“The impact of infrastructure investments on the country’s economic growth”

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THE IMPACT OF INFRASTRUCTURE INVESTMENTS ON THE COUNTRY'S ECONOMIC GROWTH

Abstract

This study aims to assess the positive impact of infrastructure investments on the dynamics of economic growth. The sample includes ten countries (Azerbaijan, Albania, Belarus, Bulgaria, China, Georgia, Mexico, Moldova, Serbia, and Turkey) for 2011–2020 that meet the following criteria:

1) belong to upper-middle-income economies (according to the World Bank Atlas method);

2) the OECD statistical database contains data on investment volumes in infrastructure development of road, railway transport, inland waterways, sea, and airports (by all financing sources). The primary focus was put on the analysis of this issue in Azerbaijan.

GDP per capita growth was selected as the resulting parameter; the main dependent variable was infrastructure investment volumes (total inland and infrastructure road, rail, and air investment), and additional dependent variables were a foreign direct investment (net inflows) and gross domestic investment. Shapiro-Wilk test (for checking normal data), Spearman and Pearson methods (for correlation estimation), Granger test (for detecting causal relationships), and Arellano-Bond dynamic panel-data estimation (for influence formalization) were used. As a result, the following parameters exert the greatest influence on economic growth level: value of gross domestic investment (its growth by 1% causes GDP per capita growth to increase by 0.54% without a time lag); value of infrastructure investment inland (total) (by 1.51% with a three-year lag); value of infrastructure road investment (by 0.41% with a three-year lag). These results can help future research and decision-making at different management levels to strengthen economic growth through infrastructure investment.

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INTRODUCTION

Sustainable economic growth is one of the most significant targets of public management and policy, especially during the recovery of world economies after the Covid-19 pandemic and other modern challenges. In the group of upper-middle-income countries, annual GDP growth per capita is 7.1% (in middle-income economies – 6.1%, in lower-middle-income economies – 4.3%), and net inflows of foreign direct investment are 2.2% of GDP (in the group of middle-income countries – 2.1%, in lower-middle-income countries – 1.7%) that means the existing gap (World Bank, n.d.c, n.d.d). At the same time, infrastructure investment in the group of upper-middle-income countries is 3.6% of GDP (2.7% – in high-income economies, 5.4% – in lower-middle-income economies), and the infrastructure gap is 1.1% of GDP (0.3% – in high-income economies, 1.7% – in lower-middle-income economies) (GI Hub, n.d.). Thus, infrastructure investment is considered one of the drivers of economic development management.

Today investment in infrastructure is a vital determinant of the sector's productivity. Adequate infrastructure provides economic and social benefits in economically developed and developing countries through improved market access, increased productivity, balanced economic development, primarily regional, and job creation. Infrastructural investments primarily cover the costs of building new and improving existing transport networks, including roads, railways, inland waterways, seaports, airports, and all sources of financing (OECD, n.d.).

According to Infrastructure Monitor 2022, special attention is put on the necessity of not only public but private investment in infrastructure to strengthen investment performance, involve future investment, and improve policy toward resilient, sustainable, and inclusive infrastructure (GI Hub, 2022). Energy, transport, and housing investments also improve lives and help reduce poverty.

Considering Azerbaijan, although its infrastructure is characterized by relatively high quality compared to other Eurasian and upper-middle-income countries, its road and rail networks require modernization and increased maintenance costs. Cross-border connectivity projects are top priorities for the government and account for most of Azerbaijan's transport investment. However, focusing on secondary and local roads could improve internal connectivity and reduce travel costs (OECD, 2019). This actualizes the issue of scientific substantiation and formalization of the effect of infrastructure investments, primarily on the country's economic growth.

1. LITERATURE REVIEW

Palei (2015) studied the impact of infrastructure on national competitiveness, including the effectiveness of infrastructure management and improving industrial policy. Thus, the quality of roads, railway infrastructure, air transport, and electricity supply are key infrastructure factors. Lyulyov et al. (2021), Tiutiunyk et al. (2022a), and Zolkover et al. (2022) described the influence on macroeconomic stability and economic growth. Maris (2022) highlighted strengths and weaknesses in this context, paying attention to infrastructure too.

Munnell (1992) described the significance of infrastructure investment for economic growth and paid attention to the policy implementation in this context. Fizza (2014) studied the impact of infrastructure investment on economic growth. Leonov et al. (2012) formalized limitations in the functioning of investment funds, which affect investment activity and the formation of its resource base. Korneyev (2019) identified the dependencies between the imbalance of financial resources and investment flows. Vasilyeva et al. (2021) developed a trajectory transformation because of the Covid-19 pandemic. Moskalenko et al. (2021) conducted a benchmarking analysis of approaches to assessing the country's investment attractiveness, covering a wide range of constituent elements. Tahat (2022) and Tiutiunyk et al. (2022a) investigated factors influencing the foreign direct investment. Pakhnenko et al. (2022) put an accent on investment risks.

Ibraghimov (2022) intensely studied the aspect of the governance of innovations. Kaya (2022) also focused on the regulation, examining whether it is an obstacle in the post-crisis period. Oe et al. (2022) analyzed the issue of leadership and management of innovation in the post-Covid-19 period. Post and Ishihara (2010) focused on innovations and investment projects for sustainable infrastructure. Melnyk et al. (2021) studied the issue of sustainable development and inclusive growth promotion in this research context. Lyeonov et al. (2021) strengthened the impact of institutional and infrastructure quality on inclusive growth. Vysochyna et al. (2022) investigated the impact of financial resilience on sustainable development. Bardy and Rubens (2022) characterized economic recovery projects in the context of sustainable infrastructure. Sotnyk et al. (2022) determined key directions of investment, in particular, in renewable energy projects.

Ansar et al. (2016) tried to find an answer to whether investment in infrastructure leads to economic fragility or growth, based on the experience of China.

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The studies of Yu (2023) and Chen et al. (2022) are based on Chinese evidence too. Han et al. (2019) studied two longitudinal data sets from the OECD to test the impact of infrastructure investment per worker productivity in developed and developing economies. German-Soto and Bustillos (2014) analyzed the nexus between economic growth and infrastructure investment in Mexico; Seidu et al. (2020) – in the United Kingdom; Bekhti et al. (2022) – in Singapore; Kozmenko and Vasylieva (2008), and Vasilyeva et al. (2013) – in Ukraine; Ramli et al. (2022) – in Algeria; Popoola et al. (2022), Aiyedogbon et al. (2022), and Olonila et al. (2023) – in Nigeria; Sadigov (2014), Mammadali and Gabil (2017), Aliyev (2018), Tan et al. (2018), Niftaliyev (2019), Allahverdiyev (2022), Shafizada and Aslanova (2022) – in Azerbaijan. Serdaroğlu (2016) investigated the link between economic growth and public infrastructure in Turkey but paid attention to the indicator of total public infrastructure capital investments.

However, the grounding, estimation, formalization, and interpretation of the effect of infrastructure investment on the changes in the level of economic growth are still relevant and need further scientific development.

Therefore, this study aims to test the hypothesis about the positive impact of infrastructure investments on the dynamics of economic growth.

2. METHODS

To achieve the research goal, a data sample was formed from 10 upper-middle-income economies based on the OECD data available on investment infrastructure for 2011–2020 (the 2020 limitation is explained by the data access for all investigated indicators): Azerbaijan, Albania, Belarus, Bulgaria, China, Georgia, Mexico, Moldova, Serbia, and Turkey (World Bank, n.d.d, n.d.e). The information base was the OECD statistical data and the World Bank data. The data were generalized and analyzed for the following investigated indicators: – GDP per capita growth (%) (World Bank, n.d.c); foreign direct investment (net inflows) (%) (World Bank, n.d.a); gross domestic investment (World Bank, n.d.b) (%); infrastructure investment inland, total (%) (OECD, n.d.); infrastructure road, rail, and air investment (euro) (OECD, n.d.). Dependent variables are foreign direct investment (net inflows) (%) and gross domestic investment (%) (World Bank, n.d.a, n.d.b).

It also calculates time lags through which it manifests itself and conducts the correlation and regression analysis. Correlation analysis proved the relationship between economic growth and infrastructure investment (Pearson, 1896; Pearson & Filon, 1898; Spearman, 1904). The correlation rate was calculated according to Pearson or Spearman method depending on the result of the Shapiro-Wilk test (Shapiro & Wilk, 1965; Shapiro & Francia, 1972). The Granger test was used to determine causality links between economic growth and infrastructure investment levels (Granger, 1969). Regression analysis for panel data was made to formalize the expected effect based on tools of STATA software (Anderson & Hsiao, 1982; Stata, n.d.). In particular, Arellano-Bond dynamic panel-data estimation was applied (Arellano & Bond, 1991).

3. RESULTS

Testing the hypothesis about positive impact of infrastructure investments on dynamics of economic growth level was started with grounding the existence of interconnections between their indicators. Before correlation analysis, it is necessary to apply the Shapiro-Wilk test to check normal data (Table 1).

If the result of the Shapiro-Wilk test (Prob. >z) is less than 0.05, the data do not obey the normal distribution law, and the Spearman method of correlation calculation will be used. In other cases, if the data obey the normal distribution law, Pearson's correlation calculation method will be used (Pearson, 1896; Pearson & Filon, 1898; Spearman, 1904). The results of the correlation analysis are given in Table 2.

The relationship between GDP per capita growth and foreign direct investment (net inflows) is direct (positive) and statistically significant (high or middle) in 8 sample countries. In Bulgaria, the correlation is reversed (negative), and in Mexico, it is not statistically significant (low).

Table 1. Shapiro-Wilk test

Source: Shapiro and Wilk (1965), Shapiro and Francia (1972).

Country	FDI	GDI	II_T	II_r	II_rl	II_a
Azerbaijan	0.58743	0.27216	0.20594	0.21663	0.14439	0.21323
Albania	0.74510	0.30469	0.87253	0.24282	0.80565	0.00006*
Belarus	0.00004*	0.06373	0.03847*	0.62900	0.64404	0.00551*
Bulgaria	0.82206	0.21022	0.83593	0.15752	0.00944*	0.04948*
China	0.33353	0.02508*	0.22446	0.35237	0.70299	0.41342
Georgia	0.50734	0.97895	0.04138*	0.19039	0.00099*	0.07096
Mexico	0.95866	0.08382	0.29949	0.33540	0.70329	0.00261*
Moldova	0.55298	0.93763	0.26915	0.33299	0.04513*	0.07993
Serbia	0.92596	0.13580	0.03832*	0.56187	0.14257	0.02007*
Turkey	0.47909	0.56369	0.82235	0.34410	0.94040	0.00496*

Note: * – data do not obey the law of normal distribution (test result (Prob. > z) is less than 0.05); *FDI* – foreign direct investment (net inflows); *GDI* – gross domestic investment; *II_T* – infrastructure investment inland (total); *II_r* – infrastructure road investment; *II_rl* – infrastructure rail investment; *II_a* – infrastructure air investment.

The link between gross domestic investment and GDP per capita growth is positive and statistically significant (high or middle) in 6 sample countries. The correlation is reversed in Bulgaria, and in Azerbaijan, Albania, and Georgia, it is not statistically significant (low).

It is grounded that the correlation between GDP per capita growth and infrastructure investment inland (total) is positive and statistically significant (high or middle) in 8 sample countries. In Belarus and China, the correlation is reversed.

The relationship between infrastructure road investment and GDP per capita growth is positive and statistically significant (high or middle) in 5 sample countries. In another half of the sample countries, it is reversed. It is proved that the link between GDP per capita growth and infrastructure rail investment is positive and statistically significant (high or middle) in 7 sample countries. In China, Moldova, and Turkey, the correlation is reversed.

A correlation between infrastructure air investment and GDP per capita growth is positive and statistically significant (high or middle) in 7 sample countries. In Albania, China, and Mexico, the correlation is reversed.

Generally, the relationship between investigated indicators is statistically significant and direct (positive) in most countries. However, the exclusively correlational analysis does not provide an

Table 2. Correlation analysis

Country	Correlation coefficient / Time lag / Correlation character (↑– direct, ↓ – reverse) / Correlation strength (h – high, m – middle, l – low)					
	Correlation between GDP and the following indicator:					
	FDI	GDI	II_T	II_r	II_rl	II_a
Azerbaijan	0.6/3/↑/h	–0.2/2/↓/l	0.5/0/↑/h	0.6/0/↑/h	0.6/0/↑/h	0.4/0/↑/m
Albania	0.5/3/↑/h	0.2/3/↑/l	0.4/3/↑/m	–0.6/0/↓/h	0.6/3/↑/h	–0.6/0/↓/h
Belarus	0.4/3/↑/m	0.5/0/↑/h	–0.5/3/↓/h	0.3/0/↑/m	0.4/0/↑/m	0.4/3/↑/m
Bulgaria	–0.5/0/↓/h	–0.4/2/↓/m	0.5/3/↑/h	0.5/3/↑/h	0.4/3/↑/m	0.3/3/↑/m
China	0.7/3/↑/h	0.8/3/↑/h	–0.7/0/↓/h	–0.8/0/↓/h	–0.5/3/↓/h	–0.7/3/↓/h
Georgia	0.4/0/↑/m	–0.2/2/↓/l	0.3/0/↑/m	–0.8/2/↓/h	0.5/3/↑/h	0.4/1/↑/m
Mexico	0.2/1/↑/l	0.9/0/↑/h	0.8/1/↑/h	0.9/3/↑/h	0.5/0/↑/h	–0.9/2/↓/h
Moldova	0.4/3/↑/m	0.4/3/↑/m	0.5/1/↑/h	–0.7/0/↓/h	–0.3/2/↓/m	0.3/1/↑/m
Serbia	0.6/0/↑/h	0.3/0/↑/m	0.6/2/↑/h	0.5/0/↑/h	0.5/3/↑/h	0.4/2/↑/m
Turkey	0.8/2/↑/h	0.6/0/↑/h	0.5/2/↑/h	–0.5/1/↓/h	–0.4/2/↓/h	0.7/0/↑/h

Note: GDP – GDP per capita growth; *FDI* – foreign direct investment (net inflows); *GDI* – gross domestic investment; *II_T* – infrastructure investment inland (total); *II_r* – infrastructure road investment; *II_rl* – infrastructure rail investment; *II_a* – infrastructure air investment.

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opportunity to reveal which indicator is factorial and which is the result. That is why the Granger test is applied to determine the causality of the above relationships (Granger, 1969). The results of the Granger test for Azerbaijan are presented in Table 3.

Table 3. Granger test for Azerbaijan

Result Indicator	Investigated Indicator	Prob. > chi2
GDP	FDI	0.367
FDI	*GDP*	0.004*
GDP	*GDI*	0.900
GDI	*GDP*	0.000*
GDP	*II_T*	0.010*
II_T	*GDP*	0.011*
GDP	*II_r*	0.013*
II_r	*GDP*	0.018*
GDP	*II_rl*	0.000*
II_rl	*GDP*	0.000*
GDP	*II_a*	0.004*
II_a	*GDP*	0.564

Note: * – investigated indicator causes the result indicator (test result (Prob. > chi2) is less or equal 0.05); *GDP* – GDP per capita growth; *FDI* – foreign direct investment (net inflows); GDI – gross domestic investment; *II_T* – infrastructure investment inland (total); *II_r* – infrastructure road investment; *II_rl* – infrastructure rail investment; *II_a* – infrastructure air investment.

If the Granger test result (Prob. > chi2) is less or equal to 0.05, investigated indicator causes the result indicator (Granger, 1969). Therefore, foreign direct investment (net inflows) and gross domestic investment in Azerbaijan do not cause GDP per capita growth. In turn, infrastructure investment inland (total), infrastructure road investment, infrastructure rail investment, and infrastructure air investment cause GDP per capita growth. At the same time, GDP per capita growth causes foreign direct investment (net inflows), gross domestic investment, infrastructure investment inland (total), infrastructure road investment, and infrastructure rail investment. So, in the case of infrastructure investment inland (total), infrastructure road investment, and infrastructure rail investment, there is bidirectional Granger causality.

For other countries, similar calculations were conducted. The generalized results of the Granger test for the sample are shown in Table 4.

Foreign direct investment (net inflows) causes GDP per capita growth in 4 sample countries. GDP per capita growth causes foreign direct investment (net inflows) in 4 sample countries. Bidirectional Granger causality is in Albania and Mexico.

Gross domestic investment causes GDP per capita growth in 7 sample countries. GDP per capita growth causes gross domestic investment in 6 sample countries. Bidirectional Granger causality is in Bulgaria, China, and Serbia.

Infrastructure investment inland (total) causes GDP per capita growth in 5 sample countries. GDP per capita growth causes infrastructure investment inland (total) in 5 sample countries. Bidirectional Granger causality is in Azerbaijan, China, and Turkey.

Infrastructure road investment causes GDP per capita growth in 6 sample countries. GDP per cap-

Table 4. Generalized results of the Granger test for the sample

Country	Causality link between GDP and the following indicator (the direction is noted by an arrow)					
	FDI	**GDI**	**II_T**	**II_r**	**II_rl**	**II_a**
Azerbaijan	FDI←GDP	GDI←GDP	II_T↔GDP	II_r↔GDP	II_rl↔GDP	II_a→GDP
Albania	FDI↔GDP	GDI→GDP	–	II_r←GDP	II_rl↔GDP	II_a←GDP
Belarus	–	GDI→GDP	–	–	–	II_a←GDP
Bulgaria	–	GDI↔GDP	II_T←GDP	II_r→GDP	II_rl←GDP	–
China	FDI→GDP	GDI↔GDP	II_T↔GDP	–	–	–
Georgia	FDI←GDP	GDI←GDP	–	II_r→GDP	–	II_a←GDP
Mexico	FDI↔GDP	GDI←GDP	II_T→GDP	–	II_rl→GDP	II_a→GDP
Moldova	FDI→GDP	GDI→GDP	II_T←GDP	II_r↔GDP	II_rl←GDP	II_a←GDP
Serbia	–	GDI↔GDP	II_T→GDP	II_r→GDP	II_rl←GDP	II_a→GDP
Turkey	FDI→GDP	GDI→GDP	II_T↔GDP	II_r→GDP	–	II_a←GDP

Note: "–" – not assessed; *GDP* – GDP per capita growth; *FDI* – foreign direct investment (net inflows); GDI – gross domestic investment; *II_T* – infrastructure investment inland (total); *II_r* – infrastructure road investment; *II_rl* – infrastructure rail investment; *II_a* – infrastructure air investment.

ita growth causes infrastructure road investment in 3 sample countries. Bidirectional Granger causality is in Azerbaijan and Moldova.

Infrastructure rail investment causes GDP per capita growth in 3 sample countries. GDP per capita growth causes infrastructure rail investment in 5 from 10 sample countries. Bidirectional Granger causality is in Azerbaijan and Albania. Infrastructure air investment causes GDP per capita growth in 3 sample countries. GDP per capita growth causes infrastructure air investment in 5 sample countries. Therefore, the most causes of GDP per capita growth (on the level of the research sample) are a gross domestic investment, infrastructure road investment, and infrastructure investment inland (total).

For formalization the impact of most reasonable indicators of infrastructure investment on the level of economic growth (GDP per capita growth), regression analysis for panel data (formed by the research sample of countries) was used (Anderson & Hsiao, 1982). In particular, Arellano-Bond dynamic panel-data estimation was applied (Arellano & Bond, 1991; Stata, n.d.). As there is bidirectional Granger causality in many cases, linear dynamic panel-data models are used because they include lags of the dependent variable as covariates and contain unobserved panel-level effects correlated with the lagged dependent variables. The results are given in Table 5.

If the value of criterion P > z is less than 0.05, the indicator coefficient is statistically significant (in Table 5, it is marked with *). If the value of criterion Prob. > chi2 is less than 0.05, the model is adequate (in Table 5, it is marked with *).

The obtained results of regression modeling mean the following. If the value of gross domestic investment increases by 1%, GDP per capita growth will increase on average by 0.54% without a time lag. If the value of infrastructure investment inland (total) increases by 1%, GDP per capita growth will increase on average by 1.51% with a three-year lag. If the value of infrastructure road investment increases by 1%, GDP per capita growth will increase on average by 0.41% with a three-year lag.

Table 5. Fragment of Arellano-Bond dynamic panel-data estimation

GDP	Coef.	Std. err.	z	P > z	[95% Conf.	Interval]
GDP L1	–.0708253	.1743429	–0.41	0.685	–.4125312	.2708805
GDP L2	–.4539601	.1592736	–2.85	0.004*	–.7661305	–.1417897
GDI	.5401539	.1661601	3.25	0.001*	.2144861	.8658217
_cons	–9.791694	4.152057	–2.36	0.018*	–17.92958	–1.653813
Prob. > chi2 = 0.0014*; Regression equation: $GDP = -0.45GDP_{t-2} + 0.54GDI - 9.79$						
GDP	**Coef.**	**Robust Std. err.**	**z**	**P > z**	**[95% Conf.**	**Interval]**
GDP L1	.0492781	.175087	0.28	0.778	–.293886	.3924423
GDP L2	–.4249318	.1412961	–3.01	0.003*	–.7018671	–.1479966
II_T L0	.855316	.8133221	–1.05	0.293	–2.449398	.7387659
II_T L1	.2445367	.6149358	0.40	0.691	–.9607154	1.449789
II_T L2	–1.91714	.8729681	–2.20	0.028*	–3.628126	–.206154
II_T L3	1.507016	.6664203	2.26	0.024*	.200856	2.813176
_cons	5.888566	3.77175	1.56	0.018*	–1.503928	13.28106
Prob. > chi2 = 0.0000*; Regression equation: $GDP = -0.42GDP_{t-2} + 1.51II\_T_{t-3} + 5.89$						
lnGDP	**Coef.**	**Robust Std. err.**	**z**	**P > z**	**[95% Conf.**	**Interval]**
lnGDP L1	–.1446979	.065476	–2.21	0.027	–.2730285	–.0163673
lnGDP L2	–.1496928	.0373013	–4.01	0.000*	–.222802	–.0765837
lnII_r L0	.036594	.1593364	0.23	0.818	–.2756996	.3488876
lnII_r L1	–.2341465	.0897079	–2.61	0.009*	–.4099707	–.0583223
lnII_r L2	–.1675516	.2156929	–0.78	0.437	–.5903018	.2551987
lnII_r L3	.414109	.1726945	–2.40	0.016*	–.7525841	.075634
_cons	18.3225	6.431365	2.85	0.004*	5.717257	30.92775
Prob. > chi2 = 0.0000*; Regression equation: $\ln GDP = -0.14\ln GDP_{t-2} + 0.41\ln II\_r_{t-3} + 18.32$						

Note: * – coefficient is statistically significant; *GDP* – GDP per capita growth; *GDI* – gross domestic investment; *II_T* – infrastructure investment inland (total); *II_r* – infrastructure road investment, *ln* – natural logarithm of the indicator, *L0-L3* – lags of variables.

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4. DISCUSSION

Among the analyzed indicators of infrastructure investments, those with the most significant impact on GDP per capita growth were singled out. These were confirmed mathematically based on correlation-regression analysis of cross-country statistical data and a special Granger test. Furthermore, this effect has been formalized and interpreted, unlike many existing studies.

In comparison, Kredina et al. (2022), Petrushenko et al. (2022), and Shkarupa et al. (2019) studied certain aspects of increasing the economic development of the country, including the expense of investment policy indicators. However, these studies do not involve cross-country analysis. Kasianenko et al. (2020) focused on the role of foreign direct investment in reaching a higher level of economic development. However, the emphasis is on the leading indicators of Ukraine's investment potential based on the Brown-Meier exponential smoothing model. This model is also based exclusively on the experience of one country.

Du et al. (2022) proposed a vision of how infrastructure investment influence on the quality of economic growth based on the empirical examination of provincial panel data for China for the last fifteen years. Bivens (2017) studied the case of the United States' economic development due to possible macroeconomic benefits from increasing investment in infrastructure. Makohon et al. (2020) investigated the impact of the share of capital investment in GDP and the fixed capital investment index on real GDP using correlation and regression analysis. In contrast, this study used another research method, including the Granger causality test and Arellano-Bond linear dynamic panel-data estimation. Indicators were emphasized, especially in the context of infrastructure investment.

The causality nexus between GDP and infrastructure investments, including the Granger test, was determined by Krüger (2012) but on the example only of Sweden for 1800–2000. The study concluded that the causal relationship between growth and transport infrastructure investment depends on a time scale, as it reverses in short-term and long-term dynamics. Kumo (2012) also applied Granger causality analysis for economic growth and infrastructure investment in South Africa. In contrast, this study formed another cross-country sample, put other purposes, and obtained other results.

CONCLUSION

The study proved the hypothesis about the positive impact of infrastructure investments on the dynamics of economic growth. In most countries from the studied sample, the direct relationship between investigated indicators of economic growth and infrastructure investment was confirmed based on correlation analysis, considering time lags through which the link is the closest and statistically significant. At the same time, due to the Granger test, it was proved that foreign direct investment (net inflows) causes GDP per capita growth in 4 sample countries; gross domestic investment – in 7 countries, infrastructure investment inland (total) – in 5 countries; infrastructure road investment – in 6 countries; infrastructure rail investment – in 3 countries; infrastructure air investment – in 3 countries. Reverse and bidirectional Granger causality was also emphasized for certain countries. Therefore, gross domestic investment, infrastructure road investment, and infrastructure investment inland (total) were identified as the most causes of GDP per capita growth on the level of the research sample.

Due to regression analysis for panel data (Arellano-Bond dynamic panel-data estimation), the impact of the most reasonable indicators of infrastructure investment on the level of economic growth was formalized. If the value of gross domestic investment increases by 1%, the value of GDP per capita growth will increase on average by 0.54% without a time lag, in the case of infrastructure investment inland (total) – by 1.51% with a three-year lag, in case of infrastructure road investment – by 0.41% with a three-year lag. The obtained results can be useful for future research in economic development management and decision-making at different management levels to strengthen economic growth through infrastructure investment.

The limitations of this study are the selected sample of countries, which belong only to the upper-middle income group. In future research, it is also expedient to investigate cause-and-effect relationships and assess the possible impact on countries of other income groups and, accordingly, other levels of economic development.

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