Does Infrastructure Investment lead to Economic growth? Evidence from Central Asian Countries

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Presentation
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Unlocking Private Investment in Sustainable Infrastructure in Asia

Overview of the Presentation

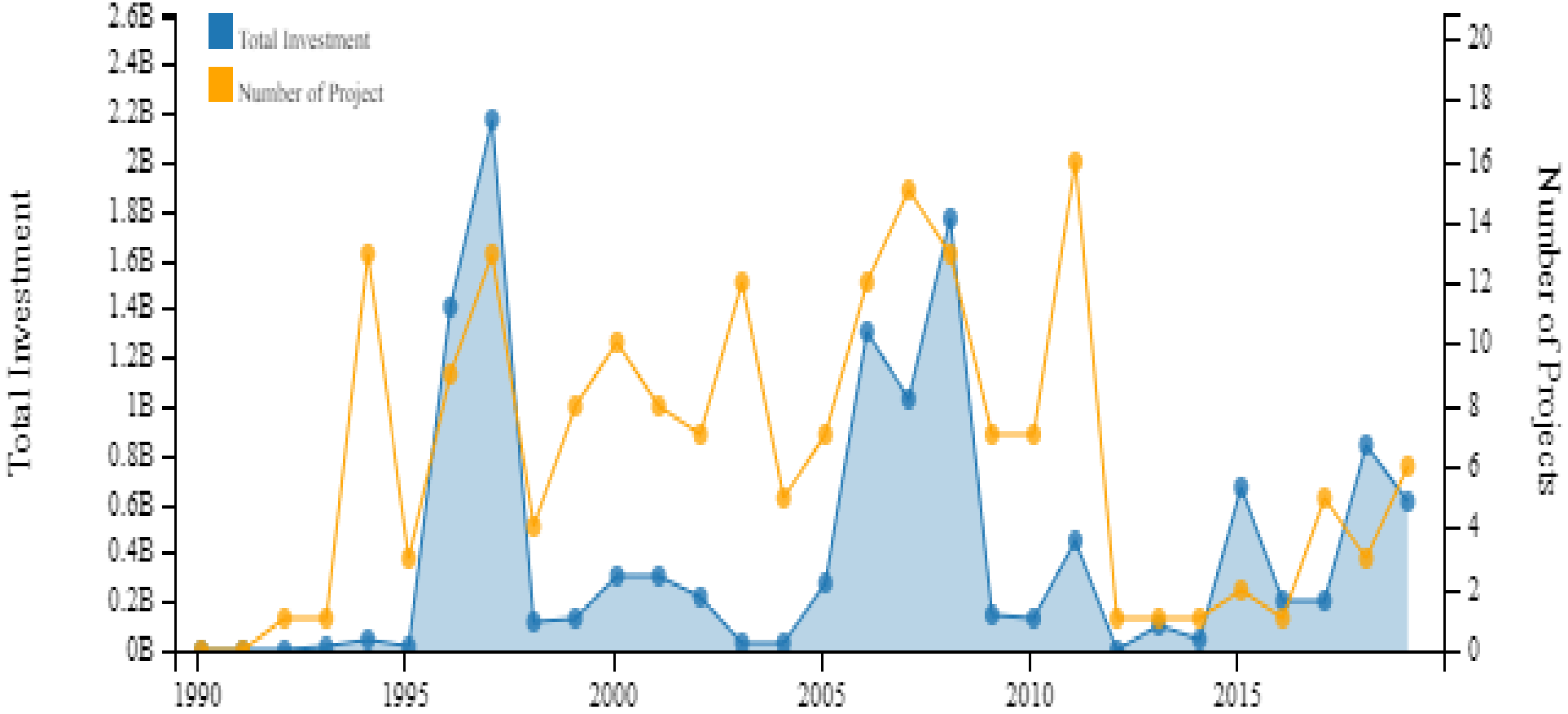
- Introduction
- Motivation-Snapshot on Infrastructure in Central Asia
- Review of Literature
- Research Questions
- Empirical Model, Data and Methodology
- Empirical Findings
- Conclusion

Introduction

- This paper tries to explore the relationship between infrastructure investment and economic growth in the Central Asian economies.
- Investment in infrastructure can enhance the productivity, competitiveness through trade facilitation, reduction in the transportation cost and employment creation and thereby improve economic development and reduction in poverty (Aschauer 1989; Easterly and Rebelo; Démurger, 2001; Estache and Mondiale, 2008).
- The countries in Central Asian economies, such as Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan, are rich in natural and human resources but quite diverse in terms of their stages of development.
- These economies lack of well-developed infrastructure. Since these countries are landlocked, the intra-regional trade is a significant challenge due to various cross-border regulations, with limited transportation connections inside and outside the region.
- Despite some infrastructure investment in the last quarter-century, the lack of connectivity between Central Asia and the outside world remains a significant obstacle to trade and economic development (Batsaikhan and Dabrowski, 2017).
- Similarly, as these economies are primarily dependent on the exports of oil, natural gas, metals, and agricultural raw materials, the development of infrastructure is crucial to obtain higher economic growth
- The estimates of the Asian Development Bank suggest that the countries of Central Asia required to invest USD 33 billion for infrastructure development by 2030 to meet the domestic and international demand (ADB, 2019). Given this scenario, it is crucial to understand how infrastructure investment affects the economic growth of these economies.

Motivation

Trends in investment in infrastructure (USD Billion) and number of projects: Central Asian Economies (1993-2018)



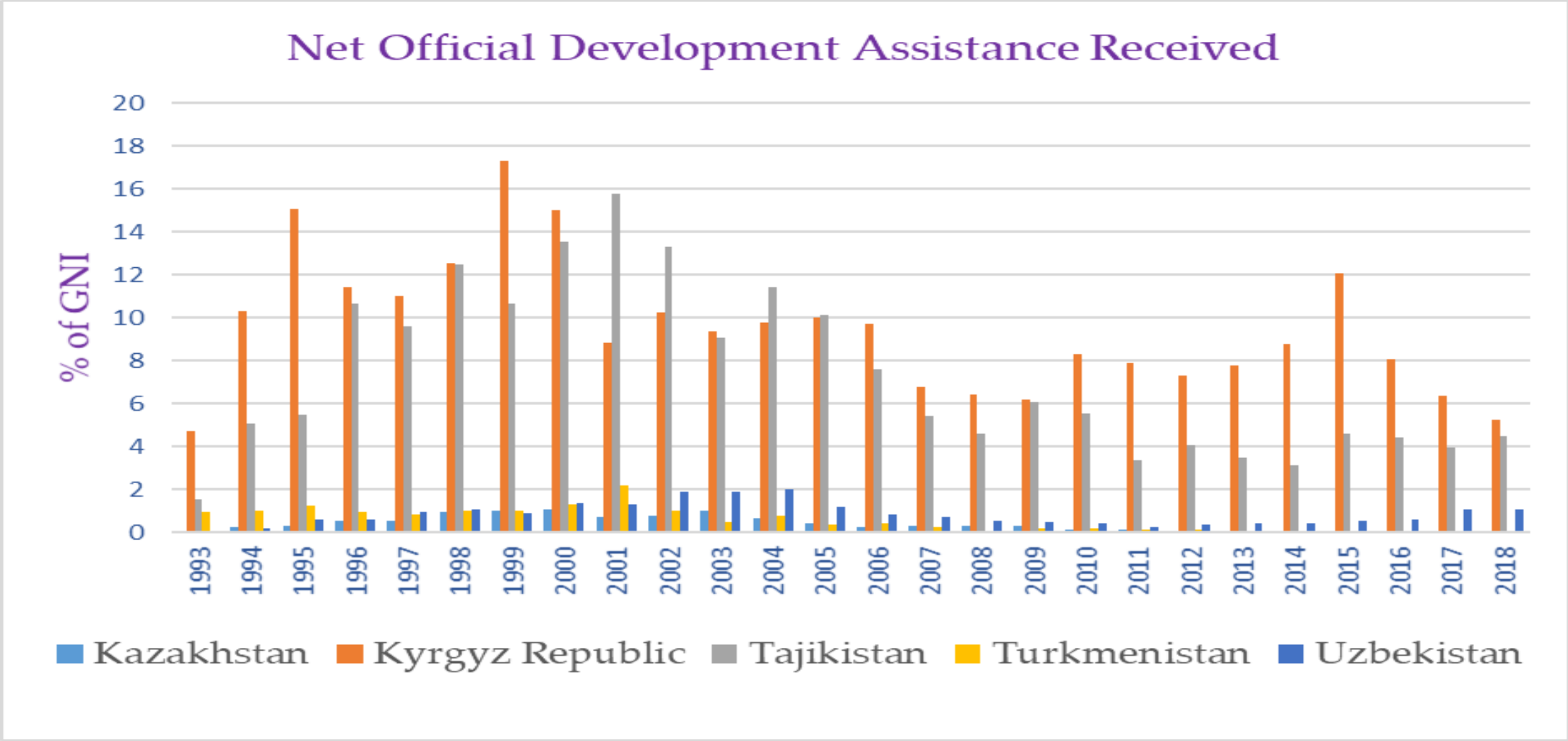
Source: World Bank

Net Official Development Assistance Received

Economies	Net official development assistance (% of GNI)
Central Asian Economies	
Kazakhstan	0.392
Kyrgyzstan	9.481
Tajikistan	7.293
Turkmenistan	0.584
Uzbekistan	0.850
Emerging Asian Economies	
China	0.133
India	0.254
Indonesia	0.473

Source: Authors' calculation from WDI data (1993-2018).

Net Official Development Assistance Received



Source: World Bank

Private Participation in Infrastructure

Countries	Total Number of Projects	Total Investment (in Millions $)	Sector with Higher Investment
Central Asian Economies			
Kazakhstan	42	5119	Electricity
Kyrgyzstan	6	140	ICT
Tajikistan	5	961	Electricity
Uzbekistan	7	369.5	ICT
Emerging Asian Economies			
China	1768	226711	Roads
India	1086	270534	Electricity
Indonesia	141	67532	Electricity

Source: World Bank-Private Participation in Infrastructure (PPI) Database

Logistic Performance Index (Infrastructure)

Year	2010		2014		2016		2018	
Countries	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Central Asian Economies								
Kazakhstan	2.66	57	2.38	106	2.72	68	2.55	81
Kyrgyzstan	2.09	118	2.05	147	1.96	150	2.38	103
Tajikistan	2.00	127	2.36	108	2.13	130	2.17	127
Turkmenistan	2.24	101	2.06	146	2.34	103	2.23	117
Uzbekistan	2.54	70	2.01	148	2.45	91	2.57	77
Emerging Asian Economies								
China	3.54	27	3.67	23	3.75	23	3.75	20
India	2.91	47	2.88	58	3.34	36	2.91	52
Indonesia	2.54	69	2.92	56	2.65	73	2.90	54
Advanced Economies								
Japan	4.19	5	4.16	7	4.10	11	4.25	2
United Kingdom	3.95	16	4.16	6	4.21	5	4.03	8
United States of America	4.15	7	4.18	5	4.15	8	4.05	7

Source: World Bank

Comparison and Infrastructure (Average 2000-2015)

Infrastructure Variables	Access to electricity (% of Population)	Railways, passenger carried (Millions passenger-KM)	Fixed telephone subscription (per 100 People)	Energy use (kg of oil equipment per capita)
Central Asian Economies				
Kazakhstan	99.571	14249.14	20.311	3749.149
Kyrgyzstan	99.692	65.138	8.407	550.776
Tajikistan	99.024	40.021	4.430	327.802
Turkmenistan	99.792	1573.077	9.570	4191.581
Uzbekistan	99.709	2688.315	6.937	1798.835
Emerging Asian Economies				
China	98.687	662471.7	20.621	1589.094
India	70.862	762133.5	3.119	503.128
Indonesia	91.692	17705.19	8.823	807.851
Advanced Economies				
Japan	100	248372.8	47.290	3830.645
United Kingdom	100	49609.75	54.761	3355.698
United States of America	100	9668.924	53.573	7436.558

Source: Authors' calculation from World Development Indicators Data.

Infrastructure Investment and Economic Growth: A Brief Review

- The literature on the economic importance of infrastructure can broadly be classified into three major strands. The first strand focuses on the micro aspect of the infrastructure project by analyzing its social cost-benefit (Aschauer, 1989; Gramlich, 1994; Marcelo et al., 2016).
- The second strand of studies deal with the demand side of the infrastructure and thereby measuring the infrastructure investment gap (Fay, 2000; Gill and Kharas, 2007; Kennedy and Corfee Morlot, 2013; McKinsey, 2013; OECD, 2006; Ruiz-Nuñez and Wei, 2015).
- The third strand looked into the role of infrastructure in promoting economic growth through productivity and trade (Bougheas et al., 1999; Cavallo and Daude, 2011; Vijil and Wagner, 2012).
- Empirical studies: infrastructure investment to economic growth- positive impact of infrastructure investment on economic growth, in Kenya (Jedwab and Storeygard, 2016), India (Donaldson, 2018), USA (Donaldson and Hornbeck, 2016), Indonesia (Chen et al., 2007), Fiji (Narayan and Singh, 2007)
- Economic growth to infrastructure investment –Australia(Narayan and Smyth, 2005); Bangladesh (Mozumder and Marathe, 2007), for United Arab Emirates **(**Shahbaz et al., 2014**)**
- It is also argued that the infrastructure investment, especially in the case of publicly financed projects, may not produce a positive effect on economic growth due to the corruption, poor maintenance, and cost overruns (Arezki et al., 2017; Warner, 2014).
- As the existing literature did not give enough attention to the Central Asian economies, the present study attempts to find the relationship between infrastructure investment and economic growth in these economies.

Research Questions

1) Does investment in infrastructure lead to higher economic growth?

2) Is there any by-directional relationship between these two?

Empirical Model, Data & Methodology

$$Y_t = \beta_0 + \beta_1 Infra_t + \varepsilon_t \qquad (1)$$

$$Infra_t = \alpha_0 + \alpha_1 Y_t + \varepsilon_t \qquad (2)$$

* Y represents the real output and $Infra$ represents infrastructure investment.

- Data Period: 1990 to 2018 (Annual)
- Turkmenistan is excluded from the analysis due to unavailability the continuous time series data related to infrastructure investment.
- Data Source: World Bank and IMF database
- $Infra$: Gross Fixed Capital Formation due to the paucity of infrastructure investment data
- Method Adopted: Auto-Regressive Distributed Lagged Model (ARDL) co-integration technique

$$\Delta Y_t = \lambda_0 + \lambda_1 Y_{t-1} + \lambda_2 Infra_{t-1} + \sum_{j=1}^{n} \emptyset_j \Delta Y_{t-j} + \sum_{j=1}^{n} \gamma_j \Delta Infra_{t-j} + \varepsilon_t$$

Empirical Findings

Unit Root Test Results

Variables	ADF Test Statistic		PP Test Statistic	
	Levels	First Difference	Levels	First Difference
Kazakhstan				
Y	2.196 (0.991)	-1.650 (0.092)***	-1.326(0.613)	-1.850 (0.062)***
$Infra$	0.468 (0.808)	-2.473 (0.015)**	-0.184 (0.610)	-2.376(0.019)**
Kyrgyzstan				
Y	1.570 (0.968)	-2.167 (-2.167)*	0.831(0.885)	-2.179 (0.030)**
$Infra$	0.724 (0.865)	-3.714 (0.000)*	0.437 (0.801)	-3.703 (0.000)*
Tajikistan				
Y	-1.043 (0.721)	-2.111 (-2.111)*	0.061(0.694)	-1.668 (0.089)***
$Infra$	-0.703 (0.400)	-2.437 (0.017)**	-0.969 (0.287)	-5.881 (0.000)*
Uzbekistan				
Y	1.626 (0.971)	-1.266 (0.183)	2.883 (0.998)	-3.051(0.000)*
$Infra$	1.586 (0.969)	-2.797 (0.007)*	1.990 (0.986)	-2.642 (0.010)**

Source: Authors' calculation. *, ** and *** denote statistical significance at 1%, 5 % and 10% levels.

Results of F-Test

Models		Optimum lag (SBC)	Calculated F-statistic	Critical values (95% level)		Conclusion
				I(0)	I(1)	
Kazakhstan						
Equation 1	Y = f($Infra$)	4	8.598	3.538	4.428	Co-integration
Equation 2	Infra = f(y)	4	3.329	3.538	4.428	No Co-integration
Kyrgyzstan						
Equation 1	Y = f($Infra$)	4	0.521	3.538	4.428	No Co-integration
Equation 2	Infra = f(y)	4	8.254	3.538	4.428	Co-integration
Tajikistan						
Equation 1	Y = f($Infra$)	4	5.703	3.538	4.428	Co-integration
Equation 2	Infra = f(y)	4	2.440	3.538	4.428	No Co-integration
Uzbekistan						
Equation 1	Y = f($Infra$)	4	13.149	3.538	4.428	Co-integration
Equation 2	Infra = f(y)	4	4.952	3.538	4.428	Co-integration

Source: Authors' calculation. *, ** and *** denote statistical significance at 1%, 5 % and 10% levels.

Long-run coefficient estimates by the ARDL approach (Equation 1) (Dependent variable, Y)

Regressor	Kazakhstan	Tajikistan	Uzbekistan
$Infra$	0.532 (3.027)*	0.378 (3.401)*	0.620 (2.71)*
Constant	3.027 (0.939)	-0.033 (-0.008)	0.449 (0.082)

Long-run coefficient estimates by the ARDL approach (Equation 2) (Dependent variable, $Infra$)

Regressor	Kyrgyzstan	Uzbekistan
Y	0.521 (4.768)*	0.715 (19.827)*
Constant	-1.233 (-2.703)*	-3.762 (-13.198)*

Source: Authors' calculation. *, ** and *** denote statistical significance at 1%, 5 % and 10% levels.

Error correction representation for the ARDL model (Equation 1) (Dependent variable, Y)

Variables	Kazakhstan	Tajikistan	Uzbekistan
	ARDL (4,1)	ARDL (2,2)	ARDL (3,2)
ΔY_{t-1}	0.867 (5.701)*	0.627(5.351)*	0.352
ΔY_{t-2}	0.827 (5.404)*		0.299
ΔY_{t-3}	0.624 (6.072)*		
$\Delta Infra_t$	0.040 (2.937)*	-0.045(-2.655)*	0.085 (2.64)*
$\Delta Infra_{t-1}$		-0.078 (-3.189)*	
Ecm (-1)	-0.262 (5.353)*	-0.130 (3.971)*	-0.150 (6.587)*
	0.318	0.203	0.367
Adjusted R^2	0.965 [0.456]	1.553(0.244)	1.846[0.169]
χ^2_{AC}	0.152 [0.958]	0.125 [0.970]	0.910[0.479]
χ^2_{Arch}	2.128 [0.541]	13.900[0.000]	0.026[0.986]
χ^2_{Norm}	Stable	Not stable	Stable
CUSUM	Stable	Not stable	Stable
CUSUMQ			

Source: Authors' calculation . Where Δ and Ecm (-1) denote first difference and the error correction term. $\chi^2_{AC}, \chi^2_{Arch}$ and LM statistics are for serial correlation, ARCH effect and Normality Test. *, ** and *** denote statistical significance at 1%, 5 % and 10% levels.

Error correction representation for the ARDL model (Equation 2) (Dependent variable, $Infra$)

Variables	Kyrgyzstan	Uzbekistan
	ARDL (2,2)	ARDL (2,4)
$\Delta Infra_{t-1}$	0.623 (2.579)*	0.718 (4.693)*
ΔY_t	0.400 (1.982)***	1.200 (1.672)
ΔY_{t-1}	0.774 (2.162)*	1.774 (1.940)***
ΔY_{t-2}		1.163 (3.079)*
ΔY_{t-3}		1.054 (2.542)**
Ecm (-1)	-0.271 (-5.17)	-0.475 (-4.074)
Adjusted R^2	0.487	0.840
χ^2_{AC}	1.183[0.346]	1.491[0.26]
χ^2_{Arch}	0.700[0.410]	0.266[0.890]
χ^2_{Norm}	0.557[0.753]	0.158[0.924]
CUSUM	Stable	Stable
CUSUMQ	Stable	Stable

Source: Authors' calculation . Where Δ and Ecm (-1) denote first difference and the error correction term. $\chi^2_{AC}, \chi^2_{Arch}$ and LM statistics are for serial correlation, ARCH effect and Normality Test. *, ** and *** denote statistical significance at 1%, 5 % and 10% levels.

Conclusion

- We find that infrastructure investment significantly leads to the economic growth in Kazakhstan, Tajikistan, and Uzbekistan.

- Whereas, in Kyrgyzstan, the economic growth drives the infrastructure investment.

- In the case of Uzbekistan, a bi-directional relationship between infrastructure investment and economic growth is observed. It may be because of the efficient use of infrastructure with the help of private participation along with strong macroeconomic fundamentals.

- Thus, attracting more private participation in various sectors of the infrastructure can accelerate growth and thereby maintain a sustainable infrastructure investment in Uzbekistan. Last but not the least, certain interventions such as efficient use of official development assistance and increased private participation may bring the positive effect of infrastructure investment on economic growth, especially in the case of Kyrgyzstan and Tajikistan.

Thank You