Ekonomi Maliye İşletme Dergisi -2023- 6(2)
Araştırma Makalesi/Research Article
Doi:10.46737/emid.1318508

RESEARCH OF IMPACTING OF CREDIT CARD USAGE AT DISTRICT LEVEL IN TÜRKİYE[1]

TÜRKİYE'DE KREDİ KARTI KULLANIMININ İLÇE DÜZEYİNDEKI ETKİSİNİN ARAŞTIRILMASI

Arif SALDANLI*, Sumeyra UZUN**
*Assoc. Prof., Istanbul University, Department of Business, saldanli@istanbul.edu.tr,
**Asst. Prof.,Istanbul University, Istanbul University, Department of Business, sumeyrauzun@istanbul.edu.tr,

ARTICLE INFO

Received
22.06.2023
Revized
03.11.2023
Accepted
23.11.2023
Article Classification:
Research Article

JEL Codes
C31
D12
D14

ABSTRACT

This study examines district-level factors affecting Turkish credit card usage. Demographic, education, health, tourism, economy, urbanization, culture, and sports parameters are used to create two spatial econometric models. Geographical data visualizes dependent variables and assesses credit card usage's spatial dependency. In this context, the study was carried out using a spatial econometric model related to credit card usage. In this context, the study was carried out using a spatial econometric model related to credit card usage. The model estimator is the Spatial Durbin Model using Buse Adj. R2 and information criteria. The first model shows a negative relationship between physical credit card payments, students per teacher, and mosques per capita. Total physical credit card payments are negatively correlated with per capita electricity consumption, markets, students per teacher, and mosques per capita in the second model. This study highlights the spatial dependence and geographical variation of credit card usage factors.
Keywords: *Credit Card, Spatial Durbin Model, Spatial Econometry*

MAKALE BİLGİSİ

Gönderilme Tarihi
22.06.2023
Revizyon Tarihi
03.11.2023
Kabul Tarihi
23.11.2023
Makale Kategorisi
Araştırma Makalesi

JEL Kodları
C31
D12
D14

ÖZ

Bu çalışmada Türkiye'de kredi kartı kullanımını etkileyen faktörler ilçe düzeyinde incelemektedir. Demografik, eğitim, sağlık, turizm, ekonomi, kentleşme, kültür ve spor ile ilgili parametreler kullanılarak iki mekansal ekonometrik model oluşturulmuştur. Mekansal ekonometrik modellerde kullanılan coğrafi veriler ile modelde yer alan değişkenlerin görselleştirilebilmesinin yanı sıra kredi kartı kullanımı ile ilgili mekansal otokorelasyonun yani mekansal bağımlılıkta değerlendirilmektedir. Bu kapsamda çalışma, kredi kartı kullanımı ile ilgili mekansal bir ekonometrik model kullanılarak gerçekleştirilmiştir. Analiz aşamasında model tahmincisini belirlemek amacıyla bilgi kriterleri ve Buse Düzeltilmiş R2 değerlerine bakılarak karar verilmiştir. Elde edilen sonuçlara göre çalışmada yer alan modellerin Mekansal Durbin Modeli olduğu sonucuna ulaşılmıştır. Model tahmin sonuçlarına bakıldığında çalışmada yer alan ilk model fiziki kredi kartı ödemeleri, öğretmen başına düşen öğrenci ve kişi başına düşen cami sayısı arasında negatif bir ilişki olduğunu göstermektedir.Çalışmada yer alan ikinci modelde ise toplam fiziki kredi kartı ödemeleri, kişi başına düşen elektrik tüketimi, market sayısı, öğretmen başına düşen öğrenci sayısı ve kişi başına düşen cami sayısı ile negatif ilişkili olduğu sonucuna ulaşılmıştır.Sonuç olarak bu çalışmada, kredi kartı kullanım faktörlerinin mekansal bağımlılığını ve coğrafi değişkenliği araştırılmıştır.
Anahtar Kelimeler: *Kredi Kartı, Mekansal Durbin Model, Mekansal Ekonometri*

[1]This paper is funded by Istanbul University Commission of Scientific Research (IU BAP Project Number:38127).

Atıf (Citation): Saldanlı, A. & Uzun, S. (2023). "Research of Impacting of Credit Card Usage at District Level in Türkiye", *Ekonomi Maliye İşletme Dergisi*, 6(2): 64-81

Genişletilmiş Özet

Bu çalışmada Türkiye'de kredi kartı kullanımını etkileyen faktörler ilçe düzeyinde mekânsal ekonometrik tahminciler kullanılarak tahmin edilmiştir. Bu amaçla demografik, eğitim, sağlık, turizm, ekonomi, kentleşme, kültür ve spor ile ilgili parametreler kullanılarak iki model oluşturulmuştur. Araştırma kapsamında ilk modelde bağımlı değişken olarak kredi kartıyla yapılan toplam fiziksel ödeme adetinin logaritması kullanılırken, ikinci modelde ise bağımlı değişken olarak kredi kartıyla yapılan toplam fiziksel ödeme tutarının logaritması değerlendirmeye alınmıştır. Kredi kartı harcamalarını etkileyen bağımsız değişkenlerin belirlenmesinde stepwise yöntemler kullanılarak, modele en uygun değişkenler tespit edilmiştir. Bağımsız değişkenler belirlendikten sonra değişkenler arasında çoklu doğrusal bağlantının varlığı durumu test edilerek modeller nihai haline getirilmiştir. Çalışmada ilk modelde yer alan bağımsız değişkenler 100.000 kişi başına düşen katılım bankası şube sayısı, kişi başına market sayısı, okuma yazma oranı, doktora mezun sayısı, erkek ortalama eğitim süresi, öğrenci başına düşen öğretmen sayısı, kişi başına düşen cami sayısı, Y kuşağı oranı ve yıllık nüfus büyüme oranıdır. İkinci modelde yer alan bağımsız değişkenler ise 100.000 kişi başına düşen katılım bankası şube sayısı, kişi başı elektrik tüketimi, kişi başına market sayısı, okuma yazma oranı, erkek ortalama eğitim süresi, erkek lisans mezuniyet oranı, öğrenci başına düşen öğretmen sayısı, kişi başına düşen cami sayısı ve yıllık nüfus büyüme oranıdır. Çalışmanın temel hipotezi, "Kredi kartı kullanımında mekânsal bir etkinin olmadığı" yönündedir. Model tahminlerine geçilmeden önce, bağımlı değişkenlerin haritalandırılmasıyla dağılımlarının bölgesel olup olmadığı incelenmiştir. Ayrıca, mekânsal bağımlılığın varlığı, Global Moran I testi kullanılarak istatistiksel olarak test edilmiştir. Yapılan analizler sonucunda, her iki bağımlı değişken için de mekânsal bağımlılığın var olduğu tespit edilmiştir. Mekânsal bağımlılığın hangi bölgelerde ve bölgeler arasında nasıl bir etkileşimi olduğunun tespiti için ise Lokal Moran I testi yapılarak mekânsal bağımlılığı olan ilçelerin komşuluk durumları haritalandırılarak belirlenmiştir. Oluşturulan haritalarda kırmızı olan ilçelerde kredi kartı kullanımı tutarı ve miktarı arttıkça komşu ilçelerinde de kredi kullanımı ve tutarı artmaktadır. Mavi ile gösterilen ilçelerde kredi kartı kullanımı azaldıkça komşu ilçelerde de kredi kartı kullanımı ve tutarı düşmektedir. Açık mavi renkle gösterilen ilçelerde kredi kartı kullanımı ve tutarı azaldıkça, komşu ilçelerde bu kullanımın ve tutarın arttığı; açık kırmızı ile işaretlenmiş ilçelerde ise kredi kartı kullanımının artmasıyla komşu ilçelerde bir azalma olduğu saptanmıştır. Mekânsal bağımlılığın tespiti ve ilçe düzeyindeki etkileşimi test edildikten sonra model tahmin aşamasına geçilmiştir. Model tahmin aşamasına geçildiğinde, modeller için en uygun tahmincilerin belirlenmesi amacıyla, en yüksek Buse R2 değeri ve en düşük bilgi kriterine sahip tahminciler seçilmiştir. Yapılan testler sonucunda, ilk model için en uygun modelin Mekânsal Durbin Modeli olduğu belirlenmiştir. Tahmin sonucuna göre kredi kartıyla yapılan toplam fiziksel ödeme adeti ile öğrenci başına düşen öğretmen sayısı ve kişi başına düşen cami sayısının negatif yönlü ilişkili olduğu; 100.000 kişi başına düşen katılım bankası şube sayısı, kişi başına düşen market sayısı, okuma yazma oranı, doktora mezun sayısı, erkek ortalama eğitim süresi, Y kuşağı oranı ve yıllık nüfus büyüme oranı arasında pozitif yönlü ilişkili olduğu bulunmuştur. İkinci model için en uygun tahmin modelinin de ilk model gibi Mekânsal Durbin Modeli olduğu belirlenmiştir. Yapılan tahmin sonucuna göre kredi kartıyla yapılan toplam fiziksel ödeme tutarı ile kişi başı elektrik tüketimi, kişi başına market sayısı, öğrenci başına düşen öğretmen sayısı ve kişi başına düşen cami sayısı ile negatif yönlü bir ilişkili; 100.000 kişi başına düşen katılım bankası şube sayısı, okuma yazma oranı, erkek ortalama eğitim süresi ve yıllık nüfus büyüme oranı ile pozitif yönlü ilişkili olduğu bulunmuştur. Sonuç olarak, çalışmada kredi kartı kullanımında mekânsal bir etkinin olduğunu ve toplumun eğitim, sosyolojik ve dini yapısının bu kullanım üzerinde etkili olduğunu sonucuna ulaşılmıştır. Bu bulgular, ilçe düzeyinde kredi kartı kullanım alışkanlıklarını etkileyen faktörlerin daha iyi anlaşılmasına katkı sağlamayı hedeflemektedir.

Introduction

Over the years, there has been a significant growth in the use of credit and debit cards as the preferred modes of payment. This trend has been further accentuated by the global pandemic, which has brought about a change in consumer spending habits. The trend towards e-commerce has led to an increased reliance on credit and debit cards as a means of conducting transactions. Upon analysis of the extant literature pertaining to credit and debit card usage, it becomes evident that it can be bifurcated into two primary streams. The initial set of research endeavours investigates consumer perceptions pertaining to the utilization of credit and debit cards through the administration of primary data-based surveys. The second cohort directs their attention towards comprehending the interrelationships between macroeconomic indicators and the utilization of credit and debit cards on a national or regional scale, frequently within the framework of financial development.

To evaluate a broad spectrum of indicators from different domains, including demographics, education, health, tourism, culture, urbanization, and infrastructure, in order to identify the determinants that impact the frequency, type, and magnitude of credit and debit card utilization in 973 districts of Turkey are analysed. The absence of district-specific investigations on this topic concerning Turkey in the current body of literature renders this research distinctive and indispensable. The study endeavours to offer a more intricate comprehension of the determinants that influence credit and debit card usage patterns in Turkey by examining various indicators. The aforementioned knowledge may hold significant value for financial institutions, policymakers, and businesses who aim to devise specific strategies to encourage the utilization of credit and debit cards or overcome any potential obstacles that may impede their widespread adoption.

Furthermore, the research findings may also offer insights that can be applied to other countries with similar economic and social contexts. By identifying the key drivers of credit card usage in Turkey, this study could serve as a valuable reference point for future research exploring the determinants of card usage in other regions. Ultimately, this comprehensive analysis has the potential to contribute significantly to the understanding of the evolving global payment landscape and inform the development of more effective policies and strategies in the future.

1. The Concept of Credit Card

The concept of credit dates to ancient Egyptian civilization, around 5000 BC. Transactions between merchants in Egypt and Harappa at that time, recorded on clay tablets, can be considered the earliest examples of credit transactions. Thousands of years later, this practice of deferring payment for a purchased product transformed into a coupon that Western merchants gave to farmers who did not have enough money to buy supplies (Forbes, 2022). Store cards, the predecessors of credit cards, were used as metal plates in the 1930s. The Diners Club Card was introduced in 1950 when founder Frank McNamara forgot his wallet at home while dining. McNamara and his partner Ralph Schneider launched the Diners Club card, considered the birth of modern cards. This system charged cardholders a monthly fee of 13 for facilitating transactions between them and the merchants. The Diner Club became a widely accepted card in its first year, usable at over 10,000 businesses (Forbes, 2021).

Technological advancements, economic growth, the emergence of ATMs, increased computer usage, and the invention of the internet have led to an incredible increase in credit card usage. Credit card usage positively impacts economic development, contributing to the growth and depth of countries' financial systems and becoming an element of economic growth. Increased credit card usage prevents the postponement of individuals' expenditures, positively affecting current consumption. This, in turn, increases transaction volume and money velocity, promoting economic growth, which supports an increase in GDP. However, to achieve this effect, individuals must have a proper level of financial literacy to plan future cash flows accurately, and the country's financial systems and relevant legal regulations must be correctly established. Uncontrolled spending leading to excessive debt, could adversely affect economic development.

The World Bank prepared the Global Findex Report (OECD, 2021) in 2021, surveying over 12,500 people in 123 countries to evaluate countries' financial management, legal structure, trade, tax system, and working conditions. According to the survey data, the credit card ownership rates among the population aged 15 and above, categorized by country income groups, are presented in Table 1.

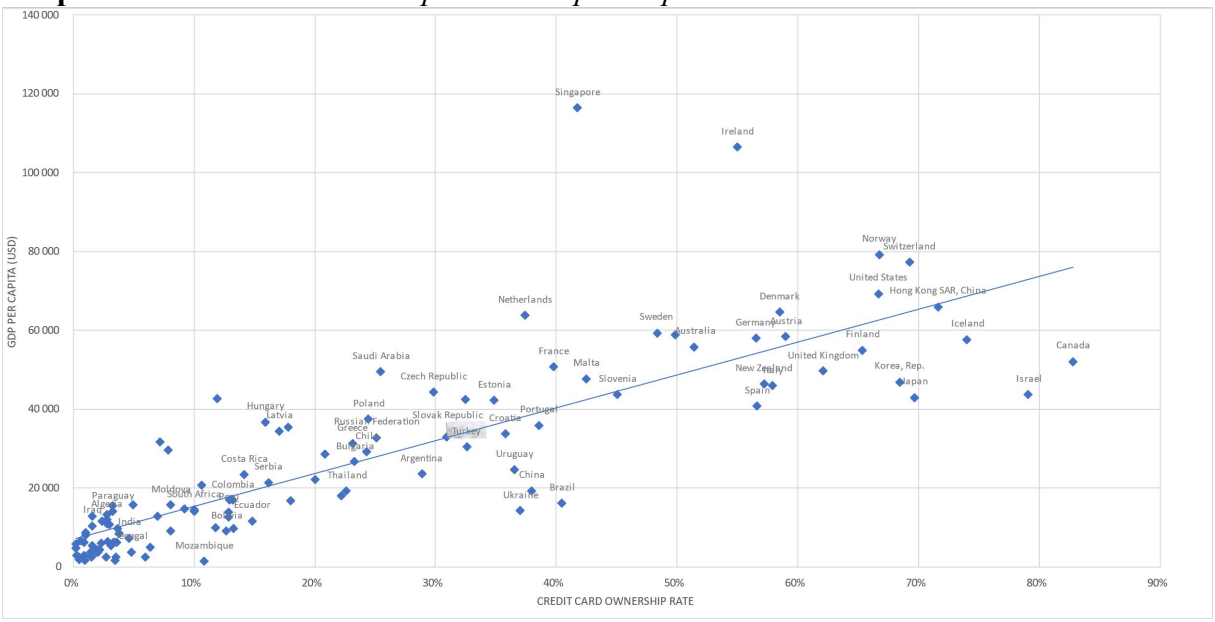
Table 1: *Credit Card and Bank Account Ownership Rates*

Income Group	Yıl	Account (age 15+)	Owns a credit card age 15+)
High income	2021	96%	57%
Low income	2021	39%	3%
Lower middle income	2021	62%	4%
Upper middle income	2021	84%	33%
World	2021	76%	24%

Source: (OECD - Global Findex Report 2021)

According to the table 1, a linear relationship exists between increased income levels and access to and usage of financial instruments. For Turkey, as of 2021, the bank account ownership rate among the population aged 15 and above is 74%, while the credit card ownership rate is based on the classification made by the World Bank. Turkey falls within the upper-middle-income group. When looking at the countries within this group, Turkey's credit card ownership rate is close to the average. Graph 1 shows the credit card ownership rates for the population aged 15 and above and GDP per capita in USD for 116 countries, based on World Bank data. Turkey lies directly on the trend line within this context, demonstrating an average performance. The graph shows a positive relationship between GDP per capita and credit card ownership rate for individuals aged 15 and above. The correlation coefficient between these two variables is measured to be 0,8305.

Graph 1: *Credit Card Ownership and GNP per Capita*



Upon reviewing academic literature, it is possible to find numerous studies that associate credit card/bank card usage with factors like economic development and financial inclusion. However, most of these studies focus on determining the factors affecting credit card usage at the macro level rather than investigating the spatial relationships. The primary goal of this study is to explore the existence of the spatial relationships in credit card expenditures, considering the socioeconomic factors of 922 districts in Turkey.

2. Literature Review

In the literature on credit card usage, most researchers (Uzgören, Ceylan, & Uzgören, 2007); (Karamustafa & Biçkes, 2003); (Ünal, Düğer, & Söylemez, 2015); (Altan & Göktürk, 2008);(Norvitilis et al., 2006); (Yücel & Çiftçi, 2019) primarily try to explain the credit and bank card usage attitudes of selected samples through surveys. These studies generally involve surveying

the researchers' institutional colleagues or students, which may limit the generalizability of the findings for policy-making purposes.

Some studies in the literature focus on identifying the existing relationships between credit card and bank card usage and macroeconomic factors (Ulucan Özkul & Tapşın, 2010); (Göv & Salihoglu, 2020); (Sönmezler, Gündüz, & Torun, 2019) . Preferred macroeconomic indicators in these studies include variables like Gross Domestic Product, Financial Development, and Inflation.

Similar research in foreign literature investigates the social and demographic reasons and consequences of credit card usage. A study conducted in 1999 (Hayhoe, Leach, Turner, & Mo, 1999) examined the relationship between students' number of credit card owners and credit card usage. The results revealed that money and credit attitudes influenced behaviours. Another study (Mathews & Slocum Jr., 1969) found that social status was a determining factor in credit card usage. In their 2012 study, Wickramasinghe and Gurugamage conducted a study on 177 individuals to determine and evaluate the effects of demographic and socioeconomic characteristics of credit card users on credit card knowledge and perceived lifestyle consequences of credit card use. The results of the study showed that gender, education level, income level, duration of credit card ownership and financial literacy affect knowledge about credit cards, perceived lifestyle consequences of credit card use and credit card use (Wickramasinghe & Gurugamage, 2012). In a study conducted by Yüksel et al. in 2016, macroeconomic factors affecting credit card usage in Turkey were investigated. As a result of the study, a negative relationship was found between credit card utilization and unemployment. It was also concluded that credit card utilization increases as the interest rate increases (Yüksel, Zengin, & Kartal, 2016).

The study conducted by Hussain and Habib in 2020 aims to determine the behavioral factors that affect credit card usage. As a result of the study, it was found that perceived benefit and perceived risk have a positive effect on credit card use (Hussain & Habib, 2020). The study conducted by DeSilva and Patabendige in 2021 examined the credit card usage behavior of consumers in Srilanka. As a result of the study, credit card features, social status, lifestyle and psychographic variables derived on the basis of different psychological characteristics of individuals are positively related to credit card usage. However, the most important variable among these variables was found to be credit card characteristics (De Silva & Patabendige, 2021)

A study conducted in 2005 examined the effects of socioeconomic factors and attitude variables on credit card usage (Chien & Devaney, 2001). Based on the 1998 Consumer Finance Survey data, the analysis showed that those with higher attitude index values had more frequent credit card usage and higher current instalment debt levels. Gan et al. (2016) investigated the relationship between credit card features and the demographic characteristics of card users in China. The survey found a significant relationship between credit card features and users' demographic characteristics. In particular, a positive relationship was found between demographic characteristics such as age, education level, income level, and credit card features. However, the survey results did not find a significant relationship between credit card features and users' gender or employment status (Gan et al., 2016).

In their research, Mansor and Che-Mat (2009) analysed the linkage between demographic attributes and the possession of Islamic credit cards. Utilizing a survey-based approach, they established a positive association. More specifically, they ascertained a direct correlation between demographic factors like age, educational attainment, and income level with the ownership of Islamic credit cards. However, there was no apparent connection between gender, employment status, and the ownership of Islamic credit cards.

Similarly, Wang et al. (2011) investigated the nexus between demographic traits, attitudes, personal dispositions, credit card features, and debt incurred in China. The survey-derived results positively correlated with demographic characteristics, attitudes, personality, and credit card features. Notably, a direct relationship was discerned between demographic factors such as age, level of education, income level, and credit card debt. This study shows that these factors have an effect on credit card debt in China.

Based on a survey conducted among credit card users, Plummer (1971) found a positive relationship between lifestyle models and commercial bank credit card usage. Specifically, individuals with higher income and education levels were found to have higher commercial bank credit card usage. Additionally, the survey results indicated a relationship between lifestyle models and commercial bank credit card usage regarding demographic characteristics like gender and employment status.

A study in Malaysia investigated factors affecting credit card spending behaviour using a survey method. The results showed that income, education, and employment status were the most critical factors affecting credit card spending behaviour. However, the survey results found no significant relationship between credit card spending behaviour and demographic characteristics such as age, gender, and family status (Teoh, Chong, & Yong, 2013).

Numerous academic studies have examined factors affecting credit card usage, including demographic factors such as age, gender, income, education, and employment status. Some research found that older individuals are more likely to use credit cards than younger ones, possibly due to increased financial freedom, income level, and creditworthiness from a regular payment history.

Some studies show that men tend to use credit cards more than women, while others indicate that women have a higher propensity to use credit cards than men. Cultural and gender roles may contribute to these differing results. Generally, individuals with higher income levels are more likely to use credit cards than those with lower incomes. This is often attributed to higher purchasing power and the natural result of using credit cards for more substantial transactions.

Another essential factor encountered in literature reviews is education level. Numerous studies have found that people with higher education levels tend to use credit cards more than those with lower education levels. This difference is often explained by increased income and financial literacy associated with higher education. The impact of gender differences on credit card usage is not universally accepted in the literature.

In conclusion, many studies in academic literature relate credit card usage to factors such as economic development and financial inclusion. However, these studies primarily focus on determining macro-level factors affecting credit card usage rather than investigating spatial relationships. There needs to research on spatial relationships related to credit card usage in the literature. The primary goal of this study is to investigate the existence of a spatial relationship in credit card spending, considering the socioeconomic factors of 922 districts in Turkey. This study aims to contribute to the literature from this perspective.

3. Methodology

In this study, the aim is to identify the indicators that have an impact on the frequency and magnitude of credit card usage. In this context, it is aimed to conduct statistical analysis at the district level in Turkey using demographic, education, health, tourism, economy, urbanization, culture, and sports statistics that are claimed to affect the frequency and magnitude of credit card usage in the literature and to visualize the data geographically.

The data used in the analysis predominantly consists of data from the Turkish Statistical Institute (TÜİK) for 2021, with other primary data providers being the Social Security Institution, Ministry of Youth and Sports, Interbank Card Center, Banks Association of Turkey, General Directorate of Mapping, Chamber of Pharmacists, Participation Banks Association, General Directorate of Security, Energy Market Regulatory Authority, Presidency of Religious Affairs, Higher Education Institution, and Ministry of National Education. Within the scope of the study, the existence of factors affecting credit card usage among districts in Turkey and the existence of a spatial relationship between these factors have been investigated taking into account the type and content of the data. The variables included in the study can be found in Table 2.

Table 2: *Variables*

Variables	Definition
lny3	The logarithm of the total number of physical payments made with credit cards
lny4	The logarithm of the total amount of physical payments made with credit cards
x2	Number of bank branches per 100,000 people
x3	Number of participation (Islamic) bank branches per 100,000 people
x5	Electricity consumption per capita
x6	Total number of discount supermarkets / Total population
x7	Number of illiterate individuals / Total population
x10	Number of doctoral graduates / Total population
x11	Average education duration for the male population
x14	Number of male bachelor's degree graduates / Total male population
x16	Number of teachers / Number of students
x18	Number of mosques / Total population
x22	Total population / Generation Y population
x26	Annual population growth rate (‰)
x31	The average age at first marriage
x33	Population density

In this study, which aims to determine the factors influencing credit card usage and the spatial effect, two models have been established where the credit card usage amount and the number of credit card transactions are the dependent variables. The other variables in Table 2 are included in the models as independent variables. The descriptive statistics of the variables can be found in Table 3.

Table 3: *Descriptive Statistics*

Variable	Number of Observations	Mean	Standard Deviation	Minimum	Maximum
lny3	969	13.146	2.063	0.000	18.567
lny4	969	18.316	2.197	0.000	23.740
x2	969	12.399	9.571	0.000	164.204
x3	969	0.471	1.246	0.000	13.689
x5	969	659.845	171.956	284.391	1333.409
x6	969	4959.055	3628.665	761.615	34956.000
x7	969	0.131	0.189	0.001	1.700
x10	969	0.014	0.055	0.000	1.345
x11	969	8.219	0.956	6.003	12.464
x14	969	0.016	0.149	0.000	4.454
x16	969	0.079	0.029	0.000	0.539
x18	969	0.003	0.003	0.000	0.026
x22	969	21.094	3.633	11.521	32.124
x26	969	-5.440	34.519	-408.835	177.670
x31	969	27.590	1.395	23.338	35.228
x33	969	772.840	3741.762	2.332	40648.170

The analyses conducted in line with the purpose of the study consist of two stages. First, the independent variables of the two models related to credit card usage were determined using the stepwise method. In the obtained models, multicollinearity tests were performed, and problematic variables were removed from the model, ultimately leading to the final models. The dependent and independent variables in the models are listed in Table 4.

Table 4: *Variables, Description*

	Dependent Variable	Independent Variable
Model 1	Number of Physical Payments Made with Total Credit Cards	• Number of Participation Banks Branches per 100,000 People • Number of Markets per Person • Illiteracy Rate • Doctoral Graduation Rate • Average Education Duration (Male) • Number of Students per Teacher • Number of Mosques per Person • Generation Y Rate • Annual Population Growth Rate (‰)
Model 2	Total Amount of Physical Payments Made with Total Credit Cards	• Number of Participation Banks Branches per 100,000 People • Residential Electricity Consumption per Person (kWh) • Number of Markets per Person • Illiteracy Rate • Average Education Duration (Male) • Bachelor's Graduation Rate for Men • Number of Students per Teacher • Number of Mosques per Person • Annual Population Growth Rate (‰)

After determining the models, the estimation process was initiated. Since the variables in the model are based on district data, the estimation processes were conducted using spatial econometric model estimators, which take spatial effects into account rather than classical econometric model estimators. Before proceeding with the spatial model estimation, data distribution maps of dependent variables have been created.

Figure 1: *Data Distribution of the Total Number of Physical Payments Made with Credit Cards*

Figure 1 presents the data distribution of the total number of physical payments made with credit cards. When examining the figure, it is evident that there is a presence of regional clustering, although it may only be uniformly applied across some areas. These clusters indicate that certain regions might exhibit similar patterns or trends in credit card usage for physical payments, highlighting the importance of considering spatial effects when analyzing the data.

Figure 1: *Data Distribution of the Total Amount of Physical Payments Made with Credit Cards*

Figure 2 displays the data distribution of the total amount of physical payments made with credit cards. As with Figure 1, regional clustering is evident, suggesting that certain regions exhibit similar patterns or trends in the total amounts of credit card usage for physical payments. From this perspective, the consistency between the two figures indicates that spatial factors influence the number and the amount of credit card transactions and should be analysed accordingly.

3.1.Spatial Econometrics

This study uses spatial econometric model estimation methods instead of classical econometric model estimation methods since the variables are district-based. Spatial econometrics is a subfield encompassing methods and models used to test spatial interactions when the units of cross-sectional data and panel data are geographic entities, such as neighbourhoods, districts, provinces, or countries(Yerdelen Tatoğlu, 2022). Spatial econometric models differ from classical econometric models in that they consider spatial effects when making estimations.

The concept of spatial effect is generally examined under two main headings: spatial dependence and spatial heterogeneity(Anselin, 1988). Spatial dependence is a phenomenon that arises when events occurring in neighbouring geographic units are not independent of each other or when their responses to sudden situations are similar. Spatial dependence manifests as positive or negative effects in neighbouring geographic units. These effects are observed in dependent, independent, or error terms. The effect is calculated with the covariance between neighbouring geographic units, and the spatial effect is interpreted based on whether the covariance value is different from zero.

Spatial heterogeneity refers to the heterogeneity of the geographic regions considered in spatial models. The presence of different clustered distributions of the variable in different geographic units is an indicator of spatial heterogeneity. Spatial econometric model estimations vary depending on whether the spatial effect is present in the dependent variable, independent variable, or error term. Models with spatial effects in the dependent variable are called spatial lag models, those with effects in the independent variable are called spatially lagged X models, and those with effects in the error term are called spatial error models.

In some models, spatial effects can be observed simultaneously in any two of the dependent variables, independent variables, or error terms. Spatial models featuring this situation are general spatial models, spatial Durbin models, and spatial Durbin error models. A general nested spatial model is one in which the spatial effect is present simultaneously in the dependent variable, independent variable, and error term. When estimating a model, spatial effects are tested, and a model estimation is conducted accordingly based on the findings.

3.2. Model Estimation And Empirical Result

In this study, the hypotheses related to credit card usage are as follows:

H_0 : There is no spatial effect on credit card usage.

H_1 : There is a spatial effect on credit card usage.

In line with the established hypothesis, spatial effects have been investigated in the models. In the second step, spatial autocorrelation in the dependent variables in the considered models has been examined. This study's main reason for conducting spatial effect tests is that the cross-sectional variables are geographic units such as districts. Therefore, estimating must consider spatial effects to provide accurate results. For this purpose, Buse Adjusted R2 values and information criteria values for possible model estimators have been calculated. The model with a high Buse Adj. R2 value and a low information criterion were selected, and the model was estimated using an estimator appropriate for the selected model. As a result of the analyses, it was found that all models are Spatial Durbin Models (SDM). The model estimation was performed according to this result.

The Spatial Durbin model is an extended version of the spatial lag model with spatially lagged explanatory variables. The general representation of the Spatial Durbin model is as follows:

$$Y = \rho WY + \alpha \iota_N + \mathbb{X}\beta + WX\theta + u$$

In the Spatial Durbin model, the spatial effect is present in the dependent and independent variables. Based on this result, the H_0 hypothesis is rejected, and it is concluded that there is a spatial effect on credit card usage models.

The Buse R^2 value and information criterion values of the first model are presented in Table 5.

Table 5: *Model 1 Information Criteria*

Information Criteria	**SAC**	**SAR**	**SEM**	**SDM**
Adjusted Buse R^2 Value	0.7851	0.7926	0.7869	0.8167*
Log-Likelihood Function	-1172.98	-1213.73*	-1174.64	-1138.74
Akaike Information Criterion	0.9307	0.8979	0.9228	0.8057*
Schwarz Information Criterion	10.087	0.9731	10.002	0.9418*
Amemiya Prediction Criterion	0.9297	0.8969	0.9219	0.8049*
Hannan-Quinn Information Criterion	0.9596	0.9258	0.9516	0.855*
Rice Information Criterion	0.9312	0.8984	0.9234	0.8075*
Shibata Information Criterion	0.9302	0.8974	0.9223	0.8041*
Craven-Wahba Generalized Cross-Validation Value	0.9309	0.8981	0.9231	0.8066*

Considering the values in the table, the highest Buse R^2 value and the lowest information criterion values are marked (refer to Table 5). We conclude that the appropriate model for the first model is the Spatial Durbin Model. According to this result, the model estimation results are presented in Table 3.

Table 6: *Model 1 Estimation Results*

Total Physical Payments Made with Credit Cards	Coefficient Value	Probability Value
Participation Bank Branches per 100,000 People	**0.10**	**0.00**
Markets per Capita	**0.00**	**0.00**
Illiteracy Rate	**3.77**	**0.00**
Doctorate Graduation Rate	**1.41**	**0.01**
Average Education Duration (Male)	**0.71**	**0.00**
Students per Teacher	**-6.93**	**0.00**
Mosques per Capita	**-123.35**	**0.00**
Generation Y Ratio	**0.12**	**0.00**
Annual Population Growth Rate (‰)	**0.00**	**0.00**
Constant Term	**6.36**	**0.00**

Upon examining the model estimation results, we observe a negative relationship between the number of students per teacher and the number of mosques per capita with the volume of physical credit card payments. Conversely, a positive relationship exists between these payments and the other variables.(refer to Table 6)

The Buse R^2 value and information criterion values for the second model can be found in Table 4.

Table 7: *Model 2 Information Criteria*

Information Criteria	SAC	SAR	SEM	SDM
Adjusted Buse R2 Value	0.7386	0.746	0.7395	0.7727*
Log-Likelihood Function	-1322.59	-1345.22*	-1322.83	-1273.28
Akaike Information Criterion	12.818	12.454	12.773	1.1293*
Schwarz Information Criterion	13.753	13.363	13.705	1.2937*
Amemiya Prediction Criterion	12.804	12.441	1.276	1.1281*
Hannan-Quinn Information Criterion	13.166	12.792	1.312	1.1893*
Rice Information Criterion	12.823	12.459	12.778	1.1311*
Shibata Information Criterion	12.813	12.448	12.768	1.1276*
Craven-Wahba Generalized Cross-Validation Value	12.821	12.456	12.776	1.1302*

According to the results in the table, the 2nd model is a Spatial Durbin Model. The model prediction results are shown in Table 5.

Table 8: *Model 2 Estimation Results*

Total Amount of Physical Payments Made with Credit Cards	Coefficient Value	Probability Value
Participation Bank Branches per 100,000 People	0.1391	0.000
Electricity Consumption per Capita	-0.0009	0.015
Markets per Capita	-0.00004	0.000
Illiteracy Rate	42.703	0.000
Average Education Duration (Male)	0.8285	0.000
Male Bachelor's Degree Graduation Rate	0.2166	0.281
Students per Teacher	-89.981	0.000
Mosques per Capita	-1.861.315	0.000
Annual Population Growth Rate (‰)	0.0063	0.000
Constant Term	99.698	0.000

Upon examining the model estimation results, we find a negative relationship between the total amount of physical payments made with credit cards and per capita electricity consumption, per capita the number of markets, students per teacher, and mosques per capita. On the other hand, a positive relationship is observed with the other variables.(refer to Table 8)

3.3. Spatial Dependence Test

One of the most used tests to examine the presence of spatial autocorrelation is the Moran I test. This test evaluates spatial autocorrelation in both variables and error terms. Generally, the Global Moran I test is used to examine spatial autocorrelation. In contrast, the Local Moran I (LISA) test is used to examine the relationship between neighbouring regions on a local level.

If the Moran I statistic is significant, i.e., H_0 is rejected, spatial autocorrelation exists. In the case of spatial autocorrelation, if the test result is significant and the z-statistic is positive, high or low values form spatial clusters. However, if the test result is significant, but the z-statistic is negative, there is no spatial clustering. The scatterplot generated with this test also provides information about neighbourhood relationships. Additionally, these relationships are visualized with the help of maps. The Local Moran I test result, calculated for each region, provides information about spatial clustering along with its neighbours. This test result evaluates spatial relationships with neighbours according to the positive and negative spatial autocorrelation. If spatial autocorrelation is positive, a region with a high value may also have neighbouring regions with high values. If a region has a low value, neighbouring regions may also have low values. However, if spatial autocorrelation is negative, a region with a high value may have neighbouring regions with low values. If a region has a low value,

neighbouring regions may have high values. These relationships are more clearly addressed with the scatterplot and map representation.

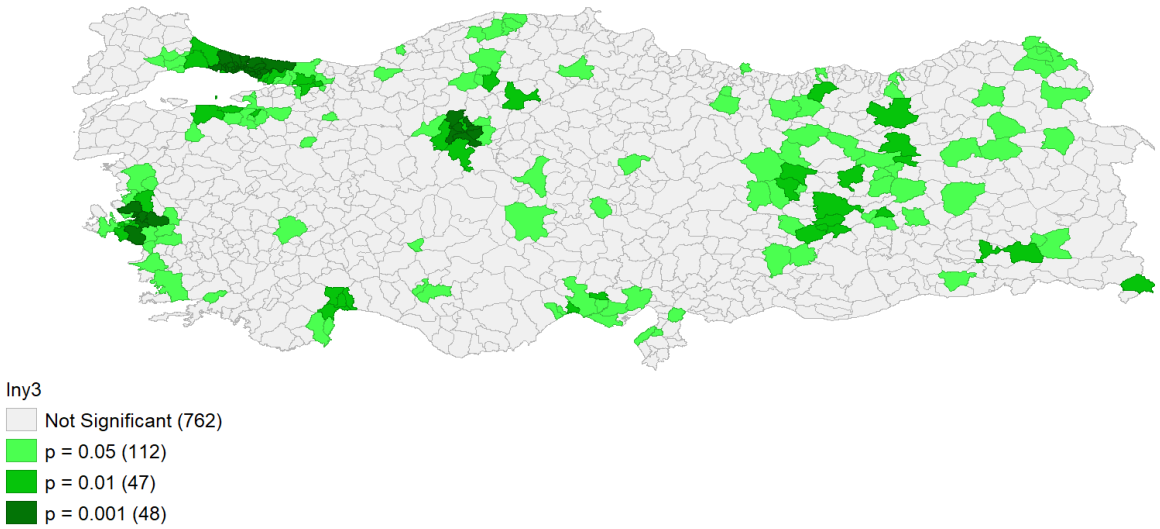
In this study, two models have been established. The regional spatial relationships of the significant variables in the models have been tested using the LISA test, and the results are displayed on a map.

Table 9: *Global Moran I Test*

Variables	I	E(I)	sd(I)	z	p-value*
Number of Physical Payments Made with Total Credit Cards	0.349	-0.001	0.020	17.349	0.000
Total Amount of Physical Payments Made with Total Credit Cards	0.357	-0.001	0.020	17.747	0.000

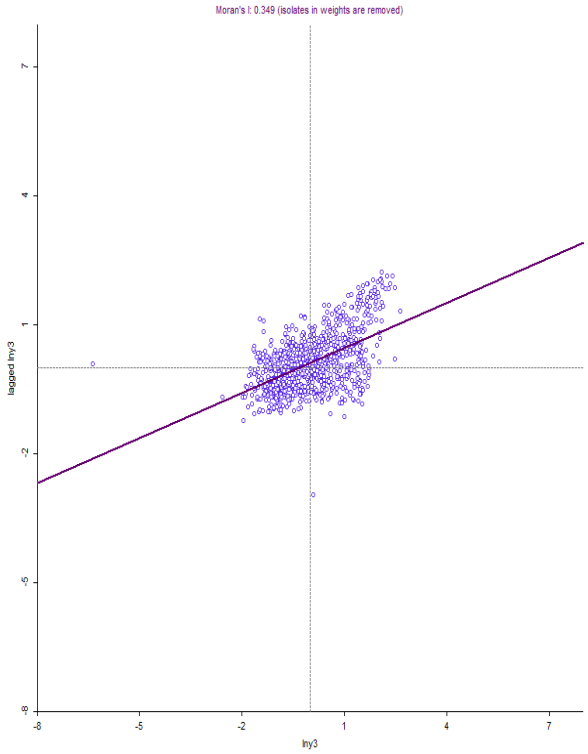
Upon examining the global Moran I statistic values of the dependent variables in the models included in the study, the null hypothesis is rejected for both variables as the probability values are less than 0.05. Based on this result, there is spatial autocorrelation in both variables. There is approximately 35% positive spatial autocorrelation for credit card usage volume and approximately 36% for credit card usage amount.(refer to Table 9) These results support the rejection of the null hypothesis (H_0) established at the beginning of the study, which is also confirmed by the Global Moran I test results. Consequently, it has been determined that there is a spatial effect on credit card usage.

Figure 3: *LISA Test Significance Results for the Total Number of Physical Payments Made with Credit Cards*



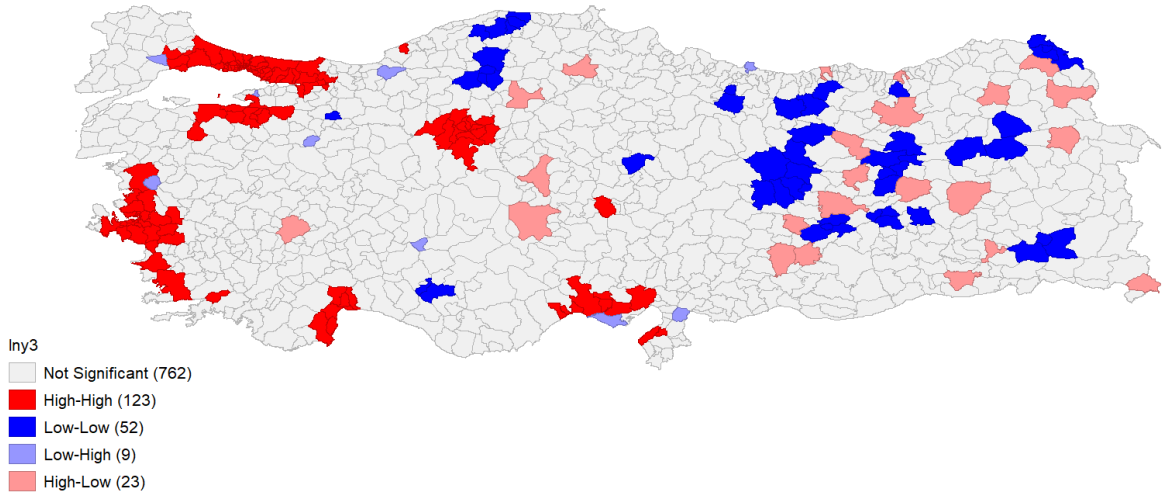
Districts with spatial clustering can be seen on the map. However, a scatterplot and map representation are required to comment on the relationship between these districts based on their neighbourhood statuses. The scatterplot and map representation of the variable are as follows:

Figure 2: *Scatter Plot of the Total Number of Physical Payments Made with Credit Cards*



Upon examining the scatterplot, it can be observed that the variable has a positive spatial autocorrelation. The map representation featuring the test results is as follows:

Figure 5: *LISA Test for the Total Number of Physical Payments Made with Credit Cards*

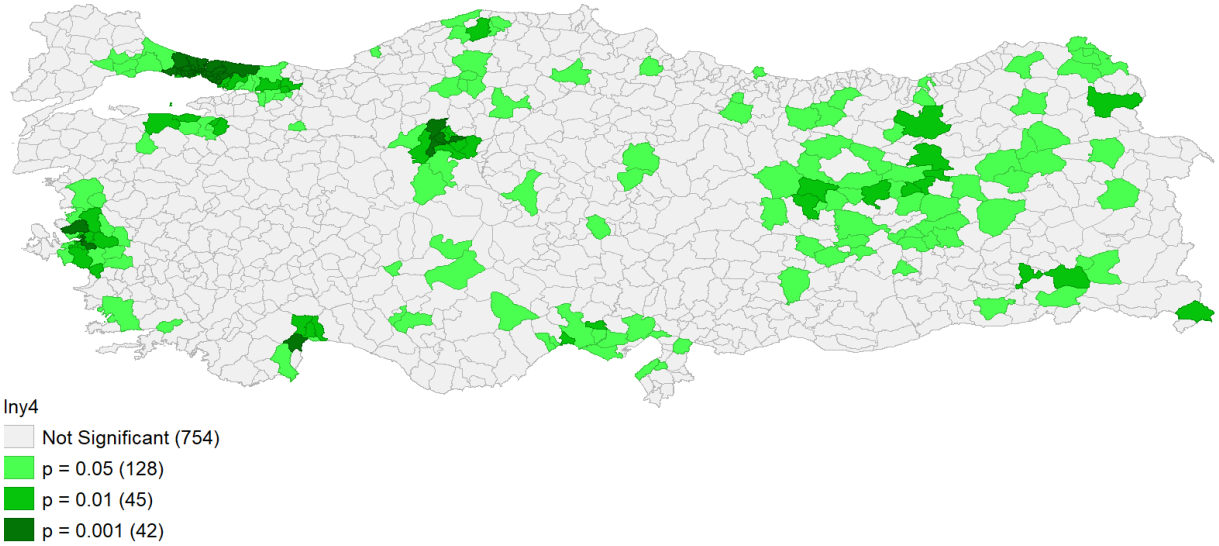


On the map, in the districts represented in red, as the total number of physical payments made with credit cards increases, the total number of physical payments made with credit cards in neighbouring districts also increases. In the districts shown in dark blue, as the number of physical payments made with credit cards decreases, the number of physical payments made with credit cards in neighbouring districts also decreases. In the districts represented by light red, as the number of physical payments

made with credit cards increases, the number of physical payments made with credit cards in neighbouring districts decreases. In the districts shown in light blue, as the number of physical payments made with credit cards decreases, the number of physical payments made with credit cards in neighbouring districts increases.(refer to Figure 5)

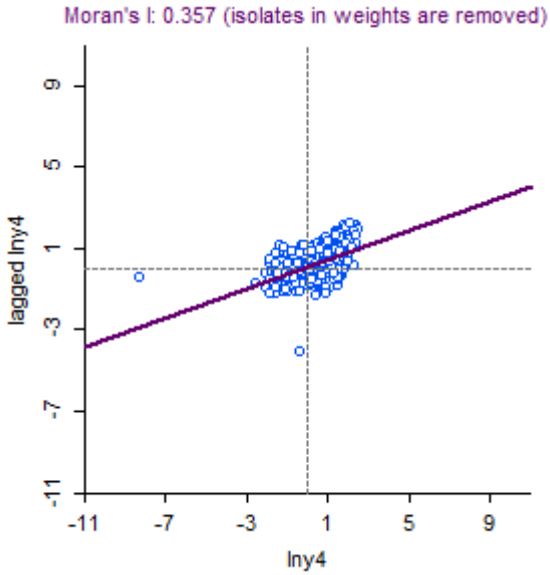
The LISA test results for the Total Amount of Physical Payments Made with Credit Cards variable are shown in Figure 6.

Figure 6: *LISA Test Significance Results for Total Amount of Physical Payments Made with Credit Cards*



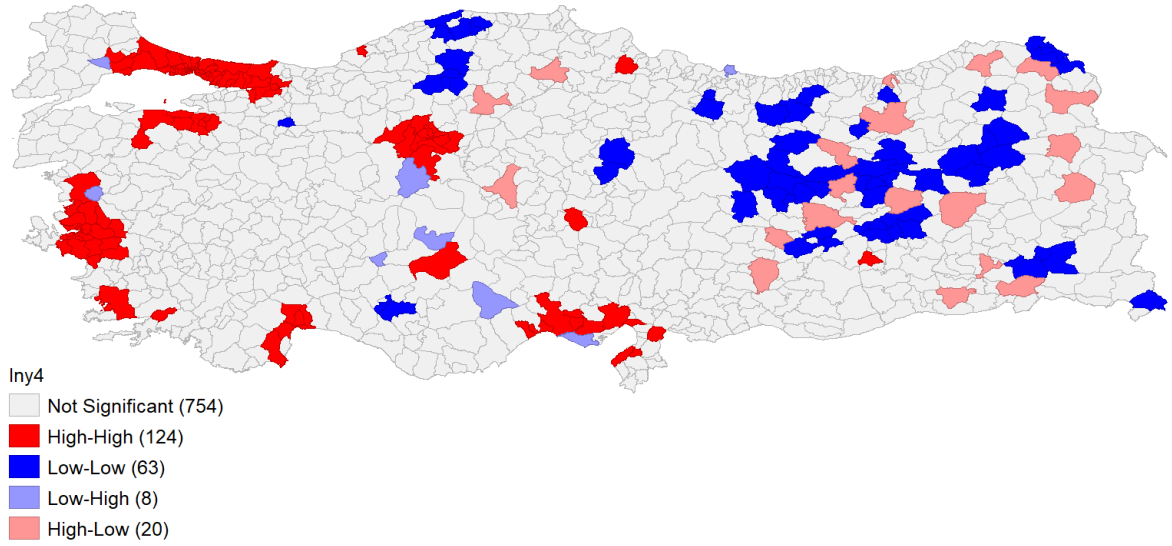
Upon examining the map, districts with significant spatial clustering can be seen. However, a scatterplot and map representation are required to comment on the relationship between these districts based on their neighbourhood statuses. The scatterplot and map representation of the variable can be seen in Figure 7.

Figure 7: *Scatterplot for the Total Amount of Physical Payments Made with Credit Cards*



Upon examining the scatterplot, it can be observed that the variable has a positive spatial autocorrelation. The map representation featuring the test results can be seen in Figure 8.

Figure 8: *LISA Test for Total Amount of Physical Payments Made with Credit Cards*



On the map, in the districts shown in red, as the total amount of physical payments made with credit cards increases, the total amount of physical payments made with credit cards in neighbouring districts also increases. In the districts shown in dark blue, as the total amount of physical payments made with credit cards decreases, the total amount of physical payments made with credit cards in neighbouring districts also decreases. In the districts shown in light red, as the total amount of physical payments made with credit cards increases, the total amount of physical payments made with credit cards in neighbouring districts decreases. In the districts shown in light blue, as the total amount of physical payments made with credit cards decreases, the total amount of physical payments made with credit cards in neighbouring districts increases.(refer to Figure 8)

4. Conclusion

This study identified factors affecting credit card usage, and model estimations was carried out using spatial estimators, leading to the results. The study's objective is to determine whether there is a spatial effect on credit card usage. In this regard, the hypothesis was tested with two models related to credit card usage. In the model determination process, the Spatial Durbin Model was identified as the model type for both models based on Buse R2 and information criterion values. In the Spatial Durbin model, there is a spatial effect in both dependent and independent variables. Accordingly, H0 was rejected, and spatial effects in credit card usage were determined.

Upon examining the analysis results, a negative relationship was found in the first model between the number of students per teacher and the number of mosques per capita and credit card usage frequency. In contrast, a positive relationship was found with the number of participation bank branches per 100,000 people, the number of markets per capita, the illiteracy rate, the doctorate graduation rate, the average male education duration, the proportion of Generation Y, and the annual population growth rate. In the second model, a negative relationship was found between per capita electricity consumption, the number of markets per capita, the number of students per teacher, and the number of mosques per capita. In contrast, a positive relationship was found between the number of participation bank branches per 100,000 people, illiteracy rate, average male education duration, male undergraduate graduation rate, and annual population growth.

Considering the significant results in the models, it was concluded that, in addition to education, the sociological and religious structure of the community also determines credit card usage. In particular, obtaining significant results related to credit card usage with the number of participating bank branches and mosques reveals that a society's religious structure affects credit card usage.

After the study's model estimation phase, spatial autocorrelation in dependent variables was tested using Global Moran I and Local Moran I test. According to the test results, it was determined that the

frequency and amount of credit card usage were spatially autocorrelated. Based on this result, an increase or decrease in credit card usage in some districts affects neighbouring districts either in the same or opposite direction.

Despite the nationwide scope of the study, it is essential to note that regional differences within Turkey may still impact the results. As such, it is essential to consider the potential influence of local economic, social, and cultural factors on credit card usage patterns. Additionally, the cross-sectional nature of the data limits the ability to draw causal inferences and understand the dynamics of credit card usage over time.

For future research, it would be valuable to conduct longitudinal studies that track changes in credit card usage patterns and investigate the causal relationships between the variables. Incorporating additional factors, such as consumer behaviour, financial literacy, and household income, could provide a more comprehensive understanding of the determinants of credit card usage. Advanced statistical and econometric techniques, including panel data analysis or structural equation modelling, could further validate and refine the results. Lastly, examining the potential moderating or mediating effects of regional and cultural factors on the relationships between credit card usage and the identified determinants would contribute to a deeper understanding of the dynamics at play in this complex phenomenon.

Author Contributions (Yazar Katkı Oranı): Arif SALDANLI (%50), Sumeyra UZUN (%50)

Ethical Responsibilities of Authors (Yazarın Etik Sorumlulukları): This study was prepared in accordance with the rules of the required ethical approval

Conflicts of Interest (Çıkar Çatışması): There is no conflict of interest with any institution related to the study.

Plagiarism Checking (İntihal Denetimi): This study has been checked for plagiarism using a plagiarism scanning programme.

REFERENCES

Altan, M., & Göktürk, İ. E. (2008). "Türkiye'de Memurların Kredi Kartı Kullanım Alışkanlıkları Üzerine Bir Araştırma". The Journal of Accounting and Finance, 39: 110–127.

Anselin, L. (1988). *Spatial Econometrics: Methods and Models*. Springer Science & Business Media.

Chien, Y. I. W., & Devaney, S. A. (2001). "The Effects of Credit Attitude and Socioeconomic Factors on Credit Card and Installment Debt". *Journal of Consumer Affairs*, 35(1): 162–179.

Demirgüç-Kunt, A., Leora K., Dorothe S. & Saniya A. (2022). *The Global Findex Database 2021: Financial Inclusion, Digital Payments, and Resilience in the Age of COVID-19*. Washington, DC: World Bank..

Forbes. (2021). When Were Credit Cards Invented: The History of Credit Cards – Forbes Advisor. https://www.forbes.com/advisor/credit-cards/history-of-credit-cards/

Gan, C. E. C., Cohen, D. A., Hu, B., Tran, M. C., Dong, W., & Wang, A. (2016). "The Relationship between Credit Card Attributes and the Demographic Characteristics of Card Users in China". *International Journal of Bank Marketing*, 34(7): 966–984.

Göv, A., & Salihoglu, E. (2020). "Türkiye'de Ekonomik Göstergeler ve Para Arzının Bireysel Kredi Kartı Kullanımına Etkileri". *The Journal of International Scientific Researches*, 5(1): 50–63.

Hayhoe, C. R., Leach, L., Turner, P. R., & Mo. (1999). "Discriminating the Number of Credit Cards Held by College Students Using Credit and Money Attitudes". *Journal of Economic Psychology*, 20(6): 643–656.

Hussain, M. Z., & Habib, K. (2020). "The Determinant of Behavioral Factors Which Influence on Credit Card Usages". *The Journal of Educational Paradigms*, 2(2): 143–145.

Karamustafa, K., & Biçkes, D. M. (2003). "Kredi Kartı Sahip ve Kullanıcılarının Kredi Kartı Kullanımlarını Değerlendirmeye Yönelik Bir Araştırma: Nevşehir Örneği". *Erciyes Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 15(1): 91–113.

Mansor, N., & Mat, A. C. (2009). "Islamic Credit Card: Are Demographic Factors a Good Indicator?". *Asian Social Science*, 5(12): 17-26

Mathews, H. L., & Slocum Jr., J. W. (1969). "Social Class and Commercial Bank Credit Card Usage". *Journal of Marketing*, 33(1): 71–78.

Norvitilis, J. M., Osberg, T. M., Young, P., Merwin, M. M., Roehling, P. V., & Kamas, M. M. (2006). "Personality Factors, Money Attitudes, Financial Knowledge, and Credit-Card Debt in College Students". *Journal of Applied Social Psychology*, 36(6): 1395–1413

Plummer, J. T. (1971). "Life Style Patterns and Commercial Bank Credit Card Usage". *Journal of Marketing*, 35(2): 35–41.

De Silva, L. G. R. V., & Patabendige, S. S. J. (2021). "Factors Impact on Consumer Credit Card Usage Behaviour: Evidence from Sri Lanka". *Sri Lanka Journal of Marketing*, 7(2): 146–168.

Sönmezler, G., Gündüz, İ. O., & Torun, M. (2019). "Türkiye'de Kredi Kartı Harcamaları ile Tüketici Güven Endeksi ve Enflasyon Arasındaki İlişki Üzerine Ampirik Bir Çalışma". *Çukurova Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 28(1): 17–29.

Teoh, W. M. Y., Chong, S. C., & Yong, S. M. (2013). "Exploring the Factors Influencing Credit Card Spending Behavior among Malaysians". *International Journal of Bank Marketing*, 31(6): 481–500.

Ulucan Özkul, F., & Tapşın, G. (2010). "Kredi Kartı Kullanımı ile Kullanılabilir Gelirin Tüketim Üzerindeki Etkisi ve Türkiye Ekonomisi Üzerine Bir Ampirik Çalışma". *Muhasebe ve Finansman Dergisi*, (47): 138–153.

Ünal, S., Düğer, Y. S., & Söylemez, C. (2015). "Ekonomi Okuryazarlığı ve Kredi Kartı Tutumunun Rasyonel Kredi Kartı Kullanımına Etkisi: Dumlupınar Üniversitesi Tavşanlı MYO Örneği". *Eskişehir Osmangazi Üniversitesi İİBF Dergisi*, 10(1): 31–52.

Uzgören, N., Ceylan, G., & Uzgören, E. (2007). "Türkiye'de Kredi Kartı Kullanımını Etkileyen Faktörleri Belirlemeye Yönelik Bir Model Çalışması". *Yönetim ve Ekonomi Dergisi*, 14(2): 247–256.

Wang, L., Lu, W., & Malhotra, N. K. (2011). "Demographics, Attitude, Personality and Credit Card Features Correlate with Credit Card Debt: A view from China". *Journal of Economic Psychology*, 32(1): 179–193.

Wickramasinghe, V., & Gurugamage, A. (2012). "Effects of Social Demographic Attributes, Knowledge About Credit Cards and Perceived Lifestyle Outcomes On Credit Card Usage". *International Journal of Consumer Studies*, 36(1): 80–89.

Yerdelen Tatoğlu, F. (2022). *Mekansal Ekonometri Stata Uygulamalı*. İstanbul: Beta Basım Yayım Dağıtım AŞ.

Yücel, S., & Çiftçi, N. (2019). "Üniversite Öğrencilerinin Kredi Kartı Kullanım Durumlarının Bazı Demografik Değişkenler Açısından İncelenmesi". *Bilecik Şeyh Edebali Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 4(1): 385–402.

Yüksel, S., Zengin, S., & Kartal, M. T. (2016). "Identifying the Macroeconomic Factors Influencing Credit Card Usage in Turkey by Using MARS Method". *China-USA Business Review*, 15(12): 611–615.