ATATÜRK ÜNİVERSİTESİ YAYINLARI
ATATURK UNIVERSITY PUBLICATIONS

Research Article *Araştırma Makalesi* DOI: 10.16951/trendbusecon.1479660

Education Indicators That Determine Welfare Level: EU Countries and Turkey

Refah Seviyesini Belirleyen Eğitim Göstergeleri: AB Üye Ülkeleri ve Türkiye

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ABSTRACT

Today, the concept of economy both expresses quantitative data ant includes factors that cannot be expressed in numbers. Economy and welfare indicators are now considered together. Education is one of the main determinants of both concepts. This study examines educational indicators that distinguish welfare states and non-welfare states by applying decision trees that are data mining techniques. Values of welfare index of EU countries and Turkey and its thirteen education indicators were used for the period of 2016-2020. Findings suggest that doctorate graduate indicator is the most important variable which discriminates welfare states and non-welfare states.

JEL Codes: I31, I28, C44

Keywords: Welfare, Higher Education, Decision Tree, Data Mining, Education.

ÖZ

Günümüzde ekonomi kavramı sadece sayısal verilerle ifade edilememektedir. Refah kavramı içerisindeki ekonomi anlayışı sayısal verilerin ötesinde yer almaktadır. Eğitim değişkeni ise hem refahın hem de ekonominin temel belirleyicilerinden biridir. Bu çalışmada veri madenciliği tekniklerinden karar ağaçları kullanılmıştır. Avrupa Birliği üye ülkeleri ve Türkiye için refahı belirleyen eğitim göstergeleri bu yöntemle incelenmiştir. 2016-2020 dönemine ait refah endeksi değerleri ve 13 eğitim göstergesi kullanılmıştır. Bulgular doktora mezun sayısı göstergesinin söz konusu ayırımı sağlayan en önemli değişken olduğunu göstermiştir.

JEL Kodları: I31, I28, C44

Anahtar Kelimeler: Refah, Yükseköğretim, Karar Ağaçları, Veri Madenciliği, Eğitim.

Geliş Tarihi/Received 07.05.2024
Kabul Tarihi/Accepted 01.11.2024
Yayın Tarihi/Publication Date 08.01.2025

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Cite this article: Yüzbaşı, G. (2024). Education Indicators That Determine Welfare Level: EU Countries and Turkey. *Trends in Business and Economics*, *39*(1), 52-61.

Introduction

In general, the concept of development is about change. The change in any society is affected by the economy. Countries, which succeed in economic development, provide improvement and social change accordingly. However, during this change process countries, which focused only on the economy, ignore other factors. Education is one of these factors. Education is evaluated from two different ways. First, when education is viewed as a means of raising income, it actually moves away from its original role., it actually moves away from its original role. Secondly, education has an important role in helping protect human rights and reduce social problems. Both aspects of education should be taken into account in real development (Bak, 2018).

None of the states can be considered without education. It cannot be mentioned culture and technology in a country with a low education level. Innovation is a result of education. Therefore, a consistent innovation policy is based on the education system (Mihaela & Titan, 2014. p. 1045). In maximizing the welfare level, the political system reveals the different characteristics of the education system (Fernandez & Rogerson, 1998). Education plays an important role in changing the characteristics of individuals and their positions in the economy, social structure and politics (Apple, 2013).

Education is very important for radical changes and innovative processes. It contributes to the entrepreneurship strengthens the labor markets especially by developing of the innovative structure in the economy. Potential workforce is not sufficient as much as the number of qualified specialists, that is needed in certain fields of education. However, the average wage is the most important indicator that affects the number of students and graduates in vocational and higher education, which are required to work in the high-tech manufacturing industry. There is a strong link between education and the labor market in the high-tech manufacturing sector (Spilova, 2015).

The role of higher education is usually to support the economic development of nations and provide opportunities for individuals. In addition, it promotes and harmonizes cultural diversity, political democracy and economic trade (Marginson, 2013). Investments in education are based on a political equation where higher skills are equal to higher wages. A knowledge-based economy demands a greater portion of the workforce, university education and with access to lifelong learning opportunities, which have a major impact on higher education participation rates (Brown et al., 2008).

The intensity of participation in higher education is quite high in global cities and there is a strong positive relationship between a country's higher education enrollment rate and global competitive performance. For this reason, the intensity of participation in higher education is very low in the countries and regions that leave the network-based economy (Marginson,2011). People with a higher education level have better living standards. It is stated in the general economic theory that education should be 10% of the national budget. The fact that spending on education is over 10% has positive results. Japan made a 50% investment in education after the Second World War and started to get results of its investments in the 1960s (Moldovan, 2012). The role of higher education is usually to support the economic development of nations and provide opportunities for individuals (Marginson, 2011).

Issues such as the contribution of education to economic growth, the profitability of education investments, the role of trained labor in economic development, the cost of education, the financing of education, the effects of education on income and welfare level are the main research fields of education economy (Woodhal, 2013). The health, education and welfare spending of the state has increased the return on education by ensuring equality and balancing the socioeconomic level between individuals. Macroeconomics, which examines long-term growth outputs, is related to different aspects of public finance of education (Gamlath & Lahiri, 2018).

This study aims to identify education variables that separate welfare countries and non-welfare countries. Education is completely associated with the welfare of countries. However, which of education variable determines that countries are welfare state or not, will be examined in the study.

In this study, Welfare rankings that are conducted by Legatum Institute discussed for the period between 2016-2020 years. The top 30 countries in the ranking for each year are taken as welfare countries. Other countries are taken as non-welfare countries. By using 13 quantitative education indicators and the categorical variable of welfare belonging to the countries, important education variables, which affect the welfare of the countries, were determined by the C5.0 algorithm, which is among the

decision trees algorithms of data mining methods.

Education, Economy and Welfare

As in the human capital theory, children's educational outcomes have been improved by increasing total family income and reducing extreme poverty (Ku, 2001). There is a significant performance difference between workers who are trained and workers who are not trained. Changes in spending also destabilize the economy during periods of increasing uncertainty (Franke at al., 2009). Therefore, although it may seem possible to design educational policy rules, it is also important to recognize and explain their circular effects (Lykins, 2011).

Cultural dimensions affect how regions are combined with tools of global competitive economy. This interaction takes place by means of the education system, higher education, knowledge transfer and education finance variables (Cheung & Chan, 2010). The rate of increase in education expenditures has a positive and significant effect on economic growth in all cases (Baum and Lin, 1993). Decreasing education financing may result in a lower quality learning environment, which has a final impact on employee productivity and economic welfare (Dede, 1981. p. 247). Reducing inequality in school income and school resources and ensuring equality in education finance is very effective in terms of political economy (Skrtic, 2005).

The effect of education subsidies is uncertain and long-term. Its impact on welfare is important (Del Rey and Lopez-Garcia, 2016). There is a strong correlation between the socioeconomic structure of the parents and the education level of their children. This strong relationship shows that educated and low-income parents have a high chance of educating their children. Therefore, social welfare programs that support low income students' participation in education will break the poverty cycle (Di Pietro, 2003). There is a different relationship between education and gender-based welfare participation dynamics. Explaining the opportunities of men and women in the labor market reflects the different role of education. This role of education explains its relation to welfare exit rates (Barret, 2000). Better retirement reform implementation has a positive relationship with the increase in the educational level of the employed persons. Education factor has an impact on retirement (Li & Wu, 2018).

The education system aims to provide abilities and perspectives on life in an economically developed and democratic society. This purpose of the education system has non-competitive features that are equal to everyone. The choice and diversity within a democratic education system should be linked to the expectations of ethnic minorities, women and the working class. Therefore, intakes to schools should be in social balance. If a privileged segment is created, the general education standard decreases and a low trust economy occur with low-skilled personnel. In addition welfare standards are not met (Lauder, 2012). Welfare state type and social security expenses are stronger predictors of educational spending than the socialist election power (Hega & Hokenmaie, 2002). Welfare mothers are provided to low education and income groups for the purpose of ensuring welfare eligibility. Education equality is an important policy for welfare (Turner, 2016). Countries with a liberal welfare approach apply the philosophy of strong human capital, which requires the most resources for higher education (Peacher & Andres, 2011). When it is discussed education spending as a share of total public spending, social democratic and liberal nations are doing the same relatively, and they certainly do more than conservative states (Hega & Hokenmaie, 2002). Education, which is an important element of a country's overall social policy set (or welfare system), is influenced by welfare factors such as labor force policy, family and child protection policy, and social security (Peter at al. 2010).

Academic system and welfare support are mandatory but not sufficient. Organizing and making this support more important was found to be significant in increasing student success (Jacklin & Robinson, 2007).

Legatum Prosperity Index

Developed countries have provided good economic development. However, these societies also had problems such as mental and behavioral disorders, family disintegration and decreasing of social trust. If the goal for development is defined as GDP only, society will work only to produce GDP. None of these values will be produced if a target for the society is not determined and the indicators of welfare, equality, justice and efficiency are not measured regularly. Today's welfare vision does not only include economic development. Actions such as human development, reducing environmental impacts, and ensuring social cohesion reflect the true meaning of welfare. The position of a country in determining the level of welfare does not change based on GDP. The effective new measure of welfare can be considered as a radical

change that determines the levels of development. Therefore, this measure regulates the reallocation of resources.

When the economy and society operate in a virtuous and high-confidence, service-oriented moral framework, the resources will flow to the most productive people and places for the benefit of many. Otherwise, wealth only tends to a certain group. This situation has been put forward by the Legatum. This institute was established in 2009. Its mission is to generate and distribute capital and ideas for people to live a more prosperous life. Legatum Institute applies a combination of material wealth and life's satisfying factors. It realizes the welfare rankings of countries with Legatum Prosperity Index by using these applications. Khan and Ahmad evaluated LPI in their studies. They concluded that LPI is a valid source of assessment as it expresses the dimensions that are essential for individual and national welfare.

The Institute has provided a redefinition of the mechanism used to measure human well-being, wealth and progress in human life by bringing together human aspects beyond GDP growth per capita. The components considered by Legatum are listed below.

Social Aspects: Health; safety and security; social capital; education and environment

Economic Aspects: Economic quality and; business environment

Institutional Aspects: Personal freedom: infrastructure and; governance (Khan & Ahmed, 2016).

Methods

Data

In this study, the European Union member states and Turkey's 13 education variables were used for 2014-2018 years. Legatum Welfare Index rankings are used together with 13 education variables of countries in data mining application. Firstly, the countries that entered and did not enter to top 30 in the Legatum Prosperity Index Rankings were determined for the years 2016, 2017, 2018, 2019, 2020. While countries, which are in top 30 for Legatum Prosperity Indeks, are taken as welfare countries, the others are taken as non-welfare countries. The names and descriptions of the education variables are given in Table.1.

Table 1. *Definition of Education Variables*

Education Variables	Definition
Student Participation Percent	The percentage of participants in the education of all students
Students Enrolled in Tertiary Education	The total number of students enrolled territory education
Degree mobile graduates from abroad	The number of graduates from abroad
Total Graduates	Total number of graduates
Classroom Teachers and Academic Staff	Percentage of teachers and academicians by population
Funding of Vocational Education	Sum of Public funds and private funds devoted to vocational education
Expenditure of The Educational İnstitutions on Vocational Education	The total expenditure of educational institutions in vocational education
Public expenditure on education (%GDP)	GDP rate on the state's education expenditures
Pupils and Students by Early childhood Education	The number of students enrolled in pre-school education
Mobile Students from Abroad Enrolled by Tertiary Education	Total number of students coming from abroad and enrolled in territory education
Employment rates by Education Level	Total employment rate by education level
Unemployment Rates by Education Level	Total unemployment rate by education levels
Graduates At Doctoral Level	Total number of graduates from doctorate degree

Then, a decision tree application of data mining techniques was carried out in this study. In the decision tree application, 13 quantitative education variables and one categorical variable that indicates welfare country or not-welfare country according to LPI rankings were used for 2016, 2017, 2018, 2019, 2020. years. In the analysis, the welfare categorical variable was taken as the target variable. Education quantitative variables were used as predictive variables. Data on the education variable is taken from EUROSTAT. Data showing the welfare feature is taken from the Legatum Prosperity Index reports for 2016, 2017, 2018, 2019 and 2020.

Welfare Rankings of LPI

The countries, that are and are not in top 30 according to the rankings in the Legatum Welfare index, are listed in

Table.2. The top 30 countries are welfare countries according to Table.2 and these countries are coded with 1. The countries that cannot enter the top 30 are not welfare and are coded with 0.

According to Table 2, while Estonia was not a welfare country in 2016 and 2017, it was ranked as a welfare country in 2018, 2019, 2020. Italy was welfare country only in 2019, Cyprus was welfare country only in 2020 and Poland was welfare country only in 2017.

Table 2. *Welfare Rankings of Countries by Legatum Institute*

COUNTRIES	2016	2017	2018	2019	2020
Belgium	1	1	1	1	1
Bulgaria	0	0	0	0	0
Czech	1	1	1	1	1
Denmark	1	1	1	1	1
Germany	1	1	1	1	1
Estonia	**0**	**0**	**1**	**1**	**1**
Ireland	1	1	1	1	1
Greece	0	0	0	0	0
Spain	1	1	1	1	1
France	1	1	1	1	1
Croatia	0	0	0	0	0
Italy	**0**	**0**	**0**	**1**	**0**
Cyprus	**0**	**0**	**0**	**0**	**1**
Latvia	0	0	0	0	0
Lithuania	0	0	0	0	0
Luxembourg	1	1	1	1	1
Hungary	0	0	0	0	0
Malta	1	1	1	1	1
Netherlands	1	1	1	1	1
Austria	1	1	1	1	1
Poland	**0**	**1**	**0**	**0**	**0**
Portugal	1	1	1	1	1
Romania	0	0	0	0	0
Slovenia	1	1	1	1	1
Slovakia	0	0	0	0	0
Finland	1	1	1	1	1
Sweden	1	1	1	1	1
United K	1	1	1	1	1
Iceland	1	1	1	1	1
Norway	1	1	1	1	1
Switzerland	1	1	1	1	1
Montenegro	0	0	0	0	0
Serbia	0	0	0	0	0
Turkey	0	0	0	0	0

Data Mining

Today, much significant information revealed with the accumulation of data, has created the field of data mining. Firstly, the concept of data mining emerged in the 1990s through the process of knowledge discovery in databases and it took part as one of the stages of this process. Data mining techniques make large amounts of data both understandable and useful with different methods; in addition enable analysis of observational data sets to find unexpected relationships. (Chye et al. 2004. p. 101). These relationships and confidential information have to be previously unknown relationships and information (Silahtaroğlu, 2013. p. 12).

Data mining is described as a new and different discipline associated with statistics, mathematics, database technologies, pattern recognition, and machine learning (Hand, 1998. p. 115). Different methods are used in data mining according to their objectives. Therefore, the purpose of data mining techniques should be known. Different data mining models have been developed for purposes such as classification, clustering, prediction, relationship analysis, association analysis. The information is filtered, prepared and also classified for useful decisions and strategies (Hand, 1995. p. 1). Classification application of data mining is used in this study.

The most common techniques used for classification are decision trees and artificial neural networks (Öztemel, 2006. p. 15). Decision trees is used more widely than other classification models due to its features such as being cheap, ease of interpretation, simple integration with database systems, and high reliability (Özekes, 2003. p. 16). Therefore, decision trees, one of the classification methods, were used in the study.

It can basically be said to consist of two steps. The first one is the establishment of the tree. Second, the data is applied to the tree one by one and classification is carried out. When the decision trees generate, which algorithm is used, is very important. Trees with different structures can give different classification results (Silahtaroğlu, 2013. p. 36).

There are different algorithms for decision trees. These are:

- Entropy-based ID3, C4.5, C5.0 algorithms,
- Classification and regression trees (CART) and
- Memory-based classification algorithms.

In this study, since the predictive variables are quantitative, C5.0, an algorithm based on entropy, was

used.

C 5.0. Algorithm

It allows being used features that are quantitative in decision trees. It shows how to design the decision trees. It points out this way for clusters, which have previously unknown feature values. It has the same process as the ID3 algorithm. In addition, quantitative data are converted with a certain threshold value in C5.0 algorithm. In the first stage, the midpoint of the values of the variable with quantitative data is determined as the threshold value and then the data are grouped as less than, equal or greater than this value. In the second stage, the entropy value of the target variable is calculated. Entropy is a measure used in branching decision trees. In short, it is defined as the measure of uncertainty in a system. Entropy value is calculated with the following formula:

k class according to the values that any variable will take let be $\mathbf{c_1}, \mathbf{c_2}, \dots \dots \mathbf{c_k}$

Let t be the number of all values of the variable,

If k group possibilities are $\mathbf{P_t} = {}^{\mathbf{c_1}}/_{\mathbf{t}}$, ${}^{\mathbf{c_2}}/_{\mathbf{t}}, \dots \dots {}^{\mathbf{c_k}}/_{\mathbf{t}}$,

Entropy is calculated as
$H(t) = \sum P_i \log_2 P_i$.

In the third stage, equivalents in target features of groups belonging to each class feature are examined. Entropy of these groups in themselves is calculated. The calculated entropy values are multiplied by the probabilities of the groups belonging to the feature and then these values are summed.

$$H(x, t) = \sum {}^{t}/_{t_i} H({}_{t_i})$$

In the fourth stage, the criteria of gain are determined. To calculate this measure, the value of the examined feature is subtracted from the entropy value of the target feature.

$$Gain(x\ t) = H\ (t) - H(x\ t)$$

All of the processes examined above, are applied for each feature. Branching in decision trees begins with the highest gain feature. The same processes iteratively continue until the decision tree is completed (Özkan, 2013. p. 110).

Results

Decision Tree Outcomes

European Union member states and Turkey were examined in this study. Thirteen different education variables and one categorical welfare variable were used in this study. These data are for the years 2016, 2017, 2018, 2019, 2020. Decision tree application, one of the data mining techniques, was realized. With the decision tree analysis, it was aimed to determine the most important education variables that affect being a welfare country or not.

Decision tree was used to determine which education variables come to the fore according to the welfare levels of the countries. C5.0 algorithm was used in the decision tree application of the study. Since the C5.0 algorithm performs the classification process, the decision tree is trained first. The model obtained is tested with a new data set and the performance of the model is observed. For this reason, 136 of 170 unit data were randomly selected and the model was created as a training data set. Countries, whose welfare levels are grouped according to LPI, were used as the target variable at this stage. Therefore, the target variable is determined as the welfare level and is grouped as 0 and 1. 13 educational variables were used as predictive fields.

According to the decision tree model, the first distinctive education variable is the graduate rate of the doctorate. Countries that value of this variable are less than 1.6, are not welfare states. These countries do not take place in the top 30 of welfare index. Countries that value of this variable are larger than 1.6, are welfare states. These countries take place in the top 30 of welfare index. Other distinctive variable is percentage of teachers and academic staff. Countries which this variable value are above 0.003, take place the top 30 countries in welfare index.

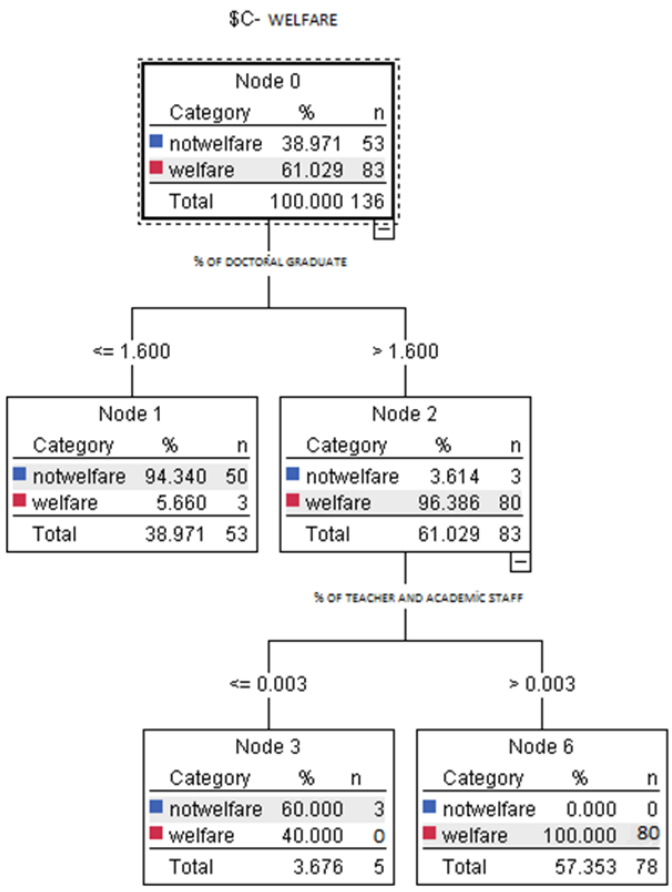

Figure 1. Dendrogram of Decision Tree

Model Consistency

The table, that shows the classification performance of the model, is given below. The model was tested with the remaining 34 data. Classification success for both data sets is given in Table 3. The accuracy of the model was analyzed. In this context The model generated 96.3% correct grouping and 3.7% incorrect grouping in the training dataset. The accuracy rate of the model was investigated with test data. The correct classification success in the model was obtained 93,75%. The fault classification rate was showed up %6,25. In the learning dataset, Cyprus for the year 2020, Poland for 2017 and Estonia for 2016, Italy for 2020, and Portugal for 2019 are grouped incorrectly. In the test dataset, Estonia for 2018 and Italy for 2017 are grouped incorrectly.

Table 3. *Results of model consistency*

CLASSİFİCATİON	TRAINING DATA SET		TEST DATA SET	
	NUMBER	PERCENT	NUMBER	PERCENT
TRUE	131	96.3	32	93.75
FALSE	5	3.7	2	6.25

Discussion

The fact that higher education variable among the education indicators are significative in terms of welfare country, supports in the literature. For this reason, countries that want to increase their welfare should develop their education policies especially in higher education. To reveal undiscovered human capital in the society and ensure welfare of the society, accessing higher education needs to be expanded (Jones-De Weever, 2006. p. 120).

After World War II, higher education was considered an important part of a consistent welfare policy structure. Combining the analysis of higher education and welfare policies broadens the understanding of national differences in both areas. There is a strong link between higher education and welfare regimes (Peacher and Andres, 2011. p. 50). Academic literature, which considers education as part of the welfare state, supports that higher education is indispensable for the welfare state. Our empirical analysis revealed that the educational indicator that distinguishes welfare countries and non-welfare countries is the number of doctoral graduates. It has indicated that higher education is more important for welfare than other education factors. In addition, it has been revealed that the rates of academicians and teachers are another distinctive variable. Teacher quality is the most important component of human capital, which is difficult to measure (Mehta, 2018. p. 70).

Conclusion and Recommendations

Education, economy and welfare are three important interconnected issues. These issues are intertwined with each other and cannot be independently considered from each other. While education directly and indirectly affects the economy, economy and education affect direct welfare. Welfare concept is not only considered economically. Education complements most of this concept. Education consists of different variables. It is important to identify the determinants of these variables in terms of welfare. This study has revealed the important educational variable affecting welfare.

In this study, data of 13 quantitative educational variable and welfare categorical variable is used between 2016-2020 years. These data are received for EU membership countries and Turkey. It was concluded from the study that the variable, which separates welfare states and non-welfare states, is the number of doctorate

graduates. These results revealed an important relationship between higher education and welfare. Considering the education indicators in the concept of welfare, the importance of higher education becomes apparent. Material variables such as education expenses, funds, etc. in the economy were used in practice. However, the education indicator that determines the attribute of welfare has been the number of doctoral graduates, which are the most important stage of higher education. In terms of welfare, it is important to reduce unemployment and promote higher education, rather than relying on the needs of financial markets. In addition, high levels of unemployment, higher education and employment are strong determinants of welfare (Guardiola & Guillen-Royo, 2015. p. 400).

With the influence of globalization, the countries of the world are in constant change and development. It is explained in the study that one of the most important education factors separating developed welfare countries and developing countries, is higher education. There is a common view in the academic literature that education should be viewed as part of the welfare state. Higher education cannot be excluded from research on the welfare state (Willemse & De Beer, 2012. p. 108). The relationship between higher education and welfare has been revealed in many studies. In future studies, the strength of this relationship and other factors affecting this relationship can be explored.

The presence of educators in a society and the development of higher education ensure that the welfare level of that society is increased. Based on this study, the importance of teacher and academician ratios has been revealed.

Hakem Değerlendirmesi: Dış bağımsız.
Çıkar Çatışması: Yazar, çıkar çatışması olmadığını beyan etmiştir.
Finansal Destek: Yazar, bu çalışma için finansal destek almadığını beyan etmiştir.

Peer-review: Externally peer-reviewed.
Conflict of Interest: The author have no conflicts of interest to declare.
Financial Disclosure: The author declared that this study has received no financial support.

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Genişletilmiş Özet

Refah ve eğitim faktörü arasında güçlü bir ilişki bulunmaktadır. Eğitim ise kendi içerisinde farklı birçok değişkene sahiptir. Bu güçlü ilişkiyi belirleyen eğitim göstergeleri ise gelişmekte olan ülkeler açısından oldukça önemlidir. Bu çalışmanın motivasyonu ise bu ilişkinin belirleyici değişkenlerini ortaya çıkarmaktır. Bu çalışmanın amacı refah seviyesini belirleyen eğitim değişkenlerinin ortaya çıkarmaktır. Dünyadaki sürekli değişim ve gelişim ülkelerin refah seviyesini etkilemektedir. Refah kavramı ise günümüzde sadece ekonomik açıdan değil birçok faktör açısından değerlendirilmektedir. Bu değişim ve gelişim süreci boyunca gelişmekte olan çoğu ülke refah seviyesini yükseltmek için sadece ekonomiye odaklanmaktadır ve diğer faktörleri ise göz ardı etmektedir. Bu nedenle ulaşmaya çalıştıkları refah seviyesine varamamaktadırlar. Bir ülke ekonomik açıdan ne kadar gelişmiş olursa olsun, eğitim, sağlık vb. gibi farklı açılardan da ilerlemezse gerçek refah seviyesine ulaşamaz. Gelişmiş ülkelerin çoğu eğitimde fark ortaya çıkaranlardır. Bu nedenle refah kavramı eğitim olmadan düşünülemez. Özellikle eğitimin insan haklarının korunmasında ve sosyal problemlerin azaltılmasında önemli bir yer vardır (Bak, 2018). Ayrıca günümüzde ekonomik açıdan önemli olan inovasyon kavramı da eğitimin bir sonucu olarak değerlendirilmektedir. Tutarlı bir inovasyon politikası eğitim sistemine bağlıdır (Mihaela & Titan, 2014). Eğitim sübvansiyonlarının etkisi belirsiz ve uzun vadelidir. Refah üzerindeki etkisi önemlidir (Del Rey ve Lopez-Garcia, 2016: 536). Ebeveynlerin sosyoekonomik yapısı ile çocuklarının eğitim düzeyi arasında kuvvetli bir ilişki vardır. Bu güçlü ilişki, eğitimli ve düşük gelirli ebeveynlerin çocuklarını eğitme şansının yüksek olduğunu göstermektedir. Bu nedenle, düşük gelirli öğrencilerin eğitime katılımını destekleyen sosyal refah politikaları uygulanmaktadır (Di Pietro, 2003: 8). Eğitim ile cinsiyet temelli refaha katılım dinamikleri arasında farklı bir ilişki vardır. Erkeklerin ve kadınların işgücü piyasasındaki fırsatlarını açıklamak, eğitimin farklı rolünü yansıtır. Eğitimin bu rolü, refah ile ilişkisini açıklamaktadır (Barret, 2000: 210). Refah seviyesini belirleyen eğitim göstergelerini oartaya çıkarmak için veri madenciliği tekniklerinden karar ağaçları C5.0 algoritması kullanılmıştır. 33 Avrupa Birliği üye ülkesinin ve Türkiye'nin verileri çalışmada kullanılmıştır. Bu verileri 2015, 2016, 2017, 2018, 2019 yılları için ayrı ayrı elde edilmiştir. Dolayısıyla 170 birim gruplanmıştır. Bunlardan 136 tanesi eğitim veri seti olarak C5.0 algoritmasında kullanılmıştır. Geriye kalan 34 tanesi ise test veri seti olarak C5.0 algoritmasında kullanılmıştır. LPI' ya göre refah özelliği açısından gruplanan veriler hedef değişken, eğitim değişkenlerine ait veriler ise tahminleyici değişken olarak C5.0 algoritmasında kullanılmıştır. Çalışmada refah değişkeni olarak Legatum Refah Enstitüsü tarafından her yıl yapılan sıralamalar kullanılmıştır. Bu enstitü tarafından her yıl refah endeksi hesaplanmaktadır ve hesaplanan endeks değerlerine göre ülkeler sıralanmaktadır. Bu indekste ilk 30'a giren ülkeler refah ülkesi, ilk 30'a giremeyen ülkeler ise refah olmayan ülkeler olarak gruplandırılmıştır. Çalışmada 13 adet eğitim göstergesi kullanılmıştır. Bu değişkenler literatürde yer alan çalışmalardan elde edilmiştir. Söz konusu değişkenler; öğrencilerin eğitime katılımım yüzdesi, okula kayıtlı öğrenci sayısı, yurtdışından mezunların sayısı, mezunların toplam sayısı, öğretmen ve akademisyenlerin toplam popülasyona oranı, mesleki eğitime ayrılan kamu fonlarının ve özel fonların toplamı, mesleki eğitimdeki kurumlarının toplam harcaması, devletin GSYH'deki eğitim harcamaları oranı, okul öncesi eğitime kayıtlı öğrenci sayısı, yurt dışından gelen ve yükseköğretime kayıtlı toplam öğrenci sayısı, eğitim seviyesine göre istihdam oranı, eğitim seviyelerine göre işsizlik oranı ve doktora derecesinden mezun sayısıdır. Çalışmamızda kullanılan eğitim değişkenine ait veriler EUROSTAT isimli internet sitesinden alınmıştır. Refah seviyesi kategorik değişkenine ait veriler ise Legatum Instıtute adlı web sitesinden alınmıştır. Çalışmayla birlikte literatür incelenerek refah seviyesi ve eğitim ilişkisinin önemi ortaya çıkarılmıştır. Bu bağlamda çalışmada refah seviyesini belirleyen ayırıcı eğitim göstergeleri tespit edilmiştir. Bu göstergelerden ilki doktora mezun oranıdır. Diğeri ise öğretmen ve akademisyenlerin popülasyondaki oranıdır. Çalışmayla birlikte yükseköğretimin refah seviyesi açısından oldukça önemli olduğu ortaya çıkarılmıştır. Ülkeler refah seviyelerini yükseltmek için sadece ekonomiye değil özellikle yükseköğretime önem vermelidirler. Ayrıca öğretmen ve akademisyen yetiştirmek de gelişmekte olan ülkeler için önemlidir.