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SPATIAL ECONOMETRIC ANALYSIS OF GENDER DIFFERENCES IN STOCK MARKET PARTICIPATION: EVIDENCE FROM TURKEY (*)

HİSSE SENEDİ PİYASASI KATILIMINDA CİNSİYET FARKLILIKLARININ MEKÂNSAL EKONOMETRİK ANALİZİ: TÜRKİYE'DEN KANITLAR

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Abstract: This study employs spatial econometric analysis to investigate gender differences in stock market participation across Turkey, using data from 2011 to 2022. Leveraging province-based and gender-disaggregated data from the Central Registry Agency, we explore whether significant gender-based disparities exist among equity security investors in Turkish securities markets and whether these differences exhibit spatial correlations across 81 provinces. Initial findings suggest that while overall participation in financial markets has risen, substantial gender gaps persist, potentially influenced by socioeconomic, cultural, and educational factors. The research contributes to the broader understanding of gender inequality in financial inclusion and proposes implications for policy interventions to reduce gender disparities in economic participation.

Keywords: Spatial Analysis, Gender Equity, Stock Markets

JEL: *C58, D5, G53*

Öz: *Bu çalışmada, 2011-2022 yıllarını kapsayan veriler kullanılarak, Türkiye genelinde hisse senedi piyasasına katılımda cinsiyet farklılıklarını araştırmak için mekânsal ekonometrik analiz kullanılmıştır. Merkezi Kayıt Kuruluşu'nun il bazlı ve cinsiyete göre ayrıştırılmış verilerinden yararlanarak, Türk menkul kıymet piyasalarında hisse senedi yatırımcıları arasında cinsiyete dayalı önemli farklılıklar olup olmadığını ve bu farklılıkların ülkenin 81 ilinde mekânsal korelasyonlar sergileyip sergilemediğini araştırıyoruz. İlk bulgular, finansal piyasalara genel katılım artarken, potansiyel olarak sosyo-ekonomik, kültürel ve eğitim faktörlerinden etkilenen önemli cinsiyet farklılıklarının devam ettiğini göstermektedir. Araştırma, finansal katılımda cinsiyet eşitsizliğinin daha geniş bir şekilde anlaşılmasına katkıda bulunmakta ve ekonomik katılımda cinsiyet eşitsizliklerini azaltmayı amaçlayan politika müdahaleleri için çıkarımlar önermektedir.*

Anahtar Kelimeler: *Mekansal Ekonometri, Cinsiyet Eşitliği, Menkul Kıymet Piyasaları*

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1. Introduction

The fact that inequalities based on gender persist today causes the world's economic size to be approximately 6 trillion dollars less and the labor force participation rate to be 12% lower, according to the OECD Social Institutions and Gender Index Report (OECD, 2019). Even though countries and international organizations are making many efforts to eliminate this problem, this is the first country to achieve this fully. One of the most critical stages in these efforts was realized at the G20 Leaders Summit in 2012.

In the declaration at the conclusion of the G20 Summit in Los Cobos, Colombia, on June 18-19, 2012, leaders committed to take concrete steps to overcome barriers to women's full participation in the economy and society and to expand economic opportunities for women in G-20 economies in Article 23 under the heading Employment and Social Protection.

Article 53 of the same declaration, under the heading Regulating the Financial Sector and Promoting Financial Inclusion, recognizes the need for women and youth to have access to financial services and financial education and encourages GPFI, OECD/INFE, and the World Bank to identify barriers that women and youth may face and prepare a progress report to be presented at the next Summit (G20, 2012).

As of 2023, while the problem of gender inequality is at relatively lower levels in developed economies, it still stands out as a problem to be overcome in many countries of the world. One of the most fundamental studies on this issue is the Global Gender Inequality Index created by the World Economic Forum. Published periodically since 2006, "The Global Gender Gap Index" consists of 4 sub-indices: Economic Participation and Opportunity, Educational Attainment, Health and Survival, and Political Empowerment(Hausmann, Tyson, & Zahidi, 2019).

According to the report published in 2022, 146 countries were measured based on the relevant sub-indices and main indices between the values of 1, indicating absolute equality, and 0, indicating absolute inequality. The average values for 146 countries in the relevant indices and Turkey's scores and rankings are presented in Table 1.

Table 1. The Global Gender Gap Index Rankings

	World Average	*Turkey*	*Rank*
The Global Gender Gap Index	0,681	0,639	124
Economic Participation and Opportunity	0,603	0,493	134
Educational Attainment	0,944	0,973	101
Health and Survival	0,958	0,966	99
Political Empowerment	0,220	0,123	112

Generally, it can be seen that Political Empowerment, Economic Participation, and Opportunity are the areas where gender inequality is most intense. There is a high correlation between the economic development levels of countries and their Gender Equality scores. Of course, it would be a relatively shallow approach to see economic development as the main factor that ensures gender equality. In this context, many cultural, social, and political factors must be considered. Turkey has scored close to the average values in the relevant categories, and the main reason for this situation is the existence of countries such as Afghanistan, Pakistan, Democratic Republic of Congo, Democratic Republic of Congo, Islamic Republic of Iran, Chad, and Mali,

where gender inequality is very high. Turkey's ranking among the ten countries considered as Central Asian countries is given in Table 2.

Table 2. Global-Regional Ranks and Scores

	Regional Rank	*Global Rank*	*Score*
Moldova	1	16	0,788
Belarus	2	36	0,750
Georgia	3	55	0,731
Kazakhstan	4	65	0,719
Ukrania	5	81	0,707
Kyrgyz Republic	6	86	0,700
Armenia	7	89	0,698
Azerbaijan	8	101	0,687
Tajikistan	9	114	0,663
Turkey	10	124	0,639

According to the Social Institutions and Gender Index (SIGI) report published by the OECD (OECD, 2019), the situation where there is no gender-based discrimination is indexed with a score of 0, and the situation where there is full gender-based discrimination is indexed with a score of 100. In the main index, Turkey is in a relatively good position with a score of 24,7 compared to the world average of 30, but it is behind the OEDC average score of 16,5 in the same category. The sub-index "Restricted access to productive and financial resources" has a score of 30,7. Although women's participation as traders in financial markets varies from country to country, the most important obstacles to women's participation in financial markets can be listed as follows.

- Lack of financial information
- Lack of Self-Confidence
- Gender-based Wage Inequality
- Risk Sensitivity
- Family responsibilities
- Gender Norms

As a result of the monetary policy implemented in the country, financial institutions were insufficient to meet the current funding needs in the markets, which led to a change in companies' preferences for public offerings in terms of fund supply as of 2022. This led to a similarly rapid increase in the number of investors in securities markets. According to data from the Central Registry Agency, while there were 6,8 million investors with outstanding balances in Turkey as of February 2023, this figure increased by 63.9% to 11,1 million as of February 2024 (Data Analysis Platform, 2024). In other words, 13,15% of the total population is in securities markets.

This study aims to investigate whether there is a gender-based difference between those who invest in equity securities in securities markets in Turkey between 2011 and 2022. In this context, the data obtained from the Central Registry Agency will be used to examine whether there is a significant difference between women and men in 81 provinces and whether there is a spatial relationship between these differences.

2. Literature Review

Although the study will specifically analyze gender inequality in financial markets, gender inequality is a multidimensional concept that needs to be addressed. In the literature, the main indicators used to measure gender inequality include gender-based differential remuneration, representation in politics, access to education, adult

mortality rates, access to health services, labor force participation rates, and many other primary and sub-indicators. As can be understood from the OECD report, women's level of economic independence and gender inequality have a very intense relationship.

A literature review reveals that studies are generally conducted to reveal that the factors affecting investments differ for men and women. Factors that influence investment decisions include personal characteristics such as self-confidence, financial knowledge, risk sensitivity, financial goals, and environmental characteristics such as educational level, cultural structure, social norms, family background, and access to financial markets.

Psychological research shows that men are more overconfident than women, especially in male-dominated fields such as finance. In a study (Barber & Odean, 2001) analyzing the relationship between differences in the self-confidence levels of male and female individuals and their propensity to trade in financial markets (Barber & Odean, 2001), using data from around 35.000 households between 1991 and 1997, it was concluded that men traded 45% more than women, while the effect on net returns was -2,65% for men and -1,72% for women.

In the study conducted by Croson and Gneezy (Croson & Gneezy, 2009), the reasons for the fact that men are less sensitive to risk than women in the literature were investigated. According to the results obtained, they concluded that emotional reactions to risk vary depending on gender and that men have a higher tendency to take higher risks in financial transactions by seeing risky situations as a challenge with higher levels of self-confidence.

Many studies have shown the relationship between women's participation in financial markets and economic development.

In a study conducted by Li, Lee, and Luo in 2021 using a household survey in China, it was found that women are less involved in stock markets compared to men. It is argued that the main factors that create differences in gender-related capital market participation are influenced by the characteristics of spouses, their interactions, risk preferences, and power dynamics between them. In addition, cultural factors and gender norms embedded in society limit women's sphere of influence, another reason for the gender gap (Li, Lee, & Luo, 2021).

In a study conducted by Almenberg and Dreber using 1300 questionnaires for Sweden, it was similarly stated that women are less involved in stock markets and have a lower level of financial literacy compared to men. The study also concluded that there is a statistically significant difference between men and women in terms of risk sensitivity (Almenberg & Dreber, 2015).

Another study investigated the cross-sectional heterogeneity between financial literacy and stock market participation in Pakistan. Using 300 questionnaires, the study found that those with higher levels of financial literacy are more likely to participate in stock markets and that there is a gender-related difference between these levels. The authors also found that age, qualitative characteristics, and income level significantly positively affect trading in financial markets. (Munir, Yue, Ijaz, Hussain, & Zaidi, 2020).

Fungáčová and Weill analyzed the levels of financial inclusion in China and other countries using the World Bank Global Findeks data. They concluded that bank account ownership and savings rates are similarly higher in China than in BRICS countries. The study, which revealed a negative relationship between being a woman and bank account ownership, also stated that having a high-income level facilitates financial inclusion (Fungáčová & Weill, 2015).

In the study analyzing the factors affecting women's participation in securities markets in India, it is stated that financial constraints are the most important barrier to women's participation in the market, followed by personal constraints, social constraints, and gender stereotypes(Kaur & Vohra, 2012). Similarly, in a study investigating the reasons for the lower participation of women in securities markets in Saudi Arabia compared to men, it is emphasized that educational level, social barriers, and cultural factors emerge as significant obstacles. (Al-Amir, Othman, & Qureshi, 2020).

Lack of motivation to invest, lack of financial awareness, and low self-confidence were other important factors among the reasons for women's low participation in securities markets. (Martenson, 2008). Bernasek and Bajtelsmit show that increased household income triggers women to participate in securities markets (Bernasek & Bajtelsmit, 2002). Kaur and Vohra supported this study by concluding that more difficult access to financial transaction channels and lower levels of financial literacy are the main reasons women are less involved in securities markets than men (Kaur & Vohra, 2012).

In the study conducted in Austria, Italy, the Netherlands, and Spain, 4 European countries with different social norms, according to the data obtained from the household survey, it was concluded that an increase in the level of asymmetry in the WEF gender equality index significantly increases the level of women's participation in securities markets. This result is independent of women's marital status (Barasinska & Schäfer, 2018).

In addition, it is also possible to find many studies from different countries (Aggarwal & Gupta, 2016), (Vohra & Kaur, 2018), (Koengkan et al., 2022), which indicate that women trade less in securities markets than men.

3. Methodology

This study aims to investigate whether there is a gender-based difference among those who invest in equity securities in the securities markets in Turkey between 2011 and 2021 and whether these differences are spatially correlated. For this purpose, dependent variables are calculated based on the data on the Number of Investors with Registered Balances, the Number of Balances in Registered Balanced Accounts, and the Balance Amount in Registered Balanced Accounts obtained from the Central Registry Agency. These data are province-based and gender-disaggregated. The independent variable data in the study were also calculated from TURKSTAT. All the data used are province-based and cover 2011-2021. The variables in the study are given in the Table 3 below.

Table 3. Variables

Code	*Variable*
y_1	Number of Balances in Registered Account with Balance(Female) /Total Number of Balances
y_2	Balance Amount in Account with Registered Balance (Female)/Total Balance Amount
x_1	Faculty or Higher Graduate (Female) /Total Faculty or Higher Graduate
x_2	Crude Suicide Rate
x_3	Household Size
x_4	Rate of Consanguineous Marriage to First Cousins
x_5	Infant Mortality Rate
x_6	Net Divorce Rate
x_7	Fertility Rate
x_8	Gross Domestic Product Growth Rate

Considering the variables in the models, y_1 variable is calculated by dividing the number of balances by the total number of balances in the female gender breakdown by province. y_2 variable is calculated by dividing the balance amount by the total balance amount in the female gender breakdown by province. The x_1 variable is calculated by dividing the number of female faculty or higher graduates by the total number of faculty or higher graduates. The x8 variable is calculated by dividing the year-on-year change in gross domestic product by the previous year's data. The remaining variables are used without any calculation. Descriptive statistics of the variables in the models are given in Table 4.

Table 4. Descriptive Statistics

Variable	*Observation*	*Mean*	*Std. Dev*	*Min.*	*Max.*
y_1	891	0,0878	0,0582	0,0000	0,2917
y_2	891	0,1046	0,0711	0,0000	0,3267
x_1	891	0,4135	0,0456	0,2292	0,5014
x_2	891	4,4278	1,6074	0,0000	11,969
x_3	891	3,6470	0,9510	2,5400	8,1500
x_4	891	4,7774	3,8533	0,3870	18,4213
x_5	891	9,9505	3,1178	2,9965	24,5161
x_6	891	1,4117	0,6487	0,1128	3,0499
x_7	891	2,0644	0,6483	1,2103	4,5738
x_8	891	0,1646	0,0903	-0,1570	0,6074

First, the variables related to women investors were determined in line with the information in the literature. Then, the model was finalized by dropping the appropriate variables using stepwise methods. A total of 22 models, two models for each year, were created with these variables, and the estimation process of these models was realized. The dependent and independent variables of the models in the study are given in Table 5.

Table 5. Dependent and Independent Variables

	Dependent Variable	*Independent Variable*
Model 1	*Number of Balances in Registered Account with Balance(Female) /Total Balance (y_1)*	Faculty or Higher Graduate (Female) /Total Faculty or Higher Graduate (x_1)
		Crude Suicide Rate(x_2)
		Household Size(x_3)
		Rate of Consanguineous Marriage to First Cousin (x_4)
		Infant Mortality Rate(x_5)
		Net Divorce Rate(x_6)
		Fertility Rate(x_7)

		Gross Domestic Product Growth Rate(x_8)
Model 2	*Balance Amount in Account with Registered Balance (Female) / Total Balance Amount (y_2)*	Faculty or Higher Graduate (Female) /Total Faculty or Higher Graduate (x_1)
		Crude Suicide Rate(x_2)
		Household Size(x_3)
		Rate of Consanguineous Marriage to First Cousin (x_4)
		Infant Mortality Rate(x_5)
		Net Divorce Rate(x_6)
		Fertility Rate(x_7)
		Gross Domestic Product Growth Rate(x_8)

Since the models created are province-based, the spatial econometric model estimation process carried out the analysis process. The data distribution of the dependent variables in the model is as follows.

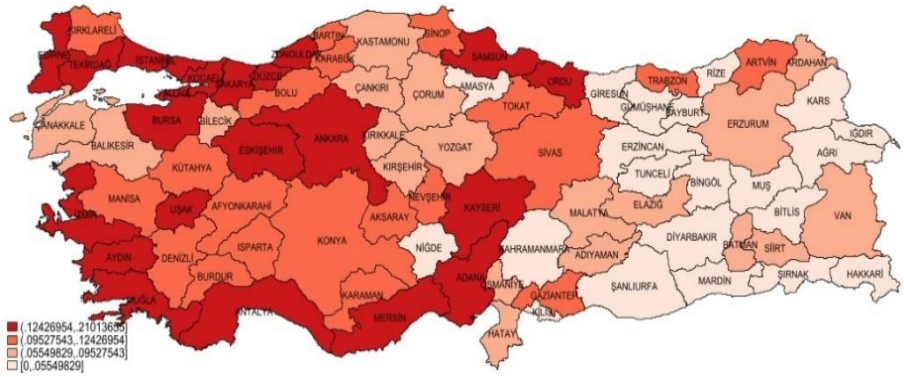

Figure 1. Distribution of Number of Balances (Female) in Accounts with Registered Balances / Total Number of Balances

Figure 1 shows the geographical distribution of the variable Number of Balances in Accounts with Registered Balances (Female) / Total Number of Balances. When the map is analyzed, it is seen that there is a regional clustering. In the cities shown in dark red, the ratio of balances held by female investors to the total number of balances is higher than in light red regions. The ratio decreases as the color gets lighter.

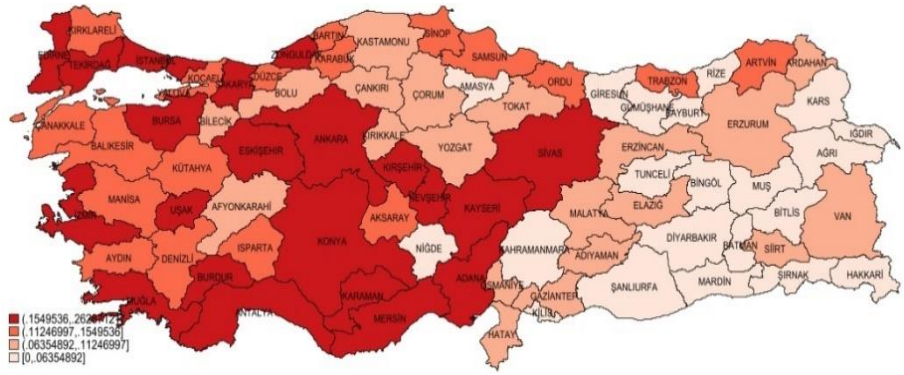

Figure 2. Balance Amount in Account with Registered Balance (Female)/Total Balance Amount

Figure 2 shows the geographical distribution of the variable of Balance Amount in Registered Account with Balance (Female)/Total Balance Amount. When the map is analyzed, a distribution similar to the other variable but not identical is observed. Accordingly, in some regions, although the ratio of the number of balances is high, the balance amount is lower. In dark red regions, the ratio of Balance Amount in Registered Account with Balance (Female)/Total Balance Amount is higher than in light red regions. The ratio decreases as the color gets lighter.

3.1. Spatial Econometrics

Spatial econometrics is a sub-branch in which the estimation process of cross-sectional or panel data regression models involves spatial interaction (spatial autocorrelation) and spatial structure (spatial heterogeneity). As a result of the development of geographical information systems, obtaining data with geographical breakdowns has led to an increase in econometric research on these data. If the dataset containing geographic data is estimated using classical regression estimation methods, appropriate estimation results may not be obtained since the interaction between geographical regions must be addressed. Therefore, methods that consider spatial interaction are used to obtain more accurate forecasts in spatial econometric models (Anselin, 1999).

In models built with geographical data, spatial influence is considered in two parts: spatial cohesion and heterogeneity. Spatial interdependence is the result of the interaction between two neighboring regions. Geographical regions can affect each other positively or negatively. These effects can be observed in the dependent, independent, or error terms. This effect is determined by calculating the covariance between geographical units (Anselin, 1988). Spatial heterogeneity is a concept related to the geographical variation of the data distribution. When deciding on model estimators, the status of the spatial effect is considered. The estimator changes according to whether the spatial effect is in the dependent variable, independent variable error term, or both. When deciding on model estimators, the spatial effect can be investigated, or the estimator decision process can be managed using the information criteria method.

3.2. Model Estimation and Empirical Results

This study investigated the relationship between the number of women investors and other socioeconomic factors on a provincial basis for the years 2011-2021. In this direction, both the variables affecting the number of women investors from year to year and the effect of these variables on the variables related to women investors were investigated. For this purpose, the hypotheses of the study are as follows:

The first hypothesis of the study:
H_0: There is spatial autocorrelation on the number of female investors.
H_1: There is no spatial autocorrelation on the number of female investors.

Second Hypothesis:
H_0: Variables affecting the number of women investors differ yearly.
H_1: Variables affecting the number of female investors do not differ yearly.

Third Hypothesis:
H_0: The effect of variables on the number of female investors varies yearly.
H_1: The effect of variables on the number of female investors does not vary yearly.

In order to test these hypotheses, a total of 22 models were estimated, two for each year. In the estimation processes related to the models, information criteria were determined to determine the appropriate estimator for the models—the highest Adj. Buse R^2 and the estimator with the lowest information criterion were determined as the appropriate estimator for the model. Accordingly, the estimators suitable for the models in the study are given in Table 6 below.

Table 6. Estimator Selection Criteria

Year	*Model 1*	*Model 2*
2011	SAC	SAC
2012	SAC	SAC
2013	SAC	SAC
2014	SAC	SAC
2015	SAC	SEM
2016	SAC	SEM
2017	SAR	SAR
2018	SAC	SAR
2019	SAC	SAR
2020	SAC	SAR
2021	SAC	SAR

In spatial econometric models, the spatial effect may appear in the dependent variable, the independent variable, the error term, or any two or all components of the dependent variable, the independent variable, or the error term. Models are named according to the component in which the spatial effect is present. Models with spatial effects in all components are called general nested models. The model obtained by removing spatially lagged independent variables from the nested model is called a spatially autoregressive mixed model. In a spatially autoregressive mixed model (SAC), the dependent variable interacts with the dependent variables of neighboring locations, and the error terms of the locations interact. The SAC model is shown as follows:

$$Y = \rho W_1 + X\beta + u \quad (1)$$

$$u = \lambda W u + \varepsilon \quad (2)$$

In the case of a spatial autoregressive mixed model (SAC) λ=0, the new model is called a spatial lag model (SAR), where only the locations' dependent variables interact. The SAR model is shown as follows:

$$Y = \rho WY + X\beta + u \quad (3)$$

If (SAC) ρ=0 in the spatial autoregressive mixed model (SAC), the new model is called the spatial error model (SEM). The spatial error model (SEM) has a spatial interaction between the error terms. The SEM model is shown as follows.

$$Y = X\beta + (I - \lambda W)^{-1}\varepsilon \quad (4)$$

In some periods, when the model is a SAR model, it is concluded that there is a spatial effect only in the dependent variables of the variables in the model, while in the case of a SEM model, it is concluded that there is a spatial interaction only in the error term. However, since most of the models in this study are SAC models, there is a spatial interaction in both the dependent variable and the error term.

After deciding on the model estimators, we tested for multicollinearity. Multicollinearity was assessed according to the average VIF value of the models.

Table 7. Models VIF Values

Year	*Model 1&2 Mean VIF Value*
2011	5,76
2012	6,02
2013	6,02
2014	6,11
2015	6,31
2016	5,78
2017	6,18
2018	5,98
2019	5,45
2020	6,14
2021	6,52

Since the average VIF values of the models are less than 10, there is no multicollinearity in the models(Hair, Black, Babin, & Anderson, 2010). Heteroskedasticity was tested after testing for multicollinearity. Hal-Pagan LM test, Harvey LM test, Wald LM test, Glejser LM test, Machado-Santos-Silva Test, White test, and Cook-Weisberg LM test were performed to test for heteroskedasticity. The test results were evaluated to determine whether there is heteroskedasticity.

Table 8. Model 1 Heteroskedasticity Test Results

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Hall Pagan LM Test	,976	,650	,873	,933	,565	,734	,774	,593	,450	,469	,795
	,725	,425	,823	,635	,855	,944	,842	,366	,565	,341	,622
	,654	,983	,543	,671	,410	,451	,416	,943	,377	,686	,976
Harvey LM Test	,000	,007	,000	,013	,010	,035	,005	,009	,000	,000	,057
Wald LM Test	,000	,000	,000	,000	,000	,000	,000	,000	,000	,000	,000
Glejser LM Test	,001	,003	,000	,007	,000	,003	,008	,012	,000	,000	,000
MachadoSantos Silva Test	,839	,474	,650	,346	,468	,269	,350	,676	,814	,471	,291
	,246	,336	,098	,481	,053	,419	,590	,575	,006	,082	,400
White Test Koenker	,246	,510	,081	,436	,027	,244	,482	,580	,007	,291	,119
	,545	,604	,094	,781	,204	,151	,535	,456	,007	,316	,101
	,279	,838	,239	,595	,134	,026	,332	,260	,052	,538	,037
White Test B-P-G	,515	,465	,008	,502	,005	,005	,143	,041	,000	,007	,000
	,228	,411	,013	,222	,000	,037	,195	,192	,000	,023	,001
	,236	,664	,009	,123	,000	,000	,007	,000	,000	,001	,000
CookWeisberg LM Test	,975	,629	,851	,922	,456	,669	,727	,487	,277	,326	,705
	,228	,411	,013	,222	,000	,037	,195	,192	,000	,023	,001

Since there is heteroskedasticity for the first model for 2015, 2016, and 2019, the model estimation results for the other years are shown in Table 9.

Table 9. Model 1 Results

	Buse Adj.R^2	Adj.R^2	P value
2011	0,3519	0,7915	0,0000
2012	0,3811	0,8057	0,0000
2013	0,4800	0,8318	0,0000
2014	0,4903	0,8381	0,0000
2017	0,3664	0,8116	0,0000
2018	0,4924	0,8512	0,0000
2020	0,3567	0,8355	0,0000
2021	0,2424	0,8091	0,0005

The models are significant in all periods estimated; Buse Adj. R^2 and Adj. R^2 values are high. Accordingly, the explanatory power of the independent variables in the models for the dependent variable is relatively high.

Table 10. Model 1 Estimation Results

Variable		x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	Cons
2011	Coefficient	,695	-,004	,015	-,001	,002	,023	-,012	-,105	-,200
	P>z	,000	,234	,272	,740	,380	,104	,669	,408	,020
2012	Coefficient	,649	-,001	,022	,000	,001	,021	-,027	-,010	-,221
	P>z	,000	,676	,071	,967	,555	,096	,263	,923	,005
2013	Coefficient	,668	-,002	,045	-,004	-,002	,024	-,028	,161	-,305
	P>z	,000	,403	,000	,236	,339	,027	,140	,087	,000

2014	Coefficient	,662	,001	,025	-,004	-,001	,018	,001	,176	-,307
	P>z	,000	,625	,015	,166	,758	,077	,962	,103	,000
2017	Coefficient	,663	,003	,037	-,007	,003	,022	-,004	,003	-,332
	P>z	,000	,187	,009	,046	,201	,037	,843	,970	,000
2018	Coefficient	,527	,004	,047	-,003	-,002	,022	-,016	-,067	-,296
	P>z	,000	,032	,000	,201	,163	,016	,348	,257	,000
2020	Coefficient	,415	-,004	,010	,000	,001	,027	-,015	-,044	-,123
	P>z	,003	,059	,388	,957	,458	,006	,461	,308	,075
2021	Coefficient	,815	,001	,017	,002	,000	,006	-,020	-,008	-,324
	P>z	,000	,493	,162	,462	,940	,398	,299	,765	,000

Model 1 estimation results show that x_1 variable and the constant term are significant for 2011 and 2012. In 2013, x_1, x_3, and x_6 variables and the constant term are significant. 2014, the x_1 and x_3 variables and the constant term are significant. In 2017, x_1, x_3, x_4, and x_6 variables and the constant term are significant. In 2018, x_1, x_2, x_3, and x_6 variables and the constant term are significant. In 2020, x_1 and x_6 variables are significant. In 2021, the x_1 variable and the constant term are significant. Considering the results, the x_1 variable is significant for all years. In addition, the coefficient of the variable varied from year to year. Therefore, the hypothesis that the effect of the variables in the study varies from year to year is confirmed for Model 1.

Table 11. Model 1 Significant Variables

Variables-Model 1	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Faculty or Higher Graduate (Female) /Total Faculty or Higher Graduate (x_1)	x	x	x	x			x	x		x	x
Crude Suicide Rate(x2)								x			
Household Size(x_3)			x	x			x	x			
Rate of Consanguineous Marriage to First Cousin (x_4)											
Infant Mortality Rate(x_5)											
Net Divorce Rate(x_6)			x	x			x	x		x	
Fertility Rate(x_7)											
Gross Domestic Product Growth Rate(x_8)											

When the significant variables were analyzed, it was found that the variables differed from year to year. According to this result, one of the study's hypotheses, that the variables affecting the dependent variable differ yearly, is confirmed for Model 1.

The table containing the test results for heteroskedasticity, which is one of the basic assumptions about Model 2, is as follows:

Table 12. Model 2 Heteroskedasticity Test Results

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021

HallPagan LM Test	,976	,650	,873	,933	,565	,734	,774	,593	,450	0,469	0,795
	,725	,425	,823	,635	,855	,944	,842	,366	,565	0,341	0,622
	,654	,983	,543	,671	,410	,451	,416	,943	,377	0,686	0,976
Harvey LM Test	,000	,007	,000	,013	,010	,035	,005	,009	,000	0,000	0,057
Wald LM Test	,000	,000	,000	,000	,000	,000	,000	,000	,000	0,000	0,000
Glejser LM Test	,001	,003	,000	,007	,000	,003	,008	,012	,000	0,000	0,000
MachadoSantos Silva Test	,839	,474	,650	,346	,468	,269	,350	,676	,814	0,471	0,291
	,246	,336	,098	,481	,053	,419	,590	,575	,006	0,082	0,400
White Test Koenker	,246	,510	,081	,436	,027	,244	,482	,580	,007	0,291	0,119
	,545	,604	,094	,781	,204	,151	,535	,456	,007	0,316	0,101
	,279	,838	,239	,595	,134	,026	,332	,260	,052	0,538	0,037
White Test B-P-G	,515	,465	,008	,502	,005	,005	,143	,041	,000	0,007	0,000
	,228	,411	,013	,222	,000	,037	,195	,192	,000	0,023	0,001
	,236	,664	,009	,123	,000	,000	,007	,000	,000	0,001	0,000
CookWeisberg LM Test	,975	,629	,851	,922	,456	,669	,727	,487	,277	0,326	0,705
	,228	,411	,013	,222	,000	,037	,195	,192	,000	0,023	0,001

When the test results are analyzed, it is found that heteroskedasticity for Model 2 is present only in the model for the 2013 period. Therefore, the model was estimated for all periods except 2013. Model 2 estimation results are presented in the Table 12 below.

Table 13. Model 2 Results

	Buse Adj.R^2	Adj.R^2	P value
2011	0,4224	0,8179	0,0000
2012	0,4314	0,8135	0,0000
2014	0,4509	0,8160	0,0000
2015	0,3872	0,8002	0,0000
2016	0,3500	0,7880	0,0000
2017	0,2949	0,7716	0,0000
2018	0,3907	0,8154	0,0000
2019	0,4706	0,8427	0,0000
2020	0,3451	0,8309	0,0000
2021	0,2675	0,8086	0,0000

The models are significant in all periods estimated; Buse Adj. R^2 and Adj. R^2 values are quite high. Accordingly, the explanatory power of the independent variables in the models for the dependent variable is quite high.

Table 14. Model 2 Estimation Results

Variable		x1	x2	x3	x4	x5	x6	x7	x8	cons
2011	Coefficient	,745	-,005	,029	,000	,003	,035	-,034	-,149	-,237
	P>z	,000	,123	,032	,925	,314	,015	,222	,237	,004
2012	Coefficient	,658	-,002	,031	,002	-,001	,042	-,042	,040	-,227
	P>z	,002	,561	,032	,655	,564	,008	,147	,735	,017
2014	Coefficient	,565	,003	,023	-,004	-,006	,031	,005	,080	-,195
	P>z	,023	,311	,164	,443	,031	,058	,865	,637	,070

2015	Coefficient	,470	,000	,037	-,006	,000	,040	-,022	,097	-,197
	P>z	,075	,927	,031	,191	,993	,007	,512	,348	,073
2016	Coefficient	,444	,001	,043	-,005	-,004	,038	-,009	,070	-,193
	P>z	,130	,837	,020	,291	,159	,027	,776	,574	,128
2017	Coefficient	,547	,004	,039	-,010	,006	,040	-,008	-,075	-,289
	P>z	,053	,308	,091	,090	,097	,030	,806	,533	,030
2018	Coefficient	,511	,007	,041	-,001	,000	,033	-,030	-,082	-,269
	P>z	,017	,064	,024	,842	,924	,030	,302	,411	,008
2019	Coefficient	,580	-,003	,035	,003	,005	,021	-,077	-,031	-,228
	P>z	,002	,309	,019	,408	,003	,065	,002	,656	,012
2020	Coefficient	,469	-,003	,010	,002	,004	,020	-,037	-,062	-,138
	P>z	,004	,238	,414	,629	,043	,061	,083	,167	,074
2021	Coefficient	,752	-,001	,026	,002	,001	,021	-,035	-,017	-,295
	P>z	,000	,594	,092	,504	,787	,047	,178	,628	,000

Model 2 estimation results show that x_1, x_3, and x_6 variables and the constant term are significant in 2011, 2012, 2018, and 2019. In 2014, x_1 and x_5 variables are significant. In 2015 and 2016, x_3 and x_6 variables are significant. In 2017, x_6 and the constant term are significant. In 2020, x_1 and x_5 variables are significant. In 2021, the x_1 and x_6 variables and the constant term are significant. Considering the results, the x_1 variable is significant for seven years. In the years when it was significant, the variable's coefficient varied from year to year. Therefore, the hypothesis that the effect of the variables in the study varies from year to year is also confirmed for Model 2.

The year-based representation of the significant variables in the models is as follows:

Table 15. Model 2 Significant Variables

Variables-Model 2	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Faculty or Higher Graduate (Female) / Total Faculty or Higher Graduate (x_1)	x	x		x				x	x	x	x
Crude Suicide Rate(x_2)											
Household Size(x_3)	x	x			x	x		x	x		
Rate of Consanguineous Marriage to First Cousin (x_4)											
Infant Mortality Rate(x_5)				x						x	
Net Divorce Rate(x_6)	x	x			x	x	x	x	x		x
Fertility Rate(x_7)									x		
Gross Domestic Product Growth Rate(x_8)											

When the variables that are significant for Model 2 yearly are examined, it is observed that there is a difference from year to year. According to this result, one of the study's hypotheses, that the variables affecting the dependent variable differ yearly, is confirmed for Model 2.

Global Moran I test was conducted to test for spatial autocorrelation in the dependent variables. The test result is as follows:

Table 162. Global Moran I Test Results

Variables	I	E(I)	Sd(I)	Z	p-value
y_1	0,397	-0,013	0,072	5,686	0,000
y_2	0,383	-0,013	0,072	5,496	0,000

According to the results of the Global Moran I test, the hypothesis "There is no spatial autocorrelation" for both dependent variables is rejected and it is concluded that there is spatial autocorrelation. According to this result, the hypothesis of spatial autocorrelation in the dependent variables established in the study is confirmed. The map created to see the provinces where spatial autocorrelation is significant is as follows.

Figure 3. Model 1 Spatial Autocorrelated Cities

The blue cities on the map have low spatial autocorrelation, while the red ones have high spatial autocorrelation. This statement can be explained as follows. In blue cities, the ratio of female investor balances to total balances is low and even lower in neighboring cities. The ratio of female investor balances to total balances in red provinces is high, while it is high in neighboring provinces.

The result is as follows when we look at the cities where spatial autocorrelation is significant for the y_2 variable.

Figure 4. Model 2 Spatial Autocorelated Cities

The blue cities on the map have low spatial autocorrelation, while the red ones have high spatial autocorrelation. This statement can be explained as follows. In blue cities, the ratio of female investor balances to total balances is low and even lower in neighboring cities. The ratio of female investor balances to total balances in red provinces is high, while it is high in neighboring provinces.

4. Findings and Results

In this study, to investigate the factors affecting the number of women investors on a provincial basis and whether these factors change from year to year, a total of 22 models, two models for each year, were established, and an answer to the research question was sought. In the model decision-making stage, the most appropriate model was determined using stepwise methods. After determining the model, the basic assumptions about the models were tested, and the models with appropriate results in the years were considered. The information criteria were used to determine which spatial econometric estimators were appropriate for the models in the study, and the models were analyzed with the decided estimators. As a result, it was concluded that all estimated models were significant and had high R^2 values. Accordingly, it is concluded that the independent variable in the models has a high explanatory power for the dependent variable. When we look at the significant variables in the models, we see that most models' ratio of female faculty graduates to the total number of graduates is significant and positive.

Based on this result, the higher the rate of female faculty graduates, the higher the number of female investors. Another variable with a significant and positive relationship in most of the models is household size. According to the results, it is concluded that as the household size increases, the number of female investors also increases. Another variable with high significance in the models is the net divorce rate. A positive relationship is found between the net divorce rate and the ratio of the number of female investor balances and the ratio of the amount of female investor balances. According to this result, it is concluded that as the net divorce rate increases, the number of female investors increases.

The number of faculty graduates, which is one of the indicators of economic development in a country, and the net divorce rate are significant in most of the models in the study, showing that the research results are important.

In addition, when the coefficients of the significant variables are examined, it is seen that the coefficients differ from year to year. According to this result, it is concluded that the effect of variables affecting the number of women investors differs from year to year. When the existence of spatial autocorrelation in the variables included in the study on the number of women investors is tested with the Global Moran I test, it is concluded that spatial autocorrelation exists for both variables. Considering all these results, all three hypotheses established at the beginning of the study are confirmed.

5. Recommendations

Women's participation in stock markets is expected to positively affect countries' capital markets and economies in terms of increasing the cumulative number of investors and financial inclusion. In this framework, efforts should be made to increase women's financial literacy levels, which are lower than men's, as found in

many countries, and to ensure equal opportunities in education. In addition, the need for more role models to serve as success stories that women can look up to is also an important problem for women. Notably, the most well-known investors in the financial markets today are all men. This is a result of gender bias rather than men's achievements. It is essential to implement policies to eliminate gender biases at the social level. Although some financial institutions in Turkey have introduced financial instruments such as loans etc. that provide positive discrimination for women, increasing the variety and size of these products and making them permanent rather than limited to a specific campaign period are among the practices that can be useful in reducing the existing gender inequality in economic activities and thus in financial markets.

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