



Clustering OECD Countries According to Tax Indicators

Selim Tüzüntürk¹

RESEARCH ARTICLE

Araştırma Makalesi

ARTICLE INFO

Submitted : 11.06.2024

Revised : 30.08.2024

Accepted : 09.09.2024

Available : 25.12.2024

iThenticate similarity
score: 13%

JEL classification:

H20, H24, C38

Keywords:

Goods and Services
Tax, Personal Income
Tax, Property Tax,
Cluster Analysis

ABSTRACT

This study aims to cluster a particular group of countries (OECD countries) according to tax indicators and to determine essential variables in clustering. The recent data on taxation percentages 2021 in OECD countries were obtained from the OECD website. Since the number of clusters was not known a priori, the hierarchical clustering analysis and two-stage clustering methods were used, and the findings of both methods were compared. Research findings show that OECD countries are classified into two meaningful clusters regarding statistically significant tax indicators (goods and services tax, personal income tax, and property tax) for both methods. The first cluster's goods and services tax average is lower than the second. The personal income tax average of the first cluster is higher than the second. The property tax average of the first cluster is higher than the second. The tax differences indicate that countries in the first cluster collect more personal income and property taxes but fewer goods and services taxes than countries in the second cluster, which points out the characteristics of developed countries in the scope of tax policies.

Citation: Tüzüntürk, S. (2024). "Clustering OECD Countries According to Tax Indicators". *International Journal of Public Finance*. 9(2), 293 – 306. <https://doi.org/10.30927/ijpf.1499553>

1. Introduction

Cluster analysis methods are methods used to classify a data set (Morey, Blashfield & Skinner, 1983: 309). Clustering involves collecting objects with high similarity under the same groups and those with low similarity under different groups (Shih et al., 2010: 11). The analysis aims to create homogeneous groups (Gore, 2000: 298). Group members can be individuals, countries, or variables (Landau & Ster, 2010:

¹ Assoc. Prof. PhD., Bursa Uludağ University, Türkiye, ORCID: <https://orcid.org/0000-0002-8987-2280>, selimtuzunturk@uludag.edu.tr

72). In grouping objects, two broad classes of algorithms were designed that are the hierarchical and nonhierarchical clustering methods (Timm, 2002: 522; Tatlıdil, 2002: 334). When the cluster number is unknown, hierarchical clustering is the proper method (Bülbül & Camkıran, 2018: 371). The number of clusters is discovered using a tree diagram called a dendrogram. When the cluster number is known, the nonhierarchical clustering method is proper. When prior knowledge about the number of clusters is not available, the two-stage clustering analysis method can also be used (Kayri, 2007: 91; Alpar, 2011: 314; Giray, 2016: 16; Bülbül et al., 2017: 23).

Cluster analysis was first discussed in the social sciences during the 1930's (Blashfield & Aldenderfer, 1978: 272). It has a long history. As can be seen in detail in the recent literature review in the second part of this study, there are many studies that subject OECD countries to cluster analysis according to many different issues such as health indicators, agricultural performance, economic indicators, number of traffic accidents, carbon emission indicators, labor force indicators, innovation indicators and so on. However, the literature review shows that more cluster analysis studies on taxation in OECD countries must be conducted. In this respect, this study is essential and contributes to the relevant literature.

This study aims to cluster a particular group of countries (OECD countries) according to tax indicators and to determine essential variables in clustering. In this context, the study will seek answers to the following research questions: (i) Are OECD countries divided into clusters? (ii) If so, how many clusters are they divided into? (iii) Do the clusters consist of meaningful country groups? and (iv) Which tax indicator variables are statistically significant in dividing OECD countries into clusters? The findings (similar countries in the context of tax indicators) will be interpreted. Based on the research questions, the study has the following sections: A literature review related to the clustering of OECD countries was conducted in the second part. In the third part, the research design of this study and the findings were given. The last part contains the conclusion.

2. Recent Literature Review on Clustering of OECD Countries

When the literature was reviewed, it was seen that cluster analysis studies had been carried out on various subjects related to OECD countries. However, the literature review shows that more cluster analysis studies on taxation in OECD countries need to be conducted. OECD countries' research subjected to cluster analysis within the scope of taxation are as follows: Birkalan & Tekeli (2022) clustered OECD countries according to tax wedge using 2021 data. Researchers found a 3-cluster solution. When researchers evaluated the country clusters they obtained, they concluded that Türkiye was seen to be in the same cluster (Cluster 3) together with European Union member countries in terms of its tax wedge. Ünal (2021) clustered OECD countries according to tax burden

and shadow economy using 2017 data. The researcher found a 3-cluster solution. When the researchers evaluated the country clusters they obtained, they concluded that Türkiye was seen to be in the same cluster (Cluster 1) as Colombia, Costa Rica, Ireland, South Korea, Mexico, and the United States. Gülşen (2019) clustered OECD countries according to tax payment periods using 2004-2015 period data. The researcher found a 3-cluster solution. When researchers evaluated the country clusters, they obtained that Türkiye was in the same cluster (Cluster 3) with the following countries: Germany, Czechia, Greece, Slovakia, Hungary, Portugal, Mexico, Poland, Italy, Chili and Slovenia. The analysis in the article proves the theoretical idea that personal income taxes are fairer than goods and services taxes. In this respect, it is a study that contributes to the literature.

Recent domestic studies on different topics in which OECD countries were clustered are illustrated in Table 1.

Table 1. Recent Domestic Studies on Various Topics Clustering OECD Countries

Author(s)	Clustering Indicator(s) or Data Used
Filiz & Budak (2024)	Health Data
Dağ (2023)	Exported and Imported Product Groups
Kutlar et al. (2023)	Economic Indicators
Madenoğlu (2023)	Covid-19 Pandemic
Bulut (2023)	Economic Freedom
Eroğlu & Özen (2023)	Corruption
Köse (2022)	Health Indicators
Ayabakan (2022)	Global Gender Gap Index Data
Güler & Veysikarani (2022)	PISA Scores
Yılmaz (2022)	Labor Index
Alkaya & Alkaş (2021)	Health Indicators
Eren & Ömürbek (2021)	Logistics Performances
Akçakaya & Ömürbek (2021)	Democracy Indicators
Değirmenci & Yayan (2020)	Health Indicators
Kandemir (2020)	Traffic Accident Data
Çetintürk & Gençtürk (2020)	Health Expenditure Indicators
Sel (2020)	Carbon Emission Indicators
Keklik et al., (2020)	Better Life Index
Aslan & Açıkgöz (2019)	Labor Market Flexibility Indicators
Arı & Gülcemal (2019)	Insurance Market Share
Akdamar (2019)	Labor Market Indicators
Şen & Varüer (2019)	Suicide Rates
Taşçı & Özarı (2019)	Economic Freedom Criteria
Soydan & Yakut (2018)	Renewable Energy
Güler & Veysikarani (2018)	Innovation Indicators
Arı & Yıldız (2018)	Migration Statistics
Engin (2018)	Information Economy Index
Yorulmaz et al. (2018)	Factors Affecting Foreign Direct Investments

Akça et al. (2017)	Corruption Indicators
Kuşkaya & Gençoğlu (2017)	Green Gas Emission
Aksaraylı & Pala (2017)	Life Satisfaction and Innovation Levels
Mut & Akyürek (2017)	Health Indicators
Ertuş & Atik (2016)	Development Indicators
Alptekin & Yeşilaydın (2015)	Health Indicators
Kangallı et al. (2014)	Economic Freedom
Dalkılıç (2013)	Private Pension Funds
Akın & Eren (2012)	Education Indicators
Çemrek et al. (2010)	CO ₂ Emissions

3. Research Design and Findings

The recent data in percentages of taxation for the year 2021 of OECD countries were taken from the official website of the OECD (<https://data.oecd.org/>) in May 2024.

Table 2. OECD Countries' List

Australia		Japan
Austria		Korea
Belgium		Latvia
Canada		Lithuania
Chile		Luxemburg
Colombia		Mexico
Costa Rica		Netherlands
Czechia		New Zealand
Denmark		Norway
Estonia		Poland
Finland		Portugal
France		Slovak Republic
Germany		Slovenia
Greece		Spain
Hungary		Sweden
Iceland		Switzerland
Ireland		Türkiye
Israel		United Kingdom
Italy		United States

Data consists of 5 tax indicators (or variables) for 38 OECD countries: personal income tax, corporate profits tax, payroll tax, property tax, and goods and services tax. Variables were coded as is seen in the Table 3 below:

Table 3: Tax Indicators on OECD Countries (% of Taxation)

Symbols	Names
T1	Personal income tax
T2	Corporate profits tax
T3	Payroll tax
T4	Property tax
T5	Goods and services tax

Statistical analyses were done by using SPSS 23. Descriptive statistics and F test results are illustrated in Tables 4 and 5, respectively:

Table 4: Descriptive Statistics of Tax Indicators on OECD Countries

	N	Minimum	Maximum	Mean	Variance
T1	38	6.216	52.810	23.740	113.329
T2	38	2.794	23.714	10.230	30.780
T3	38	0.000	11.994	1.312	6.089
T4	38	0.563	15.065	5.643	14.498
T5	38	16.550	53.060	31.918	65.464

Table 5: F Test (Analysis of Variance Test) Results

	Cluster		Error		F	Sig.
	MS	df.	MS	df.		
T1	2155.648	1	56.598	36	38.087	0.000
T2	5.540	1	31.481	36	0.176	0.677
T3	2.247	1	6.196	36	0.363	0.551
T4	109.813	1	11.850	36	9.267	0.004
T5	1454.635	1	26.876	36	54.125	0.000

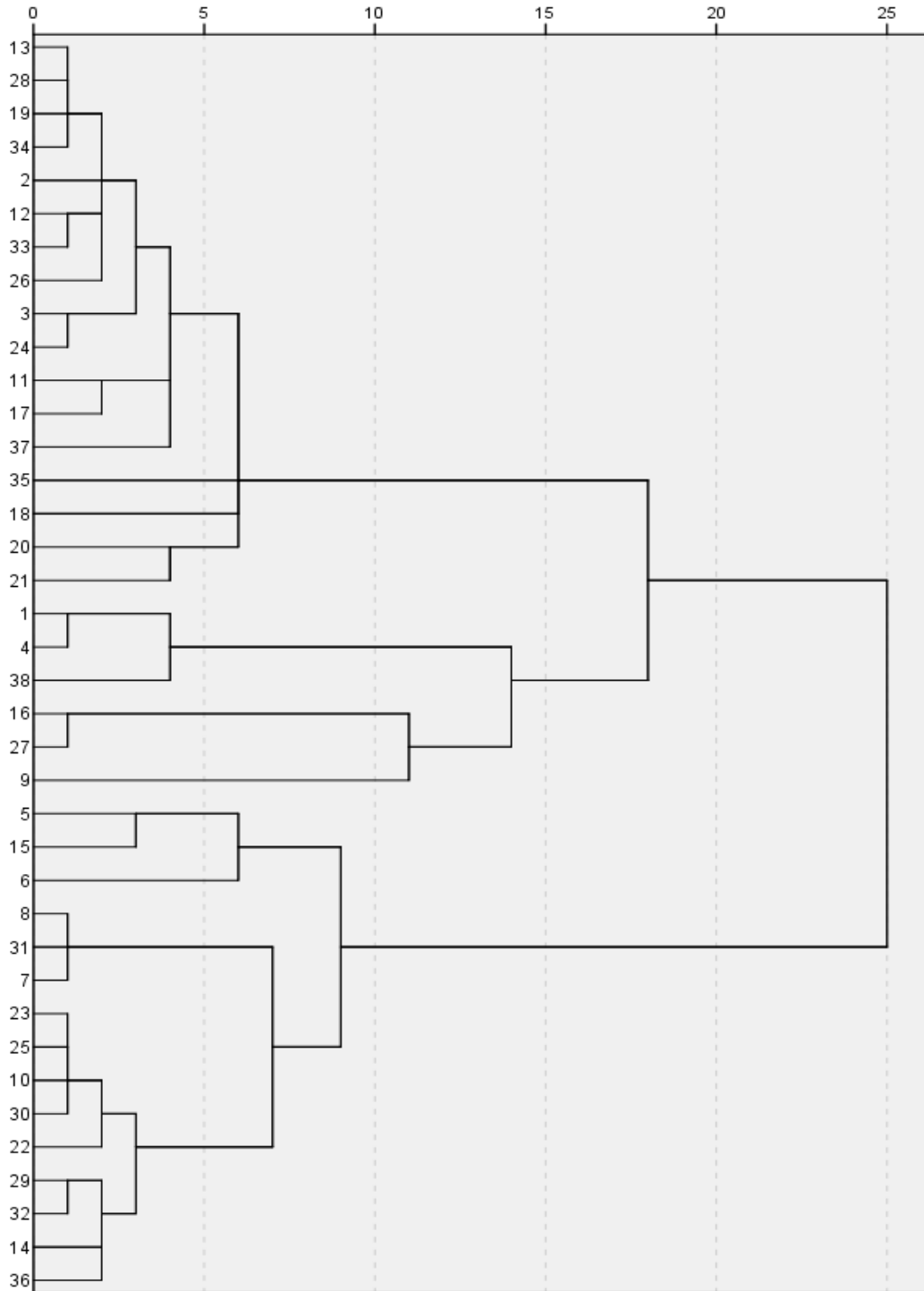
Analysis of Variance Tests showed that while the ratios containing the variables T1, T4, and T5 are statistically significant ($\text{Sig.} < \alpha=0.05$), the ratios containing the variables T2 and T3 are statistically insignificant ($\text{Sig.} \geq \alpha=0.05$). Therefore, cluster analyses were conducted with variables T1, T4, and T5.

3.1. Hierarchical Cluster Analysis Findings

In general, in cluster analysis, cluster numbers are not known in advance, and clusters are obtained only based on the current state of the data (Turanlı et al., 2006: 97). In such situations when there isn't prior knowledge about the cluster numbers. Generally, it is discovered by using hierarchical clustering analysis methods (Bülbül &

Camkıran, 2018: 371). The centroid clustering method is robust against outliers (Rencher & Christensen, 2012: 529). Therefore, the centroid clustering method was used. A squared Euclidean distance was used.

Figure 1: Dendrogram Plot for Tax Indicators



When a vertical line is drawn on the far right side of the dendrogram chart in Figure 1, it is seen that the vertical line first intersects two horizontal lines. The fact that the vertical line drawn crosses two horizontal lines indicates that OECD countries are divided into two clusters, which means a two-cluster solution was obtained with three statistically significant input data (or variables). The numbers on the branches connected to each horizontal line show the row numbers of the countries in the relevant clusters. The upper horizontal line contains the first cluster members, while the lower horizontal line contains the second cluster members.

When the dendrogram graph is examined in Figure 1, it is seen that 23 countries were grouped in the first cluster, and 15 countries were grouped in the second cluster. Country names for the first group: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxemburg, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, United Kingdom, and the United States. Country names for the second group: Chile, Colombia, Costa Rica, Czechia, Estonia, Greece, Hungary, Latvia, Lithuania, Mexico, Poland, Portugal, Slovak Republic, Slovenia, and Türkiye.

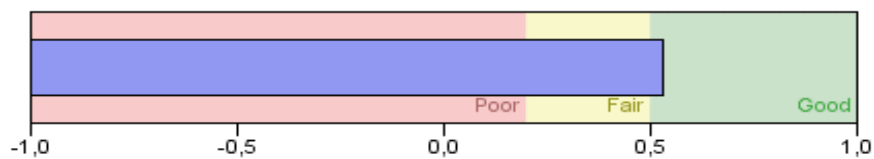
3.2. Two-Step Cluster Analysis Findings

Hierarchical cluster analysis yielded a meaningful two-cluster solution. However, we need to confirm this solution. To do so, the next strategy we follow is to apply a two-stage cluster analysis method that automatically discovers the unknown cluster number. The two-stage clustering method is a method that can be used when there is no prior knowledge about the cluster numbers (Giray, 2016: 16; Bülbül et al., 2017: 23). When applying the two-stage cluster method; Euclidean distance was used since continuous variables were used. Akaike Information Criteria (AIC) or Schwarz's Bayesian Criterion (BIC) determines the number of clusters. The two-step cluster analysis procedures evaluated the importance of cluster quality and predictor (T variables). Depending on the analysis results, a two-cluster solution was obtained with three input data (or variables). OECD countries determined cluster memberships for the related clusters as shown in Table 6 below:

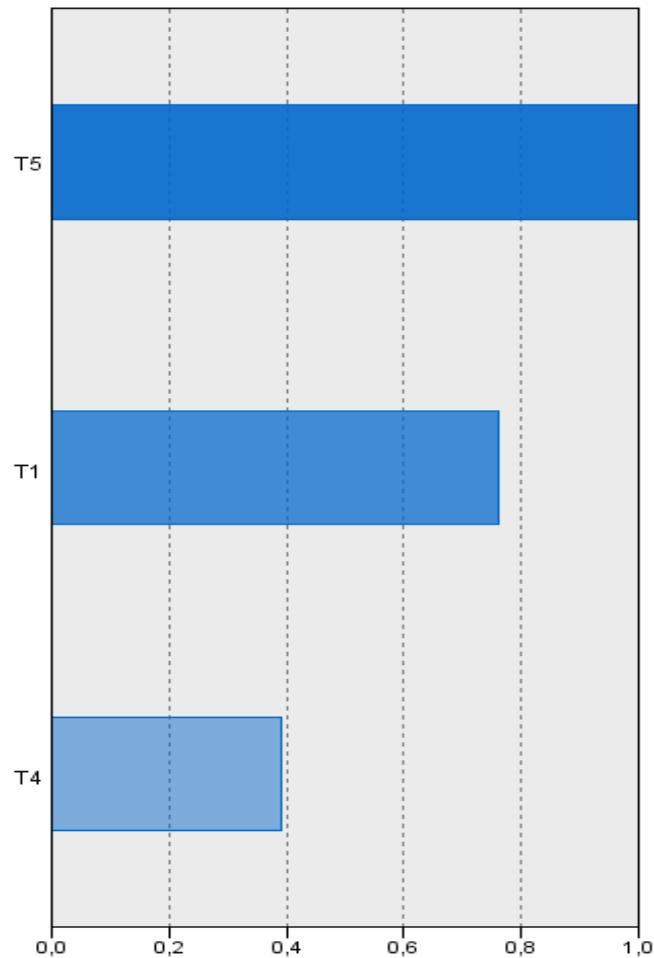
Table 6: Clustered OECD Countries and Cluster Memberships

Row Number	Cluster 1		Row Number	Cluster 2
1	Australia		5	Chile
2	Austria		6	Colombia
3	Belgium		7	Costa Rica
4	Canada		8	Czechia
9	Denmark		10	Estonia
11	Finland		14	Greece
12	France		15	Hungary
13	Germany		22	Latvia
16	Iceland		23	Lithuania
17	Ireland		25	Mexico
18	Israel		29	Poland
19	Italy		30	Portugal
20	Japan		31	Slovak Republic
21	Korea		32	Slovenia
24	Luxemburg		36	Türkiye
26	Netherlands			
27	New Zealand			
28	Norway			
33	Spain			
34	Sweden			
35	Switzerland			
37	United Kingdom			
38	United States			

Cluster quality is illustrated in Figure 2:

Figure 2: Cluster Quality: Silhouette Measure

In this Figure, the Silhouette measure, which measures cohesion and separation, shows that cluster quality is good. Figure 3 shows the predictor variable importance.

Figure 3: Predictor Variable Importance

The order of significance levels of the predictor variables that are important in the formation of clusters are respectively as follows: goods and services tax (T5) is ordered in the first place with 1.0, personal income tax (T1) is ordered in the second place with 0.76, and property tax (T4) is ordered in the third place with 0.39.

4. Conclusion

This study sought answers to the following research questions: (i) Are OECD countries divided into clusters? (ii) If so, how many clusters are they divided into? (iii) Do the clusters consist of meaningful country groups? and (iv) Which tax indicator variables are statistically significant in dividing OECD countries into clusters? Research findings show that OECD countries are divided into two meaningful clusters depending on the tax indicators (in order of importance, goods and services tax, personal income tax, and property tax). Moreover, two separate clustering methods (hierarchical and two-stage) used without prior information about the number of clusters gave the same


results: they all pointed to a two-cluster solution and the same cluster elements (or countries). The first cluster countries are composed of 23 countries that are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxemburg, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, United Kingdom, and United States. The second cluster countries are composed of 15 countries: Chile, Colombia, Costa Rica, Czechia, Estonia, Greece, Hungary, Latvia, Lithuania, Mexico, Poland, Portugal, Slovak Republic, Slovenia, and Türkiye.

The most crucial variable dividing into two clusters is the goods and services tax. The 2021 OECD tax average for goods and services is 31.91%. The first cluster's goods and services tax average (26.87%) is lower than the OECD average. The second cluster's goods and services tax average (39.65%) is higher than the OECD average. Personal income tax is the second most crucial variable divided into two clusters. The 2021 OECD tax average for personal income tax is 23.74%. The personal income tax average for the first cluster (29.76%) is higher than the OECD average. The personal income tax average for the second cluster (14.49%) is also lower than the OECD average. The third important variable in dividing into two clusters is property tax. The 2021 OECD tax average for property tax is 5.64%. The property tax average for the first cluster (7.25%) is higher than the OECD average. The property tax average for the second cluster (3.17%) is also lower than the OECD average. These tax differences indicate that countries in the first cluster collect more personal income and property taxes but less goods and services taxes than countries in the second cluster, which points out the characteristics of developed countries regarding tax policies.

Ethics Committee Approval: It is not a study that requires an ethics committee document.

Peer Review: External| independent.

Author Contributions:

[Selim Tüzüntürk](#)  - Idea, Design, Data Collection, Interpretation of Data, Drafting, Critical Review, Final Approval and Responsibility, Literature Review, Supervising. Overall Contribution - 100%.

Conflict of Interest: The author declared no conflict of interest.

Financial Disclosure: The authors declared that this study has received no financial support.

References

- Akçakaya, E. D. U. & Ömürbek, N. (2021). "OECD Ülkelerinin Demokrasi Kalitesi Göstergeleri Açısından Kümelenmesi". *Uluslararası Toplum Araştırmaları Dergisi*. 11(18), 1365-1393. <https://doi.org/10.26466/opus.865115>
- Akça, H., Ünlükaplan, İ. & Yurdadoğ, V. (2017). "OECD Ülkelerinde Yolsuzluk: Küme Analizi". 15. *Uluslararası Türk Dünyası Sosyal Bilimler Kongresi* (116-123).
- Akdamar, E. (2019). "OECD Ülkelerinin Bazı İş Gücü Piyasası Göstergeleri Kullanılarak Kümeleme Analizi ve Çok Boyutlu Ölçekleme Analizi ile İrdelenmesi". *Akademik Araştırmalar ve Çalışmalar Dergisi*. 11(20), 50-65. <https://doi.org/10.20990/kilisiibfakademik.534700>
- Akın, H. B. & Eren, Ö. (2012). "OECD Ülkelerinin Eğitim Göstergelerinin Kümeleme Analizi ve Çok Boyutlu Ölçekleme Analizi ile Karşılaştırmalı Analizi". *Öneri*. 10(37), 175-181. <https://dergipark.org.tr/en/pub/maruoneri/issue/17895/187692>
- Aksaraylı, M. & Pala, O. (2017). "Veri Zarflama Analizi ve Kümeleme Analzi Kullanılarak OECD'ye Üye Ülkelerin Ekonomik Performansları, Yaşam Memnuniyeti ve İnovasyon Düzeyleri Açısından Değerlendirilmesi". *Aydın İktisat Fakültesi Dergisi*. 2(2), 67-80. <https://dergipark.org.tr/en/pub/aifd/issue/33315/370061>
- Alkaya, A. & Alkaş, C. (2021). "OECD Ülkelerinin Sağlık Göstergelerine Göre Kümeleme Analizi Sınıflaması". *Sosyal Güvence Dergisi*. 10(19), 427-474. <https://doi.org/10.21441/sosyalguvence.1050881>
- Alpar, R. (2011). *Uygulamalı Çok Değişkenli İstatistiksel Yöntemler*. Ankara: Detay Yayıncılık.
- Alptekin, N. & Yeşilaydın, G. (2015). "OECD Ülkelerinin Sağlık Göstergelerine Göre Bulanık Kümeleme Analizi ile Sınıflandırılması". *Journal of Business Research Turk*. 7(4), 137-155. <https://www.ceeol.com/search/article-detail?id=689986>
- Arı, E. & Gülcemal, M. E. (2019). "OECD Ülkelerinin Sigorta Pazar Paylarının Çok Değişkenli İstatistiksel Yöntemlerle İncelenmesi". *Batman Üniversitesi Yaşam Bilimleri Dergisi*. 9(2), 136-157. <https://dergipark.org.tr/en/download/article-file/910223>
- Arı, E. & Yıldız, A. (2018). "OECD Ülkelerinin Göç İstatistikleri Bakiminden Bulanık Kümeleme Analizi ile İncelenmesi". *Pamukkale Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*. 33, 17-28. <https://doi.org/10.30794/pausbed.402883>
- Aslan, B. Y. & Açıkgöz, Ş. (2019). "OECD Ülkelerinde İşgücü Piyasası Esnekliği ve Güvenceli Esneklik Göstergelerine Yönelik Bir Değerlendirme". *Çalışma İlişkileri Dergisi*. 10(2), 45-68. <https://dergipark.org.tr/tr/download/article-file/898778>
- Ayabakan, B. Ç. (2022). "OECD Ülkelerinin Küresel Cinsiyet Uçurumu Endeksi Verilerini Kümeleme Analizi ile Değerlendirilmesi". *Uluslararası Sosyal Bilimlerde Yenilikçi Yaklaşımlar Dergisi*. 6(2), 40-58. <https://doi.org/10.29329/ijiasos.2022.458.1>
- Birkalan, A. Ö. & Tekeli, R. (2022). "K-Means Yöntemi ile Türkiye'nin Vergi Takoza Açısından OECD Ülkeleri Arasındaki Yerinin Belirlenmesi". 12. *Uluslararası Sosyal Araştırmalar ve Davranış Bilimleri Konferansı* (260-270).
- Blashfield, R. K. & Aldenderfer, M. S. (1978). "The Literature on Cluster Analysis". *Multivariate Behavioral Research*. 13(3), 271-295. https://doi.org/10.1207/s15327906mbr1303_2

- Bulut, Y. (2023). "Denetimsiz Öğrenme: Kümeleme Analizi ile OECD Ülkelerinde Özgürlük". *ESBİD Uluslararası Eğitim ve Sosyal Bilimler Dergisi*. 2(2), 83-106. <https://doi.org/10.5281/zenodo.10429529>
- Bülbül, Ş. & Camkiran, C. (2018). "Bankaların Klasik ve Bulanık Yaklaşımlarla Sınıflandırılması". *Trakya Üniversitesi Sosyal Bilimler Dergisi*. 20(2), 367-385. <https://doi.org/10.26468/trakyasobed.464442>
- Bülbül, Ş., Çilingirtürk, A. M., Altaş, D., Yıldırım, E. & Yakut, S. G. (2017). "Türkiye'de İşgücü Talep Yapısına Göre İllerin Sınıflandırılması". *Journal of Awareness*. 2(4), 15-36. <https://dergipark.org.tr/en/pub/joa/issue/43500/531666>
- Çemrek, F., Şentürk, S. & Terlemez, L. (2010). "Bulanık Kümeleme Analizi ile OECD Ülkelerinin Co2 Emisyonları Bakımından İncelenmesi". *E-Journal of New World Sciences Academy*. 5(3), 52-69. <https://dergipark.org.tr/en/pub/nwsaphysic/issue/20033/213536>
- Çetintürk, İ. & Gençtürk, M. (2020). "OECD Ülkelerinin Sağlık Harcama Göstergelerinin Kümeleme Analizi ile Sınıflandırılması". *Süleyman Demirel Üniversitesi Vizyoner Dergisi*. 11(26), 228-244. <https://doi.org/10.21076/vizyoner.650681>
- Dağ, O. (2023). "OECD Ülkelerinin İhracat ve İthal Edilen Ürün Gruplarına Göre Kümelenmesi". *Gazi Journal of Engineering Sciences*. 9(4), 186-200. <https://doi.org/10.30855/10.30855/gmbd.0705518>
- Dalkılıç, N. (2013). "Özel Emeklilik Fonlarının OECD Ülkelerinde Değerlendirilmesi". *The Journal of Financial Researches and Studies*. 4(8), 35-53. <https://dergipark.org.tr/en/pub/marufacd/issue/502/4565>
- Değirmenci, N. & Ayan, T. Y. (2020). "OECD Ülkelerinin Sağlık Göstergeleri Açısından Bulanık Kümeleme Analizi ve TOPSI Yöntemini Göre Değerlendirilmesi". *Hacettepe Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*. 38(2), 229-241. <https://doi.org/10.17065/huniibf.592991>
- Engin, M. (2018). "Hiyerarşik Kümeleme Analizi ile OECD Ülkelerinin Bilgi Ekonomi İndekslerine Göre Sınıflandırılması". *Paradoks Ekonomi, Sosyoloji ve Politika Dergisi*. 14(1), 73-86. <https://dergipark.org.tr/en/pub/paradoks/issue/41450/427508>
- Eren, H. & Ömürbek, N. (2021). "OECD Ülkelerinin Lojistik Performansları Açısından Kümelenmesi". *Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*. 26(2), 153-166. <https://dergipark.org.tr/tr/pub/sduibfd/issue/62132/869510>
- Eroğlu, A. & Özen, A. (2023). "OECD Ülkelerinde Yolsuzluk ve Belirleyicilerinin Hiyerarşik Kümeleme ile Analizi". *Sosyoekonomi*. 31(57), 331-355. <https://doi.org/10.17233/sosyoekonomi.2023.03.16>
- Ertaş, S. A. & Atik, H. (2016). "Kalkınma Göstergeleri Bakımından Türkiye'nin OECD Ülkeleri Arasındaki Yeri: İstatistiksel Bir Analiz". *Kesit Akademi Dergisi*. 2(5), 13-24. <https://dergipark.org.tr/en/pub/kesitakademi/issue/59841/864775>
- Filiz, M. & Budak, O. (2024). "Classification of OECD Countries According to Health Data with Clustering Analysis." *International Journal of Health Administration and Education (Sanitas Magisterium)*. 10(1), 1-15. <https://dergipark.org.tr/tr/download/article-file/3657700>
- Giray, S. (2016). "İki Aşamalı Kümeleme Analizi ile Hükümlü Verilerinin İncelenmesi". *İstanbul Üniversitesi İktisat Fakültesi Ekonometri ve İstatistik Dergisi*. 25, 1-31.

- Gore, P. A. (2000). "Handbook of Applied Multivariate Statistics and Mathematical Modeling", In Tinsley, H. E. A. & Brown, S. D. (Eds.), *Cluster Analysis* (297-321). Massachusetts: Academic Press.
- Güler, E. Ö. & Veysikarani, D. (2018). "OECD Ülkelerinin İnovasyon Göstergeleri Açısından Çok Değişkenli İstatistiksel Analizlerle Karşılaştırılması". *Cumhuriyet Üniversitesi İktisadi ve İdari Bilimler Dergisi*. 19(2), 157-168. <http://esjournal.cumhuriyet.edu.tr/tr/pub/issue/40744/430554>
- Güler, E. Ö. & Veysikarani, D. (2022). "Sosyo-Ekonomik Göstergeler ve PISA Skorlarına Göre Sınıflandırılması: OECD Örneği". *Ömer Halisdemir Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*. 15(3), 506-522. <https://doi.org/506-522>. 10.24287. 958903
- Gülşen, M. İ. (2019). "Türkiye ve OECD Ülkelerinin Vergi Ödeme Sürelerinin Bulanık Kümeleme Analizi ile Modellenmesi". *İnsan ve Toplum Bilimleri Araştırmaları Dergisi*. 8(1), 447-471.
- Kandemir, A. Ş. (2020). "Yaralanmalı Trafik Kaza Sayılarının OECD Ülkelerine Göre İncelenmesi". *Journal of Original Studies*. 1(1), 31-38. <https://doi.org/10.47243/jos.1.1.03>
- Kangallı, S. G., Uyar, U. & Buyrukoğlu, S. (2014). "OECD Ülkelerinde Ekonomik Özgürlük: Bir Kümeleme Analizi". *Uluslararası Alanya İşletme Fakültesi Dergisi*. 6(3), 95-109. <https://dergipark.org.tr/en/pub/uaifd/issue/21601/231994>
- Kayri, M. (2007). "Araştırmalarda İki Aşamalı Kümeleme Analizi ve Bir Uygulaması". *Euroasian Journal of Educational Research*. 28, 89-99. https://ejer.com.tr/wp-content/uploads/2021/01/ejer_2007_issue_28.pdf
- Keklik, A., Başol, O. & Yalçın, E. C. (2020). "İş Yaşam Dengesinin Daha İyi Yaşam Endeksi Çerçevesinde Değerlendirilmesi: OECD Ülkeleri Üzerine Bir İnceleme". *Kırklareli Üniversitesi Sosyal Bilimler Dergisi*. 4(1), 20-33. <https://dergipark.org.tr/en/download/article-file/1166909>
- Köse, A. (2022). "OECD Ülkelerinin Sağlık Göstergeleri Açısından Kümeleme Analizi Yöntemine Göre Değerlendirilmesi". *Nevşehir Hacı Bektaş Veli Üniversitesi SBE Dergisi*, 12(4), 2010-2021. <https://doi.org/10.30783/nevsosbilen.1080274>
- Kuşkaya, S. & Gençoğlu, P. (2017). "OECD Ülkelerinin 1995-2015 Yılları İtibariyle Sera Gazı Salımları Açısından Karşılaştırılması: İstatistiksel Bir Analiz". *International Journal of Disciplines Economics & Administrative Sciences Studies*. 3(3), 177-188.
- Kutlar, A., Gülmez, A. Koç, P. & Öncel, A. (2023). "Pandemi Sürecinde Meydana Gelen Makroekonomik Kayıpların Analizi: OECD Ülkeleri Üzerine Bir Araştırma". *Sakarya İktisat Dergisi*. 12(1), 125-150. <https://dergipark.org.tr/tr/pub/sid/issue/76355/1234245>
- Landau, S. & Ster, I. C. (2010). "Cluster Analysis: Overview". *International Encyclopedia of Education*, 72-82. <https://doi.org/10.1016/B978-0-08-044894-7.01315-4>
- Madenoğlu, F. S. (2023). "Cluster Analysis of OECD Countries During the Covid-19 Pandemic". *International Journal of Economic and Administrative Academic Research*. 3(2), 163-180. <https://ijerdersisi.com/index.php/ijer/article/view/47>
- Morey, L. C., Blashfield, R. K. & Skinner, H. A. (1983). "A Comparison of Cluster Analysis Techniques Within a Sequential Validation Framework". *Multivariate Behavioral Research*. 18, 309-329. https://doi.org/10.1207/s15327906mbr1803_4

- Mut, S. & Akyürek, Ç. E. (2017). "OECD Ülkelerinin Sağlık Göstergelerine Göre Kümeleme Analizi ile Sınıflandırılması". *International Journal of Academic Value Studies*. 3(12), <https://doi.org/411-422>. 10.13934/1999.393
- Rencher, A. C. & Christensen, W. F. (2012). *Methods of Multivariate Analysis*. New Jersey: John Wiley & Sons, Inc.
- Sel, A. (2020). "Veri Madenciliği Kümeleme Yöntemleri Kullanarak Karbon Emisyonu Göstergeleri Açısından Oecd Ülkelerinin Sınıflandırılması". *Karadeniz Uluslararası Bilimsel Dergi*. 46, 169-187. <https://doi.org/10.17498/kdeniz.679555>
- Shih, M. Y., Jheng, J. W. & Lai, L. F. (2010). "A Two-Step Method for Clustering Mixed Categorical and Numeric Data". *Tamkang Journal of Applied Science and Engineering*. 13(1), 11-19. <https://doi.org/10.6180/jase.2010.13.1.02>
- Soydan, N. T. Y. & Yakut, S. G. (2018). "Yenilenebilir Enerji Kullanımı Açısından OECD Ülkelerinin Etkinliğinin İncelenmesi". 3. *Uluslararası Sosyal Beşeri ve Eğitim Bilimleri Kongresi*.
- Şen, H. & Varüer, İ. (2019). "OECD Üye Ülkeleri için İntihar Oranları Araştırması: Bir Kümeleme Analizi Çalışması". *Alphanumeric Journal*. 7(2), 471-484. <https://doi.org/10.17093/alphanumeric.573611>
- Taşçı, M. & Özari, Ç. (2019). "OECD Ülkelerinin Ekonomik Özgürlük Göstergelerinin K-Ortalamlar Kümeleme Yöntemi ve Gri İlişkisel Yöntemi ile Analizi". *Akademik Sosyal Araştırmalar Dergisi*. 7(96), 464-488. <http://dx.doi.org/10.29228/ASOS.36738>
- Tatlıdil, H. (2002). *Uygulamalı Çok Değişkenli İstatistiksel Analiz*. Ankara: Akademi Matbaası.
- Timm., N. H. (2002). *Applied Multivariate Analysis*. New York: Springer.
- Turanlı, M., Özden, Ü. H. & Türedi, S. (2006). "Avrupa Birliği'ne Aday ve Üye Ülkelerin Ekonomik Bnezerliklerinin Kümeleme Analiziyle İncelenmesi". *İstanbul Ticaret Üniversitesi Sosyal Bilimler Dergisi*. 5(9), 95-108.
- Ünal, S. (2021). "K-Means Kümeleme Algoritması ile OECD Ülkelerinin Vergi Yükü ve Kayıtdışı Ekonomi Analizi". *Kırklareli Üniversitesi Sosyal Bilimler Meslek Yüksekokulu Dergisi*. 2(2), 1-15. <https://doi.org/10.51969/klusbmyo.1033170>
- Yılmaz, T. (2022). "OECD Ülkelerinin İş Gücü Endeksi Açısından Kümeleme Analizi ile İncelenmesi". *Journal of International Management, Educational and Economics Perspectives*. 10(1), 84-101.
- Yorulmaz, Ö, Yakut, S. G. & Gacar, B. K. (2018). "Doğrudan Yabancı Yatırımları Etkileyen Faktörlerin Çok Değişkenli İstatistiksel Yöntemler ile İncelenmesi". *Uluslararası İnsan Çalışmaları Dergisi*. 1(2), 157-171. <https://doi.org/10.35235/uicd.475432>