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MEASURING THE IMPACT AND FINANCING OF INFRASTRUCTURE IN THE KYRGYZ REPUBLIC

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In this report, "$" refers to United States dollars.

The Asian Development Bank refers to "Kyrgyzstan" as the Kyrgyz Republic.

Abstract

This study examines the impact of the Osh–Sarytash–Irkeshtam and Sarytash–Karamyk road construction projects in the Kyrgyz Republic on regional social and economic development. Discussions of financing infrastructure in the Kyrgyz Republic context are also provided. Evaluation of impact is based on estimations from the panel dataset for the period 2005–2017 using both regional and district-level information. The findings indicate that the road construction projects had a positive effect on poverty reduction and retail trade growth, which was especially evident in the sample of two mountainous districts. The long-term sustainable economic effects of road construction require the creation of a business ecosystem along the road. International road construction should be accompanied by external trade promotion initiatives and the reduction of barriers at borders. The efficiency of road infrastructure also depends on improved regional cooperation, which necessitates consideration of the road not only as a transit or transport corridor, but also more comprehensively as an economic corridor with a potential wider economic effect. The development of public–private partnership for infrastructure investment is another strategic direction for government policy, which should be associated with policies to decrease regulatory burden, private investment risk, and increase institutional development.

Keywords: infrastructure, investment, public–private partnership, Kyrgyz Republic

JEL Classification: H54, O18, O22, R42

Contents

1. INTRODUCTION

Transportation costs play an important role in economic exchange by altering the transaction cost (Arvis, Marteau, and Raballand 2010). The development of infrastructure creates conditions for economic integration of countries and expands their economic performance. This is particularly important for land-locked countries. As land-locked countries, Central Asian economies are heavily dependent on border-crossings, which may have a negative effect on their international trade activities (Raballand 2003).

The transportation infrastructure of the Kyrgyz Republic is not well developed, although recently the government has made a substantial effort at improvements. As the country is without direct access to seaports, the primary means of transportation remains road transport, which plays an important role for cargo turnover in the country. Railway infrastructure is not well developed and is represented by only a short distance of tracks within the country territory, although the railway is linked to Kazakhstan and is mostly used for transport to Kazakhstan and the Russian Federation. Given these facts, the development of infrastructure is one of the fundamental challenges confronting the Kyrgyz Republic's long-term economic performance.

During the last ten years, considerable financial resources have been used for road construction both within regional economic integration programs, such as the Central Asia Regional Economic Cooperation Program (CAREC), and within country infrastructure development programs. Within the current policy context, these developments are considered necessary and the infrastructure investments important for economic development. Given the low internal financial potential of the country to finance large infrastructure projects, use of external funds in the most efficient way is critical. Evaluation of the impact of infrastructure investment in the Kyrgyz Republic is therefore important for the perspective evidence-based policy decisions. However, impact evaluation analysis for such projects is not widespread in the country, and such analysis faces several technical issues such as, among others, data availability, realization of infrastructure projects by steps, and the variable completion rate of infrastructure projects.

Given these facts, this study seeks to provide with empirical evidence on the impact of road construction projects in the Kyrgyz Republic and discuss the financing infrastructure in the context of the Kyrgyz Republic. This report is organized as follows. The next section presents recent macroeconomic trends, while section 3 includes an empirical analysis of the infrastructure investment project impact in the Kyrgyz Republic. The following two sections discuss the current state of infrastructure financing and public–private partnership in the Kyrgyz Republic. Section 6 presents the conclusions and recommendations for future research.

2. MACROECONOMIC DEVELOPMENTS AND INFRASTRUCTURE INVESTMENT IN THE KYRGYZ REPUBLIC

The population of the Kyrgyz Republic was estimated at 6.14 million people in 2017, of which one third (33.8%) resides in urban areas. More than half of the population, 59.1%, is of working age, with about 8% of unemployment level, and 33.6% are under the age of 15, while 7.3% are over working age (NSCKR, Demographic Yearbook of the Kyrgyz Republic for 2012–2016 n.d.). The real gross domestic product (GDP) at purchasing power parity (PPP) per capita in the Kyrgyz Republic has been steadily growing since

2001, but it still has not reached the values from before the collapse of the Soviet Union. Hence GDP per capita in 2016 was only 94.8% of the 1990 level ($3,474.7).

Table 1: Macroeconomic Indicators for the Kyrgyz Republic

	2001–2005	2006–2010	2011–2015	2016
GDP per capita (PPP, US $)	2,270.1	2,687.0	3,066.0	3,293.7
GDP growth	3.8	4.5	4.9	3.8
Sectorial share in GDP (%)				
− Services	40.3	50.0	54.1	55.9
− Industry	24.2	23.7	28.3	29.2
− Agriculture	35.5	26.3	17.6	14.9
Inflation rate (CPI, %)	4.1	11.0	8.0	0.4
Public External Debt (% of GDP)*	89.7	54.7	50.9	56.6
FDI, net inflows (% of GDP)	2.5	6.6	9.0	9.5
Trade (% of GDP)	85.9	134.1	129.2	108.7
− Imports of goods and services	46.7	83.2	86.4	71.9
− Exports of goods and services	39.2	50.9	42.8	36.8
Remittances, received (% of GDP)	5.3	21.3	28.9	30.4
Unemployment rate	9.4	8.3	8.2	7.2

* Bulletin of the National Bank of the Kyrgyz Republic; GDP, gross domestic product; PPP, purchasing power parity; CPI, consumer price index.
Source: World Development Indicators, World Bank.

The economy of the Kyrgyz Republic has an average growth rate of 4.38%, which peaked in 2007, 2008, and 2013 with 8.5%, 8.4%, and 10.9%, respectively. The general growth of the economy is believed to be caused mostly by private consumption, which is significantly influenced by the growth of remittances (from 5.3% of GDP in the 2001–2005 period to 30.4% in 2016; World Bank 2017), and the steady increase in the price of gold, which is the Kyrgyz Republic's main export commodity (IFC 2015). The economy has, however, witnessed negative growth rates; in 2002 and 2012 the GDP fell as a result of an accident in the Kumtor Gold mining company in 2002 and output decrease by the company in 2012. Kumtor Gold mining company is the main commodity exporter in the Kyrgyz Republic and its output accounts for more than the half of total exports and about 10% of the country's GDP. In 2005 and 2010 there was zero economic growth, which was caused by political instabilities and revolutions. Overall, the recent economic growth performance of the Kyrgyz Republic has not been sustainable; for instance, in 2017 it accounted for 4.5%, while in 2018 was expected to be 3.2% (Kudryavtseva 2018). The service sector is one of the main sectors of the economy of the Kyrgyz Republic, accounting for more than the half of total GDP. The agriculture sector employs nearly the half of the labor force, but its share of GDP has been decreasing from 37.3% in 2001 to 14.9% in 2016.

The Kyrgyz Republic has an ongoing negative trade balance; in 2016, the volume of imported and exported goods was 71.9% and 36.8% of GDP, respectively. The main commodities exported are metals (gold, precious metal ore, uranium, etc.), hydropower, and cotton, and the top export destination countries are Switzerland, the Russian Federation and Kazakhstan. The main imported commodities are consumer goods, industrial supplies, machinery and fuel, and the main trading partners are the People's Republic of China (PRC), the Russian Federation, Kazakhstan, and Turkey.

The level of public external debt is, on average, about 55% of GDP, and it is vulnerable to external shocks, such as declines in exports or depreciation of the national currency (IMF 2018). According to the IMF (2018) debt sustainability in the Kyrgyz Republic remains vulnerable to external and domestic shocks. External public debt is expected to be around 56% in 2019, while in the medium-term, under the conditions of appropriate policies, it is expected to gradually decline to around 50%. The main vulnerability factors have been identified as the depreciation of the national currency and potential deterioration in the fiscal balance, which could be caused by the potential increase of public investments, among other reasons. In the context of externally financed public investments, strengthening the public debt and public investment management is therefore recommended (IMF 2018).

Figure 1: Structure of Foreign Investments
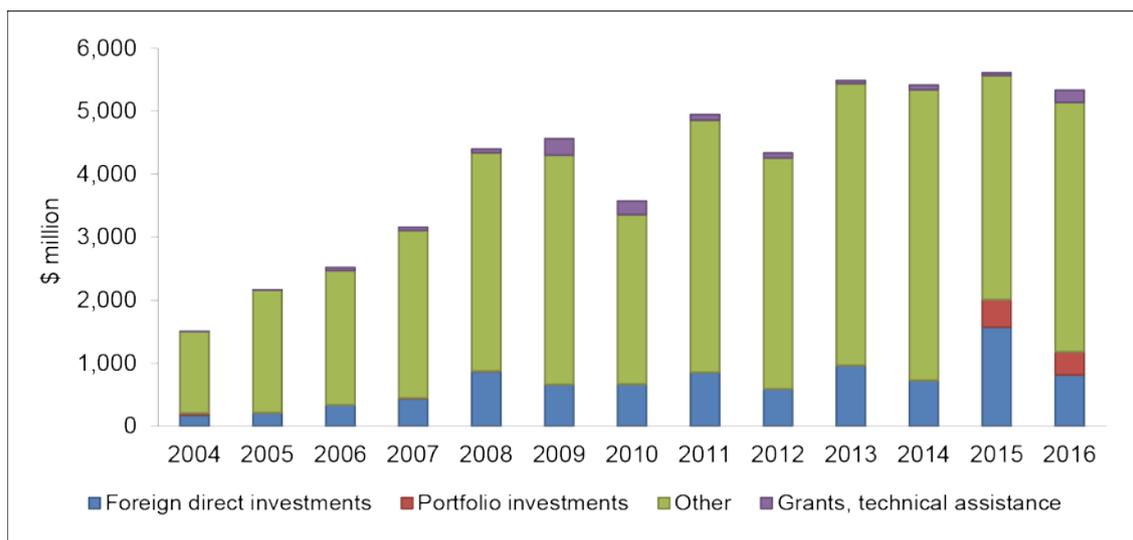
Source: National Statistical Committee of the Kyrgyz Republic.

The volume of foreign investment inflow from 2004 to 2016 increased by 3.5 times. The share of FDI has been gradually increasing, so the bulk of foreign investment counts for other types of investment. The major investing countries in 2008 were Canada, Kazakhstan, the Russian Federation, and the PRC. In 2016, the share of the PRC in total investment volume increased from 3% to 15%, that of the Russian Federation from 18% to 31%, while the share of investment from United Kingdom and Kazakhstan decreased from 4% to 2.4% and 18% to 5%, respectively.

The main investments were made in manufacturing, and this share has increased since 2008. While the sectors with increasing investment shares are mining (from 1% in 2008 to 4% in 2016), transportation and storage (from 2% to 7%), electricity and gas (from less than 1% to 7%), the sectors with decreasing shares in total foreign investment are wholesale and retail trade (from 24% to 7%), construction (from 3% to less than 1%), and information and communication (from 6% to less than 1%).

Figure 2: Foreign Investment Inflow by Country
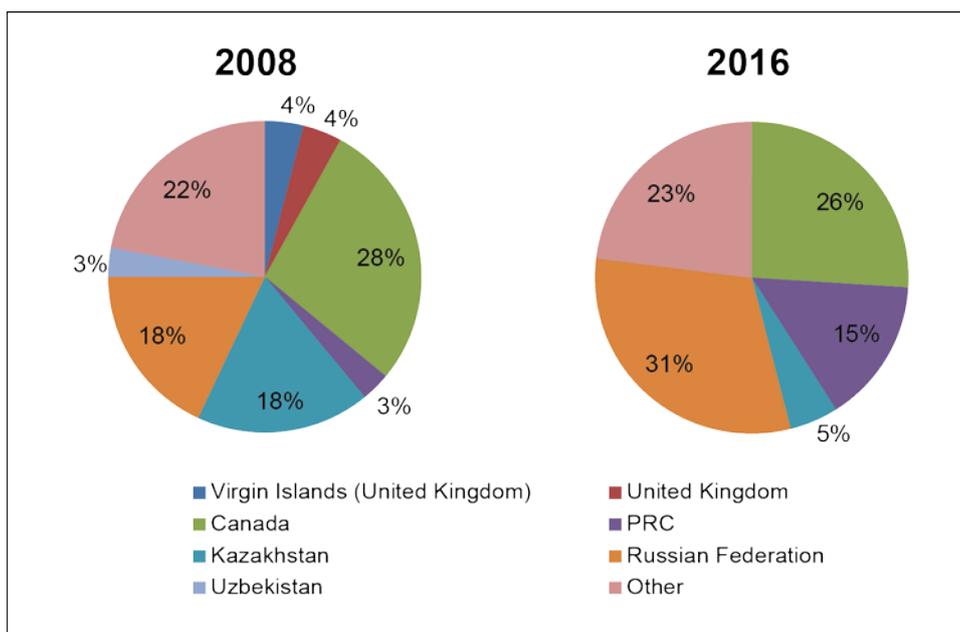
Source: National Statistical Committee of the Kyrgyz Republic.

Figure 3: Foreign Investment Inflow by Sector
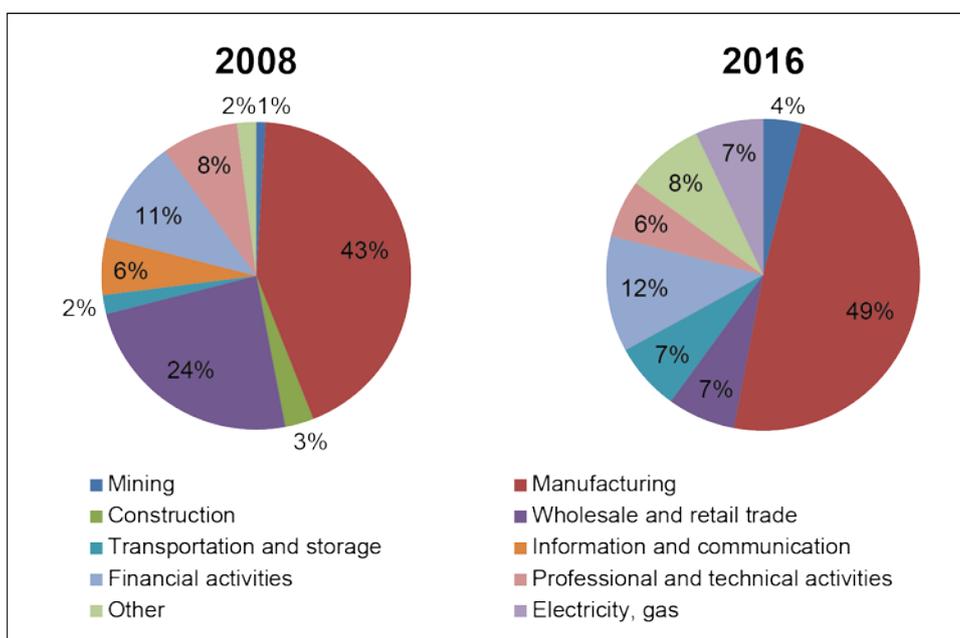
Source: National Statistical Committee of the Kyrgyz Republic.

According to the report of International Finance Corporation (2015), the main foreign investors in the Kyrgyz Republic are the PRC (69% of investment received), the United Kingdom (99.6%), and Canada (96.2%), which are investing in mining. The main part of the investments from Kazakhstan were made in financial intermediation and insurance (48%), and the investments from the Russian Federation were made in gas, power, steam, and conditioned air supply companies (38.6%) and processing companies (27.7%). Foreign investment statistics do not provide detailed information on

foreign development assistance, which are a significant source of funding for financing infrastructure projects in the Kyrgyz Republic.

The macroeconomic trends indicate insufficient economic performance to provide a strong basis for long-term economic development. One of the fundamental challenges for the economy of the Kyrgyz Republic in the long term is the development of infrastructure. Its geographic location as a mountainous and land-locked country increases transportation costs and, therefore, integration into the international trade system (ADB 2014b). Further development of infrastructure, with an emphasis on the transportation sector, is expected to provide a strong contribution to long-term economic performance.

3. EMPIRICAL ANALYSIS OF THE IMPACT OF INFRASTRUCTURE INVESTMENT

3.1 Description of the Infrastructure Projects

One of the features of infrastructure projects in the context of the Kyrgyz Republic is that most such projects were launched after the 2000s, and completion of the projects took several years, although some projects are still considered as being in the process of implementation. In particular, road construction investment is realized in part through financial support from different international donor organizations. As mentioned above, a large proportion of infrastructure investment has been concentrated on the road and energy sectors. Although the energy sector is strategic, from the methodological standpoint of impact evaluation, the road construction projects are more representative of the control and treatment units at the regional level.

Among the recent road construction projects, several important projects have been launched that have regional strategic importance and are considered within CAREC corridors.

Table 2: Road Construction Projects in the Kyrgyz Republic

	Length (km)	Regions Covered	Status	Strategic Content
Bishkek–Naryn – Torugart	539	Chui Issyk-Kul Naryn	Most part completed, some parts under construction	CAREC 1 corridor
Osh–Batken–Isfana	358	Batken Osh	Not completed, several parts under construction	Improved transport connections to Uzbekistan, Tajikistan, and the PRC
Taraz–Talas–Suusamyr	199	Talas Chui	Not completed, 3rd phase under construction	Improvement of intraregional connections and to Kazakhstan
Osh–Sarytash–Irkeshtam	258	Osh	Completed. Project duration 2007–2012	CAREC 2 and 5 corridors
Sarytash-Karamyk	136	Osh	Completed. Project duration 2008–2012	CAREC 3, 4, and 5 corridors

Source: Authors' analysis based on information from the Ministry of Transportation and Communication of the Kyrgyz Republic. Available from: http://piumotc.kg/ru/projects/.

Table 2 shows the major road construction projects in the Kyrgyz Republic during the last ten years, most of which have not yet been completed. Although, significant milestones have been completed for some projects, current application of impact evaluation would produce biased results. The most rational approach would therefore be to select those projects that were completed at least four or five years ago to evaluate short-term and medium-term effects. The Osh–Sarytash–Irkeshtam and Sarytash–Karamyk road construction projects meet these requirements, so our impact evaluation focuses on these two projects, which were launched in 2007–2008 and completed officially in 2012. These projects were financed by the Asian Development Bank, Islamic Development Bank, Export-Import Bank of the PRC and State Development Bank of the PRC (Nalobina 2014). According to the project description, implementation of the projects was expected to have a positive economic impact by reducing the transport costs, improving access to markets, and increasing regional trade (ADB 2011).

The two projects are complementary in terms of their direction from Sarytash to Osh. The road from Sarytash to Irkeshtam leads to the border with the PRC, while the road from Sarytash to Karamyk leads to Tajikistan. Both roads promote transport connections to neighboring countries (Tajikistan and the PRC). These roads are in the territory of the Kyrgyz Republic in the Osh region (*oblast*) and, at the district (*rayon*) level pass through the Kara Suu, Alai, and Chong Alai districts in Osh. The Alai and Chong Alai districts are mountainous, remote, and comparatively less populated districts in Osh. For the purposes of empirical analysis, the Osh region represents the treated unit for regional level analysis, while the Kara Suu, Alai, and Chong Alai districts are treated as the units for district level analysis.

3.2 Methodology

To estimate the impact of the infrastructure projects, the difference-in-difference approach is used. Analyses are done both at the regional and district level. Following Yoshino and Abidhadjaev (2017) and Yoshino and Pontines (2015), the general estimation equation can be represented as follows:

$$Y_{it} = \beta_0 + \beta_1(T * D_{treated}) + \beta_2 X_{it} + \varepsilon_{it}$$

where Y_{it} is the outcome of interest; in our case, at the regional level these are Gross Regional Product (GRP), agricultural output, industrial output, poverty rate, passenger turnover, and cargo transportation volume and at district level these are industrial output, retail trade, passenger turnover, and cargo transportation. The variable *T* shows the treatment period and takes value 0 if the period belongs to the pre-construction period, and 1 if the period belongs to the post-construction period. The binary variable $D_{treated}$ shows the treated places, which at the regional level is Osh and at district level is Alai, Chon-alai, or Kara-Suu. The $(T * D_{treated})$ is an interaction term between intervention time and treated region, and β_3 is the difference-in-difference estimator. X_{it} is the vector of control variables, such as population, investment, microcredit, and export. The nominal values of the variables are converted into real values using the consumer price index (CPI) for each region.

Table 3: Description of Treatment, Control Groups, and Variables

Treatment Group	
Regional Level Analysis	**District Level Analysis**
Osh region	Kara Suu, Chon Alai and Alai districts

Control group	
(Remaining 6 regions)	*(Remaining 37 districts)*
	− Osh region: Aravan, Kara-Kulja, Nookat, Uzgen
− Issyk-Kul region	− Issyk-Kul region: Ak-Suu, Jeti-Oguz, Tong, Tup, Issyk-Kul
− Batken region	− Batken region: Batken, Kadamjay, Leilek
− Talas region	− Talas region: Bakay-Ata, Kara-Buura, Manas, Talas
− Djalal-Abad region	− Djalal-Abad region: Aksy, Ala-Buka, Bazar-Korgon, Nooken, Suzak, Toguz-Toro, Toktogul, Chatkal
− Naryn region	− Naryn region: Ak-Talaa, At-Bashy, Jumgal, Kochkor, Naryn
− Chui region	− Chuy region: Alamudun, Chuy, Jayil, Kemin, Moskva, Panfilov, Sokuluk, Isyk-Ata

Outcome variables	
Log of GRP	Log of Industrial output
Log of agricultural production	Log of retail trade
Log of industrial production	Log of passenger turnover
Poverty level	Log of cargo transportation
Log of cargo transportation	
Log of passenger turnover	

Explanatory variables	
Log of population	Log of population
Log of investment	
Log of microcredit	
Log of export	
Consumer price index (CPI)	

Impact evaluation of the project necessitates definition of the before and after periods. As mentioned above, these roads construction projects started in 2007 and 2008 and were officially completed in 2012. However, construction of the road in stages means that when a significant part is implemented, but the project as a whole is not yet complete, there may be some effects even before project completion. To avoid this potential bias, we defined our pre-construction period as 2005–2010, while the post-construction period includes the period 2011–2017. We defined three different post-construction impact periods: 1) 2011, for short-term construction impact; 2) 2012–2013 is the medium-term period; and 3) 2014–2017 is the long-term construction impact period for the variables of interest.

3.3 Data

To measure the impact of road construction in Osh region, the annual panel data at the regional level for seven oblasts in the Kyrgyz Republic for the period of 2005–2017 and the annual panel data at the district level for 40 districts for the period of 2006–2017 were collected from the National Statistical Committee of the Kyrgyz Republic.[1] In Table 4 the descriptive statistics for the control and treated regions for the pre- and post-construction periods are given. As mentioned above, the variables given for monetary values are converted from nominal to real values using the CPI for each region.

Table 4: Summary of Statistics for Control and Treated Regions
(*regional level data*)

	Total Sample		Pre-construction Period (2005–2010)				T Period (2011–2017)			
	All Regions		Treatment Group		Control Group		Treatment Group		Control Group	
	Mean	Obs.	Mean	Obs.	Mean	Obs.	Mean	Obs.	Mean	Obs.
GRP *(million KGS)*	20,626.62	84	13,410.13	6	12,108.88	36	27,795.13	6	29,152.35	36
Industrial output *(million KGS)*	13,864.96	91	883.4754	6	8,546.921	36	3,368.39	7	22,027.2	42
Agricultural output *(million KGS)*	18,526.73	91	14,786.58	6	11,040.78	36	32325.85	7	23,177.72	42
Cargo transportation *(million ton)*	3.193407	91	2.95	6	3.2	36	2.557143	7	3.328571	42
Passenger turnover *(million pass. per km)*	537.7538	91	553.28	6	468.26	36	581.4	7	587.83	42
Poverty rate *(%)*	37.05495	91	45.37	6	39.87	36	33.78	7	34	42
Investments *(million KGS)*	5,130.754	91	1,303.349	6	2,219.223	36	3,399.731	7	8,461.627	42
Microcredits *(million KGS)*	1,584.686	91	1,109.825	6	744.7848	36	3,145.105	7	2,112.368	42
Export *(million KGS)*	2,261.6	91	841.3187	6	1,790.22	36	1,635.697	7	2,972.855	42
Population *(million people)*	0.6305066	91	1.077817	6	0.5186417	36	1.2039	7	0.5669238	42

Source: Authors' calculations based on data from the National Statistical Committee of the Kyrgyz Republic.

The average GRP is 20,626 million *soms* (Kyrgyz national currency, KGS), where the average for treatment in the Osh region was 13,410 million KGS and for the control regions was 12,108 million KGS for the 2005–2010 period; in 2011–2017 these indicators have more than doubled. Agricultural output for Osh region was, on average, higher, while the industrial output, cargo transportation, and exports were less than in the control regions. Poverty level, microcredit volume, and population were, on average, higher than in the control group. Passenger turnover volume decreased with respect to the control group during the post-construction period.

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[1] Main reports of the NSCKR used for data collection are: annual reports on consumer market, manufacturing industry and demographic yearbooks of the Kyrgyz Republic for 2005–2017. Also, annual publication by the NSCKR on investments and quarterly reports on Kyrgyz Republic and Regions are used.

Table 5: Summary of Statistics for Control and Treated Regions
(*district level data*)

	Total Sample		Pre-construction Period (2005–2010)				Post-construction Period (2011–2017)			
	All Regions		Treatment Group		Control group		Treatment group		Control group	
	Mean	Obs.	Mean	Obs.	Mean	Obs.	Mean	Obs.	Mean	Obs.
Industrial output *(Index of output growth in per cent of the previous year)*	108.41	479	117.77	15	101.43	185	104.58	21	113.18	258
Retail trade *(Index of output growth in per cent of the previous year)*	109.92	479	117.81	15	112.14	185	109.10	21	107.94	258
Cargo transportation *(thousand ton)*	453.70	479	500.81	15	418.82	185	490.44	21	472.99	258
Passenger turnover *(million pass. per km)*	72.21	479	106.35	15	62.63	185	117.37	21	73.41	258
Population *(thousand people)*	99.91	479	148.17	15	89.91	185	166.69	21	98.84	258

Source: Authors' calculations based on data from the National Statistical Committee of the Kyrgyz Republic.

According to the district level data during the pre-construction period, industrial output of the treatment group was higher than the control group, while during the post-construction period it was lower. Passenger turnover and population numbers grew in both the control and treated districts. Data for the retail trade indicate that, in general, such trade was showing a decreasing tendency in the post-construction period compared to the pre-construction years, but, on average the treated group had a higher rate of retail trade compared to the control group in the post-construction period. Cargo transportation decreased in the treatment group during the post-construction period, although it was still higher than in the control group.

3.4 Estimation Results

Estimation results for the difference-in-difference estimators are given in Table 5 (for detailed estimation output results see Annex Table 1). To account for the heterogeneous impact of road construction on regional outcome variables, short-, medium-, and long-term intervention periods are specified. The estimation results indicate that in the short term, no statistically significant impact can be identified, although a positive influence over the industrial output can be noted at level below statistical significance. In the medium term for the post-construction period, industrial output was positively influenced, while the passenger turnover and cargo rates were negatively affected. The long-term impact estimations confirmed the medium-term results, although a strong negative impact on the poverty level was also noted. In the long term, road construction appears to reduce poverty level in the region. These effects on industrial output and poverty level correspond to the initial expectation that infrastructure investment would increase the production level and contribute to an increase in the welfare of local communities. However, reduction of cargo and passenger turnover rate after road construction do not correspond to the general expectations from road investment. It should be noted that these negative tendencies can be associated not only with the regional level economic conditions, but also with external conditions caused by the country's international trade trends, which may have a temporary character. It is noteworthy that in the medium term cargo was affected

severely, but the scale of this negative effect scale decreased in the long term to a level below statistical significance.

Table 6: Difference-in-difference Estimators for Regional Level Analysis

	GRP	Agricultural Output	Industrial Output	Poverty Rate	Passenger Turnover	Cargo
Short-term impact						
$D_{Osh} \times D_{2011}$	0.1316	0.1316	0.5503*	3.6733	−0.1090	−0.0029
	(0.2713)	(0.1832)	(0.3234)	(8.0847)	(0.0880)	(0.1439)
Medium-term impact						
$D_{Osh} \times D_{2012–2013}$	−0.0117	0.1347	0.5681**	6.6950	−0.1406**	−0.2387**
	(0.2077)	(0.1403)	(0.2478)	(6.1827)	(0.0675)	(0.1104)
Long-term impact						
$D_{Osh} \times D_{2014–2017}$	0.1191	0.1449	0.5910***	−16.9953***	−0.1814***	−0.1811*
	(0.1839)	(0.1163)	(0.2063)	(5.0284)	(0.0572)	(0.0946)
N	84	91	91	91	91	91

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$.

Further analysis at the district level (see Table 7) reveals that road construction appeared to have no significant impact on the industrial output of the treated Alai, Chon-Alai, and Kara-Suu districts (for detailed analysis see Annex Tables 2–4). 1) Although there is a difference in industrial output for the before and after cases for the treated districts in the descriptive statistics, the estimation results do not indicate that these differences possessed statistical significance. There is a positive and significant impact of road construction on retail trade volume during the short term, mostly for the Alai region. There was, however, a negative impact of road construction in the long term on cargo transportation, passenger turnover volume, and retail trade. These negative effects could be conditioned by the general economic conditions and tendency of external trade and transit of goods. External trade slowdown after the 2008 crisis and further movement of the Kyrgyz Republic economy towards the Eurasian Economic Union (EEU) may be reflected in the decrease of road cargo. Although one may argue that the external trade situation would affect the other regions, too, it should be pointed out that these districts (especially Alai and Chong-Alai) are highly mountainous and can thus be more sensitive to the reduction of trade flows. Indeed, on part of the road studied—Sarytash–Karamyk—connects to Tajikistan. This feature makes these districts different from the others and external trade fluctuations with Tajikistan can be directly reflected in fluctuations in the retail trade and transportation volume. The tendency of the total trade volume of the Kyrgyz Republic with Tajikistan for 2010–2017 according to data from the National Statistical Committee of the Kyrgyz Republic accords with estimation results; that is, there was an increase in trade for 2010–2011, which parallels the positive short-term effect on retail trade, while there was a decrease in trade after 2014, which agrees with the long-term negative effect.[2]

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[2] According to data from the National Statistical Committee of the Kyrgyz Republic, the total external trade volume (export and import) of the Kyrgyz Republic with Tajikistan in 2010 was 18,093.5 million KGS, while in 2011 it increased to 37,290.1 million KGS; it decreased from 36,062.8 million KGS in 2014 to 28,331.2 million KGS in 2016.

Table 7: Difference-in-difference Estimators for District Level Analysis

		Cargo Transportation	Passenger Turnover	Retail Trade	Industrial Output
Kara-Suu, Alai, and Chon-Alai					
Short-term impact	$D_{rayons} \times D_{2011}$	0.0547	−0.0864	0.1333**	0.0929
		(0.1795)	(0.1220)	(0.0651)	(0.1749)
Medium-term impact	$D_{rayons} \times D_{2012–2013}$	−0.0504	−0.1194	−0.0474	−0.0437
		(0.1374)	(0.0934)	(0.0479)	(0.1246)
Long-term impact	$D_{rayons} \times D_{2014–2017}$	−0.3576***	−0.1529**	−0.0684*	−0.0078
		(0.1120)	(0.0764)	(0.0363)	(0.0896)
Alai and Chon-Alai					
Short-term impact	$D_{rayons} \times D_{2011}$	0.0449	−0.1286	0.1819**	0.1592
		(0.2186)	(0.1495)	(0.0795)	(0.2142)
Medium-term impact	$D_{rayons} \times D_{2012–2013}$	−0.0848	−0.1744	−0.0657	−0.0303
		(0.1670)	(0.1143)	(0.0584)	(0.1525)
Long-term impact	$D_{rayons} \times D_{2014–2017}$	−0.5182***	−0.1749*	−0.0968**	0.0145
		(0.1349)	(0.0925)	(0.0441)	(0.1092)
Alai					
Short-term impact	$D_{rayons} \times D_{2011}$	0.3449	−0.3217	0.2536**	0.2241
		(0.3114)	(0.2093)	(0.1129)	(0.3019)
Medium-term impact	$D_{rayons} \times D_{2012–2013}$	0.1215	−0.4002**	0.0169	0.1745
		(0.2377)	(0.1598)	(0.0828)	(0.2142)
Long-term impact	$D_{rayons} \times D_{2014–2017}$	−0.4463**	−0.4734***	−0.0632	−0.0377
		(0.1910)	(0.1286)	(0.0626)	(0.1525)

Standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$.

In general, it is important to mention the main limitation of the district level empirical estimations in terms of the data restriction for proper impact evaluation. The outcome variables were regressed with only the demographic information about the district, while there could be other conditions affecting these outcomes, such as external shocks or general macroeconomic and political conditions that may differ in effect across districts. However, due to the unavailability of more data at the district level, these estimations were limited with one control variable other than the interaction dummies. These results should therefore be interpreted taking into consideration the data limitations and that the estimation outputs give the impact of road construction at mean in general.

4. FINANCING INFRASTRUCTURE IN THE KYRGYZ REPUBLIC

The government budget resources of the Kyrgyz Republic are mainly used for social sector financing, while only a relatively small share is used for investment purposes. Almost all infrastructure investment projects are financed by international donor organizations or other countries through foreign development assistance mechanisms. Table 8 presents the main statistics for the government investment program within the government budget of the Kyrgyz Republic during the past three years. One may note that the investment program is mainly financed by external sources (more than 95%). The role of internal financing is limited, and the leading sectors of investment are also connected to infrastructure investments in energy and transport.

Table 8: Financing Public Investment Program in the Kyrgyz Republic (2015–2017)[3]

	2015	2016	2017
Total government budget expenditure (million KGS)	134,572.2	151,558.9	152,090.4
Public investment program (PIP) expenditure	19,766.2	24,675.4	28,865.1
Share of PIP in total government expenditure (in %)	14.69	16.28	18.98
Share of external financing of PIP (in %)	98.1	98.0	96.6
Share of energy sector in PIP	38.43	53.75	29.1
Share of transport sector in PIP	40.3	43.72	51.8

Source: Kyrgyz Republic Ministry of Finance. Available at: http://www.minfin.kg/ru/novosti/godovoy-otchet-ob-ispolnenii-byudzheta.html.

If the private sector, as a broad concept, is taken to include international donor organizations, then the participation of the private sector in infrastructure investment projects in the Kyrgyz Republic is represented by donors within foreign development assistance activities. Figure 4 shows the inflow of foreign development assistance (FDA) to the Kyrgyz Republic. Since independence, FDA has amounted to $8.4 billion, and since 2000 there has been a rapid increase in FDA, mostly in the form of loans. In 2013, the share of loans to total FDA reached 80%, with a value of $973.6 million (Aid Management Platform for the Kyrgyz Republic 2018).

Figure 4: Foreign Development Assistance to the Kyrgyz Republic
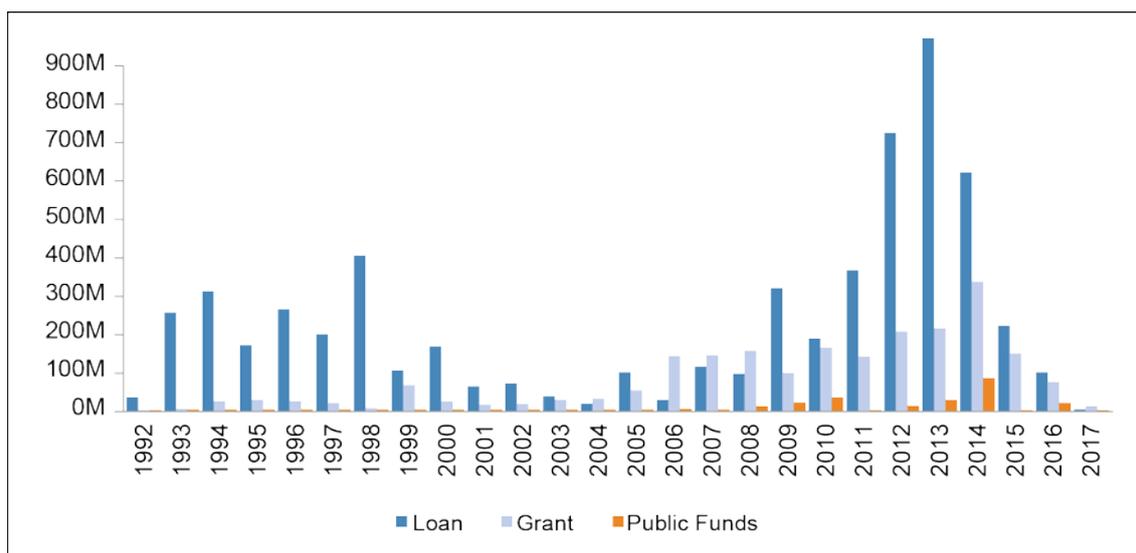
Source: Aid Management Platform for the Kyrgyz Republic (12 June 2018).

The main funding organizations for FDA are the PRC (24% of total FDA, $1,999.7 million), Asian Development Bank (18%, $1,505 million), World Bank (17%,

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3 Information available at the website of the Ministry of Finance of the Kyrgyz Republic does not provide a detailed report on the implementation of the public investment program for the government budget before 2015.
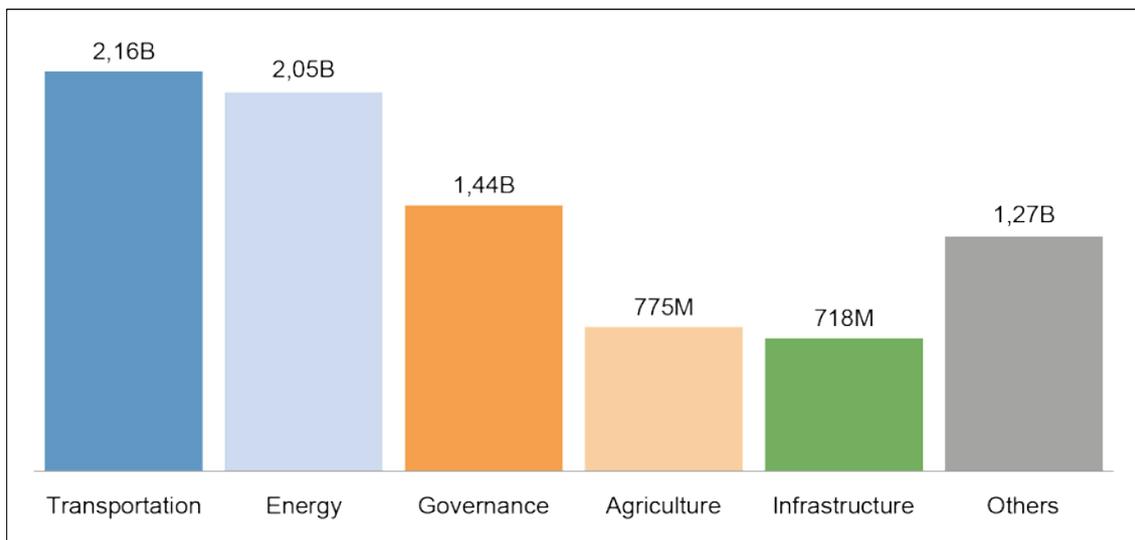
$1,447.6 million), European Union (5%, $449.3 million), International Monetary Fund (4%, $314.9 million), and other sources (32%, $2.7 billion).

Figure 5: Top Funding Groups for Foreign Development Assistance
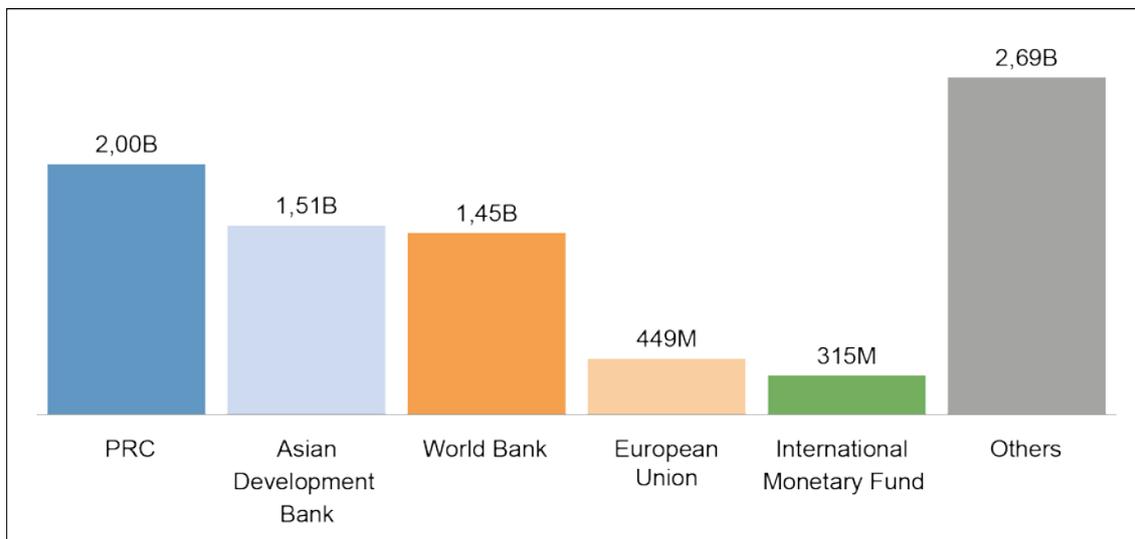
Source: Aid Management Platform for the Kyrgyz Republic (12 June 2018).

Figure 6: Top Sectors Receiving Foreign Development Assistance

Source: Aid Management Platform for the Kyrgyz Republic (12 June 2018).

Almost half of FDA was spent in the transportation (26%) and energy (24%) sectors, and among infrastructure projects, transportation or road construction saw the largest share of FDA inflows.

The use of the FDA has been found to be inefficient. Thus, the KDS (2016) has indicated that official development aid in the Kyrgyz Republic has not been effective for several reasons, including a lack of priority alignment and results-based strategic planning, which is strictly related to inadequate institutional capacity and lack of coordination between key government ministries. Moreover, lack of transparency and

accountability has caused prevalent corruption (KDS, 2016, p.38). In particular, the KDS report states that there is a weak priority alignment of foreign aid with the national development strategy. Weak institutional capacity causes poor project implementation, while limited ownership and accountability for project assessments—such as environmental assessments (EAs) and impact assessments (IAs)—result in unsatisfactory supervision of development and investment projects.

5. PUBLIC–PRIVATE PARTNERSHIP IN THE KYRGYZ REPUBLIC

One of the potential directions for the development of infrastructure investment in developing countries is the public–private partnership (PPP) mechanism. The legislative base for the PPP in the Kyrgyz Republic began to be prepared in 2008, while in 2012 the law on public–private partnership in Kyrgyz Republic was adopted. According to this law PPP is defined as:

> *long-term (up to 50 years) interaction of public and private partners in the attraction of a private partner by a public partner for the design, finance, construction, restoration, reconstruction of facilities, as well as the management of existing or newly created objects, including infrastructure.* (Kyrgyz Republic 2016a)

The law notes that PPP applies to infrastructure facilities and/or infrastructure services in sectors such as energy, petroleum, gas, transport, road and railroad, public utilities, medical and other services in the health sector, education, culture, and social services. This does not apply to the use of mineral resources, government procurement, and privatization. It can therefore be argued that the main area of application of PPP is infrastructure. The law also describes six basic principles for the operation of PPP in the Kyrgyz Republic:

- Rule of law: the strict implementation of laws and other regulatory legal acts by all state bodies, officials, and other by persons;

- Justice is equally available to all bidders, which ensures objectivity and impartiality when choosing a private partner, fair and mutually beneficial PPP, agreed separation and distribution of powers, responsibilities and risks, and equality before the law of public and private partners;

- Transparency, including access to information on PPP projects for private partners and the public at all stages of PPP under the conditions stipulated by the law of the Kyrgyz Republic;

- Competition, ensuring the absence of any discriminatory restrictions on participation in competition;

- Freedom of contract, which includes the right of public and private partners to freely determine the rights and obligations of parties to a PPP agreement in addition to the rights and obligations that the parties established by this law and other legal acts;

- Environmental friendliness, which means that the implementation of PPP projects should take into account the requirements of environmental protection.

Along with the government and related governmental partners in the project, the law indicates two state bodies to regulate the process of PPP: the authorized state body and the risk management authority. The authorized state body has competences

to implement general policy of the government in the sphere of PPP, including strategies and programs for PPP development, the evaluation and approval of PPP projects from other government partners, and the development of norms, regulations and other norms for unification of PPP processes. The risk management authority is mainly focused on approval of and changes in tender documentation. By government resolution, the Ministry of Economy is the authorized state body, while the Ministry of Finance is the state risk management body (Kyrgyz Republic 2012).

The law envisages two mechanisms to support PPP: state finance support and economic support. Financial support is expressed through provision of loans on concessional terms, credit guarantees, tariff subsidies, and guarantees on the minimum profitability of a PPP project, among other mechanisms. Economic support includes the granting of rights to movable or immovable property; assistance in obtaining licenses, permits, approvals; and the establishment of preferential rental rates for the use of property, state and/or municipal property. Along with these potential support mechanisms, the partner and project company are guaranteed with non-intervention by the public partner, protection from nationalization, and the right to free possession of investment and its income.

Along with the adoption the law, the Council on PPP in the Kyrgyz Republic was formed. This Council is a consultative and advisory body under the Government of the Kyrgyz Republic and formed to coordinate the activities of state bodies and local governments in the development of PPP. The Council consists of the Vice Prime Minister of the Kyrgyz Republic, the Minister of Economy, the Minister of Finance, the Minister of Justice, the Director of the Agency for the Promotion and Protection of Investments, and the Director of the State Agency for Local Government Affairs (Kyrgyz Republic 2016b).

The availability of financial resources is one of the main issues in the promotion of PPP activities in the Kyrgyz Republic. Given this potential barrier, a fund for financing the preparation of PPP projects was created in 2014 with the support of the Asian Development Bank (ADB). The financial resources of this fund can be gathered from the central government budget and international and other organizations. These resources can be used for consulting services to prepare a draft PPP, for the preparation of tender documents, or feasibility studies (Kyrgyz Republic 2014).

According to the information given by the Investment Promotion Agency of the Kyrgyz Republic, due to annual allocation of ADB grant funds, the state budget received $2 million in 2014, $1 million in 2015, and $1 million in 2016 to promote PPP projects. From this Fund, $1.3 million was allocated for consulting services for the preparation of a feasibility study for eight projects with a total project cost of more than $79 million (Kyrgyz Republic Agency for the Promotion and Protection of Investments 2018).

In 2016, the Government of the Kyrgyz Republic adopted the Program of Development of Public–Private Partnership for 2016–2021 (Kyrgyz Republic 2016c). Within this program, the following priority sectors for PPP projects have been identified: road and transport infrastructure, healthcare, housing and communal services, construction, energy, and tourism. Investments in these areas have a high multiplier effect and can considerably increase the public welfare. The program acknowledges the following problem areas for PPP:

1. Absence in the state and municipal bodies of sectoral programs on PPP, which leads to the lack of a clear vision and strategies to improve the quality of state and municipal services, long-term investment programs, and long-term budget plans.

2. Lack of resources in terms of the administrative capacity for the preparation and implementation of PPP projects.

3. The perception of the PPP mechanism by the private sector in the Kyrgyz Republic as a high-risk zone, which limits the interest of potential investors.

4. Limited access to financial resources for the preparation and implementation of projects. Investment flow within PPP mechanisms, as a rule, comes from the own funds of investors and long-term lending by financial institutions.

5. Limited experience of the private sector in the Kyrgyz Republic in the field of PPP. The local business community is not yet able to prepare high-quality project proposals, which leads to significant costs for consulting services in the preparation of such proposals.

Taking these issues into consideration, the Program aims to create a favorable and full-fledged environment for PPPs. The main quantitative objective is to conclude an agreement with private partners for the implementation of PPP projects that meet the best international principles with a total value of at least 20 billion KGS by 2021.

To solve these issues and achieve the main objective, several tasks related to private sector development, awareness raising, and administrative capacity improvement activities are planned. Among these activities, the development of financial instruments for PPP is highlighted, in particular, the development of mechanisms to create the necessary financial instruments to improve the viability and financial attractiveness of PPP projects in accordance with the best international practices. Taking into consideration the limited capacity of the domestic banking system to provide long-term borrowing funds in the national currency, the creation of the infrastructure-financing fund is one of the main tasks prior to 2021. Among the potential sources for financing this fund budgetary resources, financial development institutions, capital market, and other potential sources have been emphasized. As an outcome of such measures, it is expected that the fund will improve the position of the country in the INFRASCOPE, moving it from the "Nascent" category (as of 2014) to the "Emerging markets" category, which will increase the country's attractiveness to foreign investors.

According to the best of our knowledge, the latest issue of the INFRASCOPE evaluation does not include the Kyrgyz Republic. The website of the Investment Promotion Agency lists investment projects, but there is no detailed information on their current status. However, recent experience indicates the successful implementation of the PPP approach in the health sector. Thus, in October 2018, the dialysis center of "Fresenius Medical Care Kyrgyzstan," a subsidiary of Fresenius Medical Care, an international company, opened in Jalal-Abad. This is the first of four dialysis centers that will begin their work in the Kyrgyz Republic under a PPP agreement between Fresenius Medical Care and the Kyrgyz Republic Ministry of Health (Ministry of Health, Kyrgyz Republic 2018).

PPP in the Kyrgyz Republic is a very recent phenomenon, but the legal basis has already been established. From the policy standpoint, adoption of the government program provides some expected objectives and action plans. However, implementation of PPP projects has remained limited. Although infrastructure development is noted as the primary objective for the PPP development in the Kyrgyz Republic both at the legislative level and within the government program, this would require the development of financial instruments oriented at PPP projects.

It can be argued that the major role of private sector participant in infrastructure investment in the Kyrgyz Republic is carried out by international organizations. Although some part of this financial inflow has taken the form of grants, the recent tendency

indicates that the prevailing share of such funds is provided in the form of loans. Other mechanisms of financing infrastructure, such as the PPP, are a new tendency for the Kyrgyz Republic and have not been applied in large infrastructure projects. This limited evidence for PPP application does not imply the low potential of its introduction. The recently established fund for PPP project preparation is a good example and requires further development. For long-term infrastructure investments, however, other financial options should be developed. Realization of the infrastructure-financing fund as envisaged by the Program is therefore important.

Along with the financial constraints, one of the main constraints faced by the potential private investors is the institutional weakness that causes low transparency and corruption. The development of private financing for infrastructure investment therefore requires government effort in several aspects: first, transparency throughout the PPP life cycle—at the preparation, procurement, and contract management stages; and second, it is important to ensure the availability to all stakeholders of necessary information about assessment results, the selection process, and project performance (World Bank 2018).

6. CONCLUSIONS

This study sought to provide empirical evidence on the impact of road construction projects in the Kyrgyz Republic and discuss financing infrastructure in Kyrgyz Republic context. The impact evaluation analysis focused on the cases of the road construction for Osh–Sarytash–Irkeshtam and Sarytash–Karamyk in the Osh region. Estimations were based on the panel dataset for the period 2005–2017 using both regional and district level information.

The findings indicate that, at the regional level, these particular road construction projects had a positive effect on poverty reduction and retail trade growth. Moreover, the estimation results at the district level showed that, in the short-term, these projects increased retail trade, which was especially in the two mountainous districts of Alain and Chong Alai. Interestingly, some negative effects on cargo transportation appeared, but this was probably due to external factors such as the general downturn of external trade flows with the PRC after 2008; external trade limitations that appeared as the result of a Customs Union with the Russian Federation, Kazakhstan, and Belarus; and, the accession of the Kyrgyz Republic to the EEU membership, which resulted in lowering trends for external trade. These findings therefore support the argument that road construction itself may not be solely responsible for catalyzing trade, but other measures towards lowering trade barriers are fundamental too.

Several limitations of the empirical approach used in this study should be mentioned. First, for impact evaluation, a comparatively large dataset was available at the regional level, while the small number of regions restricts selection of an efficient comparison group. Second, the limited data availability at the district level does not allow for the use of a larger set of explanatory covariates. Additional information on credits, investment, and other indicators of economic activity at the district level would allow more concrete measurement of the impact. Third, the road construction projects analyzed in this study were part of regional transit corridors, so their effect can be observed not only in the territory of one country, but may also have a spillover effect in the territory of neighboring countries. Complete understanding of the effects of this project may necessitate additional analysis of several regions in neighboring countries. Fourth, the economic benefits generated by infrastructure investment generally may not be observed in the official statistical data, because of informal economic activities. Nevertheless, given these potential limitations, the positive effects on poverty

reduction, along with the other benefits indicated in findings, show that road construction can make a considerable contribution to economic performance measured at the regional level within the Kyrgyz Republic.

A general overview of infrastructure investment in the Kyrgyz Republic reveals that the major role of private sector participants in infrastructure investment is carried out by the international organizations, and a large share of these financial resources takes the form of loans. The PPP mechanism is not well developed in the Kyrgyz Republic, but this does not imply a low potential for its use.

Increase of investment in infrastructure, like any other investment activity, requires improvement to the investment climate in the country. The general prerequisites for private sector participation in infrastructure investments include government policies to decrease regulatory burden and private investment risk, as well as institutional development associated with transparency. Another direction for government policy would be improvement of institutional capacity to advance PPP initiatives. Capacity building in the relevant government authorities may be necessary for effective PPP program development. To increase private sector activity, an awareness-raising campaign could be used.

Limited financial resources are one of the main constraints facing potential private investors. The envisaged establishment of the infrastructure-financing fund in the government program for PPP development is important in this regard, as it would help accumulate long-term financial resources. For efficient preparatory activities, however, the further widening of the resource of the Fund to finance the preparation of PPP projects is needed. Support for further enhancement of PPP activities in infrastructure projects depends on the transparency of these activities, so it is important to ensure availability of information to all stakeholders at all stages of the PPP.

The long-term sustainable economic effects of road construction require the creation of a business ecosystem along the road. Taking into consideration the status of the studies projects as part of regional transit corridors, it is important to undertake other comprehensive measures, and international road construction in particular should be accompanied by the lowering of border barriers and increased external trade promotion initiatives. Another important aspect of infrastructure projects is that efficient functioning depends on improved regional cooperative ties. Government policies oriented to use the potential benefits provided by EEU membership would increase the full potential of these road construction projects by increasing commodity transportation to and from Tajikistan and the PRC. Another potential regional cooperative tie is represented by the Almaty–Bishkek Economic corridor. Consideration of the infrastructure project not only as a transit or transport corridor, but more comprehensively as an economic corridor parts would increase its wider effect on the economy. It is therefore critical to identify economic potential and coordination across stakeholders through detailed economic analyses.

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ANNEX

**Annex Table 1: Difference-in-difference Estimation Results
for Regional Level Analysis**

	GRP	Agricultural Output	Industrial Output	Poverty Rate	Passenger Turnover	Cargo Transportation
$D_{Osh} \times D_{2011}$	0.1316	0.1316	0.5503*	3.6733	−0.1090	−0.0029
	(0.2713)	(0.1832)	(0.3234)	(8.0847)	(0.0880)	(0.1439)
$D_{Osh} \times D_{2012–2013}$	−0.0117	0.1347	0.5681**	6.6950	−0.1406**	−0.2387**
	(0.2077)	(0.1403)	(0.2478)	(6.1827)	(0.0675)	(0.1104)
$D_{Osh} \times D_{2014–2017}$	0.1191	0.1449	0.5910***	−16.9953***	−0.1814***	−0.1811*
	(0.1839)	(0.1163)	(0.2063)	(5.0284)	(0.0572)	(0.0946)
Log population	0.8120**	1.3935***	2.2981***	7.6057	0.8014***	−0.4025
	(0.3223)	(0.3130)	(0.5990)	(8.2534)	(0.2059)	(0.3788)
Log investment	0.1997***	0.1184***	0.1373***	−4.8380***	0.0411***	0.0255
	(0.0446)	(0.0284)	(0.0505)	(1.2144)	(0.0141)	(0.0235)
Log microcredit	0.2259***	0.2325***	0.2654***	1.5271	0.0434***	0.0565**
	(0.0492)	(0.0316)	(0.0557)	(1.3909)	(0.0152)	(0.0249)
Log export	0.1562***	0.1261***	0.2326***	−2.6480*	0.0347**	−0.0303
	(0.0477)	(0.0325)	(0.0578)	(1.3721)	(0.0161)	(0.0266)
Constant	5.9514***	7.0778***	5.2179***	87.4874***	5.6899***	0.1919
	(0.5255)	(0.4532)	(0.8556)	(14.3829)	(0.2942)	(0.5682)
Wald Chi-2	269.7274	511.9767	336.1061	57.8727	179.5249	17.7503
N	84	91	91	91	91	91

Standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$.

**Annex Table 2: Difference-in-difference Estimation Results
for Kara-Suu, Alai, and Chon-Alai Treated Districts**

	Cargo Transportation	Passenger Turnover	Retail Trade	Industrial Output
$D_{Osh} \times D_{2011}$	0.0547	−0.0864	0.1333**	0.0929
	(0.1795)	(0.1220)	(0.0651)	(0.1749)
$D_{Osh} \times D_{2012–2013}$	−0.0504	−0.1194	−0.0474	−0.0437
	(0.1374)	(0.0934)	(0.0479)	(0.1246)
$D_{Osh} \times D_{2014º2017}$	−0.3576***	−0.1529**	−0.0684*	−0.0078
	(0.1120)	(0.0764)	(0.0363)	(0.0896)
Log population	0.4289***	1.3829***	−0.0035	0.0243
	(0.1571)	(0.1143)	(0.0120)	(0.0217)
Constant	3.7372***	−2.2621***	4.7093***	4.5275***
	(0.6989)	(0.5089)	(0.0529)	(0.0958)
Wald Chi-2	16.5176	147.3142	9.9012	1.6629
N	479	479	479	479

Standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$.

**Annex Table 3: Difference-in-difference Estimation Results
for Alai and Chon-Alai Treated Districts**

	Cargo Transportation	Passenger Turnover	Retail Trade	Industrial Output
$D_{Osh} \times D_{2011}$	0.0449 (0.2186)	−0.1286 (0.1495)	0.1819** (0.0795)	0.1592 (0.2142)
$D_{Osh} \times D_{2012-2013}$	−0.0848 (0.1670)	−0.1744 (0.1143)	−0.0657 (0.0584)	−0.0303 (0.1525)
$D_{Osh} \times D_{2014-2017}$	−0.5182*** (0.1349)	−0.1749* (0.0925)	−0.0968** (0.0441)	0.0145 (0.1092)
Log population	0.4102*** (0.1550)	1.3596*** (0.1116)	−0.0056 (0.0118)	0.0249 (0.0216)
Constant	3.8189*** (0.6899)	−2.1612*** (0.4974)	4.7184*** (0.0524)	4.5241*** (0.0957)
Wald Chi-2	21.2984	149.3251	12.7324	1.8794
N	479	479	479	479

Standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$.

**Annex Table 4: Difference-in-difference Estimation Results
for Alai Treated District**

	Cargo Transportation	Passenger Turnover	Retail Trade	Industrial Output
$D_{Osh} \times D_{2011}$	0.3449 (0.3114)	−0.3217 (0.2093)	0.2536** (0.1129)	0.2241 (0.3019)
$D_{Osh} \times D_{2012-2013}$	0.1215 (0.2377)	−0.4002** (0.1598)	0.0169 (0.0828)	0.1745 (0.2142)
$D_{Osh} \times D_{2014-2017}$	−0.4463** (0.1910)	−0.4734*** (0.1286)	−0.0632 (0.0626)	−0.0377 (0.1525)
Log population	0.3596** (0.1547)	1.3659*** (0.1087)	−0.0046 (0.0119)	0.0241 (0.0211)
Constant	4.0338*** (0.6889)	−2.1877*** (0.4848)	4.7126*** (0.0528)	4.5271*** (0.0935)
Wald Chi-2	14.5086	164.9980	7.0319	2.5707
N	479	479	479	479

Standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$.