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Migration, Remittances, and Economic Growth: Evidence From Central Asian Countries*

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Abstract

In this study, the effect of remittances on economic growth is tested by panel data analysis for four Central Asian countries, namely Kazakhstan, Kyrgyzstan, Uzbekistan, and Tajikistan, for the period 2005–2022. One of the most important reasons for the focus of the study on Central Asia is that Central Asia is one of the regions in the world where labor migration is at a very high level in proportion to the population, and as a result, there is a significant number of transfers to the countries of citizenship in proportion to their Gross Domestic Product (GDP). Moreover, one of the common characteristics of labor migration in the region is that the destination is Russia. Thus, the analysis will lead us to more explanatory and clearer conclusions, and the results of the study will help to determine common policies. As a result of the regression analysis conducted with the Driscoll-Kraay estimator for the analysis, it was found that the increase in remittances positively affects economic growth. On the other hand, it is found that trade openness, which is included in the analysis as the ratio of total foreign trade to national income, has a negative effect on growth. Accordingly, there is evidence that the remittances of workers from abroad make a significant contribution to economic growth in Central Asian countries.

Keywords: Migration, Workers' Remittances, Economic Growth, Central Asian Countries.

JEL Classification: F24, O11, O53

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1. Introduction

As the Central Asian region is multicultural and multiracial, migration is always a hot topic. Increasingly attracting attention, migration can lead to changes in labor markets and economic structure, helping to increase productivity, create new jobs, and stimulate economic growth. Migrants often see their movement as a temporary measure to provide for their families. However, proper management and regulation of migration flows can help ensure economic development and improve the living conditions of local populations.

Central Asian countries have faced significant economic challenges since the dissolution of the Soviet Union, officially the Union of Soviet Socialist Republics (USSR). One of these problems is unemployment. Central Asian countries, which did not yet have enough capital for investment and thus could not create infrastructure for production after gaining independence, could not provide sufficient employment opportunities. For Central Asian countries, the direction of migration is more towards Russia. One of the most important reasons why Russia is the destination of migration is that Central Asian countries, being former USSR countries, have a good command of the Russian language and are also familiar with Russian culture. Russia also has an advantage in terms of transportation for Central Asian countries. Labor migration is an important factor that can have both positive and negative consequences in Central Asia. However, with proper management and regulation of migration flows, it can lead to economic development and better living conditions for the people of the region. Russia remains the primary destination for these countries, especially for those from Tajikistan and Kyrgyzstan, countries in the region dependent on remittances. Along with the above factors, Russia's urgent need for migrant workers is another reason that draws Central Asia into Moscow's orbit.

This study starts with the theoretical framework, which includes a brief summary of the definition of international migration and the causes of migration. This is followed by a literature review summarizing the studies on the extent of migration. The last section empirically examines the relationship between migration and economic growth in Central Asian countries. As a result of the econometric application consisting of panel data analysis with the data of Kazakhstan, Kyrgyzstan, Uzbekistan, and Tajikistan for the period 2005–2022, a positive relationship between migration and economic growth was found. In other words, while there is no evidence that increases in GDP have an impact on remittances, there is strong evidence that remittances from individuals living abroad have a significant contribution to GDP and positively affect growth. This study fills an important gap in the literature on the impact of remittances on growth in Central Asian countries, one of the most important regions in the world where migration and the remittances that emerge as a result of this migration are most important. In this context, the research plays an important role as a source of information that contributes to the formulation of sustainable development policies.

2. Quantification of Labor Migration in Central Asia

The USSR administration determined various policies to reduce economic imbalances in different regions of the country, to develop underdeveloped regions, and to use resources more efficiently. However, these strategies did not sufficiently take into account the cultural or social needs of the migrating populations. These policies have generally focused on directing the population in favor of economic interests. It caused migrants to experience adaptation problems in their new settlements and to fail to preserve their own cultures. Especially in the resettlement to underdeveloped regions, the needs of migrants and their adaptation to the local society were not sufficiently taken into account (Korobkov & Zaionchkovskaia, 2004: 489–490).

As a result of these policies, ethnic-based migration increased after the collapse of the Soviet Union. In particular, people of Russian and Slavic origin migrated due to political and economic

uncertainties in certain regions. These migration movements were widespread not only in the post-Soviet space but also across Eurasia (see Table 1 for destinations) (Tazhkuran, 2018: 71). Russia's Federal Migration Service reported that 11 million people from neighboring countries migrated to Russia between 1989 and 2002, with 70% of migrants being Russians (Petrov, 2009).

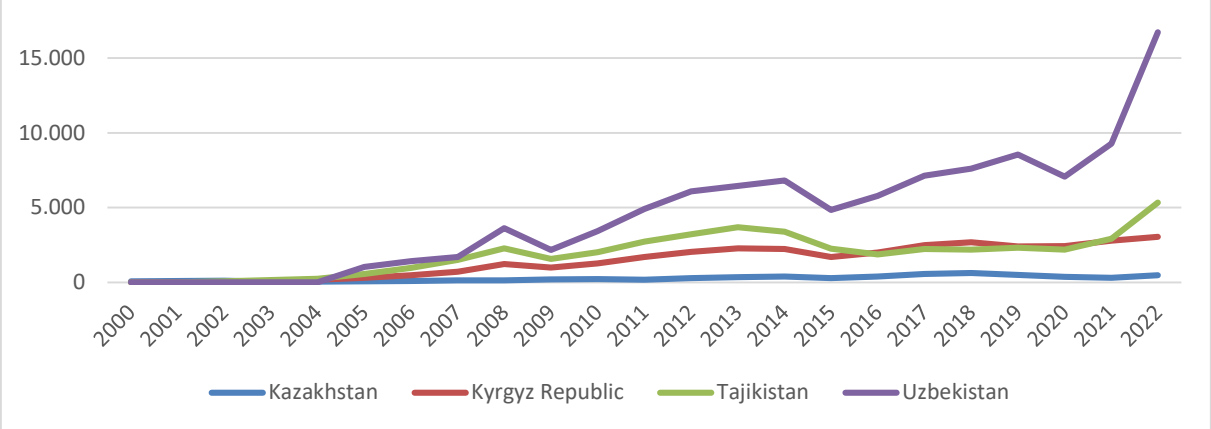
Table 1. List of Top Destinations of Eurasian Migrants (Person, 2021)

Target country / Source country	Austria	Canada	France	Germany	Russia	Spain	Turkey	Ukraine	United Kingdom	USA
Belarus	2.418	12.049	5.464	28.325	763.879	5.050	4.203	249.641	3.635	66.681
Bosnia	174.261	38.906	15.944	222.065	513	2.858	1.760	0	9.576	102.942
Bulgaria	32.971	20.060	31.985	410.885	5.836	185.437	361.904	1.760	122.000	72.023
Croatia	53.485	43.123	8.879	434.610	319	2.835	273	0	8.610	37.645
Georgia	3.698	2.765	19.466	32.280	449.973	10.852	29.285	65.475	2.427	39.422
Kazakhstan	2.781	13.406	2.954	1.128.201	2.558.907	3.675	36.216	225.962	3.882	36.353
Kyrgyzstan	1.073	3.201	821	92.834	591.025	448	32.689	27.175	775	8.890
Lithuania	1.644	5.361	3.743	58.455	71.038	25.815	702	24.825	141.000	34.321
Poland	76.527	157.733	89.138	2.141.722	29.190	97.772	2.075	3.128	835.975	411.750
Romania	138.329	97.253	141.222	844.535	3.908	975.441	8.914	0	370.000	170.469
Russia	36.633	84.735	76.830	1.198.831	0	92.021	56.974	3.330.586	65.000	397.214
Tajikistan	670	1.409	276	32.157	466.252	142	5.514	29.857	338	6.979
Türkiye	159.060	28.763	340.271	1.837.282	10.230	5.390	0	1.376	97.205	126.351
Urania	16.461	78.644	18.166	289.743	3.268.263	106.373	29.793	0	33.000	370.255
Uzbekistan	1.238	6.874	1.258	46.898	1.146.175	867	77.968	223.491	2.087	65.545

Source: (World Bank, KNOMAD, 2021)

Large-scale remittances from the Russian Federation to Central Asian countries, strong labor markets in the United States and OECD countries, and the oil boom in Gulf Cooperation Council (GCC) member countries have contributed to the growth of remittances worldwide. Remittances from Russia have not been as successful for Kazakhstan as they have been for other countries, but they have nevertheless attracted FDI and increased reserves thanks to additional oil and money from the closure of offshore locations. In contrast, countries such as the Kyrgyz Republic, Tajikistan, Armenia, Georgia and Uzbekistan experienced large inflows of remittances in 2022. Remittances to Central Asia and the South Caucasus have appreciated in US dollars as a result of capital controls in Russia, which led to an unexpected and significant appreciation of the Russian ruble. This resulted in a record level of such transfers in 2022 (Figure 1) (Ratha et al., 2023: 3, 17-18).

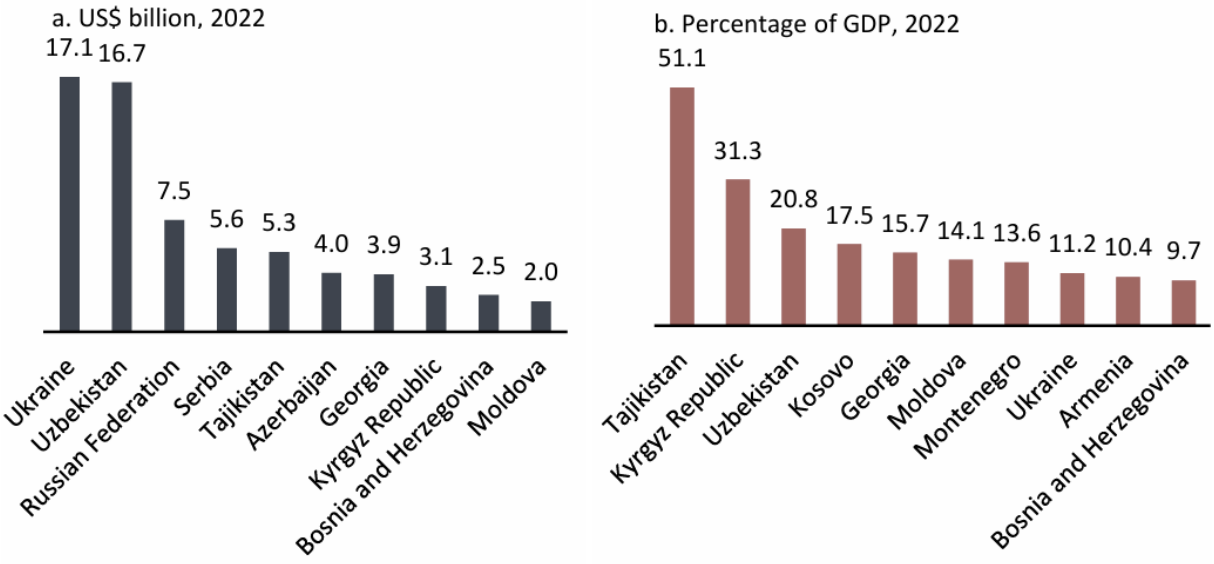
Figure 1. Remittance Inflows to Central Asian Countries (US$ million)



Source: World Bank–KNOMAD staff; World Development Indicators; IMF Balance of Payments Statistics (Ratha et al., 2023).

Among the countries of Central Asia and Europe, or in other words Eurasia, Uzbekistan, Tajikistan and the Kyrgyz Republic are at the leading positions in terms of both the amount and the ratio of remittances to GDP. According to World Bank data, in 2022, remittances inflows to Uzbekistan amounted to $16.74 billion, which is 20.8 percent of Uzbekistan's GDP. The Kyrgyz Republic received $3.05 billion in remittances, which is 31.3 percent of its GDP. In Tajikistan, remittances amounted to $5.34 billion, 51.1 percent of its GDP. As can be seen in Figure 2, these three countries are among the highest recipients of remittances from European and Asian countries. Kazakhstan, on the other hand, received 581 million USD in remittances.

Figure 2. Top Remittance Recipients in Europe and Central Asia (2022)



Source: World Bank–KNOMAD staff; World Development Indicators; IMF Balance of Payments Statistics (Ratha et al., 2023).

In Central Asia, which is a very important region in terms of remittances, especially those countries whose development is dependent on remittances still maintain their importance worldwide. On the other hand, for countries like Kazakhstan, which have accelerated their development with alternative sources, remittances seem to have lost their former importance.

3. Theoretical Framework

The theoretical background is summarized under three headings. Definition and causes of international migration, effects of labor migration in Central Asia and quantification of labor migration in Central Asia.

a. Definition and Causes of International Migration

Before entering the subject of international migration, it is necessary to define the concept in question. International migration is the temporary or permanent movement of people from one country to another and their settlement there (Bartram et al., 2017: 13). In addition, migration is a temporary or permanent action depending on different times and places (Türkyılmaz et al., 1998: 25). While some relocate in search of food, water, or security, others may do so in search of better health, education, or social standing (Gündoğmuş and Bayır, 2021: 2205). Labor migration, on the other hand, generally occurs as the use of unskilled labor in developing or underdeveloped countries in the labor force in developed countries for higher wages (Sugözü and Yaşar, 2021: 349). Basically, the reasons for the emergence of migration can be addressed under four headings. These are economic reasons, socio-cultural reasons, political reasons, and natural reasons. In addition, factors that cause migration can also be classified as attractive or repulsive. Unemployment and poverty are the most important driving factors for labor migration. Most labor migrants think that the relocation is temporary and that they are forced to migrate in order to provide for their families. Remittances, often made by migrants, are the only way to provide for many families who remain in their countries of origin (IOM, 2011). In Central Asia, this is due to the general factor associated with the difficult economic, social, political, and demographic situation in the countries formed after the collapse of the USSR (Vestnik Evrazii, 2008). There are also many attractive reasons for migration, such as the attractiveness of big cities, employment opportunities, and educational opportunities (Güreşci, 2010: 78). The primary goal of everyone who migrates, voluntarily or involuntarily, is to ensure a better quality of life (Yılmaz, 2014: 1687).

Among the primary reasons for economic reasons are the unemployment situation of people and their living standards. The most important economic reason for migration today is the desire to earn high incomes for a higher quality of life (Aksoy, 2012: 294). High tax rates, decreasing investments, low wages, unfavorable working conditions, poor social rights, poverty, and lower or unequal employment cause migration (Ünsal, 2019: 52). Countries receiving migration are usually economically strong, have a high national income, and have good living standards. In sending countries, there are economic crises and generally high unemployment rates (Mutluer, 2003: 12). Migration is also a phenomenon that should be handled together with some social factors such as population structure, education, health, etc., which are social and cultural reasons (Taşçı, 2009: 189). This is because urban centers have better educational conditions than provinces. People may migrate to have different cultural experiences, to learn a new language and culture, or to be part of a community where they understand themselves better. The search for cultural diversity and different experiences can cause people to migrate.

Political events are another reason for migration. Regime changes, political instability, and ethnic discrimination can cause migration (Kutlu, 1992: 138). Political pressures on citizens, authoritarian regimes, the use of public resources only by those in power, the requirement to be a member of the political power holders, their relatives, or their supporters in order to become a public employee, the inability to express political opinions, etc. are among the political reasons for migration.

Natural disasters and climate change can significantly affect living conditions in some places. People may leave their homes and migrate to safer places due to natural disasters such as floods, hurricanes, and droughts. In addition, nuclear accidents, chemical waste from wars and conflicts, and

the problems caused by them can be counted among other natural causes of migration (Algan & Künçek, 1998: 97–99).

b. Effects of Labor Migration in Central Asia

Some of the positive aspects of labor migration among the peoples of Central Asia, in addition to foreign exchange inflows, are the use of remittances in areas such as infrastructure, health, and education, providing security for the country in times of crisis and against indebtedness, providing employment, and reducing income inequality. There are also benefits that are not limited to the remittances that migrants transfer to their home countries or bring back home. Migrants expand their vision by learning about the culture and civilization of the countries they settle in (Yılmaz, 2014: 1962).

Migrant workers in Central Asian countries, particularly in Russia, acquire qualification, production, and organisational skills while working abroad. This is crucial as a large part of the population is under-qualified. Migrants raise labor standards, general education, and cultural standards by working in countries with higher requirements. Migration is a multifaceted action involving economic and social changes, and labour migrants are an important source of foreign exchange. Remittances increase domestic demand, stimulate growth of production and employment, and contribute to the deepening and expansion of trade and economic relations with Russia and other countries. (Ergeshbaev, 2008: 118). According to World Bank research, as a share of the balance of payments, remittances from migrant workers account for up to 34% of GDP in Tajikistan and about 33% of GDP in Kyrgyzstan. In short, remittances account for one-third of national income in these countries. In 2022, the annual remittances sent by labor migrants to Kyrgyzstan amounted to USD 1 billion 727 million. In 2022, the annual remittances sent by labor migrants to Uzbekistan amounted to 7 billion 600 million US dollars.

Those who do not want to return home after their education is those who have better educational opportunities, especially in developed countries. This is because they want to live in countries that offer better job opportunities, career opportunities, high wages, and better living conditions. International migration may seem like a positive thing as it reduces the population of the source country. However, some migrants are qualified brain drains (Ünsal, 2019: 57). Since most of the migrants are of working age, cumulative migration flows cause a significant contraction in the labour force, which is one of the important elements of production and thus development (Brownbridge & Canagarajah, 2020: 16). In addition, population decline creates a perception of a more optimal sharing of resources, but this is the case for underdeveloped countries. For a country whose ultimate goal is to become one of the most developed countries, population decline should not be considered a positive development.

Moving to another country can inevitably be a serious psychological shock for the migrants themselves. The negative consequences can have long-term negative consequences not only for migrants but also for children who are left without support and separated from their families. In addition, migrants may face significant personal risks and problems. These include travel hazards, risks to physical and psychological health, the possibility of becoming victims of human traffickers or exploiters, and having to return to their home countries due to an economic crisis or deportation in the host country (Arslanov, 2014: 122–127). Thus, it is difficult to make a definitive judgment on whether international migration is positive or negative. However, it must be said that the import of highly skilled labor is a profitable economic process, while exports (brain drain) have an extremely negative impact on the national economy (Abdulmanapov, 2019: 56). However, as in the case of Turkey, the outgoing labor force becomes permanent in the destination country after one or two generations and thus no longer brings their savings back to their home country. This situation may result in both loss of human capital and loss of remittances after a period (Sugözü & Yaşar, 2021: 368).

4. Literature Review

Studies aiming to analyze the impact of remittances on economic growth in different countries present a variety of findings that emphasize different aspects depending on geography and circumstances. The first group of studies highlights studies that support the positive impact of remittances on economic growth. Using panel data from 1993 to 2013, Azam et al. (2016) conducted research on European and Central Asian countries using Panel Ordinary Least Squares, Fully Modified OLS, and Dynamic OLS techniques. The empirical findings show that throughout the research period, FDI inflows and remittances had a considerable beneficial impact on economic growth in the European and Central Asian Countries. Feeny et al. (2014) find a positive relationship between remittances and economic growth, especially in small island developing countries, and emphasize the importance of this source of financing for such economies. Çetintaş and Baigonushova (2018) emphasized that in 2016, Kyrgyzstan was the first country in the world to reach 34.5% of GDP in remittance transfers and investigated how remittances from Russia affect changes in the Kyrgyz economy. The results showed that these changes are particularly linked to the Russian economy. According to the findings of the study, there was a causality from remittances to Kyrgyzstan's GDP, and it was concluded that this effect was in the same direction. Another study presented by Engin and Konuk (2020) draws attention to the positive impact of remittances, especially in small island developing countries. Another study by Boubtane et al. (2014) examined the relationship between migration and economic growth in 22 OECD countries between 1986 and 2006. The effect of net migration, was measured on economic productivity using the GMM system with the Panel VAR method. According to the results, human capital positively affects economic growth. Moreover, the contribution of immigrants to human capital accumulation has a significant impact. It is concluded that the key to success depends on the policies of countries that have the ability to implement selective immigration policies.

These studies emphasize that remittances can be an important source of financing that contributes to economic growth. Also, Tariq et al. (2008) focus on the importance of international remittances for promoting economic growth in Pakistan. Bettin and Zazzaro (2011) investigate the relationship between the impact of remittances on economic growth and the level of development of the domestic financial sector. The study covers 66 developing countries between 1991 and 2005. OLS analysis was used in the study. According to the results, the impact of remittances on economic growth and local financial sector development is positive. Chen (2005) investigated the impact of international migration on the economic growth of the source country for the US and the Philippines using stochastic dynamic modeling. The study shows that international migration affects fertility decisions and education expenditures and is therefore associated with economic growth. It is concluded that restrictions on skilled labor migration are beneficial in the short run but may harm the economic growth of the source country in the long run. Morley (2006) measured the causal relationship between migration and economic growth using the ARDL bounds testing approach. The study used per capita migration intake and per capita income parameters for Australia, Canada, and the US countries for the period 1930–2002 on an annual basis. As a result, a unidirectional and long-run causality relationship was found from per capita gross domestic product to migration.

A second set of studies presents contradictory results. For example, Ay et al. (2017) find a negative and significant relationship between remittances and economic growth in African countries. Konte's (1998) study emphasizes that the impact of remittances may vary across economic regimes, being positive in one regime and insignificant in another.

The third group of studies focuses on the negative impact of remittances on economic growth. For example, Karadağ et al. (2020) find that remittances have a negative, significant impact on economic growth in transition countries, possibly related to certain aspects of economic change in these regions.

Moreover, Qutb (2021) emphasized the long-term negative impact of remittances on economic growth in Egypt and warned against the simultaneous perception of the positive aspects of such remittances. Sevinç et al. (2016) investigated the relationship between migration and economic growth in 18 developing countries for the period 1962–2012 using panel data methods. According to the findings of the study, the negative impact of migration on economic growth was found.

In addition, Gligoric & Jankovic's (2016) study and Rehman et al. (2017) research emphasizing the direction of the use of funds provide important perspectives by analyzing the impact of remittances on economic growth. These studies focus on how funds are used to understand the impact of remittances on economic growth. The contribution of remittances to economic growth is not only limited to its impact on production and human capital but has also been studied in depth on financial development and overall economic growth in various regions. In this context, the effective and efficient utilization of funds emerges as a critical factor for economic growth. Brownbridge and Canagarajah (2020) also conclude that the Kyrgyz Republic and Tajikistan, which are the largest recipients of remittances relative to GDP, are not doing well in terms of trade performance. Tajikistan's global market share of merchandise exports declined significantly, while the Kyrgyz Republic's global market share of merchandise exports increased only slightly and its share of services exports barely increased.

According to the results of the literature review, it can be concluded that the impact of remittances on economic growth in Central Asia and other regions is different and depends on various factors such as geographical characteristics, the level of development of the financial sector and the policies of countries. This study will make a significant contribution to the literature as it is a panel data analysis on the countries that receive the highest number of remittances in Central Asia based on recent data and aims to eliminate this complexity to some extent.

5. Econometric Methodology and Findings

In this study, the relationship between remittances and economic growth in four selected Central Asian republics has been analyzed using the panel data analysis method using individual transfers, gross domestic product, gross fixed capital formation, and foreign trade data. The variables analyzed in the model and information about these variables are given in Table 2.

Table 2. Variable definitions and data sources

Variable	Definition	Period Type Value	Source
GDP	Gross Domestic Product	Annual, USD, Nat. Logarithm	World Bank- World Development Indicators
RE	Remittances	Annual, USD, Nat. Logarithm	
GFCF	Gross Fixed Capital Formation	Annual, USD, Nat. Logarithm	
TRO	External Openness (Ratio of total imports and exports to GDP)	Foreign Trade to GDP Ratio, Nat. Logarithm	
Countries	Kazakhstan, Kyrgyzstan, Uzbekistan, Tajikistan		

The relationship between remittances and economic growth is analyzed with annual data for the period 2005–2022. Due to the lack of data for Turkmenistan, four Central Asian countries (Kazakhstan, Kyrgyzstan, Uzbekistan, and Tajikistan) are included in the analysis.

Different statistical tests and methods were used to assess various features and dependencies in the data set. First, a cross-sectional dependence test was performed on the data to identify potential

dependencies. Then, a Hausman test was performed to assess the choice between fixed effects and random effects and to determine the validity of the model. The CADF (Cross-sectional Augmented Dickey Fuller) unit root test, which is the second generation unit root test, is applied to detect autocorrelation, variance, and cross-sectional dependence in the data. The Driscoll-Kraay test is applied to identify and correct heteroskedasticity in the error terms in the regression model using fixed effects panel data analysis.

The Pesaran (2004) CD test was applied in order to determine the effect of an economic shock in one country on the other country included in the analysis by examining the dependencies between observations in panel data sets. The cross-sectional dependence test developed by Pesaran (2004) is explained as follows (Pesaran et al., 2008: 109):

$$CD_{LM3} = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{p}_{ij}\right) \quad (1)$$

The hypotheses of the cross-sectional dependence test developed by Pesaran (2004) are as follows:

H_0= There is no cross-sectional dependence.

H_1= There is cross-sectional dependence.

The results of the cross-section dependence test are shown in Table 3.

Table 3. Cross-Section Dependence Test Results for Variables

Variable	GDP	RE	GFCF	TRO	Model
CD Test Statistic	9.701290	9.131870	9.349152	4.863001	-3.333024
Probability Value	0.0000	0.0000	0.0000	0.0000	0.0009
Decision	Rejected	Rejected	Rejected	Rejected	Rejected

In the results in Table 3, the rejection of the null hypothesis that there is no cross-sectional dependence of the variables necessitates the use of second generation tests.

Tablo 4. Cross-Section Dependence Test Results for the Model

Test	Test Statistic	Probability Value	Decision
Pesaran Scaled LM	1.952932	0.0508	Rejected

Table 4 shows the Pesaran Scaled LM cross-section dependence of the model. According to the results, it is determined that there is cross-sectional dependence among the countries in the panel.

Finding out if the slope coefficients are homogenous would enhance the analysis's outcomes after looking at the existence of cross-sectional dependency in panel data analysis. The panel data's slope homogeneity will be tested using the Pesaran and Yamagata (2008) model. The slope coefficients are homogeneous in H_0, but they are heterogeneous in H_1, the alternative hypothesis.

Tablo 5. Slope Homogeneity Test Results

	Delta	p-value
	6.801	0.000
adj.	8.003	0.000

According to the test results, since the p-values are zero, the null hypothesis is rejected and the alternative hypothesis is accepted. Therefore, it is concluded that there is heterogeneity within the slope in the model.

The unit root analysis among the variables was performed with the CADF test developed by Pesaran (2006). The CADF test is valid when the data set is both N>T and T>N. The CADF test statistic is as follows:

$$y_{it} = (1 - \varphi_i)\mu_i + \varphi_i y_{i,t-1} + u_{it} \quad (2)$$

$i = 1, \ldots, N$ ve $t = 1, \ldots, T$

$$u_{it} = y_i f_t + \varepsilon_{it} \quad (3)$$

In the equation, ft represents the unobserved common effect, while εit is the individual error. Unit root hypotheses are formulated as suggested by Pesaran (2007: 268) as follows:

$$\Delta y_t = a_i + \beta_i y_{i,t-1} + y_i f_t + \varepsilon_{it} \quad (4)$$

$H_0: \beta_i = 0$ For all i's (non-stationary)

$H_1: \beta < 0, i = 1,2, \ldots \ldots N_1, \beta_i = 0, i = N_1 + 1, N_1 + 2, \ldots \ldots N$ (stable)

The Cross-sectional Augmented Dickey Fuller (CADF) unit root test results for the model are presented in Table 5.

Table 6. CADF Unit Root Test Results

Variable	Level			Difference		
	Lag	Constant/ Trend	CIPS statistic	Lag	Constant/ Trend	CIPS statistic
GDP	4	0	-1.238	3	0	-5.005***
RE	2	0	-1.792	2	0	-3.780***
GFCF	3	1	-2.184	3	1	-3.483***
TRO	2	0	-1.330	2	0	-3.853***
Critical values of the means of the individual cross-sectional extended Dickey-Fuller distribution:						
Constant (0)	1%	5%	10%	**Trend (1)**	1%	5%	10%
N: 4 T: 18	-2.60	-2.34	-2.21	**N: 4 T: 18**	-3.15	-2.88	-2.74

Note: Statistical values are determined according to the Akaike Information Criterion. The *** symbol indicates that the statistical value is significant at 1% and the variable is stationary.

Table 6 shows that all variables in the model are non-stationary at level but become stationary in first differences.

Within the scope of panel data analysis, the Hausman test is applied to choose between a fixed effects model and a random effects model. The chi-square distribution with K degrees of freedom forms the basis of this evaluation. It also evaluates whether the effects caused by the units are related to the independent variables in the model (Baltagi, 2001: 20). In the Hausman test, rejection of the null hypothesis H_0, which states that the coefficients of the fixed effects model and the random effects model are the same, indicates that the fixed effects model is valid. The hypotheses for the Hausman Test are as follows:

H_0: The difference between the coefficients is not systematic (Random Effects Model is valid).

H_1: The difference between the coefficients is systematic (Fixed Effects Model is valid).

The Hausman test results for the model are presented in Table 6.

Table 7. Hausman Test Results

chi2(2)	(b-B)'[(V_b-V_B)^(-1)](b-B)
	99.26
Prob>chi2	0.0000

When the results of the Hausman test are analyzed, the H_0 hypothesis is rejected and the H_1 hypothesis is accepted. Thus, the fixed effects model, which claims that the difference between the coefficients is systematic, is valid.

As the Hausman test reveals that the fixed effects model is valid, an autocorrelation test was applied to determine its compliance with econometric assumptions. For this purpose, the Durbin-Watson test developed by Bhargava, Franzini, and Narendranathan (1982) and the LBI test developed by Baltagi and Wu (1999) were used. These tests do not calculate probability values. However, if the test statistic results are less than 2, it is concluded that there is an autocorrelation. Table 7 shows the autocorrelation test results of the model.

Table 8. Autocorrelation Test Results

H_0: sigma(i)^2 = sigma^2 for all i	
Prob > F	0.0000
Modified Bhargava et al. Durbin-Watson	0.72846593
Baltagi-Wu LBI	0.92425902

As seen in Table 8, as a result of the tests applied to test whether there is an autocorrelation problem in the model, the autocorrelation problem is detected in the model since the Durbin Watson and Baltagi-Wu Test results are less than the critical value of 2.

Since it is also important to determine whether the model has the problem of changing variance, the Wald test was examined. Table 8 shows the results of the constant variance test performed with the modified Wald test. The hypotheses for the Wald test are as follows:

H_0: There is no variance.
H_1: There is variable variance.

Table 9. Modified Wald Test Result

H_0: sigma(i)^2 = sigma^2 for all I	
chi2 (32)	9.03
Prob>chi2	0.0604

According to the Modified Wald test results in Table 9, the p-value (prob>chi2) is 0.0604. Therefore, the null hypothesis can be rejected, and it can be concluded that the variance is statistically significant.

As a result of the tests, the Driscoll-Kraay Test was designed to check for inter-series dependence in panel data sets. The reason for applying the Driscoll-Kraay Test, which is a robust estimator, is that it can be used in cases of both changing variance, autocorrelation, and cross-sectional dependence in the model. Table 9 presents the results of the Driscoll-Kraay test.

Table 10. Driscoll-Kraay Regression Test Result

Method: Fixed Effects Regression						
GDP	**Coefficient**	**Driscoll/ Kraay Stand. Error**	**t value**	**P>|t|**	**[95% Confidence Interval]**	
RE	0.275800	0.054033	5.1	0.015	0.103841	0.447758
GFCF	0.375566	0.050119	7.49	0.005	0.216065	0.535067
TRO	-0.369841	0.049123	-7.53	0.005	-0.526175	-0.213507
_cons	9.501100	0.503467	18.87	0.000	7.89884	11.103360

As a result of the regression analysis with the Driscoll-Kraay estimator in Table 10, the coefficients of all variables are statistically significant and it is found that the increase in remittances has a positive effect on economic growth, while gross fixed capital formation, which is included in the analysis as a control variable, affects growth in the same direction. It is also found that trade openness has a negative effect on growth. In this case, according to the results of the relevant tests, the final model in the study will be as follows:

GDP = 9,501 + 0,275RE + 0,375GFCF – 0,369TRO

6. Conclusion

Unemployment, poverty, the multicultural and multiracial nature of the Central Asian region, and political instability are recognized as important factors promoting labor migration. These observations provide an important focal point for understanding and managing the socioeconomic dynamics of the region. In this case, the outcome of whether individual remittances, also known as remittances, cause economic growth will lead policymakers to implement different policies.

In this study, the relationship between remittances and economic growth is analyzed using the data of four Central Asian republics, consisting of Kazakhstan, Kyrgyzstan, Uzbekistan, and Tajikistan, for the period 2005–2022. Central Asia was chosen as the region because it is the region of the world where remittances to GDP ratio is the highest among middle- and lower-income countries. According to the results obtained, firstly, it is determined that the data of the countries have horizontal cross-sectional dependence, that is, the data are affected by each other. Then, the stationarity of the data was investigated, and it was concluded that the first-order differences were stationary. As a result of autocorrelation and variance tests, the appropriate regression analysis was selected, and the data were subjected to regression. In general, based on the outputs obtained, it is determined that the increase in remittances positively affects economic growth in Central Asia. On the other hand, it is found that trade openness, which is included in the analysis as the ratio of total foreign trade to national income, has a negative effect on growth. According to these results, remittances are of great importance in terms of their contribution to economic growth in Central Asian republics.

In the Central Asian Republics, where remittances are almost the backbone of the economy, it is expected that policymakers will strive to maintain this source. However, in countries around the world (see the case of Turkey), the impact of remittances on national income is not sustainable. Therefore,

due to its ability to help growth by eliminating current account deficits, it is recommended that efforts should be made not to lose the advantage of remittance income on the one hand, and on the other hand, as in the case of Kazakhstan, to focus on alternative sources of income for sustainable growth.

Competing Interest

The authors declare that they have no competing interests.

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Ethical Statement

It is declared that scientific and ethical principles have been followed while carrying out and writing this study and that all the sources used have been properly cited.

Author's Contributions

The authors contributed to the study nearly equally.

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