İSTANBUL ÜNİVERSİTESİ YAYINEVİ

SİYASAL: Journal of Political Sciences, 33(2):375–389

DOI: 10.26650/siyasal.2024.33.1470287
http://jps.istanbul.edu.tr

SİYASAL: Journal of Political Sciences

Submitted: 18.04.2024
Revision Requested: 01.06.2024
Last Revision Received: 03.06.2024
Accepted: 24.06.2024

RESEARCH ARTICLE / ARAŞTIRMA MAKALESİ

The Relation between Corruption and Tax Revenues: An Assessment of Transitional economies

Yolsuzluk ve Vergi Gelirleri İlişkisi: Geçiş Ekonomileri Üzerine Bir Değerlendirme

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Abstract

Corruption affects many economic, political, and social indicators directly and indirectly. One of the economic costs of corruption is a decrease in tax revenues. In societies where corruption is high, administrators taking bribes for excess revenue may reduce tax administration performance. Therefore, corruption and taxes are closely related to each other. This study analyzes the impact of corruption on different tax types in 6 selected transition economies (Estonia, Czech Republic, Hungary, Poland, Latvia and Slovak Republic) in the 1998-2021 and Bootstrap Panel Granger causality method. According to this study, there is unidirectional causality from personal income tax to corruption in Slovakia, from corporate tax and VAT to corruption in Poland, from VAT and SCT to corruption in Hungary, and from VAT to corruption in Latvia. Additionally, there is a bidirectional causal relationship from corruption to personal income tax in Poland and from corruption to corporate tax in the Czech Republic and Hungary, but there is no causal relationship between corruption and VAT and SCT. Personal income and corporate taxes, which require a strong relationship between tax administration and taxpayers, are more affected by corruption than taxes such as VAT and SCT.

Keywords: Corruption, Tax Revenues, Granger Causality Analysis, Transition Economies

Öz

Yolsuzluklar iktisadi, siyasi ve sosyal birçok göstergeyi doğrudan ve dolaylı olarak etkilemektedir. Yolsuzluğun ekonomiye yüklediği maliyetlerden biri de vergi gelirlerinde azalmaya neden olmasıdır. Yolsuzluğun fazla olduğu bir toplumda yolsuzluğa bulaşmış idarecilerin rüşvet yoluyla fazla gelir elde etme çabası vergi idaresinin gelir toplama performansını azaltabilmektedir. Dolayısıyla yolsuzluk ve vergi birbiriyle yakın ilişki içerisinde olan kavramlardır. Bu çalışma,1998-2021 döneminde seçilmiş 6 geçiş ekonomisi (Estonya, Çekya, Macaristan, Polonya, Letonya ve Slovak Cumhuriyeti) özelinde yolsuzluğun farklı vergi türleri üzerindeki etkisini analiz etmeyi amaçlamaktadır. Bu amaçla Bootstrap Panel Grager nedensellik tahmin yönteminden istifade edilmiştir. Elde edilen sonuçlara göre, sırasıyla Slovakya'da kişisel gelir vergisinden yolsuzluğa, Polonya'da kurumlar vergisi ve KDV'den yolsuzluğa, Macaristan'da KDV ve ÖTV'den yolsuzluğa, Letonya'da KDV'den yolsuzluğa doğru tek yönlü nedensellik bulunmaktadır. İlaveten Polonya'da yolsuzluktan kişisel gelir vergisine, Çekya ve Macaristan'da yolsuzluktan kurumlar vergisine doğru tek yönlü nedensellik ilişkisi vardır ancak panel genelinde yolsuzluk ile KDV ve ÖTV arasında nedensellik ilişkisi yoktur. Çalışmada, vergi idaresi ile mükellef arasında sıkı ilişki gerektiren kişisel gelir vergisi ve kurumlar vergisi gibi vergiler vergi idaresi ile sıkı ilişki gerektirmeyen KDV ve ÖTV gibi vergilere kıyasla yolsuzluktan daha fazla etkilenmektedir.

Anahtar Kelimeler: Yolsuzluk, Vergi Gelirleri, Granger Nedensellik Analizi, Geçiş Ekonomileri

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To cite this article: Keyifli Senturk, N., Bayraktar, Y., & Ozyilmaz, A. (2024). The relation between corruption and tax revenues: an assessment of transitional economies. *SİYASAL: Journal of Political Sciences, 33*(2), 375–389. http://doi.org/10.26650/siyasal.2024.33.1470287

Introduction

Taxation is the primary source of sustainable revenue for countries. It is not possible for the public to fulfil its basic obligation to citizens and to provide the necessary infrastructure for economic growth and development without taxation (Mahdavi, 2008:608). The state transfer income to the public by generating income through assets it owns and using its tax authority. Through taxation, a portion of individuals' income is collected from individuals and companies within the framework of the law, and social income is generated in this way (Stein, 1994:28-29). So much so that the state determines how many services it will provide to society and how much labour it will employ, mostly through taxation.

Taxation policies of countries with different structural conditions vary; therefore, tax revenues and types may differ between countries. In general, in developed countries, taxes on individuals and institutions predominate, but in developing countries, taxes on the production and sale of goods and services are higher. Differences between countries are not limited to tax implementation policies; the economic, social, and institutional consequences of applied taxation may also differ. The economic, social, and institutional infrastructure of a country can affect its taxation structure.

Problems such as corruption and poor governance in the sustainability of tax policies can shape tax performance and the tax structure of countries. Corruption may occur in the form of people not paying their taxes partially or completely, usually in collusion with public officials, or it may cause collections to differ between individuals and institutions for similar accruals. This, on the one hand, causes the tax base to shrink and public revenues to decrease, and on the other hand, causes tax injustices to occur. It can be said that this process is a priority problem for transition economies.

The main features of transition economies, most of which emerged after the collapse of the Soviet Union, are the prevalence of corruption and the weakening of property rights (Şen and Kaya, 2020). Ensuring macroeconomic stability, liberalising foreign trade, and redefining the role of the state to promote growth and development in these countries. Many reforms have been implemented in economic, political, and social fields, such as the privatisation of state-owned enterprises (IMF, 2000). However, these countries, despite all policy measures, continue to experience corruption as one of the structural problems (Sandholtz and Taagepera, 2005). Furthermore, corruption is still considered one of the most critical problems facing economic development and democratisation in these countries (Svensson, 2005;Rose, 2001).

It is important to investigate the possible effects of corruption, which every country may face to some extent, on tax revenues and tax structures. This study focused on Transition economies, and although the tax systems of these countries are developing and adapting, they are still new. Starting from this point, the aim of this study is to investigate the possible relationship between tax revenues and corruption in 6 transition economies (Czechia, Estonia, Latvia, Poland, Hungary, and Slovak Republic). The focus of this study is the lack of studies investigating the relationship with corruption using broad tax indicators in Transition economies, which are one of the country groups in which corruption is at the forefront. In this context, the study is expected to contribute to the

literature. For this purpose, the analysis period in the study was 1998-2021, and Kónya's (2006) bootstrapped panel Granger causality analysis was used.

The remainder of this article is organised as follows. The second chapter presents the theoretical framework and literature review. The third section focuses on the dataset for the variables used in the econometric analysis. The fourth section explains the methodology. The fifth section presents the empirical results. The results are presented in the sixth section.

Theoretical Background and Literature Review

Theoretical Background

Taxes are an important source of income for developed and developing countries. Therefore, even in countries that have income-generating natural resources and are tourism destinations, income taxes make a stronger contribution to the public economy. therefore, taxes are an important financial tool needed for the state to finance public expenditures, achieve the intended economic and social goals, and ensure social justice and security (Salman et al., 2022; Obara and Nangih, 2017; Şentürk, 2014).

Behaviours such as issuing illegal licences or demanding unfair money from taxpayers, stealing public treasury, and selling state-owned goods at black market prices constitute corruption. Corruption is of critical importance to the sustainability of tax revenues. Because individuals contribute to the sustainability of tax policies by declaring their income honestly if they believe that the process is fair and legitimate. However, tax collection and accrual processes that are not conducted effectively and transparently by the public or public employees can damage citizens' sense of justice and undermine the effectiveness of public expenditures. Moreover, it decreases future public revenues. (Alm, et al., 2016; Martini, 2014; Purohit, 2007; Shleifer and Vishny, 1993).

In countries with high levels of corruption, tax revenues are not used to increase welfare but to serve the interests of certain individuals or groups (Monteiro, 2011). In fact, corruption is a social threat that disrupts social peace and causes the quality of the public sector to decrease in many areas. (Pellegata, 2012). The effects of corruption on taxes can occur directly and indirectly through different transfer channels. Corruptions; It affects many economic, legal, and cultural areas, such as income distribution, rule of law, inflation, public debt, law enforcement power, investment, economic growth, trust in government, and moral values. These parameters are sometimes effectively affected by purchasing power and sometimes by distrust of the public, and as a result, it can harm the tax system.

In the relationship between taxes and corruption, tax types are one of the determining parameters. Because each type of tax has a different reaction to corruption. The main factor affecting this is whether taxpayers have to deal with tax administration regarding the collection of taxes. For example, there is a close relationship with tax administration in collecting taxes on income, but there is no close relationship to collecting taxes on goods and services. The types of taxes collected on income are more transparent, and it may be more difficult to commit corruption in these taxes, especially in countries with institutionalisation. However, in indirect taxes, businesses can resort to corruption that

can lead to tax leakage. However, the weaker effect of taxes on taxpayers' perceptions may lead to priority given to indirect taxes (Şen and Kaya, 2023; Liu and Feng, 2015; Giray, 2005; Besley and Mclaren, 1993).

The direction of corruption sometimes goes from individuals to governments. As a matter of fact, companies look for ways to pay as little tax as possible because they see taxes as a burden (Marjit et al., 2016). Thus, companies may resort to taking advantage of tax loopholes, evading taxes, or bribing tax officials assigned to audit companies to reduce or eliminate their financial burdens. In this case, these individuals may sometimes be punished by judicial authorities, and sometimes they may choose to share a part of the tax with the tax officer (Besley and Persson, 2013). In this regard, the existence of deterrent penalties may be a determining factor in whether public employees and individuals choose to follow these paths.

Corruption can sometimes cause individuals who are not prone to bribery to change their tax decisions. Individuals expect taxes paid to be returned to them in the form of public services. However, they do not want to pay taxes if they believe that the taxes collected are wasted by the state; the tax system is unfair; tax amnesties are frequently applied; and penalties and inspections are not high (Chan and Ramly, 2018). Thus, people who do not have a tendency to corruption may resort to methods such as under-declaring their income, over-declaring deductions, not filing proper tax returns, and avoiding taxes to avoid paying or under-paying income taxes (Alm et al., 2016).

A country that wants to increase tax collection must minimise or eliminate corruption. Because corruption can negatively affect tax allocation by rendering governments dysfunctional (Gupta and Verhoeven, 2001). Revenue losses caused by corruption-related inefficiency in tax collection may lead to reduced public sector investments and infrastructure services, high debt, and additional taxation. This directly imposes an additional financial burden on citizens (Marjit et al., 2016). For example, in countries where corruption is high, citizens may engage in business with bribes, which can be seen as a second payment for public services. Thus, taxes lose their importance, and citizens' costs for public service increase (Gediz Oral, 2009).

Literature Review

The relationship between corruption and macroeconomic indicators is a frequently discussed topic, and tax revenues are a prominent variable in this context. The general opinion in these studies is that corruption negatively affects tax revenue (See: Johnson et al., 1998; Tanzi and Davoodi, 1997; Ghura, 1998; Ajaz and Ahmad, 2010; Örücü et al., 2012; Bertinelli and Bourgain, 2016; Drif and Rawat, 2018; Abede and Fikre, 2020). However, these studies focused on one or a few tax types, and the literature-examining comprehensive tax types and the direction of this relationship is quite limited.

Thornton (2008) examined the relationship between tax revenues and corruption using different tax indicators for 53 Middle Eastern and African countries between 1984 and 2001. Corruption negatively affects taxes on social security, taxes on goods and services, and taxes on international commercial transactions. Beşkaya and Bağgiden (2008) analysed the relationship between corruption and tax components in Turkey for the period

1980-2005. Accordingly, corruption negatively affects corporate taxes, total tax revenues, personal income taxes, taxes on international trade, and transactions, but it has no effect on taxes on goods and services. However, Iman and Jacobs (2007) argued that corruption has a statistically insignificant impact on total tax revenues, property taxes, and indirect taxes on goods and services in 12 Middle Eastern countries. Additionally, taxes that require frequent interactions between tax administration and taxpayer are more affected by corruption than other types of taxation. Tanzi and Davoodi (2000) discussed the relationship between corruption and various types of tax revenues in 83 developed and developing countries. The authors concluded that corruption negatively affects personal income tax, corporate tax, value-added tax, social security premium income, and property taxes.

Many studies have investigated the impact of corruption on tax revenues and its relationship with more limited tax types, and one prominent indicator of these tax types is corporate tax. In this context, Kong et al. (2023), in a study on companies traded on the Chinese stock exchange, revealed that the fight against corruption reduced the extent of corporate tax evasion. Acet et al. (2022) examined the relationship between corruption, corporate tax revenues, and corporate tax rates in Turkey. The study concluded that there is no relationship between corporate tax revenues and corporate tax revenues/GDP and corruption, but the change in corporate tax rates affects the level of corruption. Örücü et al. (2012) found a statistically significant and negative relationship between corruption and corporate tax revenues in 16 OECD countries, and Monteiro (2011) found a statistically significant and negative relationship between corruption and corporate tax revenues in 27 EU countries. Similarly, Kubato and Rihova (2009) concluded that corporate tax revenues are lower in OECD countries, especially countries with high corruption levels.

In addition to corporate taxes, the VAT is also a prominent tax indicator. For example, Pastusiak et al. (2022) analysed the impact of economic growth and governance quality on VAT deficits in 26 EU countries. According to the OLS and GMM results, governance effectiveness has a significant impact on VAT deficits in EU countries. In other words, the study concluded that combating corruption reduced the VAT deficit. Olexova et al. (2022),11 They examined the impact of governance quality on the value-added tax deficit by using different governance indicators, including corruption, in Central and Eastern European countries. They found that corruption was a prominent indicator of VAT deficit. Sun (2021) analysed the relationship between corruption and corporate tax avoidance among 600,000 Chinese companies. According to the findings of this study, an increase in corruption affects tax avoidance significantly and positively. Mustapha et al. (2017) argued that in the 10 most corrupt countries, increasing corruption will lead to VAT revenues losses. Similarly, according to Pluskota (2022), corruption is a decisive factor in VAT deficits in 25 EU countries and Poland. This effect is positive for Poland and negative for EU countries. The fact that the tax system in Poland was reformed during the analysis period was decisive for these findings. In contrast, Permadi and Wijaya (2022) did not find any relationship between corruption control and VAT revenues in 19 Asian Countries. It is assumed that this result is because the low level of corruption control in panel countries cannot affect the collection of VAT revenues.

Investigating how tax revenues are affected by corruption using more specific indicators, Majerová (2016) analysed the impact of corruption and economic growth on the VAT

deficit in EU countries and found that corruption increased the VAT deficit. Sokolovska and Sokolovskyi (2015) suggested that corruption significantly and negatively affects VAT efficiency in 41 countries. In addition to these studies, Alm et al. (2016), who focused on tax evasion, investigated how potential bribes to tax officials affected the company's tax evasion decision by studying 16,000 companies in 32 countries. According to the study, corruption is a determining factor in companies' tendency to engage in tax evasion.

When the studies in the literature are generally examined, it is seen that although different tax types are studied, there is insufficient literature investigating the relationship between corruption and tax revenues in the context of different tax types in transition economies. In these countries where corruption is at high levels, it is important to determine which direction this relationship is for which tax type. In this context, this study is expected to fill the gap in the literature.

Data

In this study, the relationship between tax types and corruption in six transition economies (Czechia, Estonia, Hungary, Latvia, Poland and the Slovak Republic) was investigated. For this purpose, the Bootstrap Panel Granger causality test suggested by Kónya (2006) was used in this study. The period 1998-2021 was taken as basis for econometric analysis. The beginning of the period was chosen based on data availability, particularly in line with the beginning of transition economies. The reason for choosing these countries is that no balanced dataset is suitable for econometric analysis of other transition economies excluded from the analysis. In addition, these countries are high-income countries according to the development classification established by the World Bank. Four tax instruments (personal income tax, corporate tax, value added tax and taxes on private goods and services) and corruption perception index variables were used in this study. Tax-related data were obtained from OECD's income statistics database. The independent variable of this study, the corruption perception index, was obtained from the Transparency International database. This index takes values between 0 and 100, with a value of 0 indicating high corruption in the country and a value of 100 indicating low corruption. To reduce variability in the data, the logarithms of all variables used in the econometric model were taken. The variables included in the model are described in Table 1.

Table 1
Variables ve Sources

Variables	**Abs.**	**Source**
Personal Income Tax	PIT	OECD Revenue Statistics
Value-added tax	VAT	OECD Revenue Statistics
Corporation tax	CT	OECD Revenue Statistics
Taxes on Private Goods and Services	PGST	OECD Revenue Statistics
Corruption Perception Index	CPI	Transparency International

Table 2 presents the descriptive statistics for the data used in this study. When the relevant table is evaluated, the average personal income tax, corporate tax, value-

added tax, and taxes on special goods and services are 15.170%, 6.929%, 23.094%, and 12.351%, respectively. The minimum and maximum personal income tax rates are 9.128% and 23.851%, respectively. Corporate tax is the lowest at 0.503%; It has the highest at 13.064%. However, value-added tax and taxes on special goods and services have the lowest values of 17.06% and 8.342%, respectively; It is seen that they have the highest values of 29.416% and 15.238%. The average corruption perception index variable is approximately 51. The min. and max. values of the same variable are 27 and 75, respectively.

Table 2
Descriptive Statistics

Variables	Obs.	Mean	Min.	Max.	Stand. Dev.
Personal Income Tax	144	15.170	9.128	23.851	3.870
Corporation tax	144	6.929	0.503	13.064	2.581
Value-added tax	144	23.094	17.06	29.416	2.736
Taxes on Private Goods and Services	144	12.351	8.342	15.238	1.495
Corruption Perception Index	144	50.708	27	75	9.722

Econometric Model ve Method

In this study, the Kónya (2006) bootstrapped panel causality test was used to determine the existence and direction of causal relationships between variables. Kónya's (2006) approach is a panel data estimation method that has advantages over other causality estimation methods in the literature. One of the advantages of the Kónya (2006) method is that it is based on seemingly uncorrelated regression (SUR) estimation that considers cross-sectional dependence between countries. Second, it does not require a common hypothesis for panel countries, based on a Wald test with bootstrap critical values calculated specific to each country. Another advantage is that there is no need for preliminary tests, such as unit root and co-integration. It is frequently preferred in the literature due to its advantages. Since Kónya's (2006) approach considers cross-sectional dependency and heterogeneity in estimation models, conducting relevant tests in the first stage of the econometric analysis is important.

The basic panel data models to be used for the cross-sectional dependence and homogeneity tests were as follows:

Model I:

$$\mathrm{PIT}_{it} = \beta_0 + \beta_1 \mathrm{CPI}_{it} + u_{it} \quad (1)$$

Model II:

$$\mathrm{CT}_{it} = \alpha_0 + \alpha_1 \mathrm{CPI}_{it} + \gamma_{it} \quad (2)$$

Model III:

$$VAT_{it} = \delta_0 + \delta_1 \mathrm{CPI}_{it} + \varepsilon_{it} \quad (3)$$

Model IV:

$$\mathrm{PGST}_{it} = \sigma_0 + \sigma_1 \mathrm{CPI}_{it} + \mu_{it} \quad (4)$$

PIT, CT, VAT, PGST, and CPI denote personal income tax, corporate tax, value-added tax, taxes on private goods and services, and the corruption perception index, respectively.

The countries used in the analysis are indicated with the subscript "i" and the period with the subscript "t". "β", "α", "δ" and "σ" indicate the constant terms in the models, and "u", "γ", "ε" and "μ" indicate the error terms.

The Bootstrap Panel Granger causality test suggested by Kónya (2006) was used. Since this test is based on the unrelated regression model (SUR), the models to be estimated are as in the equations (5-12) below:

Model I

$$PIT_{1,t} = \alpha_{1,1} + \sum_{i=1}^{mly_1} \beta_{1,1,j}\, PIT_{1,t-j} + \sum_{i=1}^{mlx_1} \gamma_{1,1,j} CPI_{1,t-j} + \varepsilon_{1,1,t} \quad (5)$$

$$CPI_{1,t} = \alpha_{2,1} + \sum_{i=1}^{mly_2} \beta_{2,1,j}\, PIT_{1,t-j} + \sum_{i=1}^{mlx_2} \gamma_{2,1,j} CPI_{1,t-j} + \varepsilon_{2,1,t} \quad (6)$$

Model II

$$CT_{1,t} = \alpha_{1,1} + \sum_{i=1}^{mly_1} \beta_{1,1,j}\, KV_{1,t-j} + \sum_{i=1}^{mlx_1} \gamma_{1,1,j} CPI_{1,t-j} + \varepsilon_{1,1,t} \quad (7)$$

$$CPI_{1,t} = \alpha_{2,1} + \sum_{i=1}^{mly_2} \beta_{2,1,j}\, CT_{1,t-j} + \sum_{i=1}^{mlx_2} \gamma_{2,1,j} CPI_{1,t-j} + \varepsilon_{2,1,t} \quad (8)$$

Model III

$$VAT_{1,t} = \alpha_{1,1} + \sum_{i=1}^{mly_1} \beta_{1,1,j}\, VAT_{1,t-j} + \sum_{i=1}^{mlx_1} \gamma_{1,1,j} CPI_{1,t-j} + \varepsilon_{1,1,t} \quad (9)$$

$$CPI_{1,t} = \alpha_{2,1} + \sum_{i=1}^{mly_2} \beta_{2,1,j}\, VAT_{1,t-j} + \sum_{i=1}^{mlx_2} \gamma_{2,1,j} CPI_{1,t-j} + \varepsilon_{2,1,t} \quad (10)$$

Model VI

$$PGST_{1,t} = \alpha_{1,1} + \sum_{i=1}^{mly_1} \beta_{1,1,j}\, PGST_{1,t-j} + \sum_{i=1}^{mlx_1} \gamma_{1,1,j} CPI_{1,t-j} + \varepsilon_{1,1,t} \quad (11)$$

$$CPI_{1,t} = \alpha_{2,1} + \sum_{i=1}^{mly_2} \beta_{2,1,j}\, PGST_{1,t-j} + \sum_{i=1}^{mlx_2} \gamma_{2,1,j} CPI_{1,t-j} + \varepsilon_{2,1,t} \quad (12)$$

Empirical Results

In this study, cross-sectional dependence and homogeneity tests were used before determining causal relationships between the variables. Table 3 presents the cross-sectional dependence and slope homogeneity test results for all models. As can be seen from the table, the H_0 hypothesis that "there is no cross-sectional dependence between cross-sections" is rejected for 6 transition economies (Czechia, Estonia, Hungary, Latvia,

Poland and Slovak Rep.) at the 1% significance level for all models. This means that an increase or decrease in tax types and perceptions of corruption in any country analysed may also affect other countries. Therefore, panel countries should not ignore the policies of other countries in their policies on these variables. In addition, the H_0 hypothesis, expressed as "slope parameters are homogeneous", is rejected for the panel countries at the 1% significance level in all estimation models. When the relevant table is evaluated, it can be seen that applying the bootstrapped panel Granger causality test to the panel sample. In other words, it can be seen that there is cross-sectional dependence in the panel countries, and the slope coefficients are not homogeneous.

Table 3
Cross-Section Dependency and Homogeneity Test Results

	Model I	**Model II**	**Model III**	**Model IV**
LM	104.224***	134.985***	73.366***	191.039***
CD_{LM}	16.290***	21.906***	10.656***	32.140***
CD	8.440***	10.550***	2.160***	13.028***
LM_{adj}	10.803***	5.076***	3.038***	5.752***
$\tilde{\Delta}$	4.706***	5.615***	6.367***	3.652***
$\tilde{\Delta}_{adj}$	5.177***	6.003***	6.806***	3.904***
(***) indicates a 1% significance level				

Kónya's (2006) causality test results are shown in Tables 4, 5, 6, and 7.

Table 4
Panel Causality Test Results for Personal Income Tax and Corruption Perceptions

H_0= Personal Income Tax (PIT) does not cause corruption (CPI)					
Countries	**Coef.**	**Wald Statistics**	**Bootstrap Critical Values**		
			%1	**%5**	**%10**
Czechia	-0.316	4.071	10.352	6.485	4.791
Estonia	-0.060	0.580	20.028	11.442	9.176
Hungary	0.074	1.091	7.245	4.547	3.475
Latvia	-0.263	1.503	15.366	8.710	5.667
Poland	-0.109	0.855	7.097	4.312	3.162
Slovak Rep.	-0.369	9.190***	8.305	4.529	3.201
H_0= Corruption (CPI) does not result in personal income taxes (PIT)					
Countries	**Coef.**	**Wald Statistics**	**Bootstrap Critical Values**		
			%1	**%5**	**%10**
Czechia	-0.090	0.378	4.831	3.141	2.225
Estonia	0.015	0.006	17.132	10.922	8.954
Hungary	0.201	0.946	12.548	7.523	5.712
Latvia	0.073	2.373	8.841	5.244	3.530
Poland	0.156	8.822**	9.238	5.774	4.267
Slovak Rep.	0.070	0.723	6.288	3.266	2.204
(***), (**), (*) indicate statistical significance at the 1%, 5%, and 10% levels, respectively					

Table 4 presents the empirical findings of the bidirectional causal relationship between personal income tax and corruption perception. The H_0 hypothesis that we predicted as "personal income tax does not cause corruption" is rejected at the 1% significance level

for the Slovak Republic. In this country, personal income tax has a statistically significant and negative impact on corruption perceptions. No Granger causality relationship was found from personal income tax to perception of corruption for the 6 transition economies considered in this study: Czechia, Estonia, Hungary, Latvia, and Poland. In other words, there is no statistically significant relationship between personal income tax and corruption perception in these five countries. Table 4 also displays the results of the bidirectional causal relationship between corruption perception and personal income tax. According to econometric findings, the H_0 hypothesis, established as "Corruption does not cause personal income tax", is rejected at the 5% significance level only for Poland, among the 6 transition economies. In this country, perceptions of corruption positively affect personal income taxes. For the remaining five countries (Czechia, Estonia, Hungary, Latvia and the Slovak Republic), no statistically significant causal relationship was found between corruption perception and personal income tax.

Table 5
Panel Causality Test Results for Corporate Tax and Corruption Perceptions

H_0= Corporate Tax (CT) does not engender corruption (CPI)					
Countries	**Coef.**	**Wald Statistics**	**Bootstrap Critical Values**		
			%1	**%5**	**%10**
Czechia	-0.040	0.082	6.134	3.727	2.762
Estonia	0.052	4.351	13.640	8.235	6.067
Hungary	-0.014	0.106	10.589	6.318	4.922
Latvia	-0.017	0.893	6.144	3.621	2.553
Poland	0.320	15.624***	10.605	6.628	5.083
Slovak Rep.	-0.203	2.072	37.513	25.108	19.953
H_0= Corruption (CPI) does not result in corporate income taxes (CT).					
Countries	**Coef.**	**Wald Statistics**	**Bootstrap Critical Values**		
			%1	**%5**	**%10**
Czechia	-0.184	5.700**	7.348	4.970	3.878
Estonia	0.644	1.727	12.789	6.547	4.794
Hungary	0.943	5.236*	11.782	6.244	4.439
Latvia	-0.661	1.773	6.916	4.816	3.396
Poland	-0.130	1.874	10.594	5.559	4.063
Slovak Rep.	0.460	9.050	40.287	27.418	22.644
(***), (**), (*) indicate statistical significance at the 1%, 5%, and 10% levels, respectively					

Table 5 presents the empirical results of the bidirectional causality relationship between corporate tax and corruption perception. Accordingly, the H_0 hypothesis "Corporate tax is not the cause of corruption" is rejected at the 1% significance level only for Poland. In this country, corporate tax positively affects corruption perception. For the remaining five countries (Czechia, Estonia, Hungary, Latvia and the Slovak Republic), no statistically significant causal relationship between corporate taxes and perceptions of corruption. Additionally, the H_0 hypothesis "Corruption is not the cause of corporate tax" is rejected only in the Czech Republic and Hungary at the 5% and 10% significance levels, respectively. The perception of corruption affects corporate taxes negatively in the Czech Republic and positively in Hungary. For the remaining four countries (Estonia,

Latvia, Poland and the Slovak Republic), no statistically significant causal relationship was found between corruption perception and corporate tax.

The empirical results of the bidirectional causality relationship between value-added tax and corruption perception are presented in Table 6. The H_0 hypothesis "Value added tax is not the cause of corruption" is rejected at a significance level of 10% for Hungary and Latvia and 1% for Poland. Value-added tax negatively affects corruption perceptions in Hungary and positively in Latvia and Poland. For the other three countries (Czechia, Estonia and Slovak Republic), no statistically significant causal relationship between value added tax and corruption perception. Table 6 also lists the results of the bidirectional causality relationship between corruption perception and value-added tax. The H_0 hypothesis "Corruption is not the cause of value added tax" could not be rejected for 6 transition economies. That is, no statistically significant causal relationship was found between corruption perception and value-added taxes in these countries.

Table 6
Panel Causality Test Results for Value-Added Tax and Corruption Perception

H_0= Value Added Tax (VAT) does not cause corruption (CPI)					
Countries	**Coef.**	**Wald Statistics**	**Bootstrap Critical Values**		
			%1	**%5**	**%10**
Czechia	0.381	2.942	19.056	12.501	9.488
Estonia	-0.058	0.180	5.262	2.789	1.905
Hungary	-0.409	10.419*	18.314	12.354	10.196
Latvia	0.364	5.745*	12.961	6.641	4.346
Poland	0.793	23.458***	15.668	9.703	7.775
Slovak Rep.	0.168	1.536	10.309	6.663	4.720
H_0= Corruption (CPI) does not result in value added tax (VAT)					
Countries	**Coef.**	**Wald Statistics**	**Bootstrap Critical Values**		
			%1	**%5**	**%10**
Czechia	0.090	1.601	24.392	16.569	13.321
Estonia	0.064	0.603	11.850	6.001	4.780
Hungary	-0.336	4.302	26.232	17.678	13.839
Latvia	0.067	1.546	15.563	10.244	7.707
Poland	-0.030	0.719	4.863	2.640	1.889
Slovak Rep.	-0.081	1.004	3.858	2.140	1.591
(***), (**), (*) indicate statistical significance at the 1%, 5%, and 10% levels, respectively					

Table 7 presents the results of the causality analysis of the bi-directional relationship between taxes on private goods and services and perceptions of corruption. According to the table, the H_0 hypothesis "taxes on private goods and services are not the cause of corruption" is rejected only in Hungary. In this country, there is a positive relationship between taxes on private goods and services and corruption perceptions. In the remaining 5 countries (Czechia, Estonia, Latvia, Poland and the Slovak Republic), no causal relationship was found between taxes on private goods and services and perceptions of corruption. In addition, the H_0 hypothesis established as "Corruption is not the cause of taxes on private goods and services" could not be rejected for 6 transition economies.

Table 7
Panel Causality Test Results for Taxes on Private Goods and Services and Their Perception of Corruption

H_0= Private Goods and Services Taxes (PGST) do not engender corruption (CPI)					
Countries	**Coef.**	**Wald Statistics**	**Bootstrap Critical Values**		
			%1	**%5**	**%10**
Czechia	0.004	0.001	6.738	3.513	2.512
Estonia	0.082	1.735	10.401	6.377	4.761
Hungary	0.295	8.614**	8.831	6.647	5.160
Latvia	-0.140	0.469	19.965	12.642	9.579
Poland	-0.070	0.140	5.123	3.284	2.306
Slovak Rep.	0.030	0.088	12.974	7.578	5.651
H_0= Corruption (CPI) does not result in taxes on private goods and services (PGST)					
Countries	**Coef.**	**Wald Statistics**	**Bootstrap Critical Values**		
			%1	**%5**	**%10**
Czechia	-0.103	1.342	8.212	5.319	4.042
Estonia	-0.142	0.426	15.278	9.045	6.987
Hungary	0.023	0.045	5.799	3.367	2.006
Latvia	-0.037	0.441	18.560	8.810	6.453
Poland	-0.057	1.586	10.524	6.641	5.429
Slovak Rep.	0.009	0.004	11.956	6.855	4.577
(***), (**), (*) indicate statistical significance at the 1%, 5%, and 10% levels, respectively					

Conclusion

Corruption has different meanings in different cultures and is difficult to reveal and measure because it is illegal and secret. This can make it difficult to measure the impact of corruption on tax revenues. However, it cannot change the fact that corruption has a reducing effect on tax revenues, which is one of the most important costs it imposes on the economy. The decrease in taxes, which are the source of financing public expenditures, due to corruption undermines the effectiveness of the public authority and negatively affects macroeconomic balances and social welfare.

In this context, the relationship between corruption and tax revenues was analysed selected 6 transition economies for the period 1998-2021 using the bootstrapped panel Granger causality method. The empirical findings of the study reveal that there is a negative and unidirectional Granger causality relationship between personal income tax and corruption in the Slovak Republic and a positive and unidirectional Granger causality relationship between corporate tax and corruption in Poland. In this context, as personal income taxes increase, the corruption perception index decreases, implying that corruption increases. Tax avoidance in this country not only harms tax compliance in the country but can also reduce the progressive structure of personal income tax. In Poland, corruption increases as corporate taxes rise. These results may indicate that institutions do not fulfil their public obligations by paying bribes or by resorting to tax avoidance or evasion to provide various benefits. According to empirical findings regarding the relationship between corruption and personal income and corporate taxes, there is a positive and unidirectional Granger causality relationship from corruption to personal

income tax in Poland and a positive and unidirectional Granger causality relationship from corruption to corporate tax in the Czech Republic and Hungary. This means that as the corruption perception index increases—that is, as corruption decreases—personal income taxes in Poland and corporate taxes in Czechia and Hungary increase. Therefore, individuals and institutions not fulfilling their tax obligations through corruption not only reduce public tax revenues but also significantly increase countries' public financing deficits. Corruption can prevent taxes from spreading to the base. In order to eliminate this negative effect of corruption, tax compliance should be increased by taking measures to increase individuals' trust in public administration and the legal system. These findings are consistent with studies in the literature, such as Ghura (1998), Tanzi and Davoodi (2000), Iman and Jacobs (2007), Kubato and Rihova (2009), and Ajaz Ahmad (2010).

It has been determined that there is a positive and unidirectional Granger causality relationship between VAT and corruption in Poland and Latvia, a negative and unidirectional causality relationship between VAT and corruption in Hungary, and a positive and unidirectional Granger causality relationship between taxes on private goods and services and corruption. This means that as VAT increases, the corruption perception index decreases in Hungary, that is, corruption increases, whereas in Poland and Latvia, the increase in VAT reduces corruption. Additionally, an increase in taxes on private goods and services has reduced corruption in Hungary. The findings of this research show that the relationship between VAT and corruption differs in Hungary compared with Poland and Latvia. In addition, there is no causal relationship between tax revenue types and corruption in the panel countries of Czechia and Estonia. In all panel countries, corruption has no causal relationship with VAT and Taxes on Private Goods and Services. The factor that is effective in this regard is that indirect taxes, such as taxes on private goods and services, generally consist of registered activities, so there are relatively transparent processes, such as the use of invoices. In addition, the fact that taxpayers do not have a close relationship with tax administration and that tax administration does not have much discretion over such taxes may also be effective. These findings are compatible with studies in the literature, such as Beşkaya and Bağgiden (2008), Sokolovska and Sokolovskyi (2015), Majerová (2016), and Pluskota (2022).

These results show that different tax types exhibit different reactions to corruption. In general, direct taxes, such as declaration-based income and corporate taxes, which require close interaction between the individual and the tax administration, are more affected by corruption than indirect taxes, such as VAT taxes on Private Goods and Services . Corruption generally reduces state tax revenues and can disrupt countries' tax structures. For this reason, in countries where corruption is high, governments tend to turn to taxes that are less affected by corruption to protect tax revenues. However, this may negatively affect income distribution among people in society. As a matter of fact, the efficiency of a country's tax system depends on it being built on a fair structure and free from corruption. Based on the findings of this study, governments need to prioritise some issues to combat corruption, reduce corruption, and ensure efficient tax revenues. Accordingly, i) to improve citizens' tax awareness; ii) to combat tax evasion, audit rates and penalties should be reduced to act as a deterrent and to protect the competitiveness of companies; iii) professional tax administration personnel should be employed, satisfactory wages

should be provided, and internal control systems should be strengthened; iv) to prevent illegal transactions and create a secure invoicing system, e-government applications should be implemented, and transactions should be carried out in a secure environment.

Peer-review: Externally peer-reviewed.

Conflict of Interest: The authors have no conflict of interest to declare.

Grant Support: The authors declared that this study has received no financial support.

Author Contributions: Conception/Design of study: N.K.Ş., Y.B.; Data Acquisition: A.Ö.; Data Analysis/Interpretation: N.K.Ş., A.Ö.; Drafting Manuscript: N.K.Ş. Y.B., A.Ö.; Critical Revision of Manuscript: N.K.Ş.; Final Approval and Accountability: N.K.Ş., Y.B., A.Ö.

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