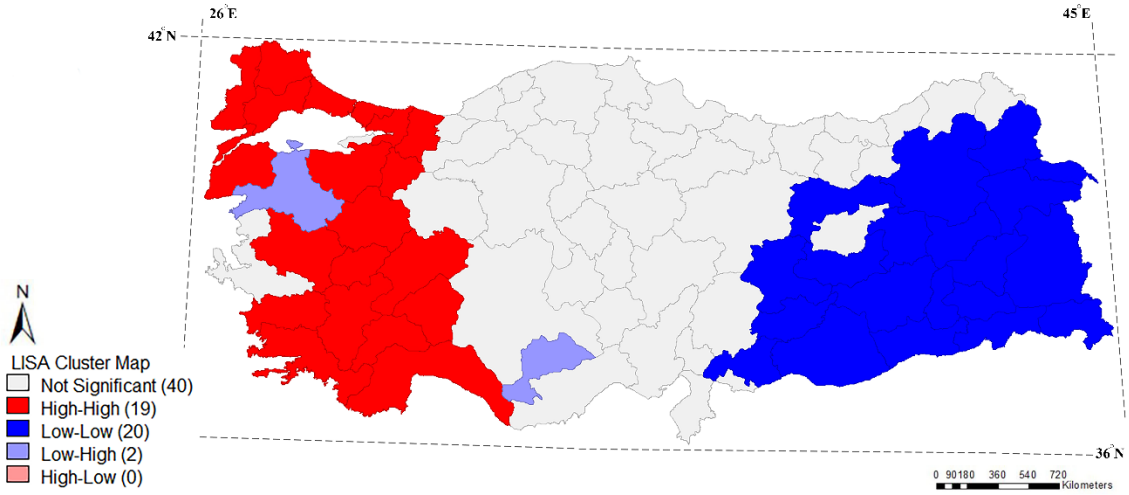


Fig 5. LISA cluster map for assurance

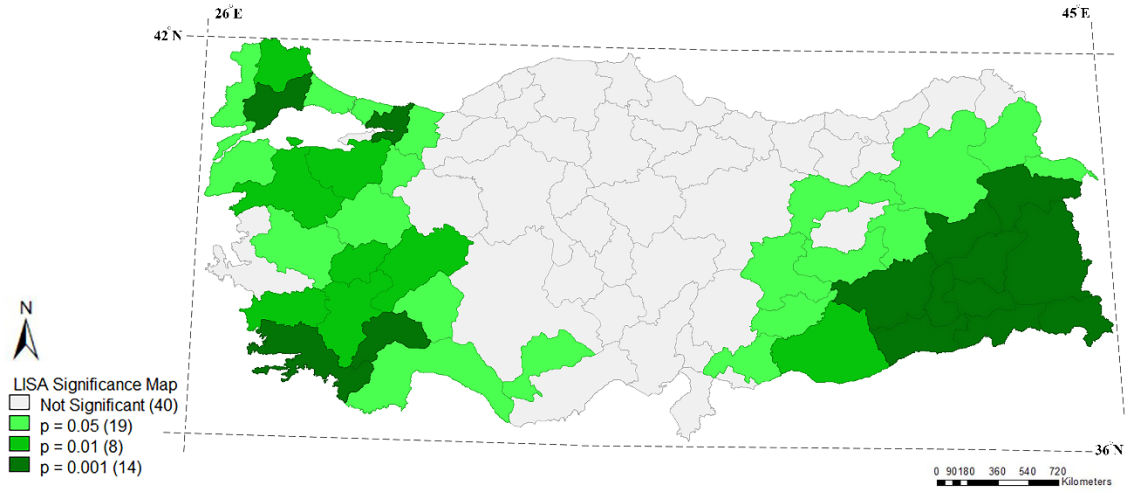
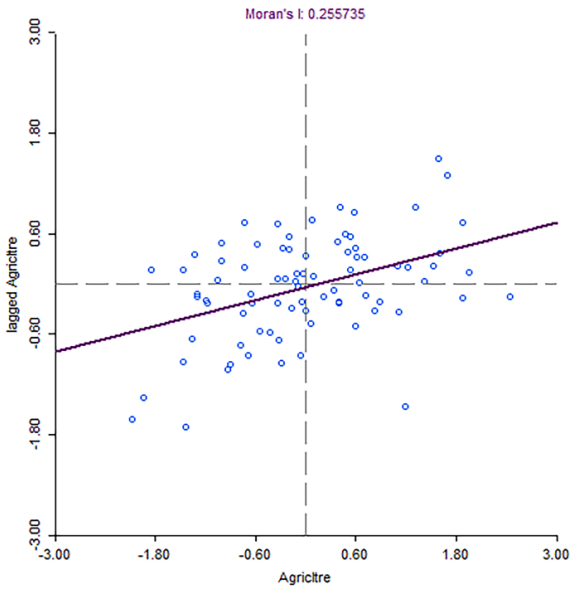


Fig 6. LISA significance map for assurance



Graphic 5. Moran's I plot for agriculture

part of Türkiye. This increases the need for agricultural workers. In general, women are forced to leave school and engage in unpaid family work. Moran's I value for agriculture is 0.25 (Graphic 5). This means that there is a positive spatial autocorrelation. In consideration of the proximity of Moran's I value to 1, spatial autocorrelation may be regarded as relatively weak.

There are mostly low-low and high-high clusters according to geographical conditions (Fig 7). In the provinces in the northwest of Türkiye, the proportion of the agricultural sector in GDP is relatively low. The region is home to a diverse range of economic sectors, with a particular focus on industry and tourism. Nevertheless, the northeastern provinces of Türkiye account for a high proportion of the agricultural sector in GDP.

The most significant clustered units are in the northwest and northeast of Türkiye (Fig 8). This indicates that the spatial autocorrelation is significant.

Geographical characteristics affect the economic structure and directly the socioeconomic level of the provinces. Moran's I value for the SEGE score is 0.63 (Graphic 6). This means that there is a positive spatial autocorrelation.

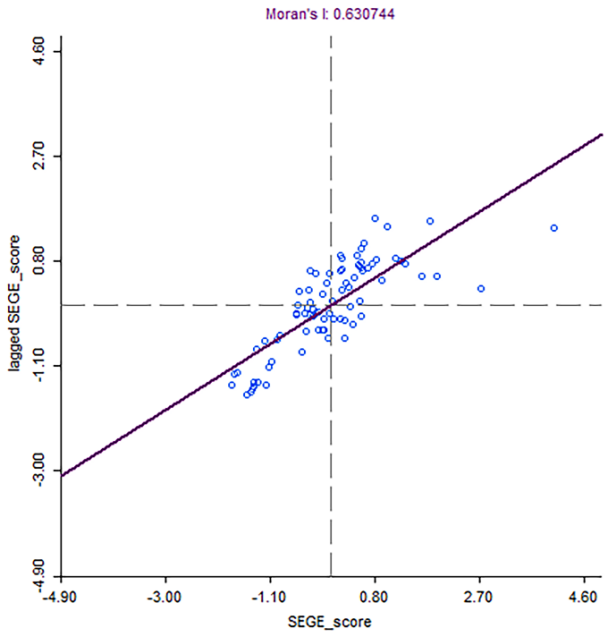
The LISA cluster map for the SEGE score shows that high values are surrounded by high values, and low values are surrounded by low values (Fig 9). In the eastern regions of Türkiye, the lack of job opportunities, the role of women in these areas, and the prevalence of unskilled labour have resulted in the underdevelopment of social and cultural life. However, the high SEGE scores observed in the western provinces are related to their geographical location.

Mostly, the provinces with the highest significance level are clustered in the southeast of Türkiye (Fig 10). It can be argued that the correlation between low SEGE values and their geographical location is more significant than that between high SEGE values and their geographical location.

The cartograms presented below illustrate the relationship between SEGE and indicators that exhibit a significant correlation with SEGE (Fig 11-13). The eastern provinces of Türkiye exhibit low SEGE scores, while they exhibit high birth rates. It can be observed that women with children are unable to participate actively in socioeconomic life, which results in lower SEGE scores in the eastern part of Türkiye (Fig 11).

An examination of the insurance indicator reveals that women in the western part of Türkiye work with insurance (Fig 12). Women employed in the eastern part of Türkiye do not have social security. Therefore, it is recommended that the provision of insurance for working women should enhance socioeconomic development in the eastern part of Türkiye.

Finally, the proportion of agriculture in GDP is high in the eastern part of Türkiye (Fig 13). However, agriculture has an inverse relationship with SEGE scores.



Graphic 6. Moran's I plot for SEGE scores

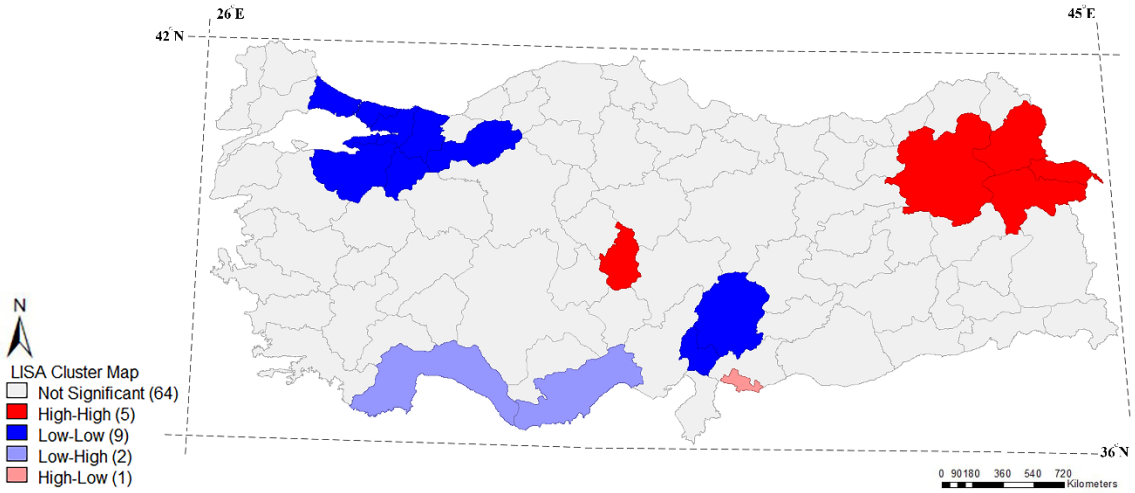


Fig 7. LISA cluster map for agriculture

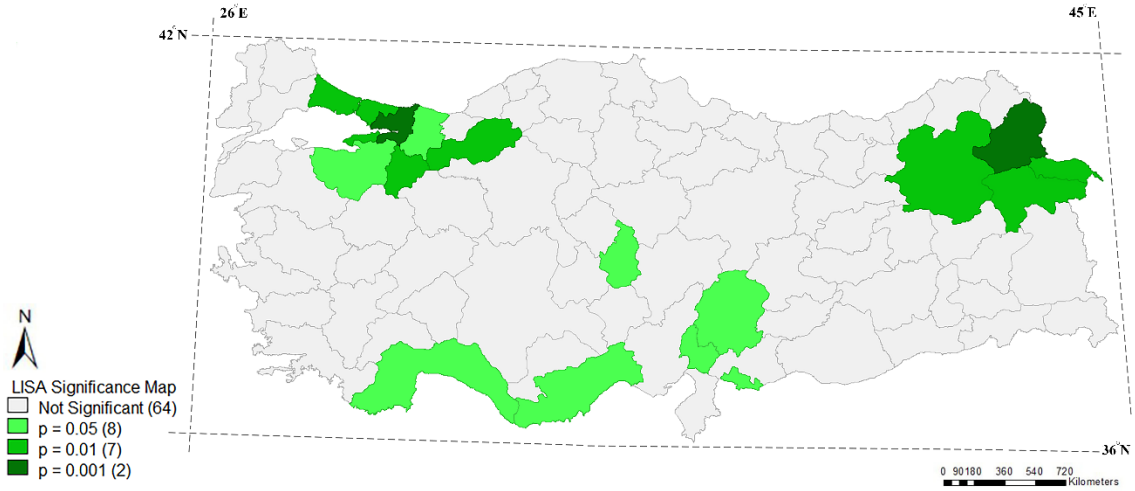


Fig 8. LISA significance map for agriculture

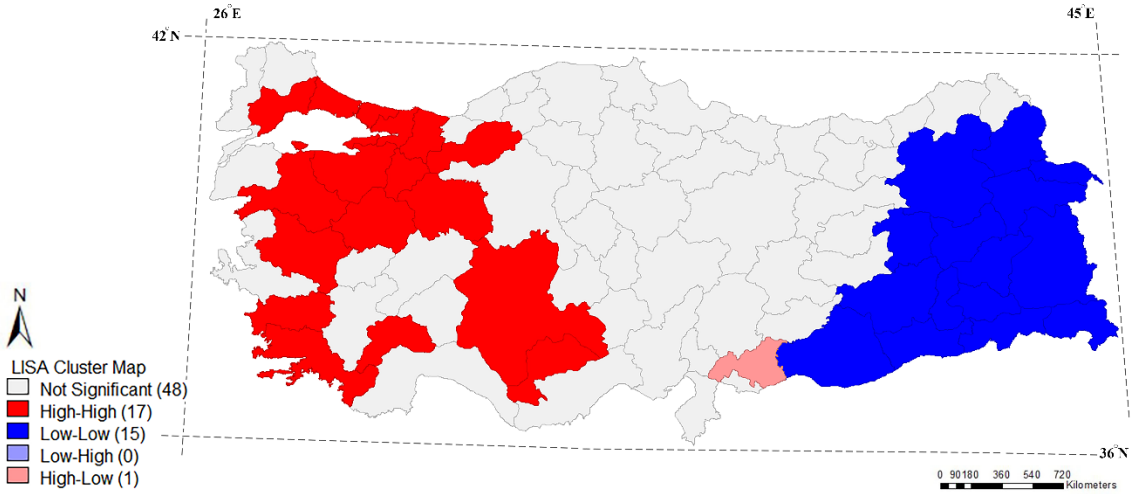


Fig 9. LISA cluster map for SEGE scores

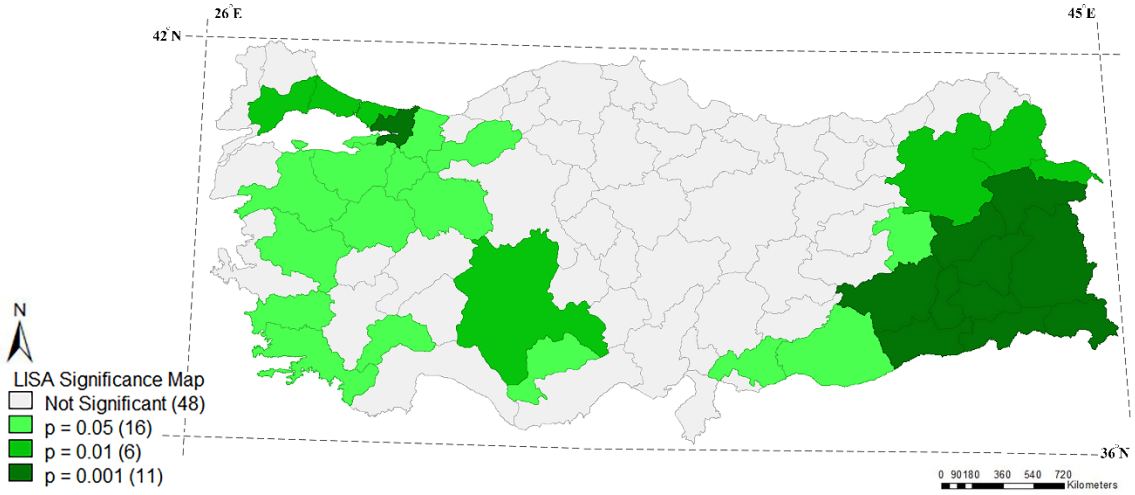


Fig 10. LISA significance map for SEGE scores

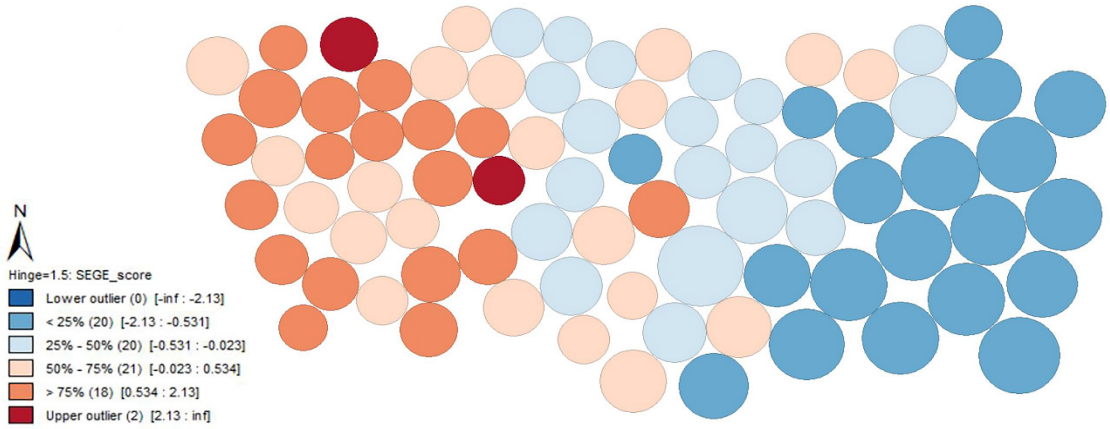


Fig 11. Cartogram map of birth

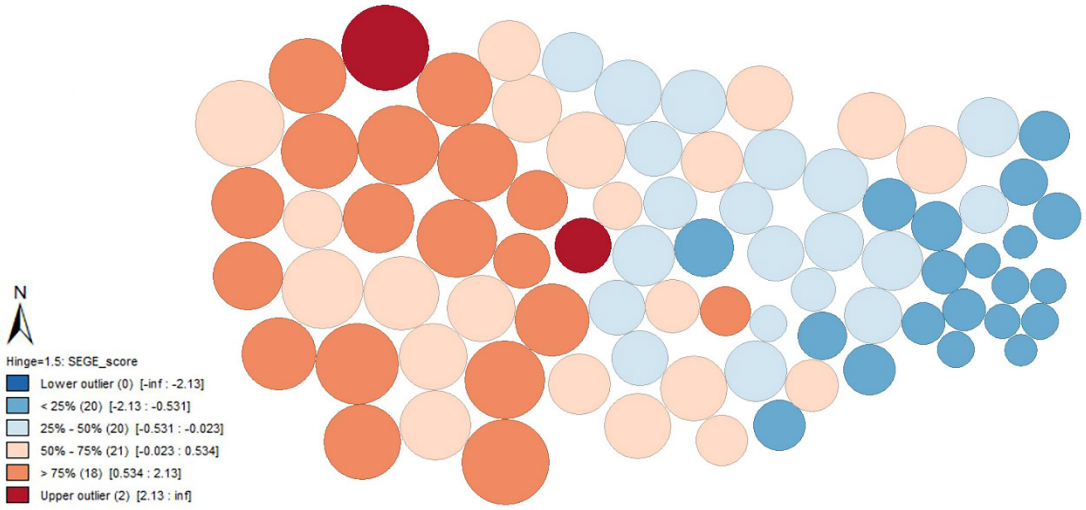


Fig 12. Cartogram map of assurance

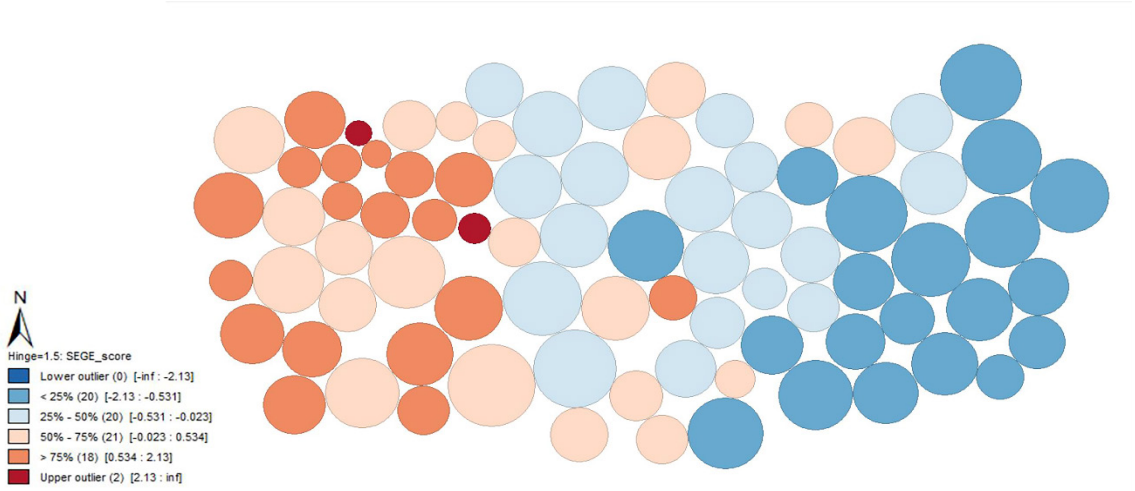


Fig 13. Cartogram map of agriculture

5. CONCLUSIONS

This study examined the relationship between SEGE scores and indicators related to women and other indicators not included in SEGE. The empirical results show that SEGE scores have a highly significant correlation with birth (the number of births of women between the ages of 20 and 39 according to the place of residence), assurance (compulsory insured women), and agriculture (proportion in GDP of agriculture). In addition, these three indicators and SEGE scores have positive spatial autocorrelations. They demonstrate clustering according to the related geographical location. This case can be considered in the context of both human and economic geography. the geographical characteristics of a region affect the social, cultural, and economic structures in place. In addition, the geographical characteristics of a region will shape attitudes towards women and their roles in society. The findings indicate that women's participation in social and economic life is constrained by their reproductive roles and familial responsibilities. This case has a negative impact on socioeconomic development. On the other hand, the indicator of assurance indicates that women with compulsory insurance are aware of their social, cultural, and economic rights. This has a beneficial effect on SEGE. Finally, agriculture has a negative relationship with SEGE because the proportion of agriculture in GDP may reflect insufficient economic diversity.

The results confirm that there is discrimination against women and gender inequality because women's roles in society are restricted. Women are also ignored. For example, certain age groups of women are absent from social life due to the burden of responsibilities such as having children and caring for them. In addition, women should have the same rights as men in business. The insurance indicator in this study indicates that when women have access to basic rights such as insurance, they contribute to the social and economic development of provinces.

This study contributes to the existing literature by focussing on the impact of women's indicators based on geographical location on SEGE scores. This study highlights that the status of women is an important factor in determining the socioeconomic development level of cities. Some social policies, such as flexible working conditions and women-friendly programmes in social and economic life, should be developed. It is also recommended that the role of women in the family structure should be given greater consideration in the context of educational life. The study emphasises the need to include women's indicators in the socioeconomic development index. In this way, more effective decisions can be made for sustainable development. As a result, this study can serve as a guide for empowering women and changing the role of women in society.

Hakem Değerlendirmesi: Dış bağımsız.
Yazar Katkıları: Çalışma Konsepti/Tasarım- L.G., Ç.G.; Veri Toplama- L.G., Ç.G.; Veri Analizi/Yorumlama- L.G., Ç.G. ; Yazı Taslağı- L.G., Ç.G.; İçeriğin Eleştirel İncelemesi- L.G., Ç.G.; Son Onay ve Sorumluluk- L.G., Ç.G.
Çıkar Çatışması: Yazarlar çıkar çatışması beyan etmemişlerdir.
Finansal Destek: Yazarlar finansal destek beyan etmemişlerdir.

Peer Review: Externally peer-reviewed.
Author Contributions: Conception/Design of Study- L.G., Ç.G.Data Acquisition- L.G., Ç.G.; Data Analysis/Interpretation- L.G., Ç.G.; Drafting Manuscript- L.G., Ç.G. ; Critical Revision of Manuscript- L.G., Ç.G.; Final Approval and Accountability- L.G., Ç.G.
Conflict of Interest: Authors declared no conflict of interest.
Financial Disclosure: Authors declared no financial support.

REFERENCES / KAYNAKÇA

Abaidoo, A. (2023). Assessment of the key indicators and dimensions of women empowerment in Rural Zambia. *Global Journal of Human-Social Science*, 22(7). Retrieved from https://socialscienceresearch.org/index.php/GJHSS/article/view/103587.

Altıparmak, Y.D.D.A. and Ozdemir, A.I. (2005). Sosyo-ekonomik göstergeler açısından illerin gelişmişlik düzeyinin karşılaştırmalı analizi. *Erciyes Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 0(24), 97-110. Retrieved from https://dergipark.org.tr/tr/pub/erciyesiibd/issue/5881/77818

Anselin, L. (1988). Spatial econometrics: methods and models (Vol. 4). *Springer Science & Business Media*. Retrieved from https://link.springer.com/book/10.1007/978-94-015-7799-1

Anselin, L. (2003). Spatial econometrics. in a companion to theoretical econometrics,B.H.Baltagi(Ed.).https://doi.org/10.1002/9780470996249.ch15

Çetin, I. and Sevüktekin, M. (2016). Türkiye'de gelişmişlik düzeyi farklılıklarının analizi. *Uluslararası Ekonomik Araştırmalar Dergisi*, 2(2), 39-61. Retrieved from https://dergipark.org.tr/tr/pub/ead/issue/48238/610663

Deniz, M. and Hobikoğlu, E. H. (2012). Cinsiyete göre gelişme endeksi çerçevesinde kadın istihdamının ekonomik değerlendirmesi: Türkiye örneği. *In International Conference on Eurasian Economies*, (pp. 11-13). Retrieved from http://acikerisim.istanbul.edu.tr:8080/handle/20.500.12627/78707

Duran, H.E. (2023). İzmir Institute of Technology - CP790 - Statistical Modelling and Forecasting.

Gebre, G.G. (2020). The role of women empowerment on reducing poverty: cross sectional data, *Developing Country Studies* (Online), 10(6), 42-49. https://doi.org/10.7176/DCS/10-6-06

GeoDa Website, 3a. Available online: https://geodacenter.github.io/workbook/3a_mapping/lab3a.html (accessed on 16.05.2023)

GeoDa Website, 5a. Available online: https://geodacenter.github.io/workbook/5a_global_auto/lab5a.html#morans-i (accessed on 16.05.2023)

GeoDa Website, 6a. Available online: https://geodacenter.github.io/workbook/6a_local_auto/lab6a.html (accessed on 16.05.2023)

Gül, H.E. and Çevik, B. (2014). "2010 ve 2012 verileriyle türkiye'de illerin gelişmişlik düzeyi araştırması", *Türkiye İş Bankası*, Retrieved from http://ekonomi.isbank.com.tr/UserFiles/pdf/ar_03_2012.pdf

Gurenko, E. (2023). The values of modern female manager in social and structural relations of the business sphere. *Discourse*, 9(2), 52-63. https://doi.org/10.32603/2412-8562-2023-9-2-52-63.

Ministry of Family and Social Policies, (2014). Analysis of women's labor force profile and statistics in Türkiye. Retrieved from https://aile.gov.tr/uploads/ksgm/uploads/pages/dagitimda-olan-yayinlar/turkiye-de-kadin-isgucu-profili-ve-istatistiklerinin-analizi-nihai-rapor.pdf

Ministry of Industry and Technology Website. Available online: https://www.sanayi.gov.tr/merkez-birimi/b94224510b7b/sege (accessed on 16.05.2023)

Özgür, E. M. (2004). Spatial Distribution of Total Fertility Rate in Türkiye. *Coğrafi Bilimler Dergisi*, 2(2), 1-12.

Şahin, B. and Şahin, S. (2019). An alternative thematic mapping technique in geography: area cartograms. *Turkish Journal Of Social Research*, 23(2), 477-500.

Sakarya, A. and İbişoglu, Ç. (2015). "Türkiye'de illerin sosyo-ekonomik gelişmişlik endeksinin coğrafi ağırlıklı regresyon modeli ile analizi", *Marmara Coğrafya Dergisi*, 0(32), 211-238. https://doi.org/10.14781/mcd.63200

Sener, U. and Demirdirek, H. (2014). Toplumsal Cinsiyete Duyarlı Veri Çalışması. Printed by the United Nations Population Fund under the Joint United Nations Women-Friendly Cities Programme, Retrieved from https://www.tepav.org.tr/upload/files/haber/1399033411-7.TCDV_Toplumsal_Cinsiyete_Duyarli_Veri_Calismasi_Egitimi.pdf

Tunç, M. (2018). Kalkınmada kadın ayrımcılığı ve toplumsal cinsiyet eşitsizliğinin rolü: ülkelerarası farklı gelir gruplarına göre yatay kesit analizi. *Sosyoekonomi,* 26 (38), 221-251. https://doi.org/10.17233/sosyoekonomi.2018.04.13

Turkish Employment Agency (İşkur) Statistical Tables, (2014). https://www.iskur.gov.tr/kurumsal-bilgi/istatistikler/

TurkStat, (2014). Women Indicators, Sectoral Proportion in GDP.

TurkStat, Gender Statistics 2021. (2022).

TurkStat, Household Labour Force Survey. (2023). Youth unemployment rate for persons by sex, 2014-2022.

TurkStat, Labour Force Statistics. (2023). Unemployment rate, 2014-2022.

TurkStat, Women Statistic, Türkiye Family Structure Research, 2021. (2022). Retrieved from https://www.tuik.gov.tr/media/announcements/toplumsal_cinsiyet_istatistikleri_2021.pdf

Wikipedia, Human geography. Available online: https://tr.wikipedia.org/wiki/Be%C5%9Feri_co%C4%9Frafya (accessed on 30.04.2024).

Table S1. Dataset

	WOMEN INDICATORS												OTHER INDICATORS					
Provinces	The Ratio of Women Giving Birth Between the Ages of 20 and 39 According to the Place of Residence Dec.	The Ratio of Women Aged 18 and Over Who Can Read and Write	The Ratio of Women Aged 18 and Over who have Graduated from High School and Equivalent Vocational Schools	The Ratio of Women Who Graduated from a College Or Faculty At the Age of 18 and Over	The Ratio of Women who Graduated from a Master's Degree (Including 5 Or 6-Year Faculties) at the Age of 22 and Older	The Ratio of Women with a Doctoral Degree Aged 22 and Older	The Average Age of Marriage of a Woman	The Ratio of Women with Compulsory Insurance	Number Of Trainees in Vocational Training Courses	Number of Trainees in Entrepreneurship Training Program	Number of Trainees on-Job Training	Registered Labour Force	Registered Unemployeds	Household Size	Proportion of Agriculture in GDP	Proportion of Industry in GDP	Proportion of Service in GDP	SEGE Scores of Provinces	2014 Population of Provinces
Balıkesir	0.011	0.420	0.062	0.034	0.002	0.001	26.5	0.046	0.00116	0.00017	0.00104	0.024	0.014	2.8	13.8	19.4	49.3	**0.476**	1189057
Kütahya	0.012	0.409	0.066	0.036	0.002	0.000	25.3	0.073	0.00176	0.00049	0.00193	0.040	0.024	3.1	11.6	26.5	43.8	**0.170**	571554
Uşak	0.013	0.404	0.058	0.034	0.001	0.000	25.7	0.061	0.00031	0.00010	0.00042	0.026	0.015	3.2	12	30.3	41.5	**0.278**	349459
Manisa	0.013	0.417	0.087	0.060	0.005	0.001	25.4	0.086	0.00061	0.00032	0.00032	0.026	0.020	3.2	19.3	30.1	34.9	**0.490**	1367905
İzmir	0.012	0.408	0.070	0.044	0.002	0.001	27.5	0.062	0.00030	0.00026	0.00073	0.028	0.017	3.1	5	25	52.5	**1.926**	4113072
Aydın	0.012	0.397	0.078	0.053	0.003	0.001	26.4	0.072	0.00048	0.00028	0.00053	0.022	0.012	3.0	15.2	15	51.3	**0.599**	1041979
Muğla	0.010	0.410	0.086	0.044	0.002	0.000	27.6	0.076	0.00230	0.00056	0.00070	0.035	0.020	2.9	14.4	9.7	57.9	**1.175**	894509
Kırklareli	0.009	0.410	0.082	0.045	0.003	0.001	26.3	0.075	0.00135	0.00022	0.00059	0.026	0.015	3.0	13.5	33.8	35.9	**0.557**	343723
Edirne	0.016	0.391	0.083	0.057	0.006	0.001	25.8	0.103	0.00026	0.00019	0.00015	0.020	0.011	2.9	19.7	12.6	50.2	**0.534**	400280
İstanbul	0.014	0.396	0.075	0.040	0.002	0.001	26.7	0.097	0.00089	0.00016	0.00028	0.038	0.021	3.5	0.1	17.3	61.6	**4.051**	14377018
Tekirdağ	0.016	0.389	0.077	0.045	0.003	0.001	25.8	0.077	0.00041	0.00027	0.00017	0.031	0.017	3.3	5.2	46	32.1	**1.014**	906732
Kocaeli	0.012	0.399	0.090	0.048	0.003	0.001	25.9	0.075	0.00057	0.00015	0.00039	0.031	0.017	3.6	1	38.6	42.3	**1.787**	1722795
Yalova	0.014	0.395	0.075	0.044	0.002	0.001	27.3	0.085	0.00083	0.00028	0.00012	0.028	0.016	3.1	4.3	35.6	41.7	**0.796**	226514
Bursa	0.010	0.420	0.078	0.046	0.003	0.001	26	0.065	0.00108	0.00047	0.00044	0.025	0.015	3.4	4.1	36.2	41.7	**1.336**	2787539
Çanakkale	0.012	0.396	0.078	0.037	0.002	0.000	26.6	0.068	0.00329	0.00024	0.00094	0.031	0.017	2.7	18.6	19.6	41.4	**0.548**	511790
Bilecik	0.012	0.413	0.091	0.058	0.005	0.002	25.6	0.083	0.00046	0.00025	0.00109	0.036	0.020	3.1	7.7	36.7	34.7	**0.556**	209925
Eskişehir	0.014	0.395	0.054	0.028	0.002	0.000	27	0.041	0.00040	0.00014	0.00030	0.015	0.009	2.8	6.1	29.6	45.9	**1.278**	812320
Afyonkarahisar	0.012	0.402	0.082	0.045	0.003	0.001	23.9	0.060	0.00038	0.00029	0.00075	0.033	0.021	3.6	23.2	14.6	45	**-0.023**	706371
Isparta	0.014	0.390	0.076	0.050	0.003	0.001	25.7	0.082	0.00023	0.00018	0.00024	0.028	0.016	3.1	17	13.7	53	**0.564**	418780
Antalya	0.014	0.402	0.095	0.071	0.008	0.002	27.2	0.097	0.00169	0.00005	0.00009	0.024	0.015	3.2	9	8.6	64.1	**1.642**	2222562
Ankara	0.011	0.392	0.079	0.036	0.002	0.000	26.9	0.042	0.00284	0.00017	0.00073	0.030	0.018	3.2	1.6	16.1	59.4	**2.718**	5150072
Kırıkkale	0.013	0.369	0.050	0.024	0.001	0.000	25.1	0.032	0.00151	0.00029	0.00055	0.021	0.013	3.2	9	22.4	49.6	**0.211**	271092
Yozgat	0.012	0.391	0.074	0.037	0.002	0.000	23.7	0.044	0.00092	0.00017	0.00075	0.027	0.016	3.4	21.9	9.6	47.1	**-0.589**	432560
Kırşehir	0.014	0.390	0.058	0.033	0.002	0.001	25.6	0.050	0.00075	0.00029	0.00051	0.017	0.010	3.2	17.4	16.5	48.3	**-0.085**	222707
Nevşehir	0.016	0.365	0.047	0.026	0.001	0.000	24.6	0.038	0.00027	0.00011	0.00026	0.014	0.008	3.4	17.7	10.1	55.9	**-0.015**	286250
Aksaray	0.015	0.378	0.056	0.031	0.002	0.001	24.5	0.041	0.00044	0.00008	0.00010	0.015	0.010	3.8	24.4	17.9	40.6	**-0.271**	384252
Niğde	0.016	0.394	0.055	0.032	0.002	0.001	23.4	0.041	0.00024	0.00014	0.00031	0.013	0.010	3.5	26.7	14.1	42.2	**-0.395**	343898
Konya	0.014	0.394	0.058	0.033	0.001	0.000	24.4	0.071	0.00190	0.00108	0.00110	0.034	0.020	3.6	17.8	18.7	45.4	**0.668**	2108808
Karaman	0.015	0.394	0.071	0.042	0.002	0.000	24.7	0.049	0.00056	0.00018	0.00028	0.028	0.018	3.3	30	22.5	31.1	**0.177**	240362
Mersin	0.011	0.401	0.056	0.032	0.002	0.000	26.4	0.057	0.00246	0.00054	0.00051	0.035	0.022	3.5	11.6	13.9	56.6	**0.413**	1727255
Bartın	0.011	0.388	0.068	0.038	0.002	0.001	25.8	0.048	0.00140	0.00038	0.00057	0.026	0.017	3.3	11.7	16.3	52.8	**-0.140**	189405
Zonguldak	0.010	0.385	0.053	0.032	0.002	0.000	26.5	0.050	0.00063	0.00000	0.00034	0.025	0.015	3.3	4.8	33	45.7	**0.333**	598796
Kastamonu	0.010	0.385	0.080	0.042	0.002	0.001	26	0.057	0.00087	0.00027	0.00118	0.039	0.024	3.1	18.1	13.1	50.5	**-0.224**	368907
Karabük	0.013	0.390	0.066	0.035	0.002	0.000	26.6	0.080	0.00125	0.00024	0.00038	0.031	0.016	3.1	5.2	29	43	**0.513**	231333
Düzce	0.014	0.391	0.072	0.036	0.002	0.001	25.7	0.062	0.00104	0.00028	0.00072	0.028	0.016	3.6	9.3	28.7	45.1	**0.200**	355549
Sakarya	0.012	0.405	0.078	0.043	0.003	0.001	25.6	0.082	0.00167	0.00026	0.00131	0.033	0.018	3.7	7.9	30.7	43.6	**0.832**	932706
Bolu	0.012	0.388	0.062	0.031	0.002	0.000	26.3	0.049	0.00198	0.00000	0.00046	0.032	0.019	3.2	11.9	24.2	46.7	**0.760**	284789
Çankırı	0.012	0.384	0.050	0.029	0.001	0.000	24.7	0.042	0.00200	0.00030	0.00167	0.026	0.016	3.0	17.8	15.1	47.4	**-0.379**	183550
Çorum	0.014	0.367	0.065	0.036	0.002	0.001	25	0.038	0.00154	0.00014	0.00056	0.024	0.015	3.2	17.2	13.1	51.7	**-0.262**	527220
Sivas	0.013	0.364	0.074	0.041	0.002	0.000	24.6	0.041	0.00107	0.00051	0.00013	0.026	0.016	3.5	16.4	14.7	49.3	**-0.137**	623116
Erzincan	0.011	0.331	0.084	0.050	0.002	0.000	25.5	0.046	0.00083	0.00014	0.00032	0.045	0.026	3.2	13.2	16.3	47.4	**-0.150**	223633
Tunceli	0.016	0.382	0.069	0.039	0.003	0.001	28.2	0.048	0.00017	0.00022	0.00004	0.018	0.010	2.9	12.7	2.9	63.8	**-0.439**	86527
Kayseri	0.015	0.384	0.062	0.036	0.002	0.001	24.8	0.034	0.00004	0.00018	0.00036	0.023	0.015	3.6	7.2	26	47.1	**0.560**	1322376
Elazığ	0.015	0.361	0.072	0.042	0.002	0.001	25.9	0.043	0.00151	0.00024	0.00060	0.023	0.014	3.7	8.9	11.4	57.8	**-0.061**	568753
Malatya	0.021	0.339	0.051	0.027	0.001	0.000	25.8	0.026	0.00144	0.00011	0.00074	0.025	0.017	3.8	5.9	14.2	58.8	**-0.113**	769544
Adıyaman	0.018	0.345	0.048	0.025	0.001	0.000	24.7	0.032	0.00069	0.00013	0.00035	0.019	0.013	4.6	14.2	17.3	48.9	**-0.926**	597835
Kahramanmaraş	0.030	0.288	0.022	0.014	0.001	0.000	23.8	0.018	0.00125	0.00007	0.00043	0.016	0.011	4.2	10.2	30	41	**-0.416**	1089038
Şanlıurfa	0.023	0.346	0.044	0.025	0.001	0.000	23.3	0.034	0.00063	0.00021	0.00033	0.013	0.007	6.1	21.2	8.7	47	**-1.350**	1845667
Gaziantep	0.017	0.352	0.063	0.035	0.001	0.000	23.5	0.037	0.00038	0.00040	0.00044	0.024	0.019	4.4	4.1	33.2	43.2	**0.250**	1889466
Osmaniye	0.017	0.375	0.074	0.040	0.002	0.001	24.9	0.050	0.00020	0.00027	0.00044	0.025	0.016	3.9	13.4	22	47.2	**-0.367**	506807
Adana	0.010	0.416	0.072	0.044	0.002	0.001	25.7	0.058	0.00071	0.00028	0.00048	0.025	0.015	3.9	9.5	20.5	51.5	**0.353**	2165595
Kilis	0.020	0.359	0.055	0.025	0.001	0.000	22.6	0.034	0.00109	0.00034	0.00092	0.025	0.014	3.9	21.7	6.8	53.2	**-0.570**	128781
Hatay	0.018	0.379	0.055	0.031	0.001	0.000	24.9	0.035	0.00010	0.00007	0.00061	0.026	0.017	4.0	8.7	22	50.2	**0.017**	1519836
Sinop	0.011	0.400	0.053	0.036	0.002	0.001	25.8	0.055	0.00040	0.00072	0.00107	0.040	0.024	3.0	17.9	8.9	56.3	**-0.317**	204526
Samsun	0.013	0.404	0.065	0.041	0.002	0.001	25.5	0.057	0.00202	0.00012	0.00077	0.029	0.017	3.6	12.5	14.4	55.1	**0.242**	1269989
Trabzon	0.013	0.387	0.082	0.045	0.003	0.001	26.3	0.059	0.00085	0.00015	0.00030	0.029	0.017	3.4	7.2	12.5	60.7	**0.389**	766782
Ordu	0.012	0.369	0.061	0.033	0.001	0.000	25.2	0.049	0.00126	0.00004	0.00092	0.026	0.016	3.2	11.6	13	56.3	**-0.486**	724268
Giresun	0.010	0.390	0.072	0.037	0.002	0.000	25.9	0.055	0.00240	0.00016	0.00124	0.036	0.022	3.0	9.6	13.9	59	**-0.323**	429984
Amasya	0.011	0.401	0.063	0.036	0.002	0.000	25.5	0.051	0.00058	0.00027	0.00047	0.028	0.017	3.3	17.4	11.4	53.3	**0.054**	321913
Gümüşhane	0.012	0.369	0.075	0.034	0.002	0.001	24.7	0.037	0.00020	0.00028	0.00073	0.024	0.011	3.2	13	15.8	51.7	**-0.623**	146353
Tokat	0.012	0.400	0.054	0.031	0.002	0.000	24.4	0.036	0.00125	0.00024	0.00116	0.018	0.011	3.4	18.5	9.3	55.3	**-0.381**	597320
Iğdır	0.021	0.305	0.046	0.027	0.001	0.000	23.5	0.029	0.00155	0.00000	0.00034	0.021	0.013	4.6	24.3	2.6	56.5	**-1.179**	192056
Erzurum	0.018	0.344	0.049	0.030	0.002	0.001	23.8	0.031	0.00061	0.00011	0.00029	0.012	0.008	4.2	16.6	7.4	57	**-0.531**	763320
Ağrı	0.026	0.281	0.022	0.014	0.001	0.000	22.1	0.015	0.00064	0.00000	0.00017	0.008	0.006	5.9	22.5	4.1	54.3	**-1.752**	549435
Bingöl	0.020	0.327	0.043	0.023	0.001	0.000	24.9	0.025	0.00145	0.00007	0.00035	0.031	0.023	4.4	13.6	3.3	54.3	**-1.208**	266019
Muş	0.025	0.291	0.026	0.014	0.001	0.000	22.6	0.017	0.00046	0.00007	0.00028	0.016	0.012	6.0	23.9	6.3	48.2	**-1.704**	411216
Van	0.024	0.306	0.029	0.015	0.001	0.000	22.6	0.017	0.00114	0.00012	0.00033	0.010	0.006	5.8	13.1	6.3	59.8	**-1.452**	1085542
Bitlis	0.023	0.307	0.028	0.017	0.001	0.000	22.6	0.018	0.00106	0.00007	0.00022	0.013	0.008	5.5	16.3	3.2	52.8	**-1.428**	338023
Siirt	0.024	0.292	0.027	0.018	0.001	0.000	22.4	0.017	0.00063	0.00014	0.00035	0.011	0.008	6.0	16.5	9.4	52.5	**-1.405**	318366
Diyarbakır	0.024	0.315	0.038	0.024	0.001	0.000	23.9	0.024	0.00051	0.00006	0.00029	0.019	0.013	5.4	12.2	10.1	54.3	**-1.074**	1635048
Hakkari	0.021	0.290	0.038	0.017	0.001	0.000	24.3	0.018	0.00071	0.00010	0.00047	0.030	0.022	6.6	11	3.4	66.2	**-1.518**	276287
Şırnak	0.027	0.276	0.021	0.014	0.000	0.000	23.1	0.014	0.00052	0.00007	0.00028	0.009	0.006	7.3	6.9	5.3	71.3	**-1.788**	488966
Mardin	0.024	0.298	0.034	0.017	0.001	0.000	23.5	0.019	0.00069	0.00008	0.00032	0.011	0.008	5.9	16	8.4	57.3	**-1.396**	788996
Artvin	0.011	0.394	0.074	0.040	0.002	0.000	26.1	0.048	0.00187	0.00067	0.00131	0.048	0.028	3.1	14.3	10.8	49.6	**-0.235**	169674
Ardahan	0.014	0.338	0.043	0.026	0.001	0.000	23.4	0.034	0.00217	0.00000	0.00089	0.022	0.017	3.8	26.2	2.5	49.8	**-0.983**	100809
Rize	0.012	0.395	0.075	0.041	0.002	0.001	26.2	0.063	0.00170	0.00022	0.00044	0.046	0.029	3.4	13.8	20.6	47.9	**0.174**	329779
Kars	0.018	0.320	0.044	0.025	0.001	0.000	22.8	0.029	0.00062	0.00031	0.00045	0.019	0.010	4.4	25	5	51.6	**-1.125**	296466
Bayburt	0.014	0.354	0.052	0.026	0.001	0.000	23.7	0.033	0.01125	0.00088	0.00056	0.029	0.015	3.6	26.2	3.2	51	**-0.629**	80607
Burdur	0.011	0.409	0.069	0.040	0.002	0.001	25.7	0.064	0.00136	0.00029	0.00046	0.031	0.018	2.9	21.1	18.7	44.9	**0.211**	256898
Batman	0.024	0.316	0.036	0.020	0.001	0.000	24	0.024	0.00376	0.00008	0.00068	0.026	0.019	6.1	10	19.4	48.6	**-1.324**	557593
Denizli	0.013	0.412	0.073	0.042	0.002	0.001	26.1	0.088	0.00126	0.00029	0.00031	0.027	0.015	3.1	12.5	27.6	43.6	**0.923**	978700

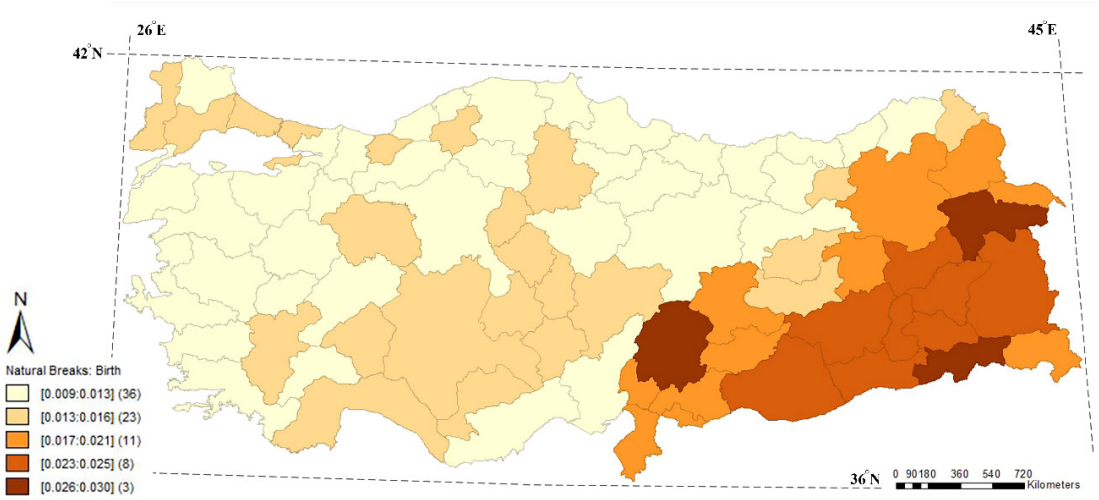


Fig S1. Geographical Distribution of Birth (The Number of Births of Women Between the Ages of 20 and 39 According to the Place of Residence)

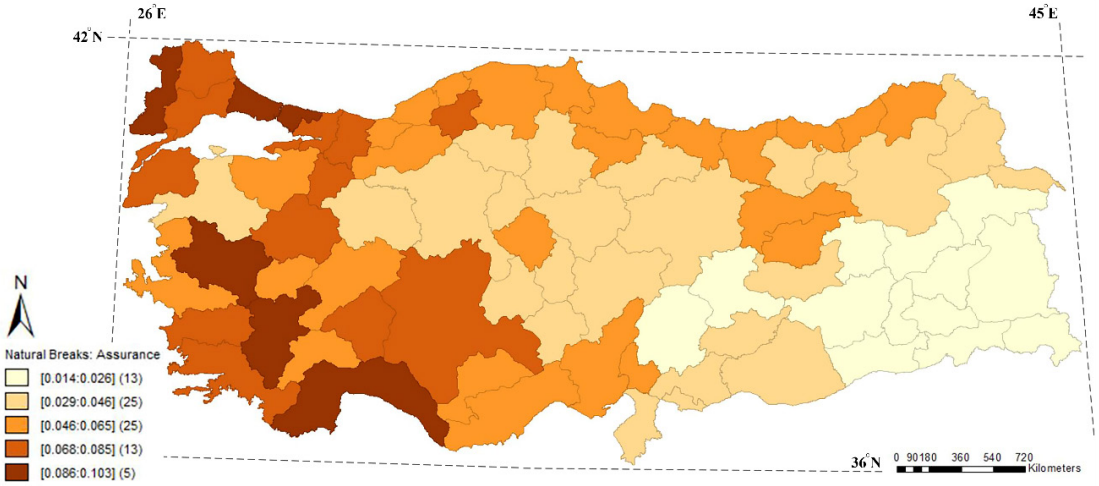


Fig S2. Geographical Distribution of Assurance (Compulsory Insured Women)

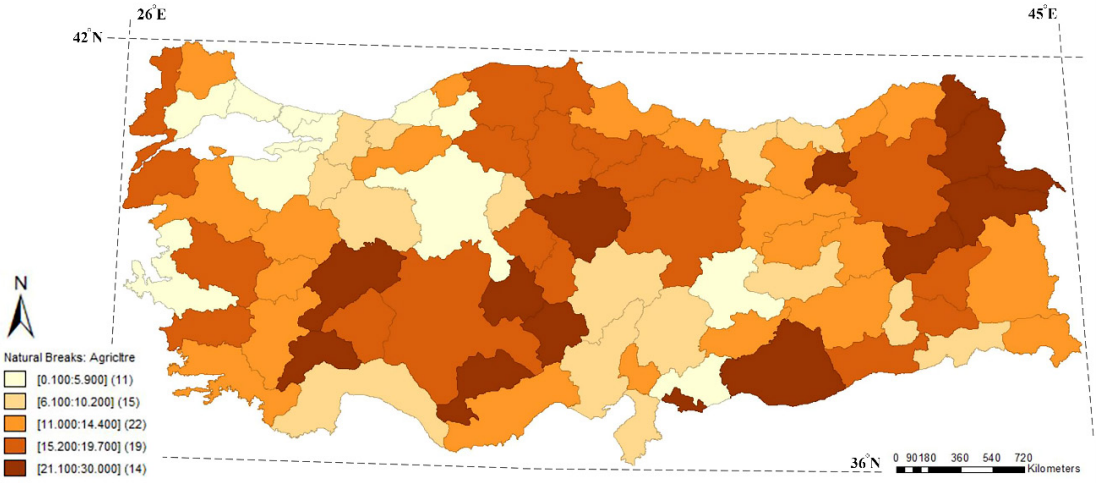


Fig S3. Geographical Distribution of Agriculture (Proportion in GDP of Agriculture)