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Analysis of the European Union Countries and Turkey in Terms of Criminal Tendencies

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Abstract

This study uses criminal tendencies data to reveal the relations between the member states of the European Union and Turkey. The relations between these countries and criminal tendency trends are of vital importance for our future. Eight factors in our research are used to show the impact of criminal tendencies for countries. These factors are homicide, violent crime, robbery, domestic burglary, motor vehicle theft, drug trafficking, number of police officers and prison population. It is possible to find many sources in the literature related to each of these factors for the member states of the European Union and Turkey. However, there is a need for studies to take all of these factors into account. So we can clearly identify the relations among countries in terms of criminal tendencies in a highly variable space. We use correspondence analysis method and clustering method based on chi-squared distance which is used for categorical data to analyze the relationship between these countries in terms of criminal tendencies. As a result, we can say that robbery; domestic burglary and motor vehicle theft trends in Estonia, Germany, Denmark, France and Ireland are similar. Also Turkey, Luxemburg, Slovenia and Croatia are in the same group. Mainly, these countries have homicide and drug trafficking trends. The other striking finding is that the trend of violent crime is high in the countries such as England, Sweden, Finland, Netherlands and Belgium which have a good level of education and income.

Keywords: correspondence analysis; clustering, criminal tendencies; Turkey; European Union Countries; crime.

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1. Introduction

Determination of differences among the criminal tendencies of countries gives crucial information about their macroeconomic, educational and levels of development. There is a lot of empirical work on member states of the European Union and Turkey, analyzing criminal tendencies in different perspectives. Buonanno and his colleagues [4] study the causal impact of demographic changes, incarceration, abortion, unemployment and immigration on crime. They use time series data from European countries and the United States over the period 1970-2008. They find that demographic structure of the population and the incarceration rate are important determinants of crime. Dursun and his colleagues [8] analyze the relation between crime types and unemployment, economic variables and gross domestic product per capita. They use data set over the period 1990-2010. Hauner and his colleagues [13] view the effect of inequality on crime in Russia over the period 2000-2005. Buonanno and his colleagues [5] study whether crime rates respond asymmetrically to increases in unemployment and recoveries in economic conditions. They use a longitudinal data set from 1970 to 2010. They find a positive correlation between crime rates and unemployment rates. Buonanno and his colleagues [6] also give a comparison between European countries and United States in terms of crime statistics from 1970 to 2010. They aim to decrease increasing crime rates in some developed countries. They question the reliability of official crime statistics in assessing the trends in crime rates and some crucial factors impacting on criminal activity. Besides, there are also countless studies only on violence against women [3;10;15;16;18;19;20]. Clarke [7] gives insight into the trends in the various categories of recorded crime. In this study, we investigate European Union countries and Turkey in regard to criminal tendencies. We give criminal tendencies such as homicide, violent crime, robbery, domestic burglary, moto vehicle theft, drug trafficking, number of police officers and prison population for every country. To analyze the relationship between criminal tendencies for member states of the European Union and Turkey, we use correspondence analysis method and clustering method based on chi-squared distance which is used for categorical data. The rest of this paper is organized as follows: In Section 2, we present data and methodology. In Section 3, the results of an analysis are given. Finally, we give conclusion in Section 4.

2. Data and Methodology

The data used in the study has been compiled from the Eurostat website and Europen Sourcebook of Crime and Criminal Justice Statistics for the year 2010 [1]. In this study we benefited from correspondence analysis method and clustering method based on chi-squared distance used for categorical data to investigate the relations in the data presented below.

For this data set, correspondence analysis was used to analyze the relationship between criminal tendencies for member states of the European Union and Turkey. Correspondence analysis is a method which is used for interpreting the similarities, differences and relations among the categorical variables. Here the variables are categorical and the contingency table obtained as a result of the crossings of these variables is used as the data matrix. Each row of the matrix corresponds to a category of the corresponding variable. The method is one of the methods used when the chi-square analysis is not feasible. Inertia is a measure for total variance in correspondence analysis. If the value of inertia is a good level, we can say that association between column and

row categories is high in this situation. If it is near zero, there is no association between column and row categories. More details about correspondence analysis may be found in [2;9;11;12;17]. We also used an approach proposed by Greenacre [12] to obtain a clustering based on chi-squared distance as another method of analysis. For the graphics and analysis described in this study, we have used MINITAB 16 package.

Table 1: Data of criminal tendencies for member states of the European Union and Turkey for the year 2010

	Homicide	Violent crime	Robbery	Domestic burglary	Motor vehicle theft	Drug trafficking	Number of police officers	Prison population
Belgium	184	122520	23803	68298	19816	12561	39746	10968
Bulgaria	147	9051	3737	24005	486	3765	29439	9429
Czech Republic	103	18659	3874	10091	13109	3010	43100	21987
Denmark	62	26434	12802	44788	20745	3297	11084	3965
Germany	690	201243	48166	121347	83480	49622	243625	70103
Estonia	70	5347	599	3196	870	901	4536	3393
Ireland	58	12139	3173	25420	11410	4726	14377	3556
Greece	176	12287	6079	80854	27587	10010	50798	12590
Spain	401	106509	84411	111656	65948	14010	241267	73929
France	675	351071	121038	186524	195196	5869	211262	66532
Croatia	73	11038	1245	3104	1568	7784	20846	5165
Italy	567	127736	47996	171269	197583	32761	276256	67961
Latvia	82	1414	1072	4194	1251	2189	7624	6780
Lithuania	217	3703	2727	4905	2060	896	10738	8844
Luxembourg	8	3319	316	1487	357	2574	1655	669
Hungary	132	38445	3396	19865	8624	794	8724	16328
Malta	4	372	196	703	372	181	1918	598
Netherlands	144	112695	10925	102795	16650	17275	37285	14289
Austria	56	44618	4310	15747	5150	2167	27614	8597
Poland	436	49194	19359	37941	16539	4668	97535	81094
Portugal	124	24251	20423	26641	20288	4546	46632	11613
Romania	404	5488	2484	14197	2531	3852	52146	28244
Slovenia	10	2776	463	2563	534	1756	7776	1351
Slovakia	89	8094	1188	1876	3354	584	24054	10068
Finland	112	39640	1508	6453	11150	7566	8161	3189
Sweden	91	113262	9219	19774	35009	10321	20292	6891
England and Wales	642	953047	76189	258165	106162	32336	142132	85002
Turkey	2343	234707	8575	90103	13633	81060	362710	116924

Source: Eurostat (online data code: crimgen, crimplce, crimpris)

3. Results

In this study, we use correspondence analysis method and clustering method based on chi-squared distance for investigating distribution data of European Union and Turkey according criminal tendencies.

Table 2: Results of correspondence analysis for distribution data of European Union and Turkey by criminal tendencies

Dimension	**Inertia**	**Proportion of Inertia**	
		Accounted For	**Cumulative**
1	0,1479	0,5225	0,5225
2	0,0693	0,2449	0,7674
3	0,0295	0,1041	0,8715
4	0,0212	0,0748	0,9463
5	0,0112	0,0394	0,9857
6	0,0038	0,0135	0,9992
7	0,0002	0,0008	1,0000
Total	02831	1.0000	

Correspondence analysis is applied to data matrix of contingency table (Table 1) obtained by crossing the criminal tendencies committing in each EU country and Turkey. Results of correspondence analysis for distribution data of European Union and Turkey by criminal tendencies are presented in Table 2.

According to Table 2, we can say that whole total variance can be explained by 7 dimensions. 52.25% of the total inertia is explained by the first dimension and the 24.49% of the total inertia is explained by the second dimension. 10.41% of the total inertia by the third dimension and the 7.48% of the total inertia is explained by the fourth dimension, 3.94% of the total inertia is explained by the fifth dimension, 1.35% of the total inertia is explained by the sixth dimension and 0.8% of the total inertia is explained by the sixth dimension.

As a result, 76.74% of the total inertia is explained by the two dimensioned correspondence analysis biplot graph. The relation among the categories by correspondence analysis graph is presented in Figure 1.

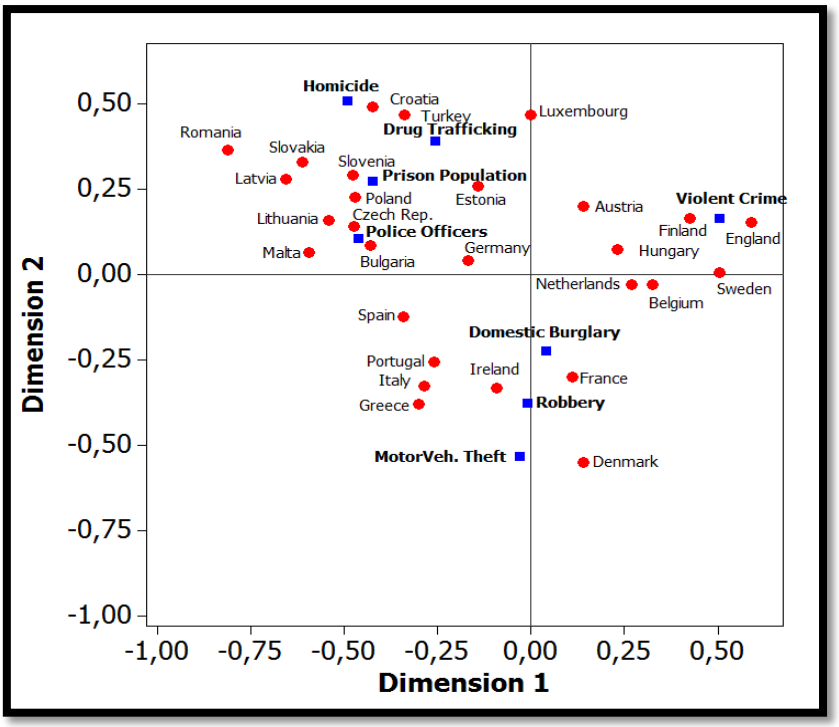

Figure 1: Correspondence analysis graph for data of criminal tendencies for member states of the European Union and Turkey

Figure 1 shows the relations between the criminal tendencies and member states of the European Union with Turkey, based geometric distances. Dimension 1-2 axes have a clear interpretation (76.74%). Dimension 1 is defined by the potential of Denmark and France as mainly opposed to Romania, Slovakia, Lithuania, Malta, Latvia. Looking at Figure 1, it appears that the number of police officers and prisoners in prison are also high in countries where drug trafficking and homicide are common. Obviously these countries, namely Germany, Estonia, Poland, Czech Rep., Bulgaria, Croatia, Slovenia and Turkey are easily seen from the graphical approach. In addition, Spain, Portugal, Italy, Greece, Ireland, France and Denmark are quite similar in terms of domestic burglary, motor vehicle immorality and robbery. Luxembourg is in a region opposite to these countries in terms of distribution of crime tendencies such as domestic burglary, motor vehicle immorality and robbery. This indicates that these crimes are happening less frequently in Luxembourg. Another result obtained from the graphical approach is that Austria, Finland, England, Hungary and Sweden Belgium and Netherlands showed similar structure in terms of violent crime distribution. In these countries, crimes such as homicide and drug trafficking are at a significantly lower level according to population. This is clearly seen when we make a comment based on the distance between the countries from the graphical approach we have achieved.

Greenacre [12] has given a way to cluster the row and the column categories in a cross-tabulation by using the chi-squared distance. Figure 2 shows the clustering of the criminal tendencies in Table 1. Figure 2 is a dendrogram graph which is obtained by using ward linkage. The clustering divides all structure in Figure 1 into three groups: the Homicide, Prison Population, Police Officers and Drug Trafficking; the newly formed united opposition block, consisting of the Violent Crime as called second group, and the third group is defined by

Robbery, Motor Vehicle Theft and Domestic Burglary. Clustering analysis results also support the Figure 1.

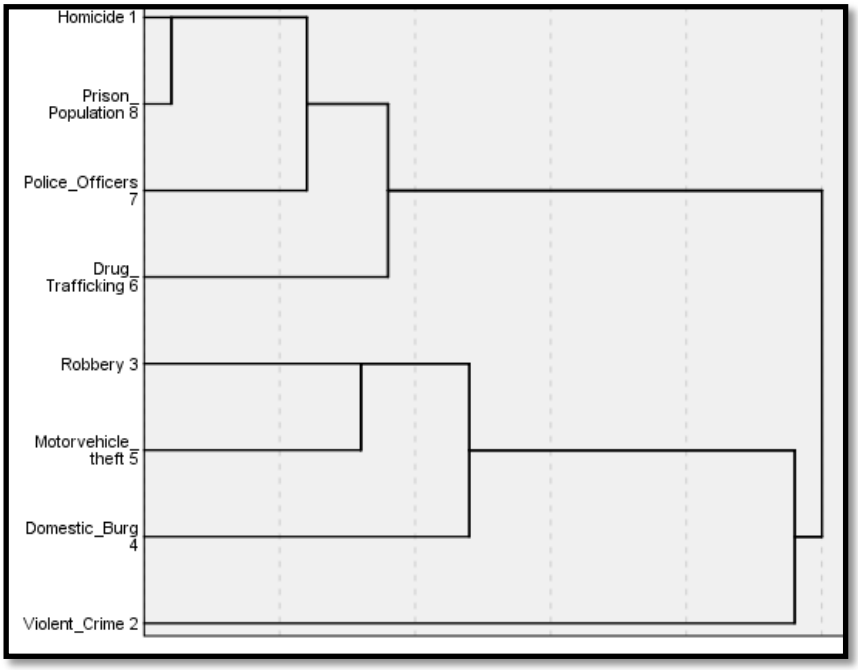

Figure 2: A clustering of the criminal tendencies in Table 1 based on chi-squared distance.

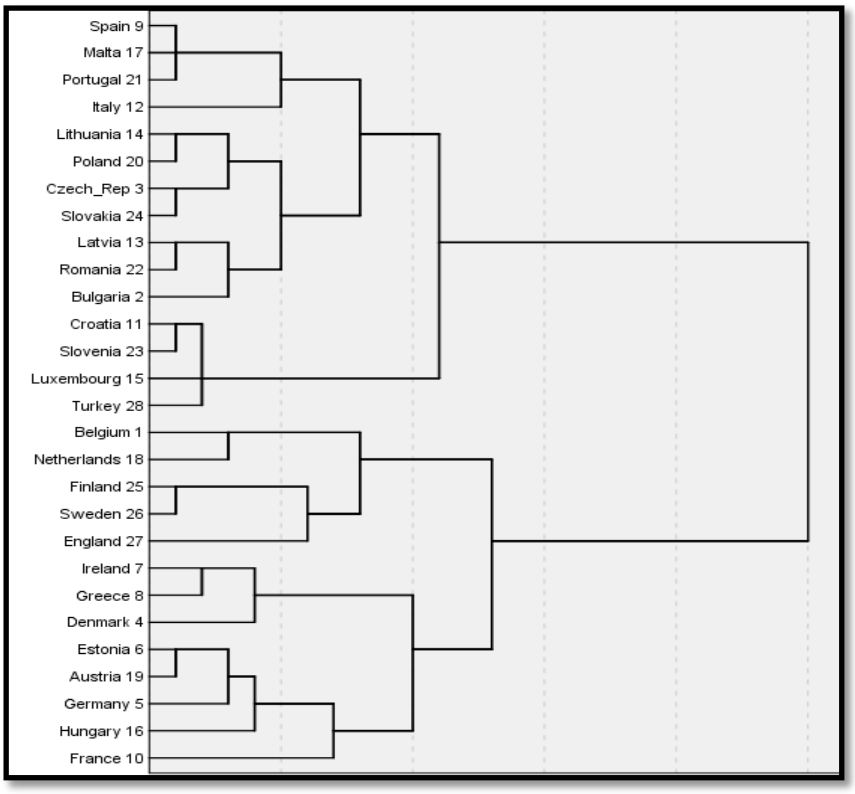

Figure 3: A clustering of the member states of the European Union and Turkey in Table 1 based on chi-squared distance.

Figure 3 shows the clustering of member states of the European Union and Turkey in Table 1. Figure 3 is a dendrogram graph which is obtained by using ward linkage. The clustering translates all structure in Figure 1 into six groups. Clustering analysis results of the member states of the European Union and Turkey also support the Figure 1.

The graphical approach obtained with the correspondence analysis method reveals only 76.74% of the total variance. So in this case there is some loss of information (23.26%). This loss is too small to be ignored. Even so, in order to avoid inconsistent interpretations that might arise from this situation, we made our comments by considering the results of clustering analysis based on chi-squared distance. Hence, we have got stronger and more consistent interpretations.

4. Conclusion

Data visualization methods have a lot of important beneficial properties. Correspondence analysis gives a graphical map to researchers. Also it provides many advantages for the visualization of the associations between the rows and column categories of a table. We use correspondence analysis method and clustering method based on chi-squared distance used for categorical data to analyze the relationship between countries in terms of criminal tendencies. The relations between countries and criminal tendencies trends are of vital importance for our future. Eight factors in our research are used to show the impact of criminal tendencies for countries. We use correspondence analysis method and clustering method based on chi-squared distance used for categorical data to analyze the relationship between these countries in terms of criminal tendencies.

As a result, we can say that robbery, domestic burglary and motor vehicle theft trends in Estonia, Germany, Denmark, France and Ireland are similar. Moreover Turkey, Luxemburg, Slovenia and Croatia are in the same group. Mainly, these countries have homicide and drug trafficking trends. The other striking finding is that the trend of violent crime is high in the countries such as England, Sweden, Finland, Netherlands and Belgium which have a good level of education and income.

Our findings show that the performances of correspondence analysis method and clustering method based on chi-squared distance are quite good. We also recommend these two methods to scientists working on crime data in their research because they offer opportunities to examine the hidden interactions between variables.

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