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Research Article

**Analysis of the Relationship Between Foreign Direct Investment and Corruption in
BSEC Countries Using the Granger Causality Test by Xiao et al. (2023)**

Muharrem Akın Doğanay ^a

Abstract

Introduction: This study examines the relationship between foreign direct investment (FDI) and the control of corruption in Black Sea Economic Cooperation (BSEC) member countries during the 2002-2023 period.

Method: The empirical analysis uses the control of corruption index as the dependent variable and foreign direct investment as the primary explanatory variable. Economic growth and trade openness serve as control variables. To address cross-sectional dependence and cross-country heterogeneity, the panel Granger non-causality framework of Xiao et al. (2023) is applied. In addition, robustness analysis was performed using the Westerlund (2007) panel cointegration test.

Results or Findings: The baseline level specification suggests bidirectional predictive relationships between FDI and control of corruption, indicating that each variable can predict changes in the other. The findings also indicate a strong association between economic growth and control of corruption, whereas the effect of trade openness on control of corruption is not statistically significant. Multivariate cointegration results provide only limited evidence of a long-run equilibrium among the variables studied.

Discussion or Conclusion: The study contributes to the literature by examining the FDI-corruption nexus for BSEC countries using a panel causality method that allows for dependence and heterogeneity across countries. The findings suggest that improvements in control of corruption are more robustly associated with changes in FDI than the reverse channel, implying that institutional reform remains an important component of investment and development strategy in the region.

Keywords: foreign direct investment, control of corruption, Granger causality, Black Sea Economic Cooperation

JEL Codes: F21, D73, C23

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Araştırma Makalesi

**KEİ Ülkelerinde Doğrudan Yabancı Yatırımlar ile Yolsuzluk İlişkisinin Xiao vd. (2023)
Granger Nedensellik Testi ile Analizi**

Muharrem Akın Doğanay^a

Öz

Giriş: Bu çalışma, Karadeniz Ekonomik İşbirliği Örgütü (KEİ) üyesi ülkelerde doğrudan yabancı yatırımlar (DYY) ile yolsuzluğun kontrolü arasındaki ilişkiyi 2002-2023 dönemi için incelemektedir.

Yöntem: Analizde yolsuzluğun kontrolü endeksi bağımlı değişken olarak ele alınmış, DYY temel açıklayıcı değişken olarak modele dâhil edilmiştir. Ekonomik büyüme ve ticari açıklık değişkenleri kontrol değişkenleri olarak kullanılmıştır. Ülkeler arası yatay kesit bağımlılığı ve heterojenliği dikkate alan Xiao vd. (2023) Panel Granger Nedensellik Testi uygulanmıştır. Ayrıca Westerlund (2007) panel eşbütünleşme testi ile sağlamlık analizi yapılmıştır.

Sonuçlar ya da Bulgular: Temel analiz, DYY ve yolsuzluğun kontrolü arasında önemli çift yönlü tahmin ilişkileri belirleyerek, her bir değişkenin diğerindeki değişiklikleri tahmin edebileceğini göstermektedir. Bulgular ayrıca ekonomik büyüme ve yolsuzluğun kontrolü arasında güçlü bir ilişki olduğunu, buna karşılık ticaret açıklığının yolsuzluğun kontrolü üzerindeki etkisinin istatistiksel olarak anlamlı olmadığını göstermektedir. Çok değişkenli eşbütünleşme sonuçları, incelenen değişkenler arasında uzun vadeli bir dengeye dair yalnızca sınırlı kanıt sunmaktadır.

Tartışma ya da Yapılan Çıkarımlar: Çalışma, KEİ ülkelerine özgü bu ilişkiyi yatay kesit bağımlılığı ve heterojenliği dikkate alan bir panel nedensellik yöntemiyle incelemektedir. Bulgular, yolsuzluğun kontrolündeki iyileşmelerin DYY üzerindeki etkisinin ters yöne kıyasla daha sağlam olduğunu göstermekte; bu da kurumsal reformların bölgedeki yatırım ve kalkınma stratejilerinin önemli unsurlarından biri olduğunu düşündürmektedir.

Anahtar Kelimeler: doğrudan yabancı yatırım, yolsuzluğun kontrolü, Granger nedensellik, Karadeniz Ekonomik İşbirliği Örgütü

JEL Kodlar: F21, D73, C23

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Introduction

The dissolution of the Bretton Woods System in the early 1970s marked a fundamental transformation in the international monetary framework. It replaced administratively controlled exchange rate regimes with market-oriented systems (Bordo, 1992). This structural shift removed many constraints on international financial transactions. In later decades, especially from the 1980s onward, information and communication technologies advanced rapidly. These developments further accelerated international capital movements, commonly described as financial globalization (Bekaert et al., 2011; Zheng et al., 2023; Azmeh, 2025). This process expanded financing opportunities for developing economies. At the same time, it increased their vulnerability to external shocks and financial volatility (Ali et al., 2023; Jarret et al., 2023; Novak et al., 2025).

Emerging market economies are increasingly integrated into global financial markets. Foreign direct investment (FDI) became a key channel for easing domestic savings and foreign exchange constraints. However, premature or weakly regulated financial liberalization showed that not all capital inflows bring positive outcomes. In several cases, increased exposure to volatile capital movements intensified macroeconomic fragilities and contributed toward financial crises (Fratzscher, 2012; Kiley, 2021; Aydın & Büyükoğlu, 2025). These mixed results have prompted more research into the economic effects of FDI and the factors controlling its cross-country distribution.

In the literature, the FDI literature is usually organized around two main questions. The first strand focuses on the macroeconomic and microeconomic consequences of FDI (Jansen, 1995; Lederman et al., 2013; Ciani & Imbruno, 2017; Santos, 2023), such as its effects on growth, employment, productivity, and technological diffusion. The second strand focuses on identifying the determinants of FDI by examining the motivations and strategic considerations shaping multinational firms' investment decisions (Antras et al., 2009; Xie et al., 2024).

Within this latter strand, multinational enterprises are generally assumed to undertake FDI for market-seeking, resource-seeking, efficiency-seeking, or strategic asset-seeking purposes (Wadhwa & Reddy, 2011). Accordingly, characteristics of host countries - including market size, population structure, labor costs and skills, natural resource endowments, institutional capacity, regulatory quality, and incentive schemes - are widely regarded as essential factors controlling FDI inflows. Alongside these structural and economic determinants, the quality of governance and institutional integrity has gained increasing prominence in empirical research (Kuzmina et al., 2014; Bhat et al., 2024; Gyimah et al., 2025). In this context, control of corruption (CCE) has emerged as an important institutional factor shaping the attractiveness of host economies for foreign investors.

From a theoretical perspective, the relationship between FDI and corruption may operate in both directions (Ndjokou et al., 2025). Corruption may discourage foreign investment by increasing transaction costs and uncertainty, while FDI may influence institutional quality through governance spillovers and monitoring pressures (Antonietti & Mondolo, 2023; Brazys & Kotsadam, 2020; Bussy & Zheng, 2023). This suggests a potentially two-way relationship in the BSEC context.

Although a substantial number of empirical studies have examined this relationship across several countries and regions, the existing literature does not provide evidence specific to the BSEC country group. Given that Turkey and several transition economies are members of this organization, the absence of a region-specific analysis represents an important gap in the literature.

These competing perspectives motivate the following hypotheses. The effect of corruption on FDI can be considered from two contrasting perspectives. The “grabbing hand” hypothesis, where corruption acts as a distortionary tax that discourages foreign capital by increasing transaction costs and uncertainty (Shleifer & Vishny, 1993; Busse & Hefeker, 2007; Wei, 2000), versus the “helping hand” hypothesis, where bribery might paradoxically facilitate investment by bypassing rigid administrative bureaucracies.

By contrast, the reverse channel suggests that FDI may influence CCE by improving institutional quality through governance spillovers, monitoring mechanisms, and increased competitive pressures (Javorcik & Wei, 2009; Brazys & Kotsadam, 2020; Saha et al., 2022). The analysis therefore studies whether the relationship between FDI and CCE in BSEC countries is one-way or two-way. The study tests the following hypotheses:

H₁: There is a significant causal relationship from CCE to FDI inflows, indicating whether the “grabbing hand” or “helping hand” effect empirically dominates in the BSEC region.

H₂: There is a significant causal relationship from FDI inflows to CCE, reflecting the presence of institutional spillovers and governance improvements driven by foreign capital.

The multivariate specification also includes economic growth and trade openness as additional explanatory variables affecting CCE dynamics (Ay et al., 2016; Shaari et al., 2022).

The study is structured as follows. The next section reviews the empirical literature on the relationship between corruption and FDI. Based on the insights derived from this literature, the following section introduces the data and the econometric methodology. Before turning to the causality analysis, the cross-sectional dependence (CD), slope heterogeneity, and unit root properties of the variables are examined, followed by a panel cointegration analysis to evaluate the long-run dimension of the system. The empirical findings from both the baseline level specification and the first-differenced robustness analysis are then presented and discussed.

Theoretical Framework and Literature Review

The relationship between FDI and corruption can be interpreted within the frameworks of institutional economics and political economy. From an institutional economics perspective, heavily influenced by North (2010), institutions define the formal and informal rules that influence transaction costs and uncertainty. Within this framework, corruption can be seen either as a symptom of institutional weakness or as an informal practice that distorts economic incentives.

Two main perspectives are commonly used to explain how corruption affects foreign investment: the “sand in the wheels” and the “grease the wheels” hypotheses. In the public choice and rent-seeking tradition (Shleifer & Vishny, 1993), the sand-in-the-wheels perspective holds that corruption imposes an additional, uncertain cost on investors. It increases transaction costs, exacerbates information asymmetries, and creates severe regulatory uncertainty, thereby deterring efficiency-seeking foreign capital. By contrast, the grease-the-wheels argument, associated with Leff (1964), suggests that, in heavily bureaucratized and inefficient regulatory systems, bribery may function as a second-best solution to bypass rigid administrative barriers, consequently facilitating investment that would otherwise be stifled. These theoretical perspectives help explain why empirical findings differ across countries with different institutional and political settings.

The relationship between corruption and FDI has been widely examined in the international economics literature; however, the empirical findings remain far from uniform (Zeneli, 2016; Abdella et al., 2018; Spyromitros & Panagiotidis, 2022; Bokayev et al., 2024; Patel et al., 2025). The lack of a clear consensus suggests that the relationship between corruption and FDI depends heavily on country-specific conditions, institutional environments, and the larger macroeconomic context. For this reason, broad generalizations based on a single perspective should be avoided.

A dominant line of research argues that corruption functions as an important deterrent to FDI by increasing transaction costs and amplifying uncertainty in the business environment. Empirical studies adopting this perspective emphasize that corruption undermines contract enforcement, weakens institutional credibility, and exposes investors to discretionary administrative practices (Teksöz, 2006; Zeneli, 2016; Karim et al., 2018; Topal, 2024). Improvements in governance quality and anti-corruption measures are often seen as important for attracting foreign investors (Ay et al., 2016; Bhavan, 2020; Shaari et al., 2022; Köstekçi et al., 2023).

An alternative strand of the literature maintains that the relationship between corruption and FDI is neither strictly negative nor unidirectional. From this perspective, the relationship between FDI and corruption may be more complex than a simple one-way effect. Some studies suggest that FDI inflows can, under certain conditions, support existing corrupt practices, specifically in environments characterized by weak regulatory control (Gök et al., 2018; Rizqa & Wibowo, 2024). Others argue that foreign investment, especially from countries with relatively higher corruption levels, may help reduce corruption in host economies by altering local norms, strengthening monitoring mechanisms, or increasing competitive pressures (Brazys & Kotsadam, 2020). These conclusions stress the importance of evaluating not only how corruption influences FDI, but also how FDI reshapes corruption dynamics over time.

A third group of empirical contributions emphasizes the contextual and nonlinear nature of the corruption-FDI nexus. Findings from several country groups indicate that the strength and direction of this relationship may vary depending on factors including economic development, institutional capacity, and the prevailing governance regime (Gezikol & Tunahan, 2018; Krifa-Schneider et al., 2022). In some cases, no statistically significant relationship is detected (Abdella et al., 2018; Bokayev et al., 2024), while in others, unexpected positive associations emerge (Camacho Murcia & Uysal, 2022). Moreover, several studies demonstrate that global economic conditions-such as financial crises or times of increased uncertainty-can modify the impact of corruption on foreign investment decisions (Padmanabhan et al., 2020; Cruz et al., 2023).

Overall, these outcomes justify a closer look at the BSEC region, where institutional diversity, transition changes, and geopolitical risk may shape the corruption-FDI nexus in distinctive ways.

Table 1*Selected Literature Review*

Author, Year	Period	Countries Covered	Method	Findings
Teksöz (2006)	1995-2000	83 Selected Countries	Pooled OLS	Negative and significant relationship between CCE and FDI inflows.
Zeneli (2016)	1992-2012	7 Western Balkan Countries	GMM Panel Data Analysis	CCE adversely affects FDI to Western Balkan countries and per capita income.
Ay et al. (2016)	1995-2013	10 Developing Countries	FMOLS Cointegration and Panel VEC Causality Analysis	Reduction in CCE and an increase in the level of democracy positively affect FDI in the long term.
Karim et al. (2018)	1995-2014	ASEAN-5 Countries	Pooled OLS	Countries with lower CCE levels and larger market size attract more FDI.
Gök et al. (2018)	1996-2016	17 MENA Region Countries	System GMM Panel Data Analysis	Foreign direct capital inflows make it more difficult to control CCE.
Abdella et al. (2018)	2002-2016	BRIC Countries	FM-OLS Panel Data Analysis & Pedroni Cointegration Test	No relationship was found between the extent of CCE and FDI.
Gezikol & Tunahan (2018)	1995-2015	124 Selected Countries	Prais-Winsten Robust Estimator Model	It has been determined that an increase in exports leads to greater CCE in low-income countries, an increase in imports raises CCE in lower-middle-income countries, and increased exports contribute to higher CCE in upper-middle-income countries.
Brazys & Kotsadam (2020)	2003-2017	56 African Countries	Pooled OLS	FDI was found to have a mitigating effect on CCE in regions where CCE levels are high; however, this effect is primarily attributable to investments originating from relatively corrupt countries.
Bhavan (2020)	2002-2018	5 South Asian Countries	Random Effects Model	An improvement in investors' CCE perception increases FDI inflows to these countries.
Padmanabhan et al. (2020)	2002-2016	95 Selected Countries	Smooth Transition Panel Regression Model	The 2008 crisis altered the relationship between CCE and FDI, and that this change depends on the host country's level of development and CCE regime.
Dilaveroğlu & Ersin (2021)	2002-2018	7 Emerging Market Countries	Pedroni Cointegration Test	A long-term relationship has been identified between control of CCE and FDI.
Krifa-Schneider et al. (2022)	2003-2019	80 Developed and Developing Countries	GMM Panel Data Analysis	The relationship between CCE and FDI is not linear depending on the host country's level of financial development; in advanced economies, a reduction of CCE below a certain threshold increases FDI, whereas in developing economies, this effect is less pronounced.
Camacho Murcia & Uysal (2022)	2005-2014	14 American Countries and Turkey	Random Effects Model	An increase in CCE index leads to a 41% increase in FDI.
Shaari et al. (2022)	1995-2020	9 ASEAN+3 Countries	Panel ARDL method	Reducing CCE increases FDI in the long term; however, environmental degradation in the region functions as a factor that enhances FDI.
Cruz et al. (2023)	1995-2020	20 Latin American	GMM Panel Data Analysis	While CCE generally has a deterrent effect on FDI, during periods of economic crisis and stagnation,

		and Caribbean Countries		this negative effect of CCE is significantly diminished.
Köstekçi et al. (2023)	2004-2020	5 Central Asian Turkic states & Turkey	Banerjee and Carrion-i-Silvestre Cointegration Test	CCE has a significantly positive impact on FDI in Uzbekistan and Tajikistan.
Bokayev et al. (2024)	2013-2022	15 Post-Soviet Countries	Pearson Correlation Coefficient Method	No relationship was found between CCE and FDI.
Topal (2024)	2002-2022	The 20 Countries Receiving the Most FDI	Driscoll-Kraay Estimation Method	The control of CCE variable and FDI are inversely and significantly correlated.
Rizqa & Wibowo (2024)	2017-2022	D-8 Countries	Random Effects Model	CCE weakens the effect of GRW and exports on FDI but strengthens the relationship between the exchange rate and FDI.
Ndjokou et al. (2025)	1980-2018	Sub-Saharan Countries	GMM Panel Data Analysis	Primary sector FDI enhances public sector CCE and reduce judicial CCE.
Linhartova (2025)	1995-2022	28 Selected Countries	OLS, FE, RE Panel Data Analysis	The effect of corruption on FDI is related to the level of CCE.
Küçükçolak et al. (2025)	2002-2021	G7 and E7 Countries	Pedroni, Kao, and Westerlund tests	E7 countries experience more pronounced effects of CCE control on FDI.

Note. Created by the author

The mixed findings in the literature provide a clear rationale for examining the BSEC countries separately. The BSEC region is characterized by its diversity: it encompasses countries integrated with both Europe and Asia, includes transition economies, and consists of states with governance structures exhibiting distinct dynamics.

Such diversity indicates that the relationship between corruption and FDI may differ from one country to another, even within the region. Accordingly, empirically testing this relationship over a period such as 2002-2023, which encompasses global financial crises, global political tensions, and structural transformations, will not only fill the gap in the literature but also help derive policy implications that better reflect the region's institutional differences.

Data Set and Methodology

Data Set

The empirical analysis of this study is based on a balanced panel data set obtained from 12 member countries of the BSEC (Albania, Azerbaijan, Bulgaria, Armenia, Georgia, Moldova, North Macedonia, Romania, Russian Federation, Turkey, Ukraine, and Greece). The selection of BSEC member countries is motivated by both regional relevance and analytical diversity. The BSEC region comprises economies that are geographically connected, increasingly integrated through trade and investment linkages, and exposed to similar regional shocks and international risks. At the same time, the member countries differ substantially in terms of economic development levels, institutional capacity, governance quality, and transition processes.

This combination makes the BSEC region a useful setting for examining the FDI-CCE relationship. In other words, the sample is not treated as homogeneous; rather, it consists of economies that share a regional setting and differ in their institutional and economic structures.

These distributional features support the use of methods that are robust to heterogeneity and extreme observations. However, Serbia, one of the member countries, was excluded from the analysis due to the absence of the Control of Corruption Index data in the World Bank's Worldwide Governance Indicators (WGI) database system prior to 2006. This data gap, which is inconsistent with the 2002-2023 period covered by the study, prevented Serbia from being included due to concerns about data integrity. The data sources, definitions, and symbols of the variables used are presented in detail in Table 2.

Table 2

Variables Used in the Study

Symbol	Definition	Unit	Source
CCE	Control of Corruption Index	Standard normal distribution between -2.5 and 2.5	World Bank - WGI (2025a)
FDI	Foreign direct investment	Foreign direct investment, net inflows (% of GDP)	World Bank - WDI (2025b)
TRD	Trade openness	Share of total exports and imports in GDP	World Bank - WDI (2025b)
GRW	Economic growth	Annual GDP growth rate (%)	World Bank - WDI (2025b)

Note. Created by the author

In the study, CCE denotes the dependent variable, FDI as the main explanatory variable, and TRD and GRW as controls. TRD is included as a control variable to account for the potential role of external integration in affecting both foreign investment flows and institutional quality. GRW is controlled to account for macroeconomic conditions that may jointly affect FDI and corruption dynamics. Descriptive statistics for all variables employed are summarized in Table 3.

Table 3

Basic Statistical Indicators

Statistic	CCE	FDI	GRW	TRD
Mean	-0.448	5.114	3.840	83.664
Median	-0.464	3.517	4.079	81.020
Maximum	0.828	55.073	34.466	166.147
Minimum	-1.264	-5.678	-28.759	40.834
Std. Dev.	0.459	6.444	5.845	25.329
Skew.	0.428	4.552	-0.161	0.516
Kurt.	2.755	31.308	10.519	2.795
J-B	8.719	9726.920	623.023	12.174
Prob.	0.013	0.000	0.000	0.002
Total	-118.334	1350.029	1013.879	22087.220
Num. of Obs.	264	264	264	264

Note. The dataset was derived from the official World Bank WGI and WDI and calculated by the author using EViews 12 for Windows statistical software

The primary statistical indicator values for the countries included in the study are presented in Table 3. According to the results, the mean CCE value of -0.448 indicates a weak level of CCE across the sample countries. The mean FDI value is 5.114, and its relatively high standard deviation of 6.444 indicates that FDI inflows are unevenly distributed and highly volatile across the sample.

Because FDI series contains substantial volatility and extreme observations, as indicated by the descriptive statistics, an additional robustness check was conducted. Since FDI is expressed as a percentage of GDP and includes negative values for some observations, a logarithmic transformation is unlikely to be suitable. For this reason, FDI variable was winsorized at the 1st and 99th percentiles to reduce the influence of extreme observations. The panel Granger causality tests were subsequently re-estimated using the winsorized series. The results based on the winsorized series remain similar to the baseline estimates, suggesting that the main findings are not driven only by extreme values.

The Jarque-Bera results show that the variables are not normally distributed and should therefore be interpreted with caution (Khan et al., 2025; Xuan, 2025). Overall, the data show volatility, non-normality, and heterogeneity in the economic variables of the BSEC region; therefore, these distributional features should be taken into account in the design of policies targeting the region.

Methodology

The empirical strategy consists of diagnostic tests, panel cointegration analysis, and panel causality analysis. Prior to the causality stage, it is necessary to determine whether cross-sectional units are interdependent and whether slope parameters are homogeneous across countries (Camarero et al., 2025; Chanda et al., 2025). These preliminary tests help determine the appropriate econometric framework and the panel's time-series properties.

After examining cross-sectional dependence, slope heterogeneity, and unit root characteristics, the long-run dimension of the relationship is assessed through panel cointegration analysis. The causal structure is then evaluated using the panel Granger non-causality approach proposed by Xiao et al. (2023), supported by a robustness analysis based on first-differenced series.

Cross-Sectional Dependence Test

In panel data settings involving economically and geographically interconnected countries, the assumption of cross-sectional independence is often unrealistic (Shinwari et al., 2024; Sobirov et al., 2025). Macroeconomic shocks, financial disturbances, or governmental change originating in one country may easily transmit to others through trade, financial, or institutional channels.

To examine the presence of such interdependencies among the BSEC member countries, several complementary CD tests are implemented. Specifically, the Breusch-Pagan LM test is applied alongside the Pesaran scaled LM and bias-corrected scaled LM tests, which are suitable for panels with relatively small cross-sectional dimensions. In addition, the Pesaran (2004) CD test is employed due to its robustness under large N and T conditions. Using these tests together provides a more extensive assessment of CD by capturing different panel characteristics (Uçan et al., 2024; Wang et al., 2025).

Table 4*Panel Cross-Sectional Dependence Test Results*

Test	Statistic	d.f.	p-value
Breusch-Pagan LM	276.714	66	0.000
Pesaran scaled LM	18.340	—	0.000
Bias-corrected scaled LM	18.054	—	0.000
Pesaran CD	2.149	—	0.031

Note. The dataset was derived from the official World Bank WGI and WDI and calculated by the author using EViews 12 for Windows statistical software.

The CD test results display significant cross-sectional dependence in the panel. All the CD tests reject the null hypothesis of “no cross-sectional dependence” at the 5% significance level. This result suggests that shocks in one country are likely to be associated with developments in others. This result indicates that shocks are not confined to individual countries but are transmitted across the panel.

Homogeneity Test

After assessing CD, the homogeneity of slope coefficients across panel units is evaluated. In heterogeneous panels, assuming identical parameter values for all countries may lead to misleading inferences (Ayla, 2024). Accordingly, the Delta homogeneity test proposed by Pesaran et al. (2008) is utilized to determine whether the long-run parameters vary across countries. Parameter heterogeneity suggests that the relationships differ across countries.

Table 5*Delta Homogeneity Test Results*

Test Statistic	Value	p-value
Δ Test	18.726	0.000
Adjusted Δ Test	21.459	0.000

Note. The dataset was derived from the official World Bank WGI and WDI and calculated by the author using GAUSS 10 for Windows statistical software.

The findings obtained are presented in Table 5. According to this evidence, both test statistics reject the null hypothesis of slope homogeneity at the 1% significance level, indicating parameter heterogeneity. This finding indicates that the relationships among CCE, FDI, TRD, and GRW variables differ substantially across the 12 BSEC countries examined. In other words, each country in the panel shows distinct economic characteristics, and it does not appear feasible to explain the relationship between the series using a single model.

These results suggest that first-generation panel methods are not appropriate for the present dataset (Poor et al., 2025). Therefore, it is necessary to apply second-generation unit root tests, such as Pesaran’s CIPS test.

Unit Root Test

CD, which is occasionally observed in panel data sets, poses significant challenges to the validity of econometric analyses. A review of the relevant literature on this issue indicates that, for first-generation unit root tests (Levin et al., 2002; Im et al., 2003) to yield valid results, it is necessary to assume the absence of any CD (Chang et al., 2023; Husein, 2024; Anavatan & İspir, 2025). However, if a CD is present in the series, the literature widely accepts that the reliability of first-generation tests is compromised. Those methodological limitations demand the use of second-generation unit root tests that account for cross-sectional dependence

(Baltagi, 2005; Breitung & Pesaran, 2008). In this context, this study uses the CIPS (Cross-sectionally Augmented IPS) unit root test developed by Pesaran (2007), which models CD through common factors.

The CIPS test controls for cross-sectional correlation by including common factors in the panel via principal components and cross-sectional averages, thereby increasing the validity of unit root tests. The CIPS test is calculated using the following formula:

$$CIPS = \bar{t} = \frac{1}{N} \sum_i^N t_i(N, T) \quad (1)$$

The results obtained from the applied CIPS unit root test are presented in Table 6.

Table 6

CIPS Unit Root Test Results

Variable	CIPS Statistic	Variable	CIPS Statistic	Critical Values		
				1%	5%	10%
CCE	-2.029	ΔCCE	-4.062*	-2.96	-2.76	-2.66
FDI	-2.616	ΔFDI	-4.982*	-2.96	-2.76	-2.66
TRD	-2.097	ΔTRD	-4.152*	-2.96	-2.76	-2.66
GRW	-1.822	ΔGRW	-4.759*	-2.96	-2.76	-2.66

Note. The dataset was derived from the official World Bank WGI and WDI and calculated by the author using EViews 12 for Windows statistical software

The test was estimated under the constant + trend specification. The null hypothesis H_0 indicates that the series are not stationary (contain a unit root). Significance stars (*, **, ***) indicate significance levels of 1%, 5%, and 10%, respectively. Critical values for the constant + trend model were determined as -2.96 for 1%, -2.76 for 5%, and -2.66 for 10%, based on $N=12$, $T=21-22$.

According to the analysis results presented in Table 6, all variables (CCE, FDI, TRD, and GRW) exhibit a unit root at their level values. The CIPS statistics for the variables (-2.029, -2.616, -2.097, and -1.822) indicate that the series are not stationary at the $I(0)$ level, as they exceed the critical value (-2.66) at the 10% significance level. However, when the first differences of the variables are taken, the calculated CIPS statistics for all series (-4.062, -4.982, -4.152, and -4.759) are more negative than the 1% critical value (-2.96), leading to the rejection of the null hypothesis and indicating that the series become stationary at their first differences. These results suggest that the variables follow an $I(1)$ process.

Since the CIPS results show that all variables are non-stationary in levels but become stationary after first differencing, these properties need to be considered in the causality analysis that follows. Although the panel Granger non-causality test of Xiao et al. (2023) is formulated within a panel VAR framework and does not require cointegration as a formal precondition, the presence of $I(1)$ series still makes it useful to evaluate the long-run dimension of the system.

Accordingly, before proceeding to the panel Granger causality analysis, the existence of a long-run equilibrium relationship among the variables is examined using the Westerlund (2007) panel cointegration test. This allows the causality findings to be interpreted together with the evidence on long-run comovement among the variables.

Cointegration Test

Having identified the variables as integrated of order one, the analysis next turns to the long-run dimension of their relationship. To determine whether CCE, FDI, GRW, and TRD share a common long-run equilibrium path, the panel cointegration test developed by Westerlund (2007) is employed. This approach is based on an error-correction framework and is particularly useful in heterogeneous panels where cross-sectional dependence may affect conventional inference. The results of the Westerlund panel cointegration test are presented in Table 7.

Table 7

Westerlund (2007) Panel Cointegration Test Results

Statistic	Value	Z-Value	P-Value	Robust P-Value
Gt	-2.616	0.350	0.637	0.188
Ga	-9.539	2.581	0.995	0.043
Pt	-7.135	1.485	0.931	0.323
Pa	-7.565	2.094	0.982	0.105

Note. The dataset was derived from the official World Bank WGI and WDI and calculated by the author using Stata 14 for Windows statistical software

The results are based on Westerlund's (2007) error-correction-based panel cointegration test estimated under the constant + trend specification with one lag, zero leads, lrwindow (1), and 400 bootstrap replications. The null hypothesis is that there is no cointegration.

When the bootstrap p-values are considered, the multivariate specification provides only partial support for cointegration. In particular, the Ga statistic rejects the null hypothesis of no cointegration at the 5% level, whereas the Gt, Pt, and Pa statistics do not provide equally strong support. The results do not point to a uniformly robust long-run equilibrium relationship across all test statistics.

Overall, the cointegration results suggest that the multivariate system provides only limited evidence of long-run comovement among CCE, FDI, GRW, and TRD in the BSEC panel. This finding does not invalidate the subsequent causality analysis, but it does imply that the baseline level causality results should be interpreted primarily as predictive associations within the panel framework.

Causality Test

The causality concept builds on the predictive causality framework introduced by Granger (1969). In the next stage of the analysis, the causal relationships among the variables are examined using the panel Granger non-causality test developed by Xiao et al. (2023). The method employed in this study, proposed by Xiao et al. (2023), extends the Granger non-causality framework of Juodis et al. (2021) by improving finite-sample inference. This test presents the Wald test statistic and p-value, along with the null and alternative hypotheses, within the framework of regression results based on the bias-corrected pooled estimator utilizing the half-panel jackknife (HPJ) method developed by Dhaene and Jochmans (2015). The method allows both manual and automatic lag length selection using the Bayesian Information Criterion (BIC). It also accounts for the presence of CD and cross-sectional heteroskedasticity in the error terms of the series included in the study. Another feature of the test is its ability to perform Granger causality analysis in models that include multiple dependent variables. This feature allows control variables to be incorporated into the causality framework.

For this test to be valid, the panel data set must be balanced (Xiao et al., 2023). For these reasons, the Xiao et al. (2023) procedure is selected in this study. The panel Granger non-causality test of Xiao et al. (2023) can be represented as follows:

$$y_{i,t} = \phi_{0,i} + \sum_{p=1}^p \phi_{p,i} y_{i,t-p} + \sum_{p=1}^p \beta_{p,i} x_{i,t-p} + \varepsilon_{i,t} \quad (2)$$

Among the parameters in the equation are $\phi_{0,i}$ cross-section-specific effects, $\varepsilon_{i,t}$ errors, $\phi_{p,i}$ heterogeneous autoregressive coefficients, $p = 1, \dots, P$ and $\beta_{p,i}$ heterogeneous feedback coefficients (Xiao et al., 2023). The hypotheses of the test are as follows:

$H_0: \beta_{p,i} = 0$ (for all i and p 's)

$H_1: \beta_{p,i} \neq 0$ (for some i and p 's)

The findings obtained from Xiao et al. (2023) Granger causality test are presented in Table 8. During the test, cross-sections were adjusted for heteroskedasticity, 5,000 bootstrap replications were used, and the optimal lag length was selected using the Bayesian Information Criterion (BIC), with a maximum lag order of three.

Table 8

Multivariate Causality Test Results

Dependent Variable	Independent Variable	Optimal Lag (BIC)	HPJ Wald Test	p-value
CCE	FDI, TRD, GRW	1	97.693	0.000
Univariate Causality Test Results				
	FDI	1	4.674	0.030
CCE	TRD	1	1.918	0.159
	GRW	1	6.931	0.008
FDI		2	12.326	0.002
TRD	CCE	3	0.535	0.911
GRW		1	4.845	0.027

Note. The dataset was derived from the official World Bank WGI and WDI and calculated by the author using Stata 14 for Windows statistical software

Based on the bootstrap multivariate causality test, conducted using the HPJ estimator and heteroskedasticity-robust variance, the joint null hypothesis of non-causality is rejected (Wald = 97.693, $p < 0.01$). The results show that at least one of the independent or control variables (FDI, TRD, GRW) Granger-causes CCE.

An examination of the univariate causality test results from the baseline level specification suggests two-way Granger causality between CCE and both FDI and GRW. While the causal effect of FDI on CCE is significant at the 5% level, the effect of CCE on FDI is stronger, being significant at the 1% level. A similar two-way pattern is also observed between GRW and CCE in the baseline level specification. However, no causality in either direction was identified between CCE and TRD.

While these results are informative about the predictive structure of the baseline-level specification, they should also be considered alongside the evidence on the long-run dimension of the system. Given that the panel cointegration results provide only limited evidence of a stable long-run equilibrium relationship, these baseline level findings should be interpreted as

predictive associations within the panel framework rather than as evidence of a strong long-run causal structure.

In light of the limited multivariate cointegration evidence and the non-stationary nature of the variables in levels, it is also useful to examine whether the main causal patterns stay broadly similar after first differencing. As an additional robustness check, the panel Granger non-causality test developed by Xiao et al. (2023) is re-estimated using the first-differenced series (ΔCCE , ΔFDI , ΔTRD , and ΔGRW).

The differenced specification shows that the baseline causal structure is only partially preserved, especially for the FDI–CCE nexus, and therefore provides a more conservative basis for evaluating short-run directional effects.

Table 9

Robustness Check: Causality Analysis in First Differences

Dependent Variable	Independent Variable	Optimal Lag (BIC)	HPJ Wald Test	p-value
ΔCCE	ΔFDI , ΔTRD , ΔGRW	1	11.1981	0.010
Univariate Causality Test Results				
ΔCCE	ΔFDI	1	3.2526	0.071
ΔCCE	ΔTRD	1	2.1252	0.144
ΔCCE	ΔGRW	1	3.3428	0.067
ΔFDI	ΔCCE	3	4.6890	0.000
ΔTRD	ΔCCE	3	1.2618	0.738
ΔGRW	ΔCCE	3	5.3565	0.000

Note. The dataset was derived from the official World Bank WGI and WDI and calculated by the author using Stata 14 for Windows statistical software

As shown in Table 9, the causal effect from changes in CCE to changes in FDI remains strongly significant, while the inverse effect from changes in FDI to changes in CCE becomes weaker and is only marginally significant. A similar asymmetry is observed in the relationship between GRW and CCE. The effect from changes in CCE to changes in GRW is still significant, while the reverse effect from changes in GRW to changes in CCE is weaker and only marginally significant. In contrast, the absence of a significant causal relationship between TRD and CCE is preserved in the differenced specification. These results show that the most robust finding of the study is the effect of CCE on FDI, while the inverse channel from FDI to CCE is more sensitive to non-stationarity.

The stronger effect of CCE on FDI suggests that institutional reliability is a more immediate determinant of investment decisions in the BSEC region. Although weaker, the reverse effect suggests that foreign capital may still support improvements in governance by strengthening compliance and monitoring practices.

Conclusion and Evaluation

This study examined the relationship between FDI and CCE in BSEC member states, excluding Serbia, over the period 2002-2023 by using the panel Granger non-causality framework proposed by Xiao et al. (2023). The empirical results from the baseline level specification suggest bidirectional predictive linkages between FDI and CCE. However, the additional first-differenced robustness analysis shows that the effect running from CCE to FDI is more stable than the reverse direction. Moreover, the Westerlund panel cointegration results provide only limited rather than conclusive evidence of a stable long-run equilibrium

relationship in the multivariate specification. Overall, these results suggest that the most robust result of the study is the effect of CCE on FDI, while the reverse channel from FDI to CCE appears more sensitive to model specification and the treatment of non-stationarity.

From an economic perspective, the stronger and more stable effect of CCE on FDI suggests that institutional reliability is a key determinant of investment decisions in the BSEC region. Improvements in CCE are likely to reduce uncertainty, limit bureaucratic discretion, and strengthen the predictability of the regulatory environment, thereby making host economies more attractive to foreign investors. This interpretation is consistent with studies showing that corruption acts as a deterrent to investment by raising transaction costs, increasing opacity, and weakening investor confidence (Teksöz, 2006; Zeneli, 2016; Karim et al., 2018; Topal, 2024). At the same time, the weaker but still observable reverse effect from FDI to CCE suggests that foreign capital inflows may contribute to better governance through stronger transparency standards, compliance requirements, and monitoring practices, in line with earlier findings in the literature (Ay et al., 2016; Bhavan, 2020; Köstekçi et al., 2023; Brazys & Kotsadam, 2020).

These results are also compatible with the structural features of the BSEC region. Many member countries combine development dynamics, uneven institutional development, and varying degrees of integration into global markets. In such a setting, CCE is likely to function as an important signal of institutional reliability for external investors. Also, foreign firms operating under international reporting and compliance standards may create pressures for more transparent and predictable governance practices. This may help explain why the baseline level results point to reciprocal predictive linkages, even though the differenced specification suggests that the direction from CCE to FDI is more robust than the reverse channel. This interpretation is also consistent with studies showing that the strength of the FDI-CCE relationship may vary during periods of macroeconomic instability, crisis, and uncertainty (Padmanabhan et al., 2020; Cruz et al., 2023).

The analysis also points to a close relationship between GRW and CCE. In the baseline level specification, the results suggest bidirectional predictive linkages between GRW and CCE. The first-differenced robustness analysis continues to support the effect from changes in CCE to changes in GRW, while the reverse direction becomes weaker and only marginally significant. This pattern suggests that governance quality and macroeconomic performance are interconnected, but the effect of institutional improvement on growth appears more stable than the reverse. No significant causal relationship is found between TRD and CCE in either the baseline or differenced specification. This suggests that changes in TRD alone do not directly shape corruption trends in a stable, systematic way, consistent with studies reporting heterogeneous or statistically weak effects across countries and regions (Gezikol & Tunahan, 2018; Abdella et al., 2018).

The findings have three policy implications for the region. Anti-corruption reform should be treated not only as a governance objective but also as a central part of investment and development strategy in the BSEC region. Measures that improve judicial effectiveness, reduce bureaucratic opacity, simplify administrative procedures, and expand digital public services may strengthen institutional reliability and support long-term, efficiency-seeking FDI. The results further suggest that governance reform and growth-driven development policy should be designed in a complementary way rather than as separate agendas. In particular, if improvements in CCE are more robustly associated with changes in FDI and GRW than the

reverse effects, then institutional reform may reasonably be regarded as a primary policy priority in the regional context.

Several limitations should be noted. First, the Xiao et al. (2023) framework primarily provides information about predictive causal linkages and does not directly estimate long-run equilibrium coefficients. Second, the panel cointegration results provide only limited evidence of a stable long-run relationship in the multivariate system, suggesting caution in interpreting the baseline level causality results. Third, the sample period from 2002 to 2023 includes major global and regional disruptions, including the 2008 global financial crisis, global political tensions, and the COVID-19 pandemic. Although the empirical framework accounts for cross-sectional dependence and heterogeneity, it does not explicitly model endogenous structural breaks. Further investigations could therefore extend the analysis by using alternative long-run specifications, break-sensitive panel cointegration procedures, or regime-dependent causality frameworks to examine how the FDI-CCE nexus evolves across different institutional and macroeconomic phases.

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