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DETERMINANTS OF NET MIGRATION TRENDS IN VAN PROVINCE, TÜRKİYE FROM 2008 TO 2022: A STATISTICAL ANALYSIS

Olgun ÖZDEMİR[1], Zafer AĞYAR[2] and Mehmet Şaban UÇARI[3]

ABSTRACT

In Türkiye's Eastern Anatolia region, Van province plays a crucial role as an important migration hub in the area. This study examines migration patterns in Van between 2008 and 2022 using a variety of statistical analyses. The study aims to identify key determinants and affecting factors of net migration patterns of Van province with statistical methods and to predict future migration trends. The data were obtained using annual population statistics, migration movements, and socio-economic and environmental indicators provided by the Turkish Statistical Institute (TURKSTAT) and other institutions. Descriptive statistics, correlation analysis, regression analysis, geographic information systems (GIS) analysis, and cluster analysis methods were used in the analysis. Multiple correlation analysis (MCA) showed population growth and out-migration as the top factors influencing Van province's net migration, while also demonstrating in-migration, cultivated agricultural areas, and arrivals to accommodation facilities had a moderate impact on net migration. The multiple linear regression (MLR) analysis found positive net migration growth is associated with population growth rate, average temperature, in-migration and annual number of visitors. However, regional employment negatively impacts net migration. The hierarchical cluster analysis (HCA) results showed similar migration trends between 2008 and 2013. Out-migration and tourism were observed to increase in 2014, 2015, 2016, and 2018. While the years 2017,

[1] Corresponding Author, Turkish Statistical Institute, Ankara, Turkiye. ORCID ID: https://orcid.org/0000-0002-8454-136X
[2] Turkish Statistical Institute, Ankara, Turkiye. ORCID ID: https://orcid.org/0009-0000-2319-2920
[3] Turkish Statistical Institute, Ankara, Turkiye. ORCID ID: https://orcid.org/0009-0004-3037-8538

2019, and 2022 exhibited climatic and agricultural similarities, the migration patterns differed in 2019 compared to the other years. This study statistically analyzes internal migration data from Van province to identify factors affecting net migration. The findings provide key insights to better understand migration trends and develop policies. The model can inform policy decisions by guiding regional planners and decision-makers on future provincial migration dynamics.

Keywords: Internal Migration, Net Migration, Van Province, Statistical Analysis, Determinants Of Migration

2008-2022 YILLARI ARASINDA VAN İLİNDEKİ NET GÖÇ EĞİLİMLERİNİ BELİRLEYEN UNSURLAR: İSTATİSTİKSEL BİR YAKLAŞIM

ÖZ

Türkiye'nin Doğu Anadolu Bölgesi'nde yer alan Van ili, yalnızca bölgenin sosyal ve ekonomik yapısı içinde değil, aynı zamanda göç hareketleri açısından da önemli bir yere sahiptir. Bu çalışma, 2008-2022 yılları arasında Van'da meydana gelen net göç eğilimlerini kapsamlı bir şekilde analiz etmeyi amaçlamakta; bu süreci etkileyen başlıca faktörleri istatistiksel yöntemler aracılığıyla ortaya koymaktadır. Araştırmanın temel amacı, Van'daki net göçü belirleyen değişkenleri tespit etmek ve bu bağlamda geleceğe yönelik öngörüler geliştirmektir. Çalışmanın veri seti, Türkiye İstatistik Kurumu (TÜİK) başta olmak üzere çeşitli kurumsal kaynaklardan elde edilen yıllık nüfus istatistikleri, göç verileri, sosyo-ekonomik göstergeler ve çevresel verilerden oluşmaktadır. Analiz sürecinde tanımlayıcı istatistiklerden, korelasyon analizlerinden, çoklu doğrusal regresyon (ÇDR) tekniklerinden, Coğrafi Bilgi Sistemleri (CBS) ile üretilen haritalardan ve hiyerarşik kümeleme analizinden yararlanılmıştır. Elde edilen korelasyon bulgularına göre, Van'daki net göç üzerinde en güçlü etkiye sahip değişkenler nüfus artış oranı ve dışa göç olarak öne çıkmaktadır. Öte yandan, içe göç, tarım arazilerinin genişliği ve turizm kapsamında Van'a gelen ziyaretçi sayısı gibi değişkenlerin net göç üzerinde daha sınırlı ancak istatistiksel olarak anlamlı etkileri olduğu görülmüştür. Çoklu doğrusal regresyon analizleri ise nüfus artışı, ortalama yıllık sıcaklık, içe göç sayısı ve turistik hareketliliğin net göç ile pozitif yönde ilişkili olduğunu göstermiştir.

Buna karşılık, istihdam seviyesindeki artışın net göç üzerinde ters yönlü bir etkisinin bulunduğu tespit edilmiştir. Hiyerarşik kümeleme analizleri, 2008-2013 döneminde Van'da benzer göç eğilimlerinin görüldüğünü ortaya koymuştur. 2014, 2015, 2016 ve 2018 yılları dışa göçte ve turizm faaliyetlerinde dikkat çekici artışların yaşandığı dönemler olarak öne çıkarken; 2017, 2019 ve 2022 yılları ise iklimsel ve tarımsal göstergeler açısından benzerlik göstermiştir. Ancak özellikle 2019 yılı, göç desenleri açısından diğer yıllardan farklılaşan bir yapı sergilemiştir. Sonuç olarak, bu araştırma Van ili özelinde iç ve dış göç hareketlerini çok boyutlu bir çerçevede ele alarak, net göç üzerinde etkili olan temel dinamikleri ortaya koymaktadır. Elde edilen veriler, daha etkin ve hedefe yönelik göç politikalarının geliştirilmesine katkı sağlamakta; ayrıca bölgesel kalkınma stratejileri bağlamında politika yapıcılar için bilimsel bir dayanak sunmaktadır.

Anahtar Kelimeler: İç Göç, Net Göç, Van İli, İstatistiksel Analiz, Göçün Belirleyicileri.

1. INTRODUCTION

Migration, the movement of people from one place to another, is an important global phenomenon influenced by economic, social, cultural, and political factors. In Türkiye, internal migration reshapes demographic structures, affects regional socio-economic development, and facilitates the exchange of human capital and resources between provinces. Analyzing internal migration data with statistical tools is crucial to understanding its causes, patterns, and effects. Reliable data and statistical methods help identify migration trends, explore variable correlations, and provide insights essential for developing regional policies and strategic services.

Migration has been widely studied in Türkiye, with research focusing on its causes, effects, and regional variations using both qualitative and statistical methods. Recent studies have increasingly analyzed migration from social, economic, cultural, and political perspectives. This study focuses on internal migration in Van province from 2008 to 2022, a region with high migrant mobility that significantly influences the socio-economic and demographic structure of Eastern Anatolia. By analyzing migration patterns and socio-economic impacts, the research aims to identify key drivers of migration and guide the development of effective strategies for Van's sustainable growth.

2. LITERATURE REVIEW

Several studies in recent years have used statistical methods to investigate the determinants of internal migration. Gnip (2023) conducted a study on the factors influencing internal migration in Croatia. The study utilized panel data regression analysis and regional data from 2000 to 2019. The results show that gross domestic product (GDP) per capita and employment levels significantly influence both incoming and outgoing regional migratory movements. Regional investment in environmental protection has a significant impact on migration patterns. Regions with significant tourist activity have higher rates of in-migration and lower rates of out-migration. Kulu and Billari (2004) discovered that when examining internal migration in Estonia, both personal and contextual factors, which may change over time, have a significant role in influencing the inclination for internal migration. In their study, Cebula (2005) employed regression analysis to investigate the influence of both economic and non-economic factors on significant migratory movements that occurred between 1999 and 2002. The findings indicated that anticipated per capita income had a favorable impact on significant internal migrations, but current per capita income had an adverse influence. Quality of life issues, such as relocating to more moderate temperatures, resort areas, and establishing settlements in western regions, also positively influenced large migrations. On the other hand, crime rates and proximity to hazardous waste sites adversely affected migration. Bunea's (2012) study on internal migration in Romania from 2004–2008 found that factors such as real GDP per capita, population size, road density, crime rate, amenity index, and previous migration ratio significantly influence internal migration. Jandová and Paleta (2015) conducted a study on the factors influencing internal migration in the Czech Republic, using time series data from 1991 to 2012. They applied the gravity model to a panel data analytic approach. Important variables identified in the study include income (pay), job vacancies per candidate, the possibility of finding a new job, and the unemployment rate, which all have an impact on internal migration. Vakulenko (2016) analyzes internal migration in Russia by employing an expanded gravity model and panel data from 1999 to 2010, focusing on movement patterns between different regions. Demographics, income in the destination location, unemployment, and housing factors heavily influence migration patterns. In their work, Xia et al. (2022) utilized spatial econometric analysis to investigate the data from the 2009-2011 era in China. The primary factors influencing internal migration are economic scale, as measured by GDP, population density, and the share of the workforce. There is an inverse relationship

between education and domestic migration. The proximity to the nearest provincial capital and prefecture-level city has contrasting impacts on internal migration.

Several studies employ statistical and quantitative methodologies to examine the factors influencing internal migration in Türkiye.

Table 1. Review of statistical analyses of ınternal migration in Türkiye

Author (s)	Period	Scope	Method	Result
Gezici and B. Keskin (2005)	1990	Provincial Level	Multiple Regression Analysis	Especially Per capita Gross National Product (TL), Industrial workforce, Annual estimated population growth, Geographic location positively affect migration. Being under martial law negatively affects migration.
Gürbüz and Karabulut (2008)	2002, 2005	Provincial Level	HCA, Pearson Correlation Analysis, Regression Analysis	Variables related to physiological population density, demographic characteristics of the population, mortality rates and economic activities are statistically significant in terms of rural migration rate.
Uysal and Aktaş (2011)	2009	Provincial Level	Ordinal Regression Analysis	The literate population and annual population growth have a positive impact on the net migration rate, while the number of tractors per ten thousand people has a negative impact.
Ercilasun et al. (2011)	2010	Provincial Level	OLS Regression	Education and health sectors development index and urbanization rate positively affect the net migration rate. The most important factor affecting internal migration decisions is the attractive power of those who have migrated to a place before.
Doğan and Kabadayı (2015)	2008-2012	Provincial Level	Panel Regression Analysis	It has been determined that the factors causing internal migration are job and high income opportunities, education, health and security.
Yüksel et al. (2016)	2008-2015	Provincial Level	Panel Logit	High divorce rate, illiteracy and suicide rate are important factors determining internal migration

Sigeze and Balli (2016)	2008-2014	NUTS-1 Level	Feasible Generalized Least Squares (FGLS)	Unemployment rate, poverty rate, number of students studying in higher education institutions, export amount per person, electricity amount per person and terror are important variables that affect internal migration.
Yayar et al. (2016)	2014	7 Geographical Regions	Multiple Regression Analysis	Population growth and literate population rate have a positive impact on net migration, while the unemployment rate has a negative impact.
Dücan (2016)	2007-2014	21 Subregions	Panel Regression Analysis	Increase in the schooling at secondary level and the increase in terrorist incidents increase migration, the increase in employment reduces migration.
Tatoğlu (2017)	2008-2014	NUTS-1 Level	Ordered Panel Logit Regression	The number of universities, the number of tractors, number of take-off and landing airplanes, and the number of marriages reduce the net migration rate. The number of movie theaters, population growth rate and number of divorces increase the net migration rate.
Albayrak and Abdioğlu (2017)	2015	Provincial Level	Principal Component Regression	As the employment rate, job satisfaction rate, average daily earnings, faculty and college graduation rate increase, net migration increases. As the unemployment rate and health care inadequacies increase, net migration decreases. The main reasons for interprovincial migration mobility are economic factors, education, health, infrastructure opportunities, population and peace of the city.
Anavatan (2017)	2015	Provincial Level	Spatial Econometric Analysis	Crime rates and agricultural field negatively affect net migration. The level of education, wealth, industry, tourism, trade positively affect net migration.
Özdemir (2018)	2008-2016	NUTS-2 Level	Panel Data Analysis	Education, the level of wealth of the regions and urbanization have a positive effect on the net migration rate. The problem of terrorism has a negative impact on the net migration rate.

İ. Çetin and S. Çetin (2018)	2008-2013	NUTS-2 Level	Panel Data Analysis	Per capita income and education services positively affect migration. The agricultural sector employment rate and inflation rate negatively affect migration.
Öndeş and Kızılgöl (2020)	2008-2017	NUTS-1 Level	Spatial Panel Data Analysis	In areas receiving In-migration; Türkiye's per capita income being higher than Türkiye's average, the diversity of cultivated agricultural areas, and increasing employment have a positive relationship on migration. Inadequate health and education services negatively affect migration.
Kıracı and Canan (2021)	2012-2013	Provincial Level	Robust Regression	The variables GDP capita and education are statistically the most important variables in affecting migration.
Aydın and Levent (2021)	2008-2018	NUTS-1 Level	Panel Data Analysis	Poverty, unemployment and education level have a positive relationship with the amount of migration in the long term.
Terzioğlu et al. (2021)	2011-2018	Provincial Level	Dynamic Spatial Panel Data Analysis	Increasing the applicability levels of social innovation and incremental innovation activities is important to eliminate the problems in the migration mobility of cities.
Arıcı (2021)	2019	Provincial Level	Linear Regression Analysis, Correlation Analysis	The effect of economic factors on the current migration of secondary migration centers remains low, and urbanization and distance between provinces are more effective in migration.
Aral and Oğuzlar (2021)	2013	Provincial Level	Spatial Data Analysis	Population density is negatively related to the net migration rate, while GDP and population growth rate are positively related, and the net migration rate of neighboring settlements also affects the net migration rate.
Elmalı et al. (2021)	2008-2017	Provincial Level	Spatial Panel Data Analysis	The change in the labour force, infant mortality rate and the number of students in a province have an impact on net migration.

Recepoğlu and Değer (2021)	2008-2013	Provincial Level	Panel Data Gravity Model Analysis	Distance between the provinces, population, real GDP, ratio of graduates from high school or equivalents, amount of SO2 and number of convicts in penal institutions are the determinants of internal migration in underdeveloped provinces of Türkiye.
Manavgat and Demirci (2022)	2011, 2015, 2020	NUTS-3 Level	Entropy-Based MAIRCA Method, Spatial Data Analysis	GDP per capita, wastewater services, number of automobiles, number of hospital beds, animal and plant production values per capita are most important factors affecting the cities to be centers of attraction for migration.
Tatlı and Tatoğlu (2022)	2014	NUTS-3 Level	Spatial Econometric Analysis	The marriage rate, the number of births in the provinces, the amount of honey produced, the number of college and vocational school graduates, the number of universities affect Inmigration positively, while the divorce rate affects it negatively.
Recepoğlu and Değer (2022)	2008-2013	Provincial Level	Panel Data Gravity Model Analysis	Distance between provinces, population, real GDP, unemployment rate, graduate rate from high schools or equivalents, amount of SO2 and number of prisoners in penal institutions were found to be important variables determining internal migration.
Ulucan (2022)	2008-2019	Provincial Level	Panel Data Analysis	General population growth, the young population rate of the cities and the high school graduate population affect migration positively, while the rate of university graduates affects negatively. Income decreases are push-factors, but income increases are not pull-factors in migration.
Aksoy and Yıldırım (2023)	2009-2018	Provincial Level	Hierarchical Dirichlet-Multinomial Regression model, Bayesian estimation method	Population, economic prosperity, the spatial and political distance between the origin and destination, the strength of the AKP (Justice and Development Party) in a province, and the network characteristics of the provinces are important predictors of migration.

İ. S. Özer and Türk (2023)	2012-2021	Provincial Level	Multilevel Modelling for Panel Data	The level of human capital, number of convicts, unemployment rate, farmland ratio, Gini index (for highly educated migrants) play a significant role in the decision-making process of migrants. Socioeconomic and accessibility-related factors are the main driver of internal migration.
Atalay and Akan (2023)	2008-2019	Provincial Level	Spatial Econometric Analysis	There is spatial dependence for net migration rate and GDP variables. Net migration rate is not only related to the characteristics of a settlement, but is also affected by the net migration rate of neighboring settlements.
Tekgün (2023)	2022	Provincial Level	Spatial Econometric Analysis	Population growth rate, net migration and population density are positively related to net migration rate, while the number of job vacancies is negatively related.

Table 1 analysis reveals that most research takes place at the provincial level. Furthermore, these investigations commonly employ spatial data analysis and panel regression methods. Studies indicate that characteristics such as the unemployment rate, population growth, education services, and GDP per capita are the primary determinants that influence net migration.

There exists a vast body of literature regarding internal migration in Türkiye. This body of literature encompasses research on the underlying factors and outcomes of migration, the characteristics of migrants, the influence of migrants on regional economies, and the societal ramifications of migration. While the number of studies specifically undertaken for Van province is low, research conducted for other areas in Türkiye provides a broader understanding of migration patterns in Van province. Several studies have been undertaken in the literature regarding migration patterns in various areas of Türkiye. Furthermore, numerous studies have been conducted that employ statistical approaches to assess internal migration statistics for a particular province in Türkiye. Üçdoğruk (2002) examined the patterns of internal migration in Izmir by employing a multivariate logit model based on survey data from 2002. The study revealed that age and education are the primary determinants of migration. According to reports, the likelihood of migration reduces as people get older, and the prolonged inability to

secure employment in the new location has a particularly detrimental effect on individuals with lower levels of education. Pazarlıoğlu (2007) conducted a study on the determinants of internal migration in Izmir. The study was based on a probit model and used survey data from 2002. The probit model was used to assess the impact of variables such as age, education level, sector of work, and distance to the location of movement on internal migration. The analysis concludes that the primary determinants influencing internal migration are age, education level, distance to the destination, and employment in the manufacturing or service sector. Aşkın et al. (2013) conducted an analysis on the socioeconomic attributes of migrants from the Yeşilyurt district and the factors that influenced their decisions to migrate using a probit regression model. The analysis found the following factors to be statistically significant: age, the number of children studying outside, satisfaction with health services, the number of expatriate workers in the family, the fragmentation of land by inheritance, problems in product marketing, the safety of the region, the belief that development projects will prevent migration, and the number of relatives who have migrated. Akarca and Tansel (2018) examined the patterns of internal migration to the provinces of Muğla and Antalya in 1995 and 2000 using the gravity model. The investigation revealed that factors such as the relative unemployment rate, past migration amount, population, and natural catastrophes have a positive effect on internal migration, while distance has a negative effect. H. İ. Keskin (2019) examined the phenomenon of internal migration to Istanbul by employing the gravity model. According to his research, population growth and significant migration rates in the past have contributed to a rise in the number of migrants, whereas greater distances discourage internal movement. Furthermore, studies suggest that relative unemployment has positively influenced internal migration towards Istanbul, although this effect is not statistically significant.

The research on internal migration in Van province includes studies conducted by Deniz (2009), Deniz and Etlan (2009), Zırhlıoğlu (2010), M. Yılmaz (2012), Tümtaş and Ergun (2014), Elmastaş and S. Yılmaz (2015), Alaeddinoğlu et al. (2016), Sancar et al. (2021), V. Yılmaz and Gerçeker (2023), Yüzbaşı and Görür (2023).

Migration has a significant impact on the province of Van in Türkiye. This study seeks to provide a thorough analysis of the factors that drive migration and the outcomes it produces. It does so by examining the migration phenomenon in Van from a statistical standpoint. The objective is to gain insights into the socioeconomic and environmental dynamics of Van province and offer guidance for future policy-making.

The study utilized various methods, including descriptive statistics, correlation and regression analysis, geographical information systems (GIS) analysis, and cluster analysis. The data used in the study was obtained from the Address-Based Population Registration System results, which are released annually by the TURKSTAT, covering the period from 2008 to 2022. The results acquired from the analyses were examined, and conclusions and assessments were made.

2. METHODOLOGY

2.1. Data Collection and Preparation

In the study, migration data from 2008 to 2022 were collected for Van province. We gathered migration statistics from pertinent official entities, statistical reports, and other sources. The data contains demographic information, including the population of individuals who have migrated by province, the provinces to which they have migrated, and their age, gender, and educational level. Additionally, it includes migration-related statistics, such as the cause of movement and the migration effectiveness. The dataset also encompasses diverse socio-economic and environmental statistics, such as labor force data, tourism data, and district-specific demographic and migration data. Therefore, it enables the examination of various aspects of interprovincial migration.

2.2. Descriptive Analysis

We used the descriptive analysis method to reveal the overall pattern of the migration data. In this context, the population and migration movements of Van province by year, migration exchange with neighboring provinces, and provinces to and from which Van province receives and sends most migration in Türkiye are analyzed.

2.3. Correlation Analysis

Migration results from the interaction of various social, economic, and environmental factors, and understanding these dynamics requires careful analysis. We used MCA to examine the nature and strength of the relationships between variables that influence net migration, such as economic, social, and environmental data. Net migration, defined as the difference between arrivals and departures in a region, has a significant impact on population size, labor

markets, economies, and cultural diversity. Positive net migration promotes population growth, labor market expansion, and cultural diversity, while negative net migration leads to population decline, economic challenges, and reduced cultural diversity. By analyzing publicly available data from 2008 to 2022, we have identified key correlations that provide insights into the factors shaping migration trends and their interrelationships.

2.4. Regression Analysis

As a mathematical model, regression analysis examines the relationship between dependent and independent variables and aims to model the effect of one or more independent variables on a dependent variable. In this study, the dependent variable is the net migration rate, while the independent variables include socioeconomic indicators (such as literacy rate, average duration of education, regional employment rate, etc.), tourism variables (such as the number of arrivals to tourism facilities, etc.), and environmental factors (such as average temperature). We conducted an analysis using a regression model to determine the impact of these independent variables on net migration. The objective was to uncover the elements that influence migration and acquire insights into the underlying reasons for migration.

2.5. GIS Analysis

We used GIS analysis to understand migration's spatial dispersion and geographic trends. The use of GIS analysis allowed for the examination of migratory movements, the identification of regions with high migration intensity, and the exploration of the relationship between migration and geographical parameters through the use of maps and spatial analysis. Therefore, it was feasible to obtain a perception of the geographical extent of migration.

2.6. Cluster Analysis

Cluster analysis is a statistical technique used to group observations with similar characteristics, such as population, migration, and education, to identify patterns within a dataset. HCA, a common method, organizes data into a tree-like structure called a dendrogram, where nodes represent individual data points and the distances between them indicate their similarity. This approach helps to identify inherent groups by minimizing the distance between clustered points. Applying HCA to migration data by year for a province provides insights into

year-to-year similarities, which helps to understand internal migration patterns and develop effective migration policies. In this study, we used the Euclidean distance metric and Ward's clustering method to perform the analysis, selecting a threshold point on the dendrogram to define the clusters.

3. RESULTS

3.1 Descriptive Findings

This section provides a descriptive analysis of population movements and internal migration trends in Van province in recent years. The analyzed data includes the yearly population data and population growth rates of Van province, statistics on internal migration, and the distribution of migrations to and from Van at the provincial level.

Table 2. Population and population growth rate in Van (2008-2022)

Years	Population	Population Growth Rate (per thousand)	In-Migration	Out-Migration	Net Migration	Net Migration Rate
2008	1004369	24,9	21187	30275	-9088	-9,01
2009	1022310	17,71	22866	27175	-4309	-4,21
2010	1035418	12,74	23231	31312	-8081	-7,77
2011	1022532	-12,52	23415	72273	-48858	-46,67
2012	1051975	28,39	50003	46639	3364	3,2
2013	1070113	17,09	32118	38507	-6389	-5,95
2014	1085542	14,32	27587	44435	-16848	-15,4
2015	1096397	9,95	30492	48061	-17569	-15,9
2016	1100190	3,45	28902	49035	-20133	-18,13
2017	1106891	6,07	31971	48269	-16298	-14,62
2018	1123784	15,15	34691	44954	-10263	-9,09
2019	1136757	11,48	34372	39575	-5203	-4,57
2020	1149342	11,01	26621	38114	-11493	-9,95
2021	1141015	-7,27	30318	58185	-27867	-24,13
2022	1128749	-10,81	33903	62422	-28519	-24,95

According to Table 2, the population of Van province experienced consistent growth from 2008 to 2022. Nevertheless, the population declined in the years 2011, 2021, and 2022. In 2012, the population growth rate peaked at 28.39%, with the lowest increases recorded in 2011 and 2022. Van experiences substantial inflows of internal migration annually while simultaneously witnessing huge outflows of out-migration. After analyzing net migration rates,

it becomes clear that the province generally experiences a migration deficit. The years 2011, 2021, and 2022 are notable for having negative net migration figures. Although there has been a rise in the number of individuals moving to Van, the even faster increase in the number of persons departing from Van has a detrimental effect on net migration.

Table 3. Comparative Migration Data of Van with TRB2 Provinces (2008-2022)

		In-Migration	**Out-Migration**	**Net Migration Rate**
2008	Van	21187	30275	-9,01
	Bitlis	11721	20957	-27,86
	Muş	10058	25896	-38,42
	Hakkâri	7801	6981	3,18
2009	Van	22866	27175	-4,21
	Bitlis	11594	16485	-14,78
	Muş	10158	20182	-24,48
	Hakkâri	4314	7949	-14,06
2010	Van	23231	31312	-7,77
	Bitlis	10800	15347	-13,74
	Muş	11782	17841	-14,78
	Hakkâri	6013	9225	-12,7
2011	Van	23415	72273	-46,67
	Bitlis	11419	16610	-15,3
	Muş	12895	18663	-13,81
	Hakkâri	8775	9133	-1,31
2012	Van	50003	46639	3,2
	Bitlis	10998	16886	-17,31
	Muş	9914	20646	-25,64
	Hakkâri	5622	10137	-16
2013	Van	32118	38507	-5,95
	Bitlis	11314	16174	-14,31
	Muş	11070	20193	-21,87
	Hakkâri	8007	10293	-8,34
2014	Van	27587	44435	-15,4
	Bitlis	11447	17470	-17,66
	Muş	12077	22688	-25,48
	Hakkâri	7187	10897	-13,34
2015	Van	30492	48061	-15,9
	Bitlis	11936	18801	-19,96
	Muş	12752	23855	-26,8
	Hakkâri	8216	12983	-16,95
2016	Van	28902	49035	-18,13
	Bitlis	12571	18074	-16
	Muş	11309	21683	-25,2
	Hakkâri	5945	16067	-37,09

2017	Van	31971	48269	-14,62
	Bitlis	12989	19097	-17,73
	Muş	13094	22243	-22,36
	Hakkâri	9997	10380	-1,39
2018	Van	34691	44954	-9,09
	Bitlis	17602	17398	0,58
	Muş	15742	20789	-12,29
	Hakkâri	12756	10156	9,12
2019	Van	34372	39575	-4,57
	Bitlis	12385	19050	-18,96
	Muş	13396	20063	-16,18
	Hakkâri	6898	12719	-20,5
2020	Van	26621	38114	-9,95
	Bitlis	12050	14223	-6,17
	Muş	11720	16548	-11,68
	Hakkâri	7227	8421	-4,25
2021	Van	30318	58185	-24,13
	Bitlis	14158	18814	-13,13
	Muş	12190	24243	-29,31
	Hakkâri	7886	13088	-18,52
2022	Van	33903	62422	-24,95
	Bitlis	15111	19885	-13,4
	Muş	13847	24941	-27,41
	Hakkâri	9783	13928	-14,94

Table 3 presents a comparative analysis of migration data for Van province and its adjacent provinces, namely Bitlis, Muş, and Hakkâri, from 2008 to 2022. Every year, all provinces both receive and send immigrants. Nevertheless, the provinces of Van, Bitlis, and Muş consistently exhibit a deficit in net migration rates. The net migration rates of Hakkâri province exhibit a greater equilibrium in comparison to other provinces. In recent years, there has been a noticeable increase in the negative net migration rates of Van, Bitlis, and Muş. The years 2021 and 2022 have been the most challenging periods in terms of net migration for the provinces within the region.

Table 4. Ten Provinces from Which Van Receives the Most Migration, and the Migration Amounts (2008-2022)

Provinces	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
İstanbul	4349	5271	4936	4490	9752	6122	5387	5485	4775	5980	7271	6594	5707	5323	5827	87269
Hakkâri	1278	1869	2119	2378	2349	2756	2834	3427	5452	3310	3167	3113	2112	2767	2945	41876
Ankara	1291	1089	1440	1388	4438	2091	1845	1545	1433	1876	2108	2097	1865	1762	1875	28143
İzmir	754	897	910	950	2560	1275	974	985	901	1155	1070	1157	1030	1030	1265	16913
Antalya	909	725	711	756	2620	1277	917	887	850	1083	1333	1071	1007	1025	1238	16409
Ağrı	1107	1126	849	1107	1277	1133	959	1011	887	1028	1005	1313	737	1052	1160	15751
Bitlis	1438	1083	888	721	820	876	848	819	739	845	734	956	683	855	978	13283
Mersin	681	754	721	673	1694	1256	874	918	681	905	962	776	654	622	787	12958
Bursa	397	514	491	439	2477	846	652	692	663	776	998	903	704	765	789	12106
Diyarbakır	342	708	572	525	1167	756	661	701	719	701	769	724	410	912	829	10496

Table 5. Ten Provinces with the Highest Number of Migrants from Van and Migration Amounts (2008-2022)

Provinces	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
İstanbul	9383	7927	8711	18719	13754	11930	13005	13155	12908	12505	10139	9833	9106	11982	12206	175263
Ankara	1736	1874	2303	7246	3091	2632	2618	3246	3234	2779	2797	2419	2395	3429	3805	45604
Antalya	1305	1056	1351	3878	2861	1867	2467	2502	2118	2172	1886	1873	1765	2725	2793	32619
Bursa	1139	891	1138	4126	1787	1325	1910	2087	2184	2216	1788	1446	1703	2634	3083	29457
İzmir	1171	1104	1257	3699	1756	1250	1361	1894	1928	1865	1731	1600	1531	2624	2737	27508
Tekirdağ	1004	583	594	1645	1081	906	1225	1507	2032	1871	1650	1069	1528	3484	4390	24569
Kocaeli	880	752	594	2497	1105	955	1463	1753	2159	2060	1679	1199	1545	2212	3096	23949
Hakkâri	885	683	872	1166	1227	1305	1328	1218	1326	2223	1783	1460	1635	1419	1910	20440
Mersin	763	810	940	2194	1893	1171	1255	1093	1205	1017	1002	1141	1026	1400	1605	18515
Muğla	687	360	479	866	817	737	926	987	1014	1132	1039	939	984	1921	1950	14838

Tables 4 and 5 show the provincial breakdown of migration to and from Van between 2008 and 2022. When considering both tables collectively, Istanbul, Hakkâri, and Ankara are the provinces that contribute the most migration to Van, while Istanbul, Ankara, and Antalya are the provinces that receive the most migration from Van. In terms of both in-migration and out-migration, Istanbul is a prominent province. This demonstrates the significant population movement between Van and Istanbul. Hakkâri and Ağrı, located in the east, are two provinces that contribute significantly to the migration flow towards Van. Reciprocal migration between Van and neighboring provinces can be attributed to geographical proximity and the resulting

high level of interaction due to cultural and social similarities. Additionally, the close ties between the provinces in the region, stemming from job opportunities and family connections, also contribute to these migration patterns. When examining the level of out-migration, it becomes apparent that the western provinces, such as Istanbul, Ankara, and Antalya, are leading in this regard.

3.2 MCA

Net migration plays a crucial role in the economic and social progress of a nation. Hence it is imperative to comprehend the determinants that impact net migration in order to devise more efficient net migration policies. We employed MCA, a statistical technique that assesses the association between two or more variables, to investigate these components and determine their respective levels of influence.

The objective of this study was to determine the factors that impact net migration (NET_MIG) in Van province. To achieve this, we conducted a MCA to investigate the relationship between net migration and various variables that may influence it. Variables other than YEAR in Table 6 were used. After the data of the variables were standardized, MCA was applied. The corrplot R package was used to create the correlation matrix between variables.

Table 6. Abbreviations for the variables used in the study

Variable	**Abbreviation**
Year	YEAR
Population	POP
Population Growth Rate (Per Thousand)	POP_Growth
In-migration	IM
Out-migration	OM
Net Migration	NET_MIG
Net Migration Rate	NET_RATE
Population Density	DENS
Literacy Rate	LIT_RATE
Average Temperature	AVG_TEMP
Cultivated Agricultural Area (hectares)	AGRI_AREA
Particulate Matter (PM_{10}) Concentration (μg/m3)	PM_{10}
Regional Employment Rate (15+,%))	RER
Number of Guest Arrivals to Accommodation Facilities	ARRIVALS
Annual Foreign Visitor Entry Numbers at Van Province Border Gates	ANN_VIS_NUM
Average Education Duration	EDUC_DUR

Table 7. Correlations Between the Variables Used in the Study

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
POP	1														
POP_GROWTH	-,352	1													
IM	,341	,216	1												
OM	,275	-,811	,218	1											
NET_MIG	-,075	,900	,346	-,840	1										
NET_RATE	-,022	,878	,367	-,826	,998	1									
DENS	,993	-,314	,356	,244	-,037	,014	1								
LIT_RATE	,889	-,461	,496	,532	-,236	-,193	,880	1							
AVG_TEMP	,495	,003	,081	-,153	,192	,227	,496	,321	1						
AGRI_AREA	,290	-,533	,407	,698	-,445	-,410	,251	,494	,126	1					
PM_{10}	-,853	,409	-,499	-,555	,256	,217	-,841	-,954	-,151	-,437	1				
RER	,184	-,227	,509	,586	-,280	-,277	,159	,544	-,310	,531	-,618	1			
ARRIVALS	,356	-,488	,078	,376	-,318	-,289	,283	,318	,137	,369	-,335	,214	1		
ANN_VIS_NUM	,540	-,348	,310	,326	-,141	-,112	,478	,532	,131	,272	-,553	,371	,883	1	
EDUC_DUR	,956	-,543	,373	,489	-,263	-,212	,943	,925	,453	,473	-,852	,262	,420	,564	1

Correlation analysis reveals complex dynamics in the migration patterns of Van province. The strongest correlations with NET_MIG are observed with NET_RATE (0.998), POP_GROWTH (0.900), and a strong negative correlation with OM (-0.840). This indicates that net migration is mainly influenced by population growth dynamics and out-migration patterns. The moderate positive correlation with IM (0.346) suggests that in-migration has a notable but smaller impact on net migration. These relationships show that Van's migration patterns are fundamentally shaped by population dynamics and out-migration flows.

When examining the relationships with other variables, NET_MIG shows negative correlations with AGRI_AREA (-0.445), RER (-0.280), and EDUC_DUR (-0.263), indicating that increases in agricultural area, regional employment, and education duration are associated with decreases in net migration. Tourism indicators also show negative correlations with NET_MIG, as evidenced by ARRIVALS (-0.318) and ANN_VIS_NUM (-0.141). The strong positive correlation between population-related variables, with DENS having a very high correlation with POP (0.993) and EDUC_DUR having strong correlations with both POP (0.956) and DENS (0.943), suggests that urbanization and educational development are closely linked in the region's development patterns.

Regression analysis can provide a more detailed study of the findings obtained in MCA. We can employ regression analysis as a statistical method to determine the extent and

significance of various factors' influence on net migration. This information is a crucial resource for formulating net migration policies.

3.3 MLR Analysis

Regression analysis is a statistical technique employed to quantify the impact of one or more independent variables on a dependent variable.

Strategically located in Eastern Anatolia, the province of Van is important because of its border location and the coexistence of resident and migrant populations. Understanding the socio-economic, environmental, and demographic factors influencing population movements in Van is essential to determine whether the province is attracting or losing migrants. Key determinants such as economic opportunities, environmental conditions, and the quality of services such as education play a crucial role in shaping net migration patterns. To analyze these dynamics, this study used MLR analysis to identify the independent variables affecting net migration and to assess their relative importance. The model aims to provide insights into future migration trends and help policymakers develop effective strategies by quantifying the impact of each variable and assessing its contribution to net migration. Sharing the results with regional planners and decision-makers can enhance policy effectiveness and support informed decision-making.

The MCA findings in Table 7 indicate a strong correlation (0,993) between the variables population (POP) and population density (DENS). The population density variable is excluded from the regression analysis due to its variability, which can be accounted for by the population variable. The variable net migration rate (NET_RATE) is omitted from the MLR analysis due to its high correlation (0,998) with the variable net migration (NET_MIG), as these two variables have nearly identical meanings. The variables ARRIVALS and ANN_VIS_NUM, which exhibit a strong correlation of 0,883, both measure the number of visitors to a region. Therefore, we included only the variable ANN_VIS_NUM, which represents the number of foreign visitors, in the regression analysis. The variable representing the year (YEAR), which has the potential to impact other variables and acts as a measure of the time variable, is also excluded from the model. Omitting these variables effectively mitigated overfitting of the regression model, resulting in a successful and accurate explanation of the data.

MLR analysis was applied using the lm (linear model) function in R. The results of MLR analysis for standardized variable values are presented in Table 8 and Table 9. In the MLR experiments performed with other variables included in the model, the best adjusted R^2 value was obtained in the model applied with 5 variables in Table 8. This resulted in a model with a lower standard error and p-value, a higher F-statistic, a more optimal Durbin-Watson test value, and overall greater effectiveness and efficiency.

Table 8. Coefficient values of MLR model

Variable	Coefficient	Standard Error	t-value	P-value	VIF
(Intercept)	$-4{,}115 \times 10^{-17}$	0,0996	0,000	1,000	
POP_GROWTH	0,854	0,126	6,766	$8{,}21 \times 10^{-5}$	1,497
RER	-0,239	0,149	-1,606	0,143	2,087
AVG_TEMP	0,075	0,118	0,635	0,541	1,312
IM	0,226	0,143	1,579	0,149	1,927
ANN_VIS_NUM	0,165	0,124	1,331	0,216	1,445

Table 9. Model summary (OLS)

R	R^2	Adjusted R^2	Standard Error	F-statistic	p-value	D-Watson (d)
0,951	0,904	0,851	0,386	17,01	$2{,}376 \times 10^{-4}$	2,253

Table 8 shows that the majority of the variance inflation factor (VIF) values are below 5, which does not indicate the presence of multicollinearity.

Model: NET_MIG = 0,854*POP_GROWTH - 0,239*RER + 0,075*AVG_TEMP + 0,226* IM + 0,165*ANN_VIS_NUM

The aforementioned model demonstrates that the increase in net migration is linked to the population growth rate, average temperature, in-migration, and annual number of visitors, while the decline in net migration is linked to the employment rate.

3.4 Results of GIS Analysis

We used ArcGIS GIS software to analyze the migration patterns in Van province from 2008 to 2022. This analysis uncovered the geographic distribution of both incoming and outgoing migration in the province. The GIS data not only displays Van's migration flow map, but also indicates regional variations. In 2008, the province of Van saw an influx of migrants

from two major cities, Istanbul and Ankara, as well as from adjacent provinces. Furthermore, Van experienced an influx of migrants from coastal provinces in the Mediterranean region, including Antalya, Muğla, Mersin, and Adana (Figure 1).

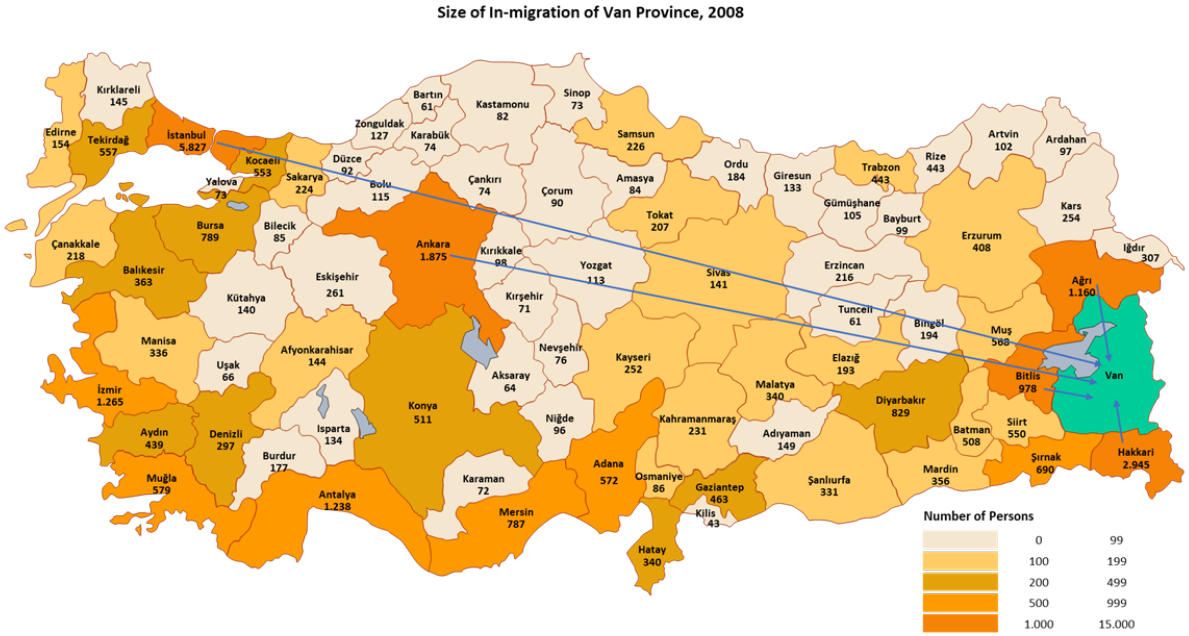

Figure 1. Size of In-migration of Van province in 2008

In 2022, the province of Van experiences an influx of migrants from major cities, adjacent provinces, and coastal provinces in the Mediterranean region.

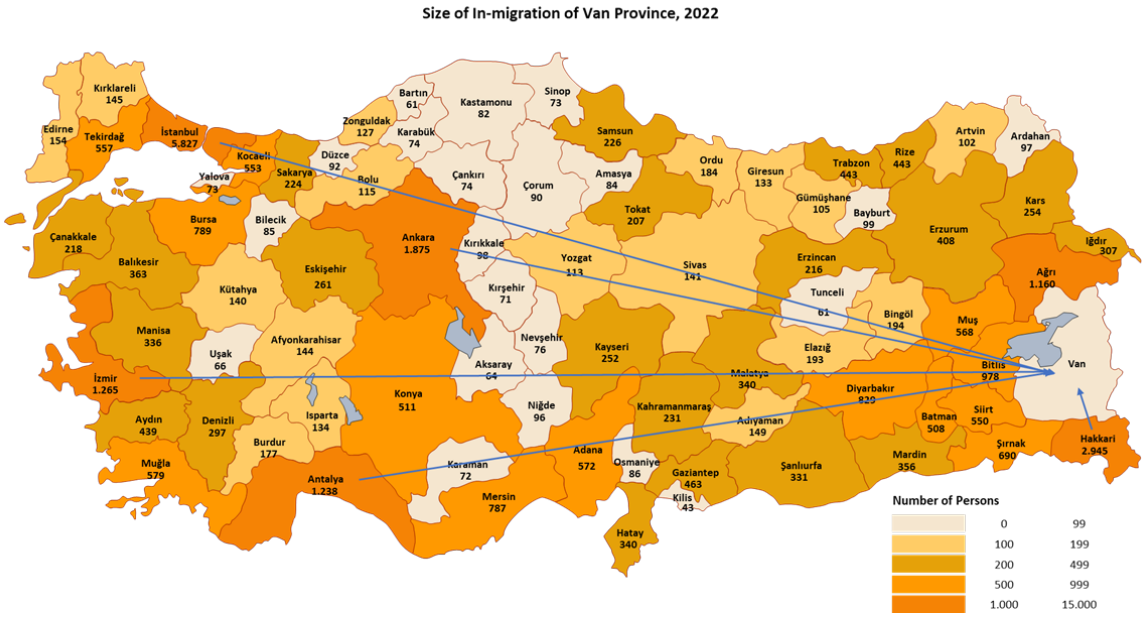

Figure 2. Size of In-migration of Van province in 2022

When examining the provinces to which Van province migrated in 2008, it becomes evident that Van province migrated to major cities like Istanbul and Ankara, as well as coastal provinces in the Marmara, Aegean, and Mediterranean areas (Figure 2).

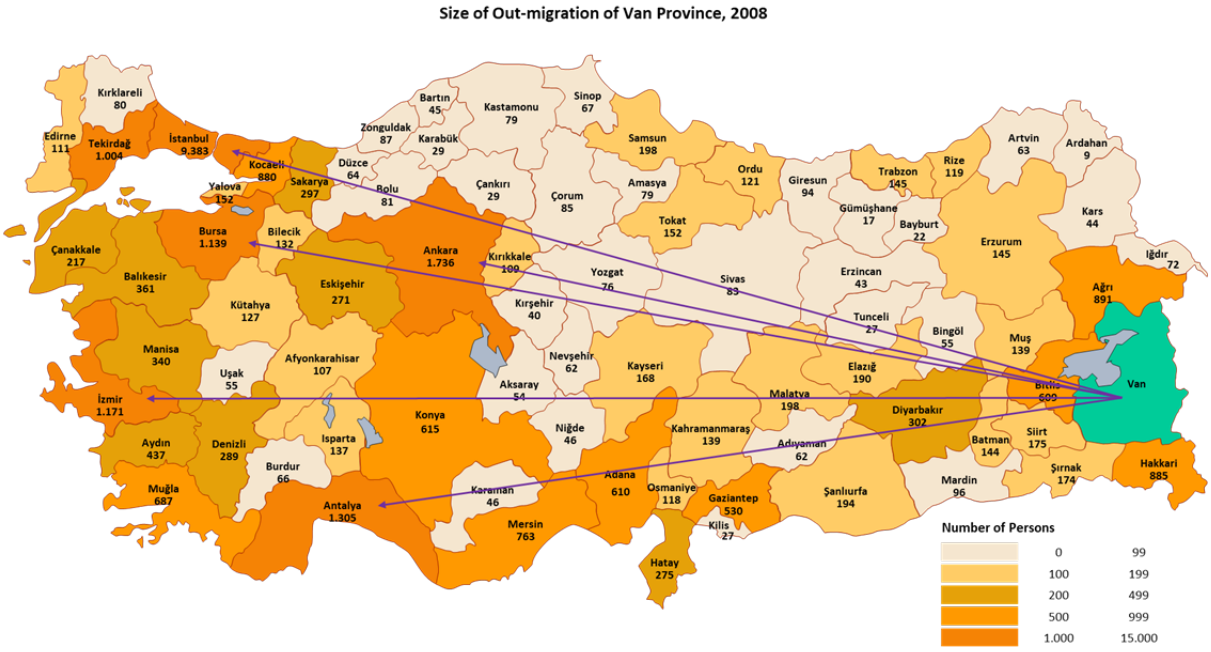

Figure 3. Size of Out-migration of Van province in 2008

In 2022, there was a significant migration from Van province to the coastal provinces in the Marmara, Aegean, and Mediterranean areas, as well as the adjacent provinces. Specifically, there was a notable amount of migration from Van province to Tekirdağ province.

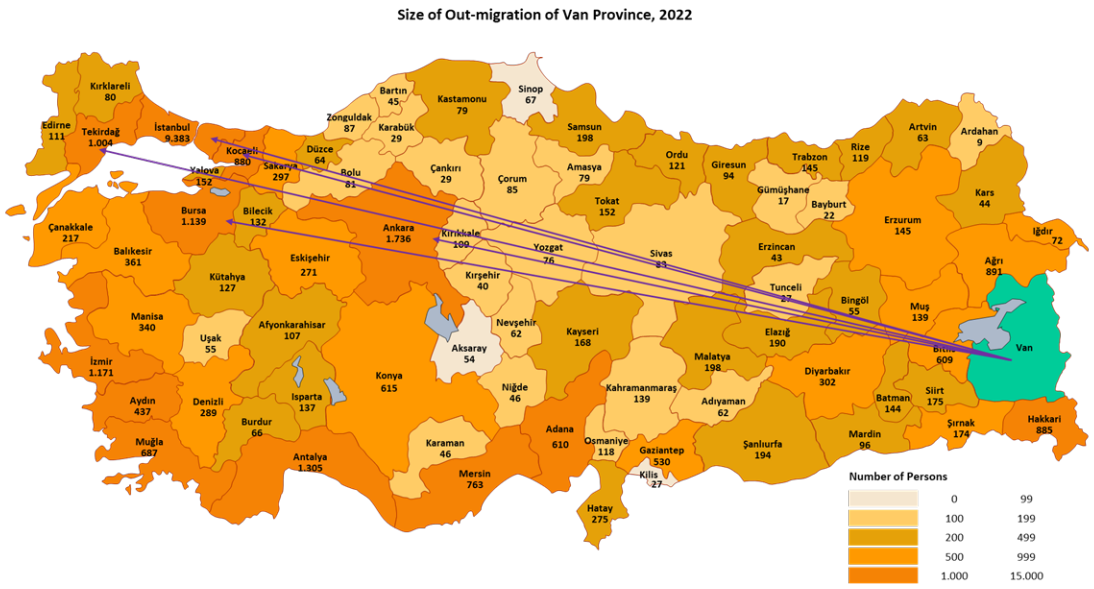

Figure 4. Size of Out-migration of Van province in 2022

Upon analyzing the annual migration data of Van province, it becomes evident that it is predominantly an out-migrating province. The earthquake in 2011 led to an upsurge in out-migration from the province, while some of those who left returned the following year.

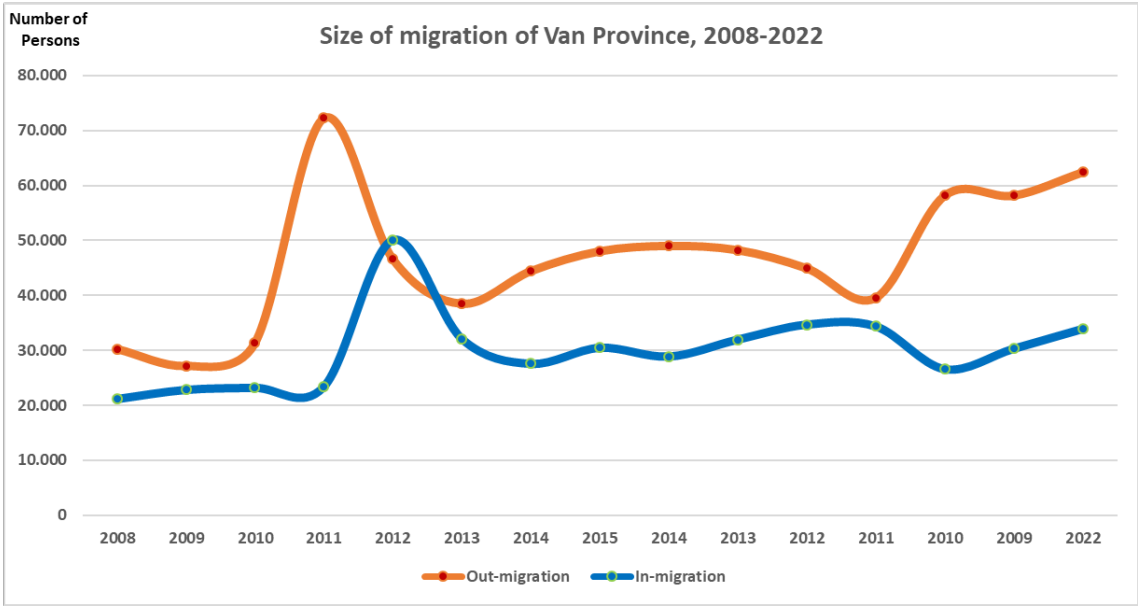

Figure 5. Size of migration of Van province, 2008-2022

3.5 Cluster Analysis

We used HCA to analyze migration patterns over different years. This involved grouping years with comparable migration trends into clusters. The analysis utilized a data set containing variables such as YEAR, POP, POP_GROWTH, IM, OM, NET_MIG, LIT_RATE, AVG_TEMP, AGRI_AREA, (PM_{10}), RER, ARRIVALS, ANN_VIS_NUM, and EDUC_DUR. To enhance the ease of detecting trends and patterns in the data set and to facilitate analysis, the variabsle YEAR was designated as a row label in the data set. As the YEAR variable does not contribute to the explanation of migration in the dataset, it is omitted from the dataset.

We used the Factoextra, NbClust, and cluster packages in the R programming language for HCA. The data for 2008-2022 are standardized and scaled between 0 and 1. HCA involves the use of several linkage methods to quantify the similarity or distance between observations. The analysis evaluated the average, single, full, and Ward linkage approaches. The agglomerative coefficient is a metric used to assess the clustering effecti-

veness of a linking method. A larger value of the agglomerative coefficient indicates superior clustering performance. The study found that Ward's linkage approach had the highest agglomerative coefficient value, indicating that it was the best suitable linkage method for the analysis. The Ward's minimum variance method is a suitable approach for identifying clusters and natural groups by decreasing the distances between them. HCA was applied by determining the Ward clustering method with Euclidean distance.

Figure 7 displays the dendrogram generated by applying HCA using the Ward method. The dendrogram analysis reveals a high concentration of data in 4 distinct clusters. Therefore, we have chosen 4 as the optimal number of clusters and visually represented these clusters on the graph using different colors.

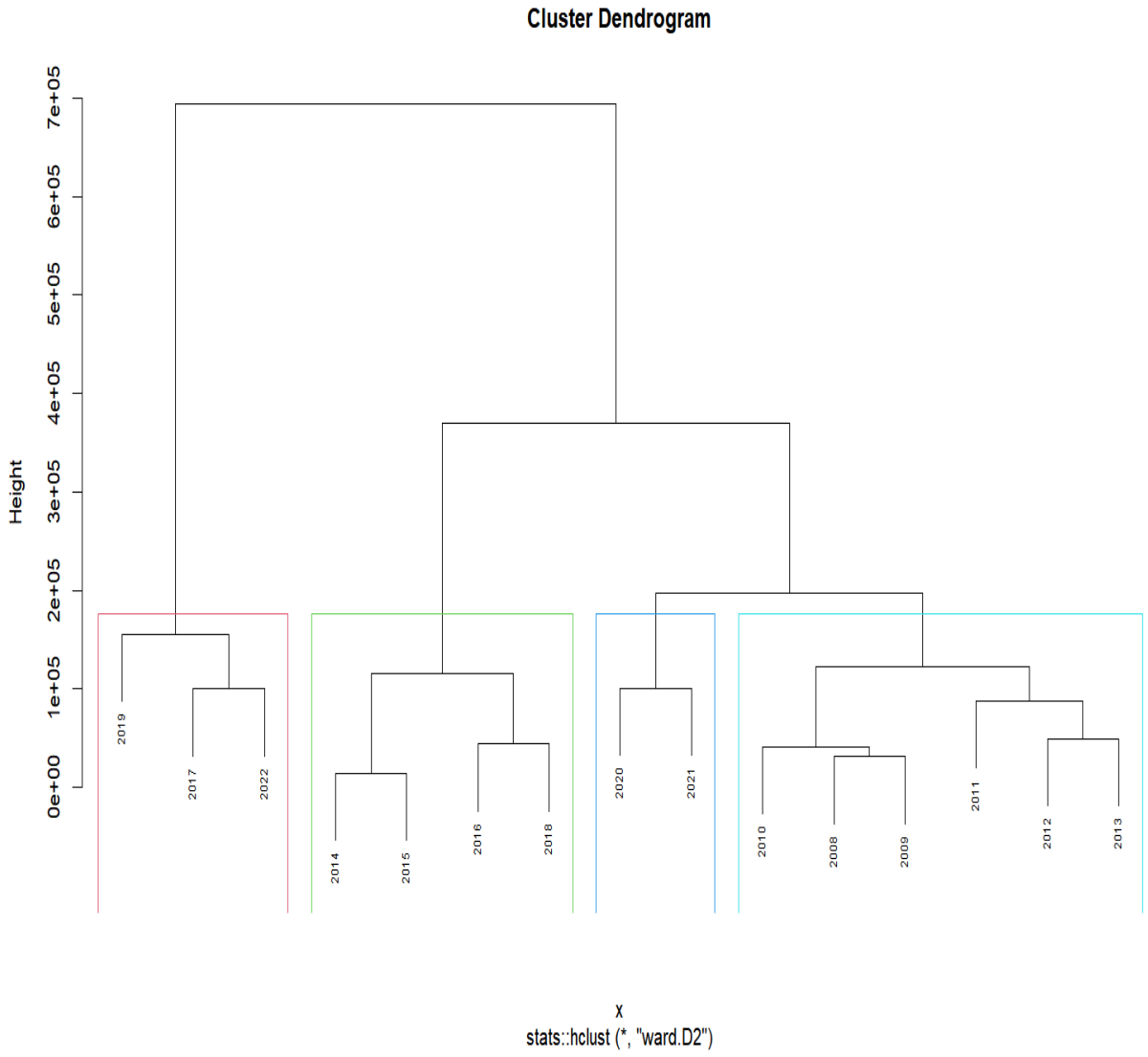

Figure 6. Dendrogram

Table 10. Classification of migration years according to cluster analysis

Clusters	**Years of Migration**
1. Cluster	2008, 2009, 2010, 2011, 2012, 2013
2. Cluster	2014, 2015, 2016, 2018
3. Cluster	2017, 2019, 2022
4. Cluster	2020, 2021

Table 10 displays the clusters and the years encompassed within these clusters, which were derived from the HCA of migration data for Van province from 2008 to 2022. The first cluster spans from 2008 to 2013; the second cluster spans from 2014 to 2016 and also includes the year 2018; the third cluster includes the years 2017, 2019, and 2022; and the fourth cluster spans from 2020 to 2021.

Table 11. Migration years similarity based on obtained clusters

YR	**POP**	**POP_GROWTH**	**IM**	**OM**	**NET_MIG**	**LIT_RATE**	**AVG_TEMP**	**AG-RI_AREA**	**(PM_{10})**	**RER**	**ARRI-VALS**	**ANN_VIS_NUM**	**EDUC_DUR**
2008	1004369	24,9	21187	30275	-9088	80,53	10,1	285303	146	33,3	111535	22500	3,9
2009	1022310	17,71	22866	27175	-4309	82,92	9,2	263246	130	34,6	121968	27066	4,3
2010	1035418	12,74	23231	31312	-8081	87,94	11,1	299273	121	36,4	105352	28149	5,0
2011	1022532	-12,52	23415	72273	-48858	89,7	8,7	316968	74	41,5	109982	51024	5,3
2012	1051975	28,39	50003	46639	3364	91	9,6	336264	65	41,8	82448	49579	5,5
2013	1070113	17,09	32118	38507	-6389	91,78	9,6	323215	65	41,1	94556	85080	5,6
2014	1085542	14,32	27587	44435	-16848	92,16	10,2	325331	49	42	136393	154174	5,8
2015	1096397	9,95	30492	48061	-17569	92,46	9,8	317100	39	42,6	136656	154569	6,0
2016	1100190	3,45	28902	49035	-20133	92,87	9,7	312651	37	38,5	165048	221691	6,2
2017	1106891	6,07	31971	48269	-16298	93,38	9,7	309457	41	41,6	176261	421977	6,5
2018	1123784	15,15	34691	44954	-10263	93,91	11,3	284209	43	38,2	147858	232202	6,8
2019	1136757	11,48	34372	39575	-5203	94,43	10,4	286747	41	37,8	148250	328326	7,2
2020	1149342	11,01	26621	38114	-11493	94,79	10,2	283322	40	36,4	71969	19652	7,4
2021	1141015	-7,27	30318	58185	-27867	94,97	11,1	362562	42	37,1	115081	54126	7,6
2022	1128749	-10,81	33903	62422	-28519	95,14	10,4	374960	44	40,2	244568	436387	7,8

Upon analyzing the produced clusters, it is evident that the indicators in the data set show similarity between the years 2008-2013 in the first cluster. Over this period, there has been no variation in population growth or agricultural area.

When examining the years 2014, 2015, 2016, and 2018 inside the second cluster, there is a significant rise in tourism data, including the number of arrivals to facilities and foreign visitors, as well as migration.

Within the third cluster (consisting of the years 2017, 2019, and 2022), it is evident that 2017 and 2022 exhibit similarities in both climatic and agricultural attributes while differing from 2019 in terms of migratory patterns.

The fourth cluster represents the 2020 and 2021 eras, during which there was a decline in both domestic and foreign migration as a result of the COVID epidemic. Additionally, during this time, the tourism data reached its lowest point.

4. DISCUSSION AND CONCLUSIONS

Internal migration, the movement of people within a country, drives socio-economic, cultural, and demographic change. Statistical analysis of migration data helps identify migration patterns, reasons, and demographic segments involved while monitoring changes over time. This information provides insight into the economic, social, and cultural factors that influence migration, enabling policymakers to design effective regional development plans, optimize resource use, and ensure balanced population distribution.

Statistical analysis is essential for understanding internal migration patterns in Türkiye, particularly in Van Province. By examining demographic and geographic data, these methods help to identify the causes of migration, the influencing factors, and the relationships between variables, thus enabling effective policy formulation. Migration has a significant impact on Van's population and socio-economic development, requiring reliable data and advanced analysis to monitor changes over time and guide regional development policies. A detailed study of Van's internal migration using statistical techniques can provide valuable insights and support future projections for the overall benefit of the region.

This study uses statistical methods to analyze the main migration trends in Van province between 2008 and 2022, as well as the demographic and economic factors that influence migration, revealing various dimensions of migration movements. For this purpose, the necessary data were mainly obtained from the TURKSTAT. For the data set, descriptive statistics were first obtained for population and migration variables. Then, a variable selection was made for the variables that could affect net migration, and MCA was applied. According to the results of the MCA, variables were identified, and multiple regression analysis was applied. GIS analysis was used to compare the provinces to which the province of Van receives and gives migration on the map for the years 2008 and 2022.

Analyzing the annual population growth rate of Van province between 2008 and 2022, the lowest levels were reached in 2011 (‰ (per thousand) -12,52) and 2022 (‰ (per thou-

sand) -10,81). Alaeddinoğlu and Choi (2022), in their study aimed at measuring the impact and recovery process of the 2011 Van earthquake, stated that the earthquake caused a decrease in the population of Van (1,24%) and a recovery in 2012 (2,88%) above the pre-earthquake population growth rate, but the city of Van could not catch up with the pre-earthquake population growth rate by the end of 2019. The COVID-19 pandemic in 2021 also had a negative impact on population growth. These results show that natural disasters and epidemics reduce population mobility.

Looking at the migration data of Van and its neighboring TRB2 provinces (Muş, Bitlis, Hakkâri) together, it can be seen that these provinces have a continuous net migration deficit between 2008 and 2022. It can be observed that the negative net migration rates of these provinces have increased, especially in recent years. Conversely, the province of Hakkâri exhibits more balanced values in comparison to other provinces. It can be said that 2021 and 2022 were the most difficult years for the provinces in the region. M. Yılmaz (2022), in his study for the TRB2 region, found that the net migration and the net migration rate have always taken negative values in recent years due to the fact that the outward migration in the region is higher than the inward migration.

Between 2008 and 2022, the provinces to which Van has received the most migration are Istanbul, Hakkâri, and Ankara, while the provinces to which it has given the most migration are Istanbul, Ankara, and Antalya. There is a high level of population mobility between Van and Istanbul. It has been observed that Hakkâri and Ağrı, the eastern provinces, are also among the provinces from which Van receives significant migration. The reasons for the reciprocal migration movements between Van and the neighboring provinces can be attributed to factors such as the geographical proximity of these provinces and the intense interaction arising from cultural and social similarities, job opportunities, and family ties. Similarly, Ercilasun et al. (2011) found that the most important factor influencing the internal migration decisions of individuals in Türkiye is the attractiveness of those who have already migrated to a place. When examining the provinces where migration occurs, the prominence of cities like Istanbul, Ankara, and Antalya indicates a preference for western regions due to their abundance of job opportunities and diverse economic opportunities. Elmastaş and S. Yılmaz (2015) also explain migration to metropolitan areas for similar reasons.

According to the results of the MCA for the province of Van, the most effective factors for net migration are the population growth rate and out-migration. The in-migration (0,346), agricultural area (-0,445), and number of visits to tourism facilities (-0,318) are mo-

derately effective. While the migration and population increase in the province create more job opportunities for migrants, the out-migration decreases. The expansion of agricultural areas also tends to increase migration. In his study, Anavatan (2017) found that the cultivated agricultural area has a negative effect on net migration. Arrival at tourism facilities and net migration are inversely proportional. Literacy rate (-0,236), particulate matter (0,256), employment (-0,280), and duration of education (0,263) are less effective. In their study, Albayrak and Abdioğlu (2017) also found that particulate matter (PM_{10}) air pollution levels have an increasing effect on net migration. Similarly, Recepoğlu and Değer (2022) determined that the amount of sulfur dioxide (SO_2), which is included in the model to indicate air pollution, is statistically significant and has a positive effect on migration.

According to the results of the MLR analysis, the factors that have a positive effect on net migration are population growth rate, average temperature, in-migration, and number of annual visitors. On the other hand, an increase in the regional employment rate tends to reduce net migration. The model shows how net migration can change depending on these factors.

According to the results of the GIS analysis, Van receives migration from metropolises, neighboring provinces, and Mediterranean coastal provinces in both 2008 and 2022. The places of emigration are the metropolises, the Marmara, the Aegean, and the Mediterranean coasts. Migration to Tekirdağ is particularly intense. In general, Van is an out-migration province.

The migration data for the province of Van are divided into four basic clusters based on the results of HCA, which places years with similar migration trends in the same cluster in order to analyze migration trends across different years. In the first cluster, the years between 2008 and 2013 show similar migration trends and little change in population and agriculture. In the second cluster, the years between 2014 and 2016 and the year 2018 show an increase in migration, while an increase in tourism indicators is noteworthy. In the third cluster, the years 2017, 2019, and 2022 are similar in terms of climate and agriculture, while 2019 has a different dynamic in terms of migration. In the fourth cluster, 2020 and 2021 reflect the period affected by the COVID-19 pandemic, when internal and external migration decreased and tourism declined. The clustering analysis identified the main trends in the Van migration data by grouping different years according to similar characteristics. The results provide useful indications for migration policies. Yakar and Saraçlı (2010) used HCA to identify similar and different provinces using net migration rates and SEGE values. Gürbüz and Karabulut (2008) grouped provinces to analyze socio-economic factors affecting rural migration using statisti-

cal techniques such as hierarchical clustering, correlation, and regression. This study used HCA to identify differences between years.

In this study, internal migration movements for Van province between 2008 and 2022 are analyzed using statistical methods. The findings provide important clues about Van's migration dynamics. According to the results of the analyses, Van maintains its population thanks to the migration it receives, even though it experiences a net migration loss in general. The main factors affecting migration include population growth rate, in-migration and out-migration, agricultural area, tourism, and employment level. Migration trends vary over the years, and especially natural disasters and epidemics have a negative impact on migration. Statistical analyses will provide guidance to policymakers by revealing the socioeconomic and geographical dimensions of Van migration. In the light of the data and findings obtained, the development dynamics of the region can be better understood, and migration management plans can be developed. This will contribute to the sustainable development of Van.

The results have provided important indications for regional development planning and migration policies. Repeating similar studies with other provinces and time intervals will make it possible to monitor dynamic migration processes.

ETHICAL DECLARATION

In the writing process of the study titled “Determinants of net migration trends in Van province, Türkiye from 2008 to 2022: A statistical analysis”, there were followed the scientific, ethical and the citation rules; was not made any falsification on the collected data and this study was not sent to any other academic media for evaluation.

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