THE CORRELATION BETWEEN CORRUPTION AND SOCIOECONOMIC DEVELOPMENT: AN APPLICATION FOR OECD COUNTRIES

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Abstract: Corruption is an ancient phenomenon that weakens all functions of the government, directly affects its monetary and fiscal policies, and causes permanent social and economic problems by disrupting human capital. Corruption can cause structural problems (e.g., unemployment, unfair distribution of income) to deepen, slow economic growth, weaken human development and lead to insecurity and social unrest. Statistical analysis of this concept, which is of great economic significance, is an important source of motivation for the present study. The current study aims to categorize the nations based on corruption levels and to identify the discriminating economic variables effective in this categorization. Thus, various economic variables that affect the level of corruption in OECD countries, including Turkey, are evaluated. The 2013 data for the thirty-four countries are tested using discriminant analysis in the study. The results indicate that in OECD members with low HDI, GDP per capita and education expenditures, and high unemployment, the level of corruption is at a higher level.

Keywords: *Corruption, economic development, human capital, discriminant analysis, OECD countries.*

YOLSUZLUK VE SOSYO EKONOMİK GELİŞME İLİŞKİSİ: OECD ÜLKELERİ İÇİN BİR UYGULAMA

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Öz: Yolsuzluk, devletin tüm işlevlerini zayıflatan, para ve maliye politikalarını doğrudan etkileyen ve beşeri sermayeye zarar vererek kalıcı sosyal ve ekonomik problemlere yol açan eski bir olgudur. Yolsuzluk, ülkelerde var olan yapısal problemlerin (işsizlik, adaletsiz gelir dağılımı gibi) derinleşmesine, ekonomik gelişmenin yavaşlamasına neden olabilmekte, insani gelişmeyi zayıflatarak, güvensizlik ortamı ve toplumsal huzursuzluklara yol açmaktadır. Bu çalışmada ülkelerin yolsuzluk düzeylerine göre gruplandırılması ve bu gruplandırmada etkili olan ayırt edici ekonomik değişkenlerin tespit edilmesi amaçlanmıştır. Bu bağlamda ülkemizin de üyesi olduğu OECD ülkeleri için yolsuzluk düzeyini etkileyen çeşitli ekonomik değişkenler değerlendirilmiştir. Araştırma kapsamında otuz dört ülkeye ilişkin derlenen 2013 yılı verileri diskriminant analizi kullanılarak test edilmiştir. Sonuçlar, İnsani Gelişme Endeksi, kişi başı gelir, eğitim harcamaları gibi değişkenlerin düşük, işsizlik oranının yüksek olduğu OECD ülkelerinde yolsuzluk düzeyinin daha yüksek olduğunu göstermektedir.

Anahtar Sözcükler: *Yolsuzluk, ekonomik gelişme, beşeri sermaye, diskriminant analizi, OECD ülkeleri.*

INTRODUCTION

According to the most accepted definition in the literature, corruption can be described as the abuse of public service for private benefits. Corruption is a complex, multi-faceted and old phenomenon with multiple causes and effects. Two thousand years ago, Kautilya, the prime minister of the King of India, discussed this issue in the book *Arthashastra*, and seven centuries ago, Dante mentioned corruption in his book Divine Comedy, and in Shakespeare's plays, corruption was a topic as well (Tanzi, 1998: 4).

Corruption, a social concept, is an important problem in both developed and developing countries. While corruption was discussed in sociology, politics, history, public administration and criminal law until the 1980s, after that time, it was mostly scrutinized based on its impact on the economy (Ahmad *et al*., 2012: 277). Today, due to the advances in globalization and information and communication technologies, capital movements, developments in foreign trade and financial systems, the boundaries of corruption were expanded to international dimensions and further widened the impacts of corruption.

Previous studies demonstrated that corruption increases the non-confidence for the government in public and decreases the capacity of the state to conduct its basic functions. As the impact of corruption increases on these functions, government policies and their implementation are further distorted. Based on its prevalence, corruption affects as macro-financial stability, public and private investment, human capital accumulation, and total factor productivity, which play a role in potential and inclusive growth, where in turn, low inclusive growth can cause an increase in corruption prevalence, resulting in a negative cycle that can feed itself and last a considerably long period of time (IMF, 2016: 5).

Recent studies concluded that economic development would suffer in situations where human development is weak. In countries with high levels of corruption, socio-economic development is a scarcity. Recent reports claimed that the annual cost of only bribery is 1.5-2 trillion dollars in developed and developing countries. This is roughly equivalent to 2% of global GDP. When it is considered that bribery is only a part of corruption, the general economic and social costs of corruption are estimated to be much higher (IMF, 2016: 5). The report, published by the International Transparency Group in 2012, argued that corruption plays an important role in European debt crisis, and fundamental problems such as accountability, bad governance, inefficiency and misconduct were not resolved in certain EU countries. An increasing number of countries improved their corruption scores in 2015, although corruption is still a worldwide problem. Corruption levels in countries such as Greece, Senegal and the

United Kingdom have significantly improved since 2012, while the corruption levels deteriorated in countries such as Australia, Brazil, Libya, Spain and Turkey in the same period (Transparency International, 2015).

Most of the studies about corruption indicate that one of the major obstacles to social and economic development is corruption. While our work confirm old studies in the literature, furthermore it provides an opportunity to evaluate position of many economic variables against corruption.

The present study attempted to test the correlation between corruption and economic development with discriminant analysis. Thirty-four OECD countries, including Turkey, were categorized based on corruption perception levels and an attempt was made to identify the economic variables that were effective in the said categorization.

The first section of the study includes a literature review on the subject. In the second section, the methodology is discussed. In the third section, information on the study data is provided. In the fourth section, empirical findings are revealed. In the fifth and final section, the theoretical and empirical results are interpreted.

1. LITERATURE REVIEW

Corruption is a multifaceted ancient concept with multiple causes and consequences. Thus, several studies have been conducted on corruption in the literature. Correlation between various economic variables and corruption and the effects of corruption on these economic variables have been examined. These studies found different results for different countries or groups of countries. In recent years, both academic studies and international organization reports focused on the negative impact of corruption on the economy and society. Corruption alters various state functions, which might lead to destabilization of macroeconomic financial stability, accumulation of human capital, investments in public and private sectors and total factor productivity. In an environment where corruption is omnipresent, it should be taken into consideration in evaluation of national economic performance beyond the direct impact of monetary and fiscal policies. In fact, universal corruption would impact all state functions and lead to a prevailing distrust among the public and social capital would erode. Under extreme corruption, the state would disintegrate, chaos and conflict would reign in society, leaving behaving long-term social and economic consequences (IMF, 2016: 27). However, corruption has little adverse effects on investment (including FDI), entrepreneurship, competition, and efficiency of the government, government expenditures and revenues, and creation of human capital. On the other hand, it has significant adverse effects on environmental quality, personal health and safety, income

distribution, which are important economic development indicators, as well as different social or civic capital such as trust that have important impact on economic welfare and national growth potential (OECD, 2013).

In a study, it was argued that corruption increases public expenditures and decreases public revenues. Therefore, contributing to higher fiscal deficit and making it difficult for the state to conduct robust fiscal policies. It was also determined that corruption could worsen income equality due to the fact that corruption will enable well positioned individuals to engage in state activities, disenfranchising the rest of the society (Tanzi, 1998). In a study by Alesina *et al.* (1992), correlation between political instability and per capita GDP growth was investigated between 1950 and 1982 using a sample of 113 countries. The study concluded that during the periods when the governments tended to collapse, economic growth was lower when compared to other times. Political stability is significant for economic growth. In another study, it was argued that increasing rent-seeking activities in the society could have a negative impact on innovative activities, reducing the economic growth rate (Murphy *et al.*, 1993) It was also found that corruption reduces investments, thus decreasing the economic growth rate (Mauro, 1995).

According to Morgan (1998), in the presence of corruption, public spending decisions change, and decisions that increase social welfare are replaced by decisions that increase individual welfare during this change. Gupta *et al.* (1998) found that high corruption levels increased income inequality and poverty, lowered economic growth, the level and effectiveness of social spending, destroyed the tax system, eroded the formation of human capital, and damaged equal opportunity in education. In another study conducted by Gupta *et al.* (2000) on numerous developed and developing countries, they found that high corruption levels negatively affected national child and infant mortality, low birth weight in total births and dropout in primary school rates. Li *et al.* (2000) stated that counties with high corruption also have low equality in their study. In that study, empirical results demonstrated that economic growth was also negatively affected by corruption.

According to Barretto (2001), there is a positive significant correlation between corruption and inequality and high income inequality is correlated with high corruption levels. In a study by Mo (2001), quantitative estimates for the effect of corruption on economic growth and significance of transmission channels were discussed. Study findings demonstrated that a 1% increase in corruption level decreased the growth rate by approximately 0.72%. According to the said study, corruption affects economic growth most significantly via political instability channel, which explained 53% of the total impact. The study also demonstrated that corruption reduced both the human capital level and the share of private investments. Akçay (2006), claimed that human

development is a function of economic freedoms, democracy, urbanization and corruption. He investigated the impact of corruption on human development using three different corruption indices and observed that significant and negative relationship between corruption and human development. His empirical results that more corrupt countries tend to have lower level of human development. Eicher *et al.* (2009) found that intermediate education level could lead to a poverty trap, because the skill levels acquired in education would result in corruption rent, however not lead to adequate supervision, while economies with low or high education levels may not fall into the abovementioned trap, while inequality plays a role in determining the occurrence of this trap via institutional changes or expansion of educational opportunities. Karagöz and Karagöz (2010) investigated the relationships between corruption, economic growth and public expenditures in Turkey and found that there was no causality between public spending and corruption, however there was a one-way causality between economic growth and corruption, from growth to corruption.

In their study, Ahmad *et al.* (2012) aimed to determine the correlation between corruption and economic growth using panel data. The study investigated the empirical linear quadratic correlation between corruption and economic growth. The study reached an estimation that a decrease in corruption level led to an increase in growth rate with an inverse U-shaped correlation. Bakırtaş (2012) analyzed how corruption in Turkey affected tax revenues in a specific time series and found a positive and strong correlation between corruption and tax revenues. The study concluded that corruption leads to a significant reduction in total tax revenues. In a study conducted with Nigerian data, Umaru *et al.* explored the correlations between crime levels, unemployment rate, poverty rate, and corruption level and inflation between 1980 and 2009. It was found that unemployment, poverty and corruption had a negative impact on crime levels and inflation rate had a positive effect on crime levels in Nigeria. It was established that there is an association among crime levels, unemployment, poverty, corruption and inflation rate, however it was determined that even when people were poor, corrupt and unemployed, it might not lead to high crime levels, but when the cost of living due to inflation rate increases, crime levels increase as well.

Uğur (2014) compiled 327 estimates for direct impact of corruption on per-capita GDP growth using 29 previously conducted studies using a peer-reviewed and pre-published systematic review methodology. The precision-effect and funnel asymmetry tests applied in the study with control on publication selection bias and within-study dependence demonstrated that per-capita GDP growth is negatively affected by corruption. In another study, the correlation between shadow economy and corruption was investigated as determinants of public debt in Spanish Autonomous Communities. Study findings demonstrated that shadow economy volume has a significant positive impact on regional public debt. There was also a direct significant correlation between

corruption and public debt in the abovementioned communities, however the impact was lower when compared to the correlation with the shadow economy (Fernandez, Velasco, 2014). Ulman and Bujanca (2014) found that as a result of the increase in corruption levels, macroeconomic indicators would deteriorate and this would lead to a decrease in economic growth, a decline in physical investments, economic productivity, public revenues and a rise in inflation rate, government inefficiency in allocation of resources for public services. Ivanyna *et al.* (2015) indicated that corruption is an important determinant of government debt and differences in debt levels in developed countries can be explained by corruption in their study. Bouzid (2016) stated that as the rent seeking behavior among public employees increases, the rate of unemployment among the young and educated population increases as well, and when there are no effective control and monitoring mechanisms, these practices increase and individuals pay a price to secure a job. Konu and Ata (2016) focused on the correlation between economic freedom and corruption, and in the empirical study they conducted on 28 EU countries and Turkey, found that economic freedom has a statistically significant and positive impact on corruption perception index. Lucic *et al.* (2016) attempted to test the causality between corruption and economic development in their study conducted on a large number of developed and developing countries, and studied the years between 1995 and 2011 in three 5-year periods. They calculated that the strongest causality between the two variables occurred during the second period, in other words, in the medium term. Ariely and Uslaner (2017) found that corruption was high in countries with high income inequality in their study conducted with 31 country data. In the study, it was stated that corruption and injustice shaped the perception of inequality.

In a recent study, it was found that there is no direct correlation between corruption and income equality, however corruption has a significant impact on the distribution of public expenditures. As government spending increases in corrupt countries, the resources tend to accumulate in the well-connected individuals. However, initial analysis demonstrated that this was only true for Asian countries and the opposite was true for Latin American cases. Because, the distribution effect of corruption in Asia and Latin America is determined by political competition, not by regional differences (Wong, 2017: 298-315).

2. METHODOLOGY

Multivariate techniques, discrimination and classification are utilized to separate distinct groups of objects or observations and categorize new objects or observations under predefined groups. R. A. Fisher introduced the terminology of discrimination in problems of separation. Discriminant analysis is an exploratory technique. Since it is a technique that aims at separation, it is frequently utilized singularly to examine the

differences between objects where an obvious correlation cannot be observed (Johnson, Wichern, 1998: 629).

Discriminant analysis is also called classification analysis. In a case, where observations are originated from several populations and there is a single observation known to originate from one of these population, but the particular population that it was originated is unknown, discriminant analysis could generate a rule or a classification method that the researcher could identify the population from which the abovementioned observation might come (Johnson, 1998: 217).

Discriminant analysis is a technique that derives functions, which would allow the separation of variables in X dataset into two or more groups, optimal allocation of these units to their actual groups in the natural environment based on the p number of properties of the units (Özdamar, 2004: 355). The technique has two basic functions of discrimination and classification, which are applied in several fields such as medicine, botanic, anthropology, education, economics and behavioral sciences. There are certain assumptions that are required for the application of discriminant analysis. These are as follows:

❖ The data matrix X should exhibit multivariate normal distribution.

❖ The variables in matrix X should be obtained from a multivariate population with a common covariance matrix. In other words, the variance and covariance of the variables should be homogenous.

❖ There should be a correlation between the variable mean and variance.

❖ There should be no multicollinearity between the variables.

❖ Matrix X should not include redundant variables and should include accurate and required variables that could discriminate g groups (Özdamar, 2004: 358).

Although the analysis is based on the assumption that the variables should be samples obtained from a multivariate population with a common covariance matrix, it could also be applied in situations the said assumption is not valid. Linear discriminant analysis is recommended when the above hypothesis is valid and quadratic discriminant analysis is recommended when it is not.

3. DATASET and VARIABLES

The present attempted to group OECD countries based on corruption levels and to determine the factors that are effective in this grouping. The reason for selection of OECD countries is as follows: OECD consists of relatively large number of countries

from different regions and furthermore Turkey is a member as well. The year 2013 is the most recent year for regulation of the data of all member states.

The data was compiled from The World Bank, The Organization for Economic Co-Operation and Development (OECD), United Nations Development Program (UNDP) and Transparency International resources for the analysis.

For the study, 2013 data for thirty-four countries (Australia, Austria, Belgium, Turkey, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, Holland, New Zealand, Norway, Poland, Portuguese, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, UK and USA) were collected. However, first, it would be appropriate to define The Corruption Perception Index (CPI).

The CPI scores and ranks countries/territories based on how corrupt a country's public sector is perceived to be. It is a composite index, a combination of surveys and assessments of corruption, collected by a variety of reputable institutions. The CPI is the most widely used indicator of corruption worldwide. The 2013 CPI draws on data sources from independent institutions specialising in governance and business climate analysis. The sources of information used for the 2013 CPI are based on data gathered in the past 24 months. The CPI includes only sources that provide a score for a set of countries/territories and that measure perceptions of corruption in the public sector. A country/territory's score indicates the perceived level of public sector corruption on a scale of 0-100, where 0 means that a country is perceived as highly corrupt and a 100 means that a country is perceived as very clean (Transparency International, 2013).

Macroeconomic variables used to group the countries are presented in Table 1, followed by a detailed explanation of the variables. The countries covered in the analysis are grouped based on their perceived corruption scores as countries with over sixty-five points and countries with under sixty-five points, hence high corruption and low corruption groups, respectively.

Table 1. Selected Economic Variables for OECD Countries

Tax revenue (GDP%)	GDP per capita (USD)
Inflation rate (%)	Human Development Index
Unemployment rate (%)	Total public debt (GDP %)
GDP growth (%)	Education expenditure (GDP %)

Tax revenues (TR): Tax revenues are public revenues that include income and profit taxes, social security payments, taxes imposed on goods and services, payroll taxes, taxes on the ownership and transfer of property, and other taxes. Total tax revenue as a percentage of GDP reflects the levies imposed by the government on national output.

GDP growth (GDPG): It is the annual growth rate as a percentage of GDP in market prices in constant local currency. Changes are calculated based on constant US dollars. GDP is the total of the gross value added in the economy by local producers and any taxes on products, minus subsidies excluded in product prices. Depreciation and fabricated assets or depletion and deprivation of natural resources are excluded in the calculation of GDP.

Unemployment rate (UR): Unemployment rate is the share of unemployed individuals in the labor force. Labor force includes all unemployed, employed and self-employed individuals.

GDP per capita (GDPPC): GDP per capita is the rate of gross domestic product to the population at midyear. GDP is the total of the gross value added in the economy by local producers and any taxes on products, minus subsidies excluded in product prices. Depreciation and fabricated assets or depletion and deprivation of natural resources are excluded in the calculation of GDP. Data are presented in current US dollars.

Inflation rate (IR): Consumer price index (CPI) inflation is the change in the prices of a set of goods and services that are commonly purchased by certain household groups.

Human Development Index (HDI): The Human Development Index (HDI) is an expression of brief mean achievements in key human development dimensions. These dimensions are a long and healthy life, having knowledge and a decent standard of living. The HDI is calculated with the geometric mean of normalized indices for each of the abovementioned three dimensions.

Health aspect is calculated by life expectancy at birth, education is assessed by mean schooling years of 25 years old and older adults and the years of education expected for school-age children. The standard of living is measured by gross national income per capita. Logarithm of income is used in the calculation of HDI to account for the reducing significance of income with the increase in GNI. The three HDI dimension index scores are finally combined in a composite index using the geometric mean.

Total public debt (TPD): Total gross public debt as a percentage of its GDP is the rate of general government debt to GDP.

Education expenditure (EE): It is the general public spending on education as a percentage of GDP that includes current, capital and transfer expenses funded by international sources. General public spending includes local, regional and central government expenditures.

4. EMPIRICIAL FINDINGS

In this section of the study, Pearson correlation analysis was applied to determine the multicollinearity problem before the analysis of the 2013 data collected for the OECD member countries. In the correlation matrix obtained with the analysis, the variables related to the coefficient that was calculated as greater than 0.70 were excluded from the analysis. Various variable combinations were tested for analysis and the results that best fulfilled the expectations are presented. In the second phase, to test the equality of the variable covariance matrices, the Box's M test was applied and the test findings are presented in Table 2.

Table 2. Box's Test of Equality of Covariances Matrices

Box's M		65.084
F	Approx.	5.534
	df1	10
	df2	3004.307
	Sig.	.000

The findings depicted in Table 2 demonstrate that the null hypothesis that the covariance matrices are homogeneous was rejected. Thus, it was concluded that the application of quadratic discriminant analysis would be adequate. The canonical correlation, eigenvalue and Wilks' lambda statistics given in Table 3 should be conducted to determine the significance of the discriminant function.

Table 3. EigenValues and Wilks' Lambda

Eigenvalues				
Function		Eigenvalue	% of Variances	Cumulative %	Canonical Correlation
	1	1.343	100	100	0.757

Wilks' Lambda				
Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	0.427	25.549	4	0

The canonical correlation value given in Table 3 indicates that the model can explain approximately 76% of the variance in the dependent variable. Furthermore, it is observed that one discriminant function and eigenvalue are generated due to fact that the dependent variable contained two categories. It can be stated that the function provided good discrimination since the eigenvalue value calculated as 1.343 is greater than 0.40. Wilks' Lambda and Sig. values showed that the discriminative power of the discriminant function that would be generated would be statistically significant. The independent variables to be included in the discriminant function obtained as the result of the analysis, related coefficient values and the structure matrix are presented in Table 4.

Table 4. Standardized Canonical Discriminant Function Coefficients and Structure Matrix

Std. Can. Discr. Func. Coefficients		Structure Matrix	
	Function 1		Function 1
HDI	.383	GDPPC	.747
EE	.323	HDI	.702
UR	-.456	UR	-.471
GDPPC	.507	EE	.428

The standardized canonical discriminant function coefficient column in Table 4 demonstrates that HDI, EE, UR and GDPPC variables were significant discriminant variables for separating the countries into low and high corruption groups. Since the coefficients of these variables can be considered as the coefficients in the regression analysis, it is observed that the coefficient symbols were also consistent with the expectations. In other words, it can be said that the HDI, EE and GDPPC variables affect the numerical value of the corruption in the positive direction and the UR variable in the negative direction. Structure matrix results indicate the relationship of each variable with the discriminant function. Here, it was observed that the variable with highest correlation with the discriminant function was GDPPC. Another criterion that was used to assess the success of the discriminant analysis is the correct classification rate presented in Table 5.

According to the rates presented in Table 5, 84.6% of the countries in the high corruption group were correctly and 15.4% were incorrectly classified, while 90.5% of the countries in the low-corruption group were correctly classified and 9.5% were incorrectly classified. Also, Table 5 demonstrates that correct classification rate was 88.2%.

Table 5. Classification Results

		Group	1	2	Total
			Predicted Group Membership		
Original	Count	1	11	2	13
		2	2	19	21
	%	1	84.6	15.4	100.0
		2	9.5	90.5	100.0

a. 88.2% of original grouped cases correctly classified.

CONCLUSION

The concept of corruption, which was often associated with underdevelopment in the past, became a popular subject today as a result of the rising globalization, the technological advances. Corruption undermines all governmental functions and directly affects monetary and fiscal policies of the government. It could cause deterioration of national structural problems (e.g., unemployment, income distribution inequality) and a decrease in economic growth and weaken human development, leading to persistent social problems such as insecure environment, social unrest, and internal conflicts. Due to these reasons, firstly an effective and independent judicial system is essential to fight corruption. Public audit institutions should be strengthened for strong public reforms. Extra significance should be given to freedom of press and transparency. Society should be raised awareness and educated about corruption. Furthermore international cooperation is vital (Transparency International).

In the present study, thirty-four OECD member countries were classified as low and high corruption countries based on perceived corruption levels and an attempt was made to determine the variables that affected the said classification. The collected data were assessed by discriminant analysis. It was determined that variables that were effective on the discriminant function, which was obtained as the result of the conducted analysis, were Human Development Index, education expenditures, unemployment rate and GDP per capita variables. It was determined that the variables that were the most influential factors in the allocation of countries to the low and high corruption groups were GDP per capita and Human Development Index. These results demonstrated that in OECD members with low HDI, GDP per capita and education expenditures, and high unemployment, level of corruption was at a higher level. The results were consistent with the findings in the literature. Human capital is crucial for a comprehensive and sustainable economic development. Countries where there is moderate level of education and unequal income distribution face poverty and corruption. Corruption significantly erodes human capital since it reduces disposable income and the capacity of educational investments. All countries should prioritize human capital in order to cope with corruption and sustain socio-economic development.

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