Sosyoekonomi

2024, Vol. 32(62), 157-177

RESEARCH ARTICLE

ISSN: 1305-5577
DOI: 10.17233/sosyoekonomi.2024.04.08
Date Submitted: 06.02.2024
Date Revised: 02.05.2024
Date Accepted: 21.08.2024

The Relationship Between Economic Growth and Foreign Direct Investment in The Turkic Republics[1]

Hasan KAZAK *(https://orcid.org/0000-0003-0699-5371), Necmettin Erbakan University, Türkiye; hsnkazak@gmail.com*

Ahmet Tayfur AKCAN *(https://orcid.org/0000-0001-8210-7327), Necmettin Erbakan University, Türkiye; tayfurakcan@hotmail.com*

Mustafa İYİBİLDİREN *(https://orcid.org/0000-0002-5076-1348), Necmettin Erbakan University, Türkiye; miyibildiren@erbakan.edu.tr*

Türk Cumhuriyetlerinde Ekonomik Büyüme ve Doğrudan Yabancı Yatırımlar Arasındaki İlişki[2]

Abstract

This research examines the correlation between economic growth and foreign direct investment (FDI) data of the Turkic Republics, namely Kazakhstan, Uzbekistan, Azerbaijan, Türkiye, and Kyrgyzstan, over the period from 1993 to 2022 through a meticulous panel data analysis. The results of the panel, Fourier Toda Yamamoto test, reveal a reciprocal causality between economic growth and FDI, especially in Azerbaijan. In the case of Uzbekistan, the study finds that FDI plays a catalytic role in inducing economic growth. The panel Fourier cointegration test carried out for all the countries studied confirms a cointegration relationship among the variables in all the countries studied.

Keywords : Turkic Republics, Foreign Direct Investment, Economic Growth, Panel Data Analysis.

JEL Classification Codes : F21, F23, O53.

Öz

Bu çalışma, Türk Cumhuriyetleri olan Kazakistan, Özbekistan, Azerbaycan, Türkiye ile Kırgızistan'ın 1993-2022 dönemine ait ekonomik büyüme ve doğrudan yabancı yatırım (DYY) verileri arasındaki ilişkiyi bir panel veri analizi ile incelemektedir. Panel Fourier Toda Yamamoto testinin sonuçları, özellikle Azerbaycan bağlamında, ekonomik büyüme ve DYY arasında karşılıklı bir nedensellik olduğunu ortaya koymaktadır. Özbekistan örneğinde ise çalışma, DYY'nin ekonomik büyümeyi tetiklemede önemli bir rol oynadığını ortaya koymaktadır. İncelenen tüm ülkeler için gerçekleştirilen panel Fourier eşbütünleşme testi, incelenen tüm ülkelerde değişkenler arasında bir eşbütünleşme ilişkisinin varlığını doğrulamaktadır.

Anahtar Sözcükler : Türk Cumhuriyetleri, Doğrudan Yabancı yatırımlar, Ekonomik Büyüme, Panel Veri Analizi.

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[1] *This article is a revised and English-translated version of the paper presented at the "Silk Road and Beyond Congress Series (SIRCON 2023) One Road One Belt: Migration, Tourism and Political Economy" congress held in Tashkent/ Uzbekistan on October 03-06, 2023.*

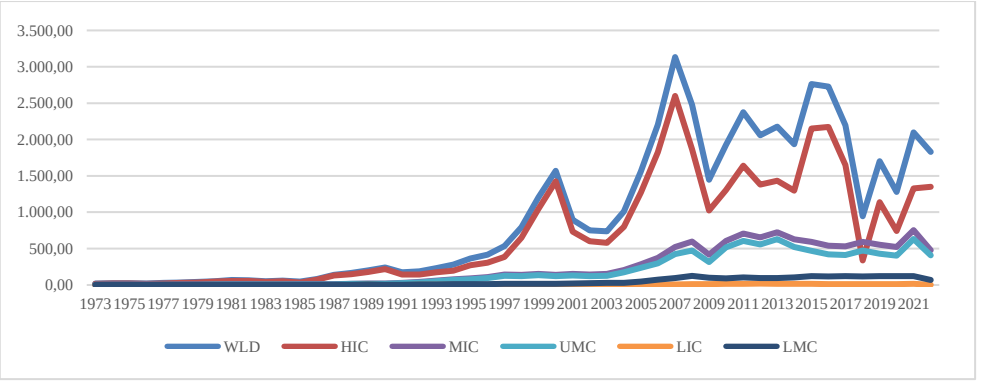
[2] *Bu makale 03-06 Ekim 2023 tarihlerinde Taşkent/Özbekistan'da düzenlenen "İpek Yolu ve Ötesi Kongre Serisi (SIRCON 2023) Bir Yol Bir Kuşak: Göç, Turizm ve Ekonomi Politik" kongresinde sunulan bildirinin gözden geçirilmiş ve İngilizceye çevrilmiş halidir.*

1. Introduction

The importance of Foreign Direct Investment (FDI) as a key determinant in the trajectories of economic growth and development processes within nations is widely recognised. Countries, in pursuit of their economic advancement, are diligently formulating strategies and policies aimed at attracting foreign capital inflows dedicated to investment endeavours (Borensztein et al., 1998; Obwona, 2001; Botrić & Škuflić, 2006; Hobbs et al., 2021). Foreign direct investment (FDI) contributes more to the development process in terms of quantity and quality. FDI brings additional economic growth activators such as R&D, technology, skilled labour, advanced management practices, experience, etc. (Findlay, 1978; Hejazi & Safarían, 1996; Xu, 2000). This resource transfer, also known as the contagion effect, supports the growth process of countries through direct capital transfer (Calvo et al., 1993; Encarnation, 1998; Emara & El Said, 2021). This transfer and contagion effect generated by FDI is not limited to the real sector but also paves the way for developing the financial and banking sectors (Amel et al., 2004). The impact of developments in finance and banking on economic growth is very important, and this importance has been demonstrated by many academic studies (Schumpeter, 1934; Levine, 2005; Elmawazini et al., 2020; Kazak et al., 2023). In this respect, the FDI-finance relationship gains importance. Considering the link between finance and economic growth, the impact of this indirect contagion effect on economic growth is quite important. Although there are different opinions on this process (Bongini et al., 2017), the inclusion of foreign banks and financial institutions in the competition process within the country leads to the development of the banking and finance fields and the development of competition and efficiency-oriented strategies, enabling the sector to work more effectively and efficiently (Levine, 1996; Claessens et al., 2001; Goldberg, 2009; El Biesi, 2010). This effect can be greater when the newly developing field of Islamic banking is included in the process (Abduh & Azmi Omar, 2012; Kazak, 2022; Abasimel, 2023; Kazak et al., 2024). Many literature studies are showing that foreign direct investment supports economic growth (Globerman, 1979; Blomström et al., 1996; K.H. Zhang, 1999; Obwona, 2001; Karahan & Çolak, 2022; Appiah et al., 2023; Hoa et al., 2024). However, within the framework of these existing literature studies, it is wrong to say that FDI supports economic growth under all conditions and circumstances. FDI supports economic growth in case of favourable conditions within the country. For this purpose, the host country should have the capacity to absorb advanced technologies at an adequate level (Borensztein et al., 1998; ALshubiri & Al Ani, 2024; L. Zhang et al., 2024; Z. Li et al., 2024), cultural infrastructure (Romero & Edwards, 2020), the existing domestic human capital development should have the capacity to absorb growth (Benhabib & Spiegel, 1994; Xu, 2000; Bengoa & Sanchez-Robles, 2003; X. Li & Liu, 2005; Z. Li et al., 2024), the absorptive capacity of financial markets should be adequate (Hermes & Lensink, 2003; Nguyen, 2022; Tan et al., 2023), the country's trade policies should be appropriate and legal protection should be adequate (Balasubramanyam et al., 1996; Bengoa et al., 2020; S. Li, 2024) and other indicators of absorptive capacity (education level, GDP level, domestic investment rate, political climate, degree of economic freedom, economic stability, etc.) (UNCTAD, 1999; Bengoa & Sanchez-Robles, 2003).

The development of direct capital investments by country groups over the years is presented below (Figure 1).

Figure: 1
1973-2022 Net Foreign Direct Investment Inflows (Current USD Billion)

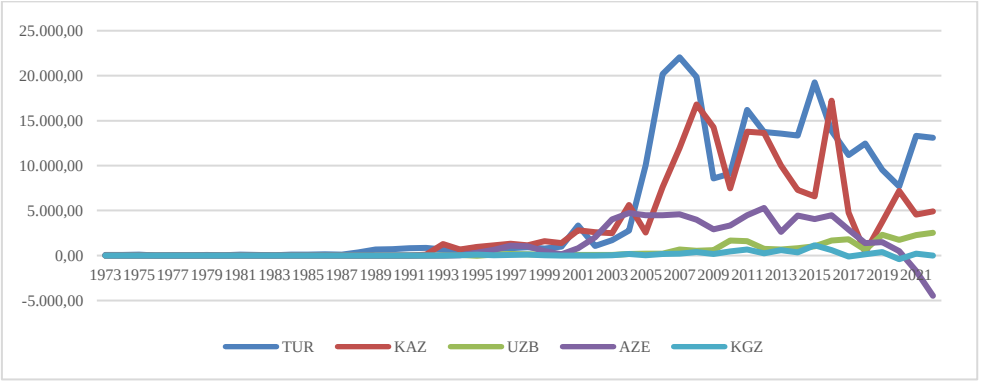


Source: TWB (World Development Indicators) (2023); created by the authors.

In Figure 1, [WLD] represents World; [HIC] High income; [LMIC] Low and middle income; [MIC] Middle income; [UMC] Upper middle income; [LIC] Low income; [LMC] Lower middle-income countries. As can be seen in the figure, it is observed that all income groups move approximately together in their upward and downward trends. When the figure is analysed, it is seen that FDIs continued to grow for years until 2000, declined with the 2001 crisis, and then increased again and reached its maximum value in 2007. After peaking, foreign direct investment (FDI) was significantly affected by the onset of the global financial crisis, marked by the collapse of Lehman Brothers in September 2008 and the ensuing Great Recession. After a brief downturn from 2007 to 2009, FDI began a recovery phase that continued upward until 2016. 2017-2018 witnessed a significant decline in global FDI due to the Venezuelan economic crisis, the European debt crisis, and the Brexit predicament, which mainly affected high-income countries. Subsequently, starting in 2019, a resurgence put FDI back on an upward trend.

This study focuses on the member countries of the Organization of Turkic States (OST) (Kazakhstan, Uzbekistan, Azerbaijan, Kyrgyz Republic, and Türkiye). CIS member Turkic republics are in the category of developing countries and consist of countries with different income groups. FDIs are of great importance for these countries. Realising growth and development requires capital flows on the one hand and innovation, R&D, skilled labour, technology, and experience on the other. The synergistic effect of FDIs is expected to impact the Turkic republics as well.

Figure: 2
Turkic Republics Foreign Direct Investment Net Inflows Between 1973-2022 (Current USD Million)



Source: TWB (World Development Indicators) (2023); created by the authors.

Figure 1 shows that Türkiye and Kazakhstan have the highest FDI inflows. The effects of crisis periods are observed in these countries' FDI inflows. Uzbekistan has had limited FDI inflows in recent years. Azerbaijan has had negative FDI inflows for the last two years. The Kyrgyz Republic has the lowest FDI inflows.

This study examines the impact of foreign direct investment (FDI) inflows on the economic growth of the Turkic Republics. To the best of our knowledge, the existing literature offers a limited body of work on this particular topic, and the present study is expected to make a substantial contribution to the academic discourse. The study consists of six chapters. Following this introductory section, the second chapter comprehensively reviews the relevant literature. The third chapter presents the model, data, and descriptive analysis. Methodological details are given in the fourth chapter, while the fifth chapter focuses on analysing the empirical results. Finally, the sixth chapter provides a comprehensive evaluation and conclusion.

2. Literature Review

Many studies have addressed the relationship between foreign direct investment (FDI) and economic growth. At the same time, the predominant literature reveals the existence of a positive relationship between FDI and economic growth (Helleiner, 1973; Globerman, 1979; Paus, 1989; Blomström et al., 1996; Sun, 1996; K.H. Zhang, 1999; Obwona, 2001; Q. Zhang & Felmingham, 2001; Hansen & Rand, 2006; Al-Iriani, 2007; Makun, 2018; Duman, 2022; Kaya et al., 2022; Songur, 2023; Esener & İpek, 2018; Kasim et al., 2021; Sungur & Altiner, 2023; Çelik & Bayrak, 2022; Öztürk & Saygin, 2020; Kurul, 2021; Naimoglu & Akal, 2021) while fewer studies have failed to detect this relationship (Dutt, 1997; Kentor, 1998; Huang et al., 2010; Magombeyi & Odhiambo, 2018). The most

important effect of FDI on economic growth is to support the investments necessary for growth by complementing capital shortages (Swan, 1956; Todaro & Smith, 2012). However, this effect is important not only through financial support but also due to the additional benefits foreign investors provide. Perhaps the most important of these is the transfer of know-how and technology (Paus, 1989). Adopting new technologies necessary for economic growth will be much easier if supported by firms with experience in using these technologies (Kojima, 1982; Easterly et al., 1994; Harrison, 1994). Again, with technology, the formation of new ideas necessary for growth, the strengthening of R&D activities and the realisation of innovation (Grossman & Helpman, 1993; Petit & Sanna-Randaccio, 2000; Roy & Acharyya, 2009), the strengthening of human capital accumulation by supporting these activities (innovation, R&D and strategic asset activities) (Okafor et al., 2015), new management practices and organisational arrangements (de Mello, 1997), increased productivity (Sjöholm, 1999), heightened competition within local markets and an elevation in corporate tax rates (Ucal, 2014), etc. Accordingly, the host country should have sufficient absorptive capacity to absorb advanced technologies (Borensztein et al., 1998), adequate growth absorption capacity of existing domestic human capital development (Blomstrom et al., 1992; Benhabib & Spiegel, 1994; Xu, 2000; Bengoa & Sanchez-Robles, 2003; X. Li & Liu, 2005), financial market development and absorptive capacity (Hermes & Lensink, 2003; Alfaro et al., 2004; Durham, 2004), appropriate trade policies and legal protection capacity (Balasubramanyam et al., 1996; La Porta et al., 1997, 2000) and other indicators of absorptive capacity (education level, GDP level, domestic investment rate, political climate, degree of economic freedom, economic stability, etc.) (UNCTAD, 1999; Bengoa & Sanchez-Robles, 2003; Botrić & Škuflić, 2006). There are also studies on the economic situation of the Turkic republic countries (Ay & Haydanli, 2018; Çilgin & Kurt, 2021; Erdoğan, 2020; Gokcekus et al., 2023; Günel, 2019; Saraç et al., 2023; Uludağ & Ümit, 2020).

No study in the literature deals with the relationship between "FDI and economic growth" in the context of Turkic Republics. However, individual studies deal with group member countries. Most studies have been conducted for Türkiye, one of the group's member countries. Some of the important studies on country groups are presented in the annexe.

Table: 1
Literature Review on Turkic Republics Studies

Researchers	Operation Range	Country / Country Group Researched	Working Method	Variables	Conclusion
(Ekinci, 2011)	1980-2010	Türkiye	"Johansen Cointegration Test and Granger Causality Test"	GDP, FDI and Employment	A long-run relationship between "FDI and GDP" and a bidirectional causality relationship is found.
(Çeştepe et al., 2013)	1974-2011	Türkiye	Wald test	GDP, FDI, Exports	No causality relationship was found between "FDI and GDP".
(Acaravci & Akyol, 2017)	1998-2015	Türkiye	Johansen Cointegration Analysis, Granger Causality Analysis	FDI/GDP, GDP, Real exports, Real imports, Openness/GDP	No long-run relationship was found between the variables. Unidirectional causality was found between FDI/GDP and GDP.

(Ağir & Rutbil, 2019)	1971-2017	Türkiye	"Johansen cointegration test, Impulse-Response Analysis and Granger Causality Analysis"	FDI, Gross Fixed Capital Investment and GDP per capita	The cointegration and causality relationships between NW GDP and FDI variables could not be detected.
(Şahin, 2021)	1998-2019	Turkiye and five selected countries	"Panel Granger Causality analysis and Westerlund Panel cointegration test"	FDI, GDP and Trade Openness	The variables have a cointegration relationship. Additionally, a bidirectional causation relationship between FDI and GDP was discovered.
(Karimov, 2022)	1980-2016	Türkiye	OLS Regression analysis	GDP and FDI	There is a positive relationship between "GDP and FDI" is favourable.
(Gövdeli & Özkan, 2022)	1985-2018	Türkiye	"Hacker & Hatemi (2006) Bootstrap Causality Test"	Economic growth (GDP), financial openness (FO) and trade openness (TO). Here FO = [(FDI, net inflows + FDI, net outflows) / (GDP)].	A bidirectional causality relationship was found between FO and GDP.
(Alrawdhan, 2022)	2000-2021	Türkiye	ARDL test	Export sector (EX), Import sector (IM), Foreign direct investment (FDI) and Domestic private sector credit (CREDIT) and GDP	A long-term connection exists between FDI and GDP (economic growth).
(Alogaili, 2023)	2011-2021	Türkiye	Hypothesis testing, Johansen Cointegration Test and SWOT analysis	FDI inflows, FDI outflows and Economic growth	Independent Variables (FDI Inflow and Outflow) significantly affect economic growth.
(Ebghaei, 2023)	1980-2020	Mena Region (Türkiye and eight other countries)	Panel cointegration test	FDI and Economic Growth (GDP)	FDI has a favourable and statistically significant effect on economic growth for Türkiye and six other nations. The two countries have no discernible relationship with one another.
(Katircioglu & Naraliyeva, 2006)	1993:Q1-2002:Q4	Kazakhstan	Johansen cointegration test and Granger causality test	GDP, Domestic Savings (DDS)/GDP, FDI/GDP	GDP and FDI are cointegrated along a single vector. The Granger causality test results show a one-way causal relationship between "FDI and real GDP" growth.
(Lee et al., 2009)	1997-2006	Kazakhstan	Multivariate regression model with weighted ECT estimates	Variables representing FDI inflows and GDP growth.	FDI has no statistically meaningful impact on GDP expansion.
(Waikar et al., 2011)	1993-2005	Kazakhstan	Simple regression analysis	FDI, GDP, GDP per capita growth rate and exports	FDI has a positive impact on GDP and GDP per capita.
(Azatbek & Ramazanov, 2016)	2010-2015	Kazakhstan	Correlation and regression analysis	FDI, GDP, Exports, Imports	Exports and economic growth both benefit from FDI.
(Ashurov et al., 2020)	2000-2017	Central Asian countries (Kazakhstan, Uzbekistan, Tajikistan, Kyrgyz Rep. and Turkmenistan)	GMM estimator	Dependent variable (FDI), Independent Variables (GDP, total debt service, labour force, trade openness and taxes collected)	Long-term FDI growth and GDP growth rate have a favourable association.
(Sultankhanova & Abdulla, 2022)	2015-2020	Kazakhstan	Correlation, Multivariate regression	FDI, GDP, exports, imports, foreign trade	The gross domestic product suffers as a result of FDI.
(Agybetova et al., 2022)		Kazakhstan	Interview and Survey		FDI positively impacts the growth of the economy in agrotourism.
(Lotfali, 2023)	1997-2019	Caspian Sea basin countries "Azerbaijan, Iran, Kazakhstan, Russia and Turkmenistan" and Central Asian countries "Kyrgyz Republic, Tajikistan and Uzbekistan"	Model estimation with Panel-FMOLS (Fully Modified Least Squares)	FDI, Economic Growth and other auxiliary variables	FDI significantly and favourably impacts economic growth.

(Hübner, 2011)		Azerbaijan	Literature review and secondary sources		The two are positively correlated in terms of economic expansion.
(Gursoy et al., 2013)	1997-2010	"Azerbaijan, Kyrgyz Republic, Kazakhstan, Tajikistan, Turkmenistan and Uzbekistan"	"Johansen cointegration and Granger causality test"	FDI, GDP	The Granger causation test indicates that FDI causes GDP for Azerbaijan and Turkmenistan, respectively, and that there is bidirectional causation in the case of Azerbaijan.
(Mammadova & Coskun, 2015)		Azerbaijan	Literature review and secondary sources		FDI contributes to GDP growth.
(Azam & Ahmed, 2015)	1993-2011	Ten member states of the Commonwealth of Independent States (Azerbaijan, Kazakhstan, Kyrgyz Rep, Uzbekistan, etc.)	Panel data is a linear regression model. Fixed effects model based on the Hausman test.	FDI, GDP	The Central Asian independent economies, which include Kazakhstan, Turkmenistan, Tajikistan, and Uzbekistan, all benefit from FDI's facilitative role in supporting growth in the former Soviet Republics when lagged FDI is used. For Azerbaijan, FDI has a non-significant effect on economic growth)
(Taghiyev & Mahmud, 2022)	1993-2020	Azerbaijan	"Johansen cointegration and Granger causality test"	FDI, GDP	There is a long-run relationship between FDI and GDP, and FDI is the Granger cause of GDP ($p<0.05$).
(Dadashov, 2023)	2000-2022	Azerbaijan	Correlation and Regression Analysis	FDI, Non-oil GDP	GDP in non-oil sectors, particularly in the manufacturing and service industries, benefits from FDI.
(Kurbanov, 2020)	2010-2019	Uzbekistan	"Johansen cointegration and Granger causality test"	FDI, GDP, Domestic investment	The three variables are related over the long term. There is unilateral causation, and GDP is the Granger cause of FDI.
(Rakhmatillo et al., 2021)	2000-2020	Uzbekistan	Variance decomposition and Granger causality test	FDI, GDP and Employment	The relationship between "FDI and GDP" is causal in both directions.
(Suyunov, 2021)	2004-2019	Uzbekistan	Estimation with vector autoregression model	FDI, Bank Loans, Employment	FDI raises the unemployment rate and has a detrimental effect on employment.
(Amirov & Avazov, 2023)	2010-2021	Uzbekistan	"Least Squares (NLS and ARMA) model"	GDP Per Capita and Dependent Variables Digital infrastructure indicators and macroeconomic indicators (FDI and others)	FDI, trade openness, and economic growth have a strong positive association.
(Mukarapov et al., 2019)	1993-2014	Kyrgyz Republic	Multiple linear regression model	FDI, GDP and other variables.	The statistical significance of the link between FDI and GDP is relatively high.
(Kemme et al., 2021)	1995-2019	GB/EU members "Belarus, Kazakhstan and Russia" and non-member countries "Armenia, Azerbaijan, Georgia, Kyrgyz Republic, Moldova, Tajikistan, Turkmenistan, Ukraine and Uzbekistan"	Panel data analysis (Fixed effect panel regressions)	FDI (net inflows as a percentage of GDP), GDP, Economic Openness and other variables.	The lagged FDI variable significantly and favourably impacts the increase of the real GDP variable.
(Makhmadisuf et al., 2021)	1993-2017	Selected post-Soviet Union countries (Tajikistan, Turkmenistan, Uzbekistan, and Kyrgyz Republic)	Panel data analysis [ordinary least squares (OLS) regressions]	FDI, GDP and other variables.	FDI positively impacts the growth of GDP.

When the literature studies are evaluated, it is seen that the predominant results indicate that FDI has a positive effect on economic growth in all countries. However, there are also results indicating that it has no effect or has a negative effect. In this study, the Turkic Republics, which are considered separately in different studies, are considered

collectively in a single study, and the relationship between FDI and economic growth is reinterpreted with up-to-date Fourier function cointegration and causality tests with up-to-date data to contribute to the evaluation of different results in the literature. The work is anticipated to advance the field of study significantly.

3. Model, Data and Descriptive Analyses

The study uses foreign direct investment and economic growth data of the Organization of Turkic States (OST) member countries (Kazakhstan, Uzbekistan, Azerbaijan, Kyrgyz Republic, and Türkiye) for the period 1993-2022. The data are defined using variable criteria.

Table: 2
Variable Definitions

Variable	Description	Data Source
GDP	"GDP growth (annual %)"	World Bank (2023)
FDI	"Foreign direct investment, net inflows (% of GDP)"	

The panel model to analyse whether FDI impacts economic growth in the Organization of Turkic States (OST) member countries is constructed as in equation (1).

$$GDP_{it} = \alpha_i + \beta(FDI)_{it} + \varepsilon_{it} \quad (1)$$

In the model, t = 1993, ...,2022 time period, i = 1, ...,5 countries, εit is the error term, αi represents country-specific fixed effects, FDI represents foreign direct investment, and GDP represents economic growth is equivalent to the long-term elasticity.

4. Methodology

The variables in the model will be subjected to more than one test to determine the relationship between the variables. Panel data analysis constitutes the basis of the tests to which the variables will be subjected. Two preliminary tests should be performed first to determine and apply the most appropriate test for panel data analysis. The first of these tests is the horizontal cross-section dependence test, and the second is the homogeneity test. The Lagrange Multiplier test in equation (2) developed by Breusch and Pagan (1980) was first used to test for horizontal cross-section dependence.

$$LM = T \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} (\widehat{p}_{ij}^{2})\ X^{2}{}_{\frac{N(N-1)}{2}} \quad (2)$$

Pesaran (2004) developed the LM test in equation (2) for cases where both (N) and (T) are large and transformed it into the CDLM test in equation (3). The additional equation (3) Pesaran (2004) developed for detecting horizontal cross-section dependence is also used.

$$CD_{LM} = \left(\frac{1}{N(N-1)}\right)^{\frac{1}{2}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \left(T\ \hat{p}_{ij}{}^{2} - 1\right) \quad (3)$$

After examining the horizontal cross-section dependence, an examination of the uniformity of the slope coefficients follows, using the formulations articulated in Eqs. (4) and (5) as introduced by Swamy (1970) and subsequently refined by Pesaran and Yamagata (2008).

$$\tilde{\Delta}= \sqrt{N}\ \frac{N^{-1}\tilde{S}-k}{\sqrt{2k}} \tag{4}$$

$$\tilde{\Delta}_{adj}= \sqrt{N}\ \left(\frac{N^{-1}\tilde{S}-E\ (\tilde{Z}_{it})}{\sqrt{Var(\tilde{Z}_{it})}}\right) \tag{5}$$

After conducting the preliminary tests required for panel data analysis, the second step is to test the unit root test. At this stage, the smooth transition Fourier panel unit root test including Fourier functions developed by Nazlioglu and Karul (2017), has significant advantages, is used. The formula used for this test is given in equation (6).

$$\Delta y_{it} = \delta_{0i} + \delta_{1i}\Delta \sin\left(\frac{2\pi kt}{T}\right) + \delta_{2i}\Delta \cos\left(\frac{2\pi kt}{T}\right) + \varepsilon_{it} \tag{6}$$

The P_{LM} and Z_{LM} values calculated for the Fourier panel unit root test using equation (6) are calculated using equations (7) and (8), respectively.

$$P_{LM}(k) = N^{-1}\sum_{i=1}^{N}\tilde{\tau}_i(k) \tag{7}$$

$$Z_{LM}(k) = \frac{\sqrt{N}(P_{\tau}(k)-\xi(k))}{\zeta(k)} \sim N(0,1) \tag{8}$$

In the third stage, "the Fractional Frequency Flexible Fourier Form panel cointegration test" developed by Olayeni et al. (2020) was used to determine the long-run relationship of the variables after the unit root test. The formulation for this test is given in equation (9).

$$\tilde{v}_{i,t} = \hat{v}_{i,t} - \hat{\alpha}_i - \hat{\chi}_i \sin\left(\frac{2\pi kt}{T}\right) - \hat{\varphi}_i \cos\left(\frac{2\pi kt}{T}\right) \tag{9}$$

In the fourth stage where the long-run coefficients are estimated in the model in which the cointegration relationship between the variables is determined, the cointegration estimator developed by Bai (2009), which takes into account the interactive fixed effects (Interactive Fix Effect-IFE), is used with the help of equations (10), (11) and (12).

$$Y_{it} = X'it\ \beta + \alpha_i + \xi_t + \varepsilon_{it} \tag{10}$$

$$\lambda'_i\ F_t = \alpha_i + \xi_t \tag{11}$$

$$SSR\ (\beta, F, \lambda) = \sum_{i=1}^{N}(\ Yi - Xi\ \beta - F\lambda i)'\ (\ Yi - Xi\beta - F\lambda i) \tag{12}$$

In the last stage, the panel Fourier Granger causality test, which was found by Enders and Jones (2014) and developed by Nazlioglu et al. (2016) and Yilanci and Gorus (2020), was applied to investigate the causality between variables. For this analysis, equation (13) is used for the causality relationship from the dependent variable to the independent variable,

while equation (14) determines the causality from the independent variable to the dependent variable.

$$y_{i,t} = \mu_i + \sum_{j=1}^{k_i+d_{max_i}} A_{11} y_{i,t-j} + \sum_{j=1}^{k_i+d_{max_i}} A_{12} x_{i,t-j} + A_{13} \sin\left(\frac{2\pi t f_i}{T}\right) + A_{14} \cos\left(\frac{2\pi t f_i}{T}\right) + u_{i,t} \quad (13)$$

$$x_{i,t} = \mu_i + \sum_{j=1}^{k_i+d_{max_i}} A_{21} y_{i,t-j} + \sum_{j=1}^{k_i+d_{max_i}} A_{22} x_{i,t-j} + A_{23} \sin\left(\frac{2\pi t f_i}{T}\right) + A_{24} \cos\left(\frac{2\pi t f_i}{T}\right) + u_{i,t} \quad (14)$$

The empirical findings section reports the statistical values calculated through these formulations.

5. Empirical Results

The analysis will first investigate whether horizontal cross-section dependence and homogeneity exist in the Turkic Republics. This is important for determining the appropriate generation test. In this context, the horizontal cross-section dependence test found by Breusch and Pagan (1980) and developed by Pesaran (2004) and Pesaran and Yamagata (2008) and the test for homogeneity of slope coefficients found by Swamy (1970) and developed by Pesaran and Yamagata (2008) are applied. Table 3 is constructed to test for horizontal cross-section dependence and homogeneity in GDP and FDI variables.

Table: 3
Horizontal Cross-Section Dependence Test

Test	Cross-Sectional Dependence Lagrange Multiplier 1		Cross-Sectional Dependence Lagrange Multiplier 2		Cross-Sectional Dependence Lagrange Multiplier 3	
Variable	**Statistic**	**Prob**	**Statistic**	**Prob**	**Statistic**	**Prob**
GDP	100.625***	0.000	20.264***	0.000	-3.954***	0.000
FDI	70.881***	0.000	13.613***	0.000	-3.789***	0.000
Panel	74.413***	0.000	14.403***	0.000	6.781***	0.000
Slope Homogeneity Test			**Statistic Value**		**Probability Value**	
Delta Tilde			**-1.161**		**0.877**	
Delta Tilde Adjusted			**-1.224**		**0.889**	

*Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.*

The above table lists the outcomes of the preliminary panel data analysis tests for homogeneity of slope coefficients and horizontal cross-section dependence. There is horizontal cross-section reliance when the variables are studied independently and assessed as a panel, according to the findings of the three horizontal cross-section dependence tests used. Additionally, since the probability value is smaller than 0.05, it is determined that the slope coefficients are homogeneous based on the homogeneity test results. In the next stage (Table 4), the results of the Fourier unit root test for the Turkic Republics are presented respectively, but at the bottom of the table, there is a general test result for all countries.

Table: 4
Fourier Lagrange Multiplier Unit Root Test

Variables	GDP	FDI

Countries	Fouriertau Lagrange Multiplier k=1	Fouriertau Lagrange Multiplier k=2	Fouriertau Lagrange Multiplier k=3	Fouriertau Lagrange Multiplier k=1	Fouriertau Lagrange Multiplier k=2	Fouriertau Lagrange Multiplier k=3
KAZ	-0.4923	-0.336	-0.349	-2.547	-1.335	-2.899
UZB	-0.905	-1.055	-1.086	-0.681	-0.2658	-0.906
AZE	-1.765	-1.592	-1.621	-0.8549	-0.2232	-1.225
TUR	-4.971	-4.526	-4.114	-1.376	-0.4235	-1.41
KGZ	-4.157	-3.009	-3.029	-2.409	0.1637	-1.789
P_{LM}	-2.458	-2.104	-2.040	-1.574	-0.4169	-1.646
Z_{LM}	1.796	0.3467	0.1096	5.013	5.547	1.453
p	0.9637	0.6356	0.5437	1.000	1.000	0.9269

According to the results of the panel Fourier Lagrange Multiplier Unit Root Test developed by Nazlioglu and Karul (2017), it is concluded that the data contain unit roots in the dependent and independent variables used in the model and the 3 frequency values separately and are non-stationary at level value. After this determination, the analysis continued with "the Fractional Frequency Flexible Fourier Form Panel Cointegration Test" developed by Olayeni et al. (2020). In this test, independent variables are tested individually with the dependent variable. In this context, the results of "the Fractional Frequency Flexible Fourier Form Panel Cointegration Test" analysed in equations 15, 16, 17 and 18 are given in Table 5.

Table: 5
Fractional Frequency Flexible Fourier Form Panel Cointegration Test Results

$GDP_{it} = \alpha_i + \beta_1(FDI)_{it} + \varepsilon_{it}$												
	GLS						PP					
Countries	**Stat**		**1%**	**5%**	**10%**	**k**	**Stat**		**1%**	**5%**	**10%**	**k**
KAZ	-4.933	***	-2.979	-2.026	-0.705	1.90	-6.359	***	-3.291	-2.240	-0.997	1.90
UZB	-5.173	***	-3.044	-2.130	-0.779	0.60	-5.760	***	-3.300	-2.264	-0.633	0.60
AZE	-4.211	***	-3.026	-1.900	-0.608	1.80	-3.914	***	-2.921	-2.115	-0.107	1.80
TUR	-5.184	***	-2.581	-1.553	0.554	0.10	-5.198	***	-2.941	-1.702	1.683	0.10
KGZ	-6.298	***	-3.287	-1.644	0.577	0.80	-11.133	***	-3.345	-1.907	0.802	0.80
Average	-5.160	***	**P val.**	0.00			-6.473	***	**P val.**	0.00		
Max.	-6.298	***	**P val.**	0.00			-11.133	***	**P val.**	0.00		
Median	-5.173	***	**P val.**	0.00			-5.760	***	**P val.**	0.00		

*Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.*

When the cointegration test results given in Table 5 are analysed, a cointegration relationship is found between the variables for all of the Turkic republics (Kazakhstan, Uzbekistan, Azerbaijan, Türkiye, Kyrgyz Republic) in the model. After determining the cointegration relationship, the coefficients of the cointegration relationship were estimated with the cointegration estimator developed by Bai (2009) for the model used in equation (1), which includes interactive fixed effects. The results of the estimation are presented in Table 6.

Table: 6
IFE (Interactive Fixed Effects) Cointegration Coefficient Estimation

GDP	Coefficient	Std. Error	Prob.
C	3.474084***	0.0782661	0.000
FDI	0.1354606*	0.5324353	0.086

*Note: *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.*

Bai's (2009) IFE estimator results show that the long-run relationship between the GDP-dependent variable and FDI is statistically significant. According to the coefficient estimates, FDI significantly and positively affects economic growth at 13.55%. These results support the findings in the literature that FDI supports economic growth (Helleiner, 1973; Globerman, 1979; Paus, 1989; Blomström et al., 1996; Sun, 1996; K.H. Zhang, 1999; Obwona, 2001; Q. Zhang & Felmingham, 2001; Hansen & Rand, 2006; Al-Iriani, 2007; Makun, 2018; Taghiyev & Mahmud, 2022).

After identifying the cointegration relationship and estimating the cointegration coefficients, Table 7 investigates the causality relationship between the variables in the established model using the panel Fourier causality test found by Enders and Jones (2014) and developed by Nazlioglu et al. (2016) and Yilanci and Gorus (2020).

Table: 7
Panel Fourier Granger Causality Test Results

Countries	H0: FDI ↛ GDP				H0: GDP↛ FDI				Causality		
	Wald Stat.		Freq.	p-val	Wald Stat.		Freq.	p-val			
KAZ	1.0484		1	0.65	0.0860		1	1.00	FDI	------	GDP
UZB	16.4725	***	2	0.00	0.4085		2	1.00	FDI	↦	GDP
AZE	23.3466	***	1	0.00	7.6241	**	1	0.05	FDI	↔	GDP
TUR	0.0900		3	0.90	3.2333		3	0.20	FDI	------	GDP
KGZ	5.0653		1	0.25	2.7614		1	0.35	FDI	------	GDP

*Note: *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.*

When the causality results in Table 7 are evaluated, it is seen that FDI investments are effective on GDP for Uzbekistan and Azerbaijan. For Azerbaijan, it is also concluded that GDP is effective on FDI. There is a unilateral causality relationship between FDI and GDP for Uzbekistan and a bilateral causality relationship between FDI and GDP for Azerbaijan. With these results, the study supports the studies conducted for Azerbaijan by Hübner (2011), Mammadova and Coskun (2015), Taghiyev and Mahmud (2022), et al. Again, for Uzbekistan, studies by Azam & Ahmed (2015), Rakhmatillo et al. (2021), Amirov & Avazov (2023), et al. are supported by the results found in this study. For other countries, although a long-run relationship was detected in the panel, no causality was detected in the short run. With these results, the study supports the results found for long-run relationships (Ekinci, 2011; Ashurov et al., 2020; Şahin, 2021; Alrawdhan, 2022; Alogaili, 2023), while it does not support the studies (Katircioglu & Naraliyeva, 2006; Ekinci, 2011; Makhmadisuf et al., 2021; Şahin, 2021) that address causality relations in the short run and find a positive relationship. However, it supports the studies (Çeştepe et al., 2013; Ağir & Rutbil, 2019) that address causality relations in the short run and find no relationship.

6. Conclusion

International relations and the resulting transfers are a fundamental consequence of the global economy. Although these relations and transfers have always been observed throughout history, they have never been as fast and interactive as they are today. With the development of internet-based technologies, there has been rapid interaction, especially in the financial sphere. Foreign direct investment (FDI) is one of the most important

components of such transfers, albeit slower and more selective than other financial transmission channels. Today, the finance literature clarifies that economic growth cannot be realised without financial resources. Among these financial resources, FDI has an important position in terms of being long-term and permanent and providing additional benefits. This study analyses the impact of FDI on economic growth using panel data analysis methods on the countries representing the Turkic Republics. The main reason for this study is that, on the one hand, there are different results in the literature, and there is not a complete consensus; on the other hand, the economic growth and development of the Turkic Republics basin, including Türkiye, is important in terms of the world economic development process.

Within the scope of the study, foreign direct investment and economic growth data of the Organization of Turkic States (OST) member countries (Kazakhstan, Uzbekistan, Azerbaijan, Kyrgyz Republic, and Türkiye) for the period 1993-2022 were used. The effect of FDI on the GDP of these countries is examined. Long-run and short-run relationships are considered independently to establish the relationships between the variables. In the third stage, the Fractional Frequency Flexible Fourier Form panel cointegration test developed by Olayeni et al. (2020) was used to identify long-run relationships. In addition, the IFE test developed by Bai (2009) was applied to estimate the long-run coefficients. Finally, "the panel Fourier Granger causality test" developed by Nazlioglu et al. (2016) and Yilanci and Gorus (2020) was applied to identify short-run causality relationships. As a result of the analysis, the cointegration test results revealed that there is a cointegration relationship between the variables in the model for all Turkic republics (Kazakhstan, Uzbekistan, Azerbaijan, Türkiye, Kyrgyz Republic). The results of Bai's (2009) IFE estimator further demonstrate the statistical significance of the long-term link between the GDP-dependent variable and FDI, as well as the fact that FDI investments have a significant and positive impact on GDP at a level of 13.55%. The results of the Panel Fourier Granger Causality Test, which deals with short-run causality relationships, found a causality relationship for some countries (Uzbekistan, Azerbaijan) but not for others (Türkiye, Kazakhstan, Kyrgyz Republic). The Panel Fourier Granger Causality Test results revealed that FDI investments impact Uzbekistan and Azerbaijan's GDP, and GDP impacts the FDI for Azerbaijan. Accordingly, there is a unilateral causality from FDI to GDP for Uzbekistan and a bilateral causality between FDI and GDP for Azerbaijan. For other countries, although a long-run relationship was detected in the panel, no causality relationship was detected in the short run. The study's results contribute to the relationship between FDI and GDP, which has different results in the literature, with new findings. Although short-run causality was not detected for some countries, the long-run cointegration relationship was detected for all countries. FDI investments have a significant positive effect on GDP in a significant percentage, revealing the importance of FDI. Given this importance, policymakers are seen as obligated to attract foreign investors to their countries with incentives and measures to support FDI investments and development processes. The study is thought to provide important insights to policymakers with these findings.

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