Impact of Macroeconomic and Financial Indicators on Economic Growth: A Case of Eight Eurasian Countries

Abstract

This study examines the multifaceted determinants of GDP growth in eight Eurasian countries (Azerbaijan, Kazakhstan, Kyrgyz Republic, Mongolia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan) focusing on the interplay of macroeconomic and financial indicators, labor markets, demographics, and trade. The research aims to provide a comprehensive analysis of the factors influencing economic growth in the Eurasian region and to offer insights for policymakers. Utilizing a panel data analysis approach over a specified time span from 1993 to 2020, the study explores the individual as well as the collective impacts of these factors on GDP growth, considering both country-specific effects and time trends. The study's findings underscore the significance of macroeconomic stability, characterized by low inflation rates and high industrial concentration in domestic GDP, in fostering GDP growth. Furthermore, the analysis highlights the anticipated substantial impact of labor market dynamics, as measured by unemployment levels, on economic growth. The study also underscores the significance of demographic trends, such as population growth and urbanization, in driving GDP growth. Furthermore, it is anticipated that trade openness and financial market development will have a positive effect on GDP growth in the Eurasian region. These expectations underscore the complex nature of economic growth in Eurasian countries, and the empirical results imply that policymakers should consider a comprehensive approach that addresses various factors to promote sustainable economic development in the long run.

Makroekonomik ve Finansal Göstergelerin Ekonomik Büyüme Üzerindeki Etkisi: Sekiz Avrasya Ülkesini Kapsayan Bir Analiz

Özet

Bu çalışma, makroekonomik ve finansal göstergeler, işgücü piyasaları, demografi ve ticaretin karşılıklı etkileşimine odaklanarak, GSMH büyümesinin çok yönlü belirleyicilerini sekiz Avrasya ülkesi çerçevesinde (Azerbaycan, Kazakistan, Kırgızistan Cumhuriyeti, Moğolistan, Tacikistan, Türkmenistan, Ukrayna, Özbekistan) incelemektedir. Araştırma, Avrasya bölgesinde ekonomik büyümeyi etkileyen faktörlerin kapsamlı bir analizini sunmayı ve politika yapıcılara içgörü sağlamayı amaçlamaktadır. Çalışma, 1993'ten 2020'ye kadar olan zaman aralığında panel veri analizi yaklaşımı kullanarak ve hem ülkeye özgü etkileri hem de zaman eğilimlerini dikkate alarak, bu faktörlerin GSMH büyümesi üzerindeki gerek ayrı ayrı ve gerekse topluca birlikte etkilerini araştırmaktadır. Çalışmanın bulguları, düşük enflasyon oranları ve yurtiçi GSMH içindeki yüksek sanayi yoğunluğu ile karakterize edilen makroekonomik istikrarın, GSMH büyümesini teşvik etmedeki öneminin altını çizmektedir. Bu bulguların analizi, işsizlik seviyeleri ile ölçülen işgücü piyasası dinamiklerinin ekonomik büyüme üzerindeki beklenen önemli etkisini de vurgulamaktadır. Çalışma, aynı zamanda, nüfus artışı ve kentleşme gibi demografik eğilimlerin GSMH büyümesini yönlendirmedeki önemine dikkat çekmektedir. Ayrıca, ticarete açıklık ve gelişmiş finansal piyasaların Avrasya bölgesinde ekonomik büyümeye pozitif etkilerinin olacağını beklemektedir. Bu beklentiler, Avrasya ülkelerindeki ekonomik büyümenin karmaşık yapısının altını çizmekte ve ampirik sonuçlar, politika yapıcıların uzun vadede sürdürülebilir ekonomik kalkınmayı teşvik etmek için çeşitli faktörleri ele alan kapsamlı bir yaklaşımı dikkate almaları gerektiğini ima etmektedir.

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1   Introduction

Higher economic growth is often associated with increasing prosperity, higher levels of consumption and investment. In the context of Eurasian countries, growth is particularly important topic as they shed the label of transition economies and embrace their status as developing countries and emerging markets. For observing this development over time, GDP growth rate is a critical determinant that reflects a country's expanding economy (Helpman, 2004; Batrancea et al., 2021).

The importance of this study emerges from the fact that this study examines the most relevant factors affects the economic growth rates in the context of eight former Soviet Union countries for two and a half decades. Based on the extended neoclassical growth model (Solow, 1956), it is crucial to understand the characteristics of these countries' path of growth and the mutual influence between them. Numerous studies examined various determinants of growth particularly including Eurasian countries (Bildirici and Kayikci, 2013; Khitakhunov et al., 2017; Gurora et al., 2018). Examining the specific attributes of economic growth within each country will shed light on both their shared impact and the disparities in their growth patterns, providing a foundation for further analysis.

The research problem addressed in this study is the complex nature of economic growth in Eurasian countries and the need to understand the determinants that drive or hinder this growth. After Eurasian countries completed their transition economies phase and reached the status of developing countries, investigating their growth potentials become increasingly important (Dell'Anno and Villa, 2013). The growth of these countries directly affects each other and the whole Eurasian region which they are part of it. Consequently, it is necessary to examine the factors behind their economic growth.

Macroeconomic stability is one of the crucial determinants of growth. Growth is facilitated by factors such as low inflation rates, steady industrialization progress, and manageable levels of external debt. In other words, macroeconomic stability is essential for creating a suitable environment for economic growth. High inflation rates, for example, can erode the purchasing power of economic units in the market, and lead to a decline in economic activity. In addition to that, the impact of financial indicators is expected various. Foreign direct investment (FDI) tends to boost economic growth by injecting capital, expertise, and technology (King and Levine, 1993; Levine, 1997). On the other hand, external debt, if managed responsibly, can finance growth-inducing projects, however, excessive debt levels may hinder growth by diverting resources to debt servicing and limiting investment opportunities. In addition to that, trade openness and integration with the global economy are also important determinants of GDP growth in Eurasian countries. Increased trade can stimulate economic growth by expanding market opportunities for businesses, increasing competition, and promoting technological transfer and innovation. Additionally, trade can lead to economies of scale and specialization, further boosting productivity and GDP growth.

This study explores the impact of macroeconomic and financial indicators on the economic growth of eight Eurasian countries. The study is further structured as follows: Section 2 delves into literature review of economic growth and its indicators of impact, followed by Section 3 details the data and methodology. Section 4 reports obtained empirical results, and the final section is conclusion with discussion remarks along with policy implications.

2   Literature Review

Economics literature overflows with empirical studies examine the indicators that affect economic growth positively or negatively. Through neoclassical theories and the emphasis of endogenous growth models, the relationship between macroeconomic and financial indicators with economic growth is widely discussed. The following review reports studies concerning macroeconomic and financial determinants and their influence on economic growth in the context panel regression analysis.

Theoretical framework points out a negative relationship between inflationary pressure of price levels within a country and its growth rates (Fischer, 1993; Barro, 1995). The disruption caused by inflation can be harmful to the economic growth. Guenichi and Benammou (2010) show that higher inflation in Tunisia due to strict monetary policies, hinder the growth. Samsuddin and Amar (2020) showed inflation has a negative impact on growth among G20 group member developing countries between 2013 and 2018. On the other hand, the theoretical perspective argues the industrialization progress and economic growth is positively correlated for developing countries (Kniivilä, 2007; Gabriel and de Santana Riberio, 2019). Mao et al. (2021) showed that infrastructure improvements along with higher industrial production ratio in China's GDP greatly improved the economic progress.

Essentially, the link between FDI and economic growth is intricate and studied extensively in various studies within the literature (Jenkins and Edwards, 2006; Gui-Diby, 2014; Balcilar et al. 2018). Demirhan and Masca (2008) revealed in their analysis of their dataset contains 38 developing countries, expanding markets tend to attract more FDI inflows than advanced countries. Through such incentivized FDI inflows, it is expected that the growth rates of developing countries will be boosted. Additionally, Akinci et al. (2014) found a long-term

relationship between financial development and growth in OECD countries using panel analysis from 1980 to 2011. Shahbaz et al. (2017) explored the factors influencing growth in India and China and their results revealed that financial development correlates with increased economic activity in both countries.

By the studies investigating the correlation between trade and economic growth, panel analyses show no uniformity in the literature contrary to the theoretical expectations. In their study, Goh et al. (2017) found no indication of cointegration when GDP was the dependent variable. Their results suggest that FDI and exports alone are not the exclusive sources of economic growth in the selected Asian economies. On the contrary, examining data from South Africa spanning from 1995 to 2011, Gossel and Biekpe (2014) reported the expansion of South Africa's economy was driven by both trade and capital inflows. Also, Calderon et al. (2020) studied the impact of trade integration on growth on the date from 147 countries from 1970 to 2014, and they revealed a positive correlation between trade integration and economic growth. Similar results are found by Malefane (2020), revealing that increased trade proxies expand growth rate for both short- and long-run.

In broader terms, Mankiw et al. (1992) suggest that the Solow model of growth aligns with international evidence when considering the importance of both physical and human capital. According to augmented Solow model, variations in population growth is expected to account for differences in growth across countries. However, while the positive relationship between population growth is revealed in several studies (Furuoka and Munir, 2011; Mohsen et al. 2017), Afzal (2009) found a negative impact by choosing a single country for analysis instead of a multicountry dataset. Čadil et al. (2014) discuss how human capital contributes to economic growth, highlighting that solely relying on human capital as population growth does not ensure economic stability or a swift recovery from economic crises. Instead, they emphasize the importance of aligning human capital with the economic structure to foster sustainable economic growth.

3   Data and Methodology

In conducting this study on the determinants of GDP growth in Eurasian countries, it is crucial to carefully consider the data sources and variables used that should be reliable, comprehensive, and relevant to the research question at hand. This study primarily relies on eight Eurasian countries, Azerbaijan, Kazakhstan, Kyrgyz Republic, Mongolia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan, publicly available data over 25 years period from 1995 to 2020. All data in table 1 are obtained from the World Development Indicators (World Bank, 2023) prepared by the World Bank.

Variables	Definition	Measurement	Source
GDP	Economic growth	Gross Domestic Product growth rate (annual %)	WDI
INF	Inflation	Inflation, GDP deflator (annual %)	WDI
IND	Industrialization	Industry including construction, value added (% GDP)	WDI
FDI	Foreign direct investment	Foreign direct investment net inflows, (% GDP)	WDI
EXD	External debt stock	External debt stocks (% GNI)	WDI
TRD	Trade openness	Merchandise trade (% GDP)	WDI
POP	Population growth	Population growth (annual %)	WDI

Table 1. Description of the variables

The descriptive statistics in table 2 reports the first round of analyses. Based on the standard deviation value, inflation has the highest volatility among the variables, while population showed the least volatility. Regarding skewness, six variables displayed right skewness, and only population exhibited left skewness. As the kurtosis values for all variables surpassed the threshold of three, it suggested that all variables have leptokurtic distribution. The utilized Jarque-Bera test reveals non-normal distribution for all variables at the 1% level of significance.

	GDP	INF	IND	FDI	EXD	TRD	POP
Mean	4.966952	34.34229	33.44750	6.441966	64.79743	74.34413	1.126315
Median	5.718438	12.70715	30.85291	4.355713	53.17654	71.96650	1.321643
Maximum	34.50000	1014.012	66.57986	55.07288	283.2539	169.6605	2.822850
Minimum	-16.70000	-18.84496	16.68230	-37.17265	4.240429	21.22528	-2.062040
Std. Dev.	6.290945	105.0953	11.75281	8.671749	49.82143	25.46372	0.943743
Skewness	-0.069698	6.463936	1.155450	2.105064	1.623083	0.682722	-1.180763
Kurtosis	7.138848	49.98661	3.754855	16.14341	6.886000	3.970848	3.868471
Jarque-Bera	148.6290***	20582.22***	51.22057***	1650.778***	222.2011***	24.32716***	54.86909***
Observations	208	208	208	208	208	208	208

Note: *** denotes significance at the 1% level

Table 2. Descriptive statistics

The correlation coefficients are reported in Table 3, as evident all correlations indicated low levels. Thus, multicollinearity poses no issues for the econometric estimations, or the conclusions derived from them.

	GDP	INF	IND	FDI	EXD	TRD	POP
GDP	1						
INF	-0.3056	1					
IND	0.2790	0.1501	1				
FDI	0.3358	-0.0422	0.3353	1			
EXD	-0.0990	-0.1411	-0.2699	-0.0910	1		
TRD	0.0625	0.2080	0.0155	0.0854	0.3706	1	
POP	0.2241	0.0367	0.1399	0.0121	0.1266	0.0374	1

Table 3. Correlation Matrix

3.1 Panel Regression Analysis

There are several tests for cross-sectional dependence between sample countries in the panel data. In panel data analysis, these tests reveal the that whether the residuals from a regression model exhibit correlation or dependence across different cross-sectional countries (Breusch, Pagan, 1980). In panel data analysis, where the data is observed over time for multiple cross-sectional units, it's crucial to ascertain these observations are independent of each other or exhibit some form of interdependence. Due to the results are presented in Table 4, the null hypothesis (H_0: No cross-sectional dependence) is rejected, as we have correlation between eight Eurasian countries and each shock in one country affects the rest of the group.

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	66.66957	28	0.0001***
Pesaran scaled LM	5.167439		0.0000***
Pesaran CD	6.002846		0.0000***

Note: *** denotes significance at the 1% level.

Table 4. Cross-Sectional Dependence Test results

The findings present the results of second-generation panel unit root tests as shown in Table 5. The results indicate that the null hypothesis of the unit root is rejected at level since $p < 0.05$, there for series have no unit root.

Method	Statistic	Prob.	Cross-Sections	Obs.
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu	-756.638	0.0000	8	192
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-670.873	0.0000	8	192
ADF - Fisher Chi-square	70.5886	0.0000	8	192
PP - Fisher Chi-square	81.1972	0.0000	8	200

Table 5. Panel Unit Root test

Baltagi (2013) states that a panel data regression has both cross-section and time subscripts on its variables:

$$y_{it} = \alpha + \beta x_{it} + e_{it} \qquad i: 1, 2,\dots, N; \quad t= 1,2,\dots ,T \tag{1}$$

$$e_{it} = \mu_i + v_{it} \tag{2}$$

i denotes countries and t represents time period while y is dependent variable, and x stands for independent one. μ is for unobservable individual specific characteristics and v serves as regression disturbance that changes with countries and time. To analyze the influence of macroeconomic, financial, and demographic indicators that led to economic growth for Eurasian countries, this study employs the basic panel model, is as below:

$$GDP_{it} = \beta_0 + \beta_{1i} INF_{it} + \beta_2 IND_{it} + \beta_3 FDI_{it} + \beta_4 EXD_{it} + \beta_5 TRD_{it} + \beta_1 POP_{it} + e_{it} \tag{3}$$

where the dependent variable is GDP_{it}, i and t subscripts are stated as i=1, 2,... ,8 Eurasian countries and t=1995,... ,2020. β_0 denotes the intercept; all β are coefficients, independent variables are employed as macroeconomic stability indicators (*INF*, *IND*), capital mobility measurements (*FDI*, *EXD*), trade openness (*TRD*), population (*POP*) and e_{it} stands as an error term.

The Equation (3) undergoes estimation using Redundant Fixed Effects and Hausman Tests to select the appropriate panel model. As evidenced by the results of Table 6, redundant fixed effect tests results, cross-section fixed effect as panel regression is suitable for the analysis and Hausman test supports this decision by rejecting its null hypothesis (Ho: random effects is suitable) on the current dataset.

Test	Statistic	d.f.	Prob.
Redundant Fixed Effects			
Cross-section F	2.669928	(7,194)	0.0117**
Cross-section Chi-Square	19.130839	7	0.0000***
Hausman			
Cross-section Random	18.326814	6	0.0055***

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

***Table 6.** Estimation tests*

4   Empirical Results

Panel data models accommodate heterogeneity across groups and introduce individual-specific effects. Eurasian countries present a bound to be heterogeneous over time while demonstrating similar effects. By incorporating successive waves of indicators, their impact on GDP growth will be addressed comprehensively.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF	-0.023643	0.003698	-1.267588	0.0000***
IND	0.096015	0.035002	-6.393542	0.0066***
FDI	0.162614	0.045179	2.743123	0.0004***
EXD	-0.022991	0.008576	3.599321	0.0080***
TRD	0.044890	0.016281	-2.680739	0.0064***
POP	1.513618	0.396504	2.757102	0.0002***
C	-2.032421	1.603377	3.817405	0.2064
F-statistic	16.22908	R-squared	0.326350	
Prob(F-statistic)	0.000000	Durbin-Watson	1.257140	

Note: *** denotes significance at the 1% level

***Table 7**. Panel Least Squares (FE) **Source:** Author's own calculations*

Utilizing panel estimation techniques, the empirical findings in Table 7 validate the existence of a long-term relationship among economic growth, inflation, industrialization progress, capital mobility, trade openness and population. Moreover, the results indicate that all explanatory variables significantly influence growth, although inflation and external debt stock have a negative impact as expected. Panel regression with fixed effects was conducted for eight Eurasian countries, revealing that all variables exhibit statistically significant impacts on growth rates. Specifically, inflation and external debt stocks demonstrate a negative effect, while other variables exert a positive influence. Among the compared variables in terms of their impacts on economic growth, population growth has the most impactful effect, 1% increase in population results in 1.51% in growth rates, while all variables yield results consistent with expectations in the economic literature. However, the relatively low R-squared value suggests a need for additional independent variables to be included in the model or adjusting the time period of the dataset after the completion of transition periods in the selected Eurasian countries after mid-2000s.

Before discussing whether the variables are cointegrated in the long run, it's essential to consider the following factor. The panel data utilized exclusively encompasses Eurasian countries, all of which are developing countries, therefore, it's plausible to regard the panel data as fairly homogeneous.

| Test	Individual Intercept		Individual Intercept and Trend	
Kao PCT results				
ADF	-6.082084 (0.0000)			
Pedroni PCT results		Weighted		Weighted
Panel PP	-3.048559 (0.0011)	-2.921828 (0.0017)	-3.287695 (0.0005)	-3.229561 (0.0006)
Panel ADF	-2.380862 (0.0086)	-2.602409 (0.0046)	-3.280930 (0.0005)	-3.120455 (0.0009)
Group PP	-3.755846 (0.0001)		-3.040317 (0.0012)	
Group ADF	-2.335342 (0.0098)		-3.527716 (0.0002)	

Note: PP and ADF reports Phillips-Peron (non-parametric) and Augmented Dickey-Fuller (parametric) results, respectively. Statistics are distributed asymptotically normal. Probabilities are in parentheses. Maximum lag length set to one and optimal length is specified automatically by Akaike (AIC) criterion.

***Table 8.** Panel Cointegration tests results*

A cointegration test is executed to ascertain the presence of a cointegration relationship among the variables in the long run. Pedroni (2004) defines cointegration as a technique that examines whether a long-term equilibrium connection exists between variables and enables the direct estimation of this relationship. According to the results in Table 8, the null hypothesis of no cointegration is rejected in both Kao ADF test and Pedroni PP, ADF tests.

There is a long-term link among inflation, industrialization progress, capital mobility, trade openness, population, and economic growth for selected Eurasian countries.

For short run causality analysis between the series, Dumitrescu and Hurlin (2012) is utilized that considers heterogeneity within the sample. The overall results are presented in Table 9 (see in Appendix) and Figure 1. Based on the findings of the panel causality test, bidirectional causality is observed among GDP and TRD, POP and GDP, POP and TRD, INF and POP, POP and IND, INF and EXD, INF and TRD, INF and FDI, whereas other causality directions exhibit unidirectional relationships. The results show similarities with other studies, such as there is a bidirectional causality between trade openness and economic growth as previously demonstrated by Raghutla (2020).
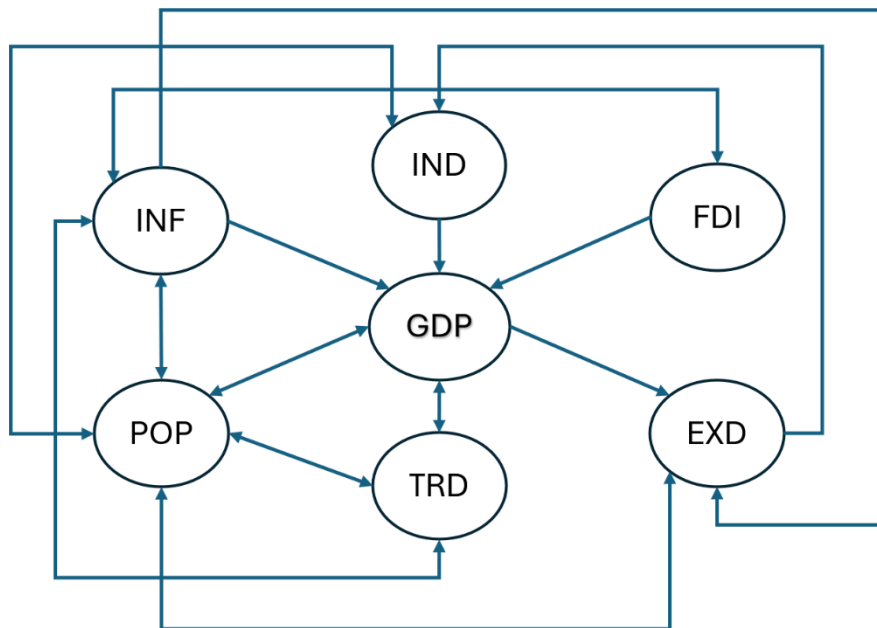
Note: →, ↔ denote unidirectional and bidirectional causality between variables, respectively.

Figure 1. Causality relationship flows.

5   Conclusion

In conducting this study, the aim is to comprehensively analyze the determinants of economic growth for selected Eurasian countries. Using panel model with various pre- and post-estimation tests, this study investigated the relationship between growth rates and various key variables, including inflation, industrialization progress, FDI, external debt stock, trade openness and population. By employing fixed effect models as supported by several diagnostic checking tests and employing both panel cointegration for long-run with panel causality for short-run analysis, this study uncovers new insights between the macroeconomic and financial determinants and economic growth.

The empirical results showed several noteworthy findings. Notably, inflation and external debt exhibited adverse effects on growth rates, other factors demonstrated positive impacts. Additionally, population growth exerted the most substantial impact on growth among the variables, consistent with existing economic literature. The results on population align with the findings of Mankiw et al. (1992) and demographics in Eurasian countries play a crucial role in promoting growth. Furthermore, the identification of bidirectional and unidirectional relationships in panel causality analysis, highlights the nuanced nature of the economic interactions within the Eurasian countries' context.

These findings carry significant implications for policymakers and fellow researchers alike. Addressing the challenges posed by inflation and external debt accumulation while capitalizing on the positive drivers of growth such as industrialization progress and FDI, is crucial for sustaining economic growth for selected Eurasian countries. Further investigations could focus on different nexus links with economic growth. For instance, fixed-effect panel threshold models can be used to explore the relationship between inflationary pressure and growth. By having further and deeper investigations on the relationships between variables, policymakers will enable to tailor more effective policies to promote growth rates and stability in Eurasian countries.

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Appendix

Hypotheses	W-bar Stat.	Z-bar Stat.	Prob.	Conclusion
INF ⇏ GDP	3.81782	1.77922	0.0752[a]	INF → GDP
GDP ⇏ INF	1.60740	-0.70594	0.4802	
IND ⇏ GDP	4.37038	2.40046	0.0164[b]	IND → GDP
GDP ⇏ IND	2.03737	-0.22253	0.8239	
FDI ⇏ GDP	6.31897	4.59124	0.0000[c]	FDI → GDP
GDP ⇏ FDI	3.38153	1.28871	0.1975	
EXD ⇏ GDP	2.91872	0.76837	0.4423	GDP → EXD
GDP ⇏ EXD	7.13711	5.51107	0.0000[c]	
TRD ⇏ GDP	4.75768	2.83590	0.0046[c]	TRD ↔ GDP
GDP ⇏ TRD	4.77968	2.86064	0.0042[c]	
POP ⇏ GDP	7.65198	6.08994	0.0000[c]	POP ↔ GDP
GDP ⇏ POP	7.17968	5.55894	0.0000[c]	
IND ⇏ INF	3.23882	1.12825	0.2592	
INF ⇏ IND	2.95876	0.81339	0.4160	
FDI ⇏ INF	1.50744	-0.81832	0.4132	
INF ⇏ FDI	1.37729	-0.96465	0.3347	
EXD ⇏ INF	2.68812	0.50910	0.6107	INF → EXD
INF ⇏ EXD	6.70682	5.02730	0.0000[c]	
TRD ⇏ INF	6.94752	5.29792	0.0000[c]	TRD ↔ INF
INF ⇏ TRD	5.12190	3.24539	0.0012[c]	
POP ⇏ INF	3.79750	1.75637	0.0790[a]	POP ↔ INF
INF ⇏ POP	12.3217	11.3400	0.0000[c]	
FDI ⇏ IND	4.87196	2.96439	0.0030[c]	FDI ↔ INF
IND ⇏ FDI	5.75958	3.96233	0.0000[c]	
EXD ⇏ IND	2.87212	0.71598	0.4740	EXD → IND
IND ⇏ EXD	4.65511	2.72058	0.0065[c]	
TRD ⇏ IND	2.56098	0.36616	0.7142	
IND ⇏ TRD	2.34761	0.12628	0.8995	
POP ⇏ IND	4.20288	2.21214	0.0270[b]	IND ↔ POP
IND ⇏ POP	8.36566	6.89232	0.0000[c]	
EXD ⇏ FDI	1.43575	-0.89892	0.3687	
FDI ⇏ EXD	2.67155	0.49047	0.6238	
TRD ⇏ FDI	1.96471	-0.30421	0.7610	
FDI ⇏ TRD	1.17634	-1.19057	0.2338	
POP ⇏ FDI	2.13279	-0.11524	0.9083	
FDI ⇏ POP	1.36677	-0.97647	0.3288	
TRD ⇏ EXD	3.22327	1.11077	0.2667	
EXD ⇏ TRD	3.46872	1.38673	0.1655	
POP ⇏ EXD	4.72542	2.79963	0.0051[c]	POP ↔ EXD
EXD ⇏ POP	4.56209	2.61600	0.0089[c]	
POP ⇏ TRD	3.28089	1.17555	0.2398	POP → TRD
TRD ⇏ POP	7.68200	6.12369	0.0000[c]	

Note: (⇏) denotes "no Granger causality from A to B by Dumitrescu and Hurlin (2012) panel causality test with two lags. →, ↔ denote unidirectional and bidirectional causality between variables, respectively.
[a] significant at the 0.1 level
[b] significant at the 0.05 level
[c] significant at the 0.01 level

Table 9. *Panel Causality test results*