Almaty–Bishkek Economic Corridor
Almaty-Issyk-Kul Alternative Road EIA

Supplementary Document: **Economic Impact Analysis**

31 October 2020

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Asian Development Bank (ADB)

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1. Multiregional Input Output Model

1.1 Approach

In addressing the economic impacts of the investment projects, it was necessary to derive multiplier models capable of estimating the economic responses stemming from investments in both countries. Given the trade ties between the two countries being analyzed, it was also desirable to simulate these effects through the generation of a multiregional input output model (MRIO model). The derivation of this sort of model is defined by the standard Leontief Inverse Process. However, it departs from the usual single region estimation process when it also endogenizes a portion of the export/import activity related to the estimated trade between Kazakhstan and the Kyrgyz Republic. A typical multiregional layout can be seen below, with the off-diagonals representing the trade between regions taking place.

Table 1: Structure of MRIO Model

KAZ I-O	KAZ (Export), KYR (Import)
KGZ (Export), KAZ(Import)	KGZ I-O

Source: Consultant team

The diagonals in grey represent the individual models for each country. This appendix documents the sources, processes and assumptions made along the way of deriving this model. Additionally, it touches upon the sources and process of filling out the data necessary to estimate type II impacts in the model, as well as the ability to estimate the impact on jobs.

1.2 Data Sources and Methods

The following data sources were used to generate the multi-regional multiplier model:

- 2017 Input output tables (ADB) for Kazakhstan, Kyrgyz Republic
- UN Comtrade Data (Trade between regions)
- Employment and Income by sector

We leveraged the Asian Development Bank's own 2017 input output tables for both countries for the work being done because it offered three main benefits. First, the consistency in structure and industry detail made it easier to relate the two countries together and to draw equivalence between sectors of the economy to put things on an even footing for discussions. Second, the data was already estimated in terms of US Dollars, which simplified the exercise by removing the bulk of currency conversion from the task, allowing us to focus on the raw data. Third, it had detail on the composition of imported activity by industry, rather than a single 'total imports' line by industry. This gives a robust platform for to try and generate an economic model from because it satisfies the three criteria:

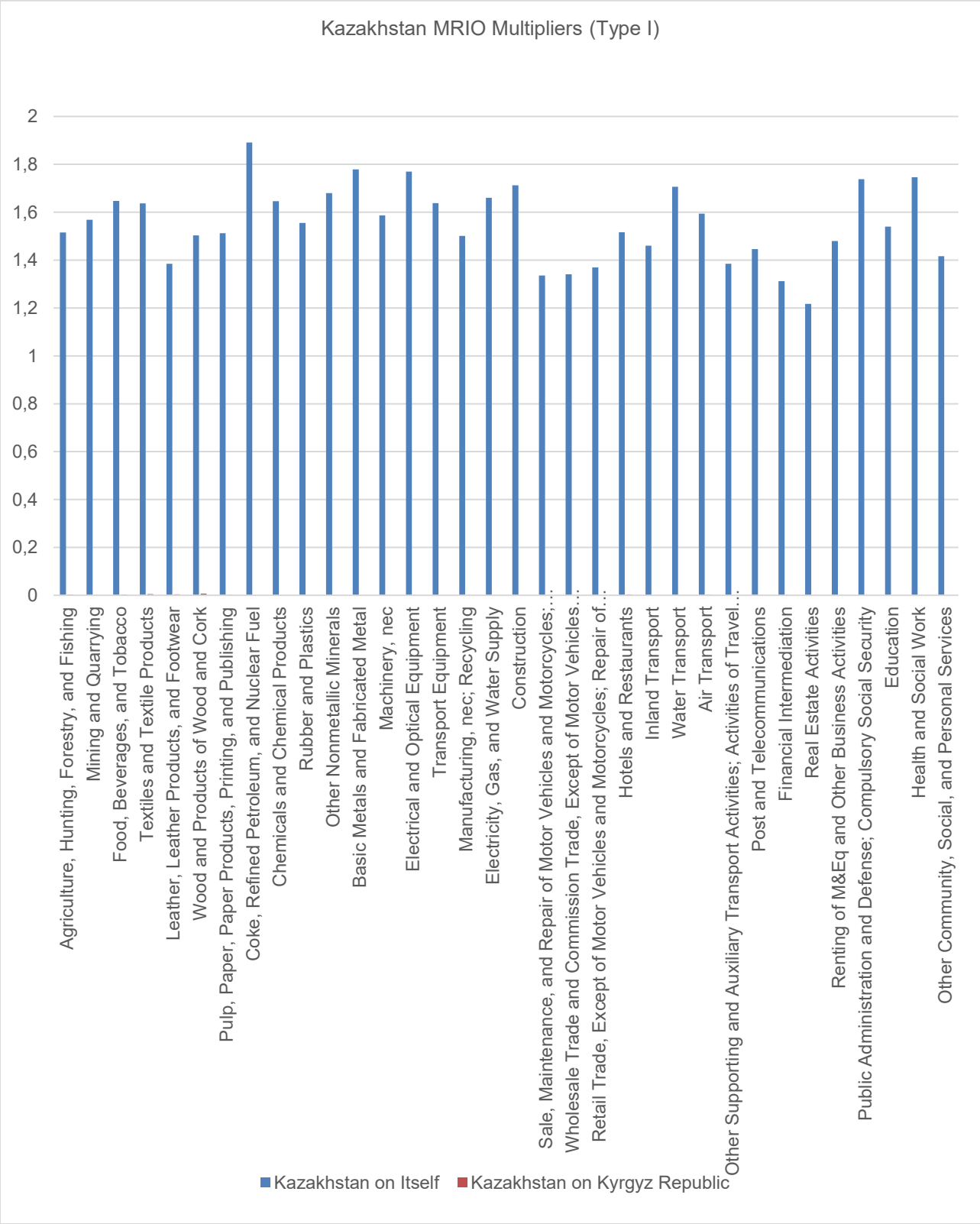
1) Exports, imports, and their use in both countries are explicit,
2) Both models are enumerated based upon a common sectoring description,
3) both are in common units of measurement:

So long as we can devise a way of isolating the export and import activities related to trade between each country, we have the foundations for estimating a multi-regional model. This is where the UN Comtrade data comes in. The team created a broad crosswalk between the kinds of goods being traded in the UN Comtrade database (HS-2 level), and the industries responsible in the IO table (attached below). We used the UN Comtrade data on exports for both countries to estimate the share of trade going to its partner relative to all value of goods being exported as the basis of breaking out the export-import activity in the model. Note that because the crosswalk relationship between industry and commodity was done at a high level, we constrained this such that the estimated share of exports from the I-O table representing one country going to the other could never exceed the volume of imports on the reciprocating country's side for its total use of those imports across all sectors. This was used for the first 16 sectors related to manufacturing activities. For the remaining industries tied to transportation and all other services, we assumed the following:

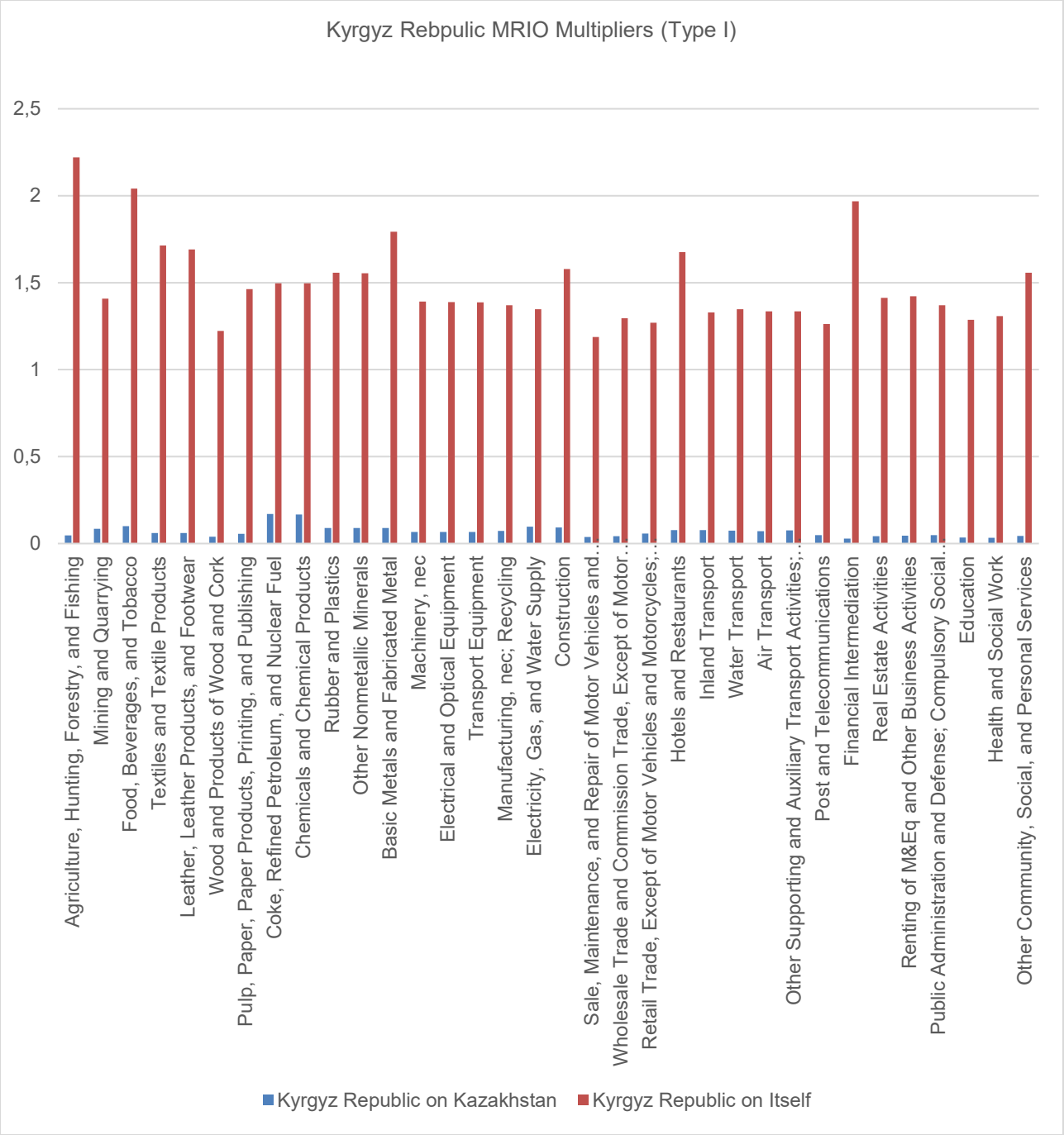
- For the following industries we assumed the trade percentage based on the share of tourism visitors (21% for Kazakhstan, 57% for the Kyrgyz Republic)
    - Retail trade, except of motor vehicles and motorcycles; repair of household goods
    - Hotels and restaurants
    - Other supporting and auxiliary transport activities; activities of travel agencies
    - Post and telecommunications
    - Renting of M&Eq and other business activities
    - Other community, social, and personal services
- For the balance of services, the average share of commodity trade between the regions based on the UN Comtrade data (1% for Kazakhstan, 12% for the Kyrgyz Republic)

To complete the model specification, we then assumed that the sectors responsible for use of the other country's imports were the same as the base distribution of usage across all industries under the import section of the model (this implicitly includes including final demand). The result was a completely specified model which could be used to estimate Type I effects, whose results are shown in Figure 1. Note that we explicitly show the relationship between the impact of each region on itself, as opposed to its trading partner in the paired bars. The height of the bars indicates the magnitude of the multiplier response for that industry within the economy. Each industry represents the total impact of a shock in that industry on the respective economy.

Figure 1: MRIO Multipliers (Type I) for Kazakhstan and Kyrgyz Republic



Source: Consultant team



Source: Consultant team

As can be seen, the trade related multipliers are modest in their estimation. The highest multiregional impact is related to fuel (petroleum, coke, refined…), which is prove of the Kyrgyz Republic's reliance on importation of petroleum/fuel. The magnitude of the Type I (Direct + Indirect) output multipliers - based on the height of the bars is also reasonable in their estimation – with only one industry in the Kyrgyz Republic showing abnormally high values (>5.0). This was tied to the financial intermediation sector, which was not a sector used in the modeling of the impacts contained in this report. It was subsequently governed such that it could not exceed 1.5 times its counterpart, Kazakhstan, as part of the model development.

1.3 Estimation of Type II (Total Multiplier Effects) and Employment Figures

In addition to the generation of the MRIO model, we also tried to enable the estimation of multiplier effects related to worker income re-spending. Since the information for each region related to household consumption was already present, then the challenge was to get an estimate of worker industry compensation. We relied on the respective statistics bureaus[1] to provide details on compensation to estimate the data. The results were higher level in terms of industry detail, so they were distributed based on output within a sector. In the case of the Kyrgyz Republic, we had to estimate worker compensation based on average Kyrgyz Soms per month per sector, times the number of workers in each sector, annualized, and converted to US Dollars using a conversion factor of 0.0145 which was the historical rate in 2017 (data year). In some cases, this produced values by sector which were in excess of value added. To govern this behavior, for those outliers, it was assumed that income could not exceed 95% of value added.

For Kazakhstan, total wages by sector were provided, which was distributed by value added (shown in

Table 2). This was sourced from the translated document 'Express Information: Gross domestic product by income for 2017. Income was allocated to industries based on value added, since compensation was a component.

[1] National Statistical Committee of the Kyrgyz Republic / Ministry of National Economy of the Republic of Kazakhstan Statistics Committee.

Table 2: Total Wages, Distributed by Sector

				As Millions of Tenge			As Millions of USD (using 1:325)		
Model		Model Value Added		Gross Value Added	Wages	Gross Income	Gross Value Added	Wages	Gross Income
Agriculture, hunting, forestry, and fishing	c1	7,522	Agriculture, Forestry and fisheries	**2,456,284.6**	604736.3	1849202.6	7,557.80	1,860.73	5,689.85
Mining and quarrying	c2	22,342	Mining and Quarrying	**7,421,694.4**	1613611.5	5472282.6	22,835.98	4,964.96	16,837.79
Food, beverages, and tobacco	c3	3,808	Manufacturing	**6,134,020.5**	1718849.2	4340692.7	18,873.91	5,288.77	13,355.98
Textiles and textile products	c4	158							
Leather, leather products, and footwear	c5	15							
Wood and products of wood and cork	c6	45							
Pulp, paper, paper products, printing, and publishing	c7	180							
Coke, refined petroleum, and nuclear fuel	c8	1,317							
Chemicals and chemical products	c9	788							
Rubber and plastics	c10	276							
Other nonmetallic minerals	c11	817							
Basic metals and fabricated metal	c12	7,343							
Machinery, nec	c13	891							
Electrical and optical equipment	c14	235							
Transport equipment	c15	203							
Manufacturing, nec; recycling	c16	74							
Electricity, gas, and water supply	c17	3,263	Electricity, Gas Supply, steam and air conditioning	**903,522.7**	444530	443487.1	2,780.07	1,367.78	1,364.58
			Water supply; sewerage system, control over the collection and distribution of waste	**141,734.5**	77925.7	60723.3	436.11	239.77	186.84
Construction	c18	7,409	Construction	**2,977,116.2**	1321412.2	1644492.8	9,160.36	4,065.88	5,059.98

				As Millions of Tenge			As Millions of USD (using 1:325)		
Model		Model Value Added		Gross Value Added	Wages	Gross Income	Gross Value Added	Wages	Gross Income
Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel	c19	1,721	Wholesale and Retail; Repairing Cars and Motorcycles	9141161.9	3257217.2	5863164.3	28,126.65	10,022.21	18,040.51
Wholesale trade and commission trade, except of motor vehicles and motorcycles	c20	18,750							
Retail trade, except of motor vehicles and motorcycles; repair of household goods	c21	8,629							
Hotels and restaurants	c22	1,300	Accommodation and Food Services	**645,467.1**	237180.8	405645.9	1,986.05	729.79	1,248.14
Inland transport	c23	10,524	Transport and Warehousing	**4,453,674.7**	1158840.4	3243547.9	13,703.61	3,565.66	9,980.15
Water transport	c24	127							
Air transport	c25	555							
Other supporting and auxiliary transport activities; activities of travel agencies	c26	2,214							
Post and telecommunications	c27	2,711	Information and Communication	**1,089,261.8**	472862.4	601958.4	3,351.57	1,454.96	1,852.18
Financial intermediation	c28	6,727	Financial and Insurance Activities	**2,020,521.6**	695206.7	1308089.1	6,216.99	2,139.10	4,024.89
Real estate activities	c29	13,879	Real Estate transactions	**4,515,363.5**	301672.7	4191245.8	13,893.43	928.22	12,896.14
Renting of M&Eq and other business activities	c30	8,475	Professional and Scientific Technical Services	**2,457,398.9**	995204.5	1446851.2	7,561.23	3,062.17	4,451.85
Public administration and defense; compulsory social security	c31	3,291	Public Administration and Defense; Compulsory Social Security	**914,529.6**	672672.7	241135.1	2,813.94	2,069.76	741.95
Education	c32	3,814	Education	**1,528,964.5**	1135434.4	391338.1	4,704.51	3,493.64	1,204.12
Health and social work	c33	1,540	Health and Social Services	**1,075,843.5**	585942.5	488001.5	3,310.29	1,802.90	1,501.54
Other community, social, and personal services	c34	4,544	Art, Entertainment and Leisure	**415,736.0**	243395.6	171378.1	1,279.19	748.91	527.32
			Other Services	**1,621,966.9**	428573.7	1191721.2	4,990.67	1,318.69	3,666.83

Source: Consultant team

When it came to estimating employment by sector, the available data was always at a higher sectoral level of detail than the model's (see Table 3), so they had to be distributed based on the share of output within a sector, implying constant productivity among jobs of a similar overarching sector. The following table shows the relationship between detailed sector in the IO tables from the Asian Development Bank, and the industry detail provided by the respective statistics bureaus of both countries.

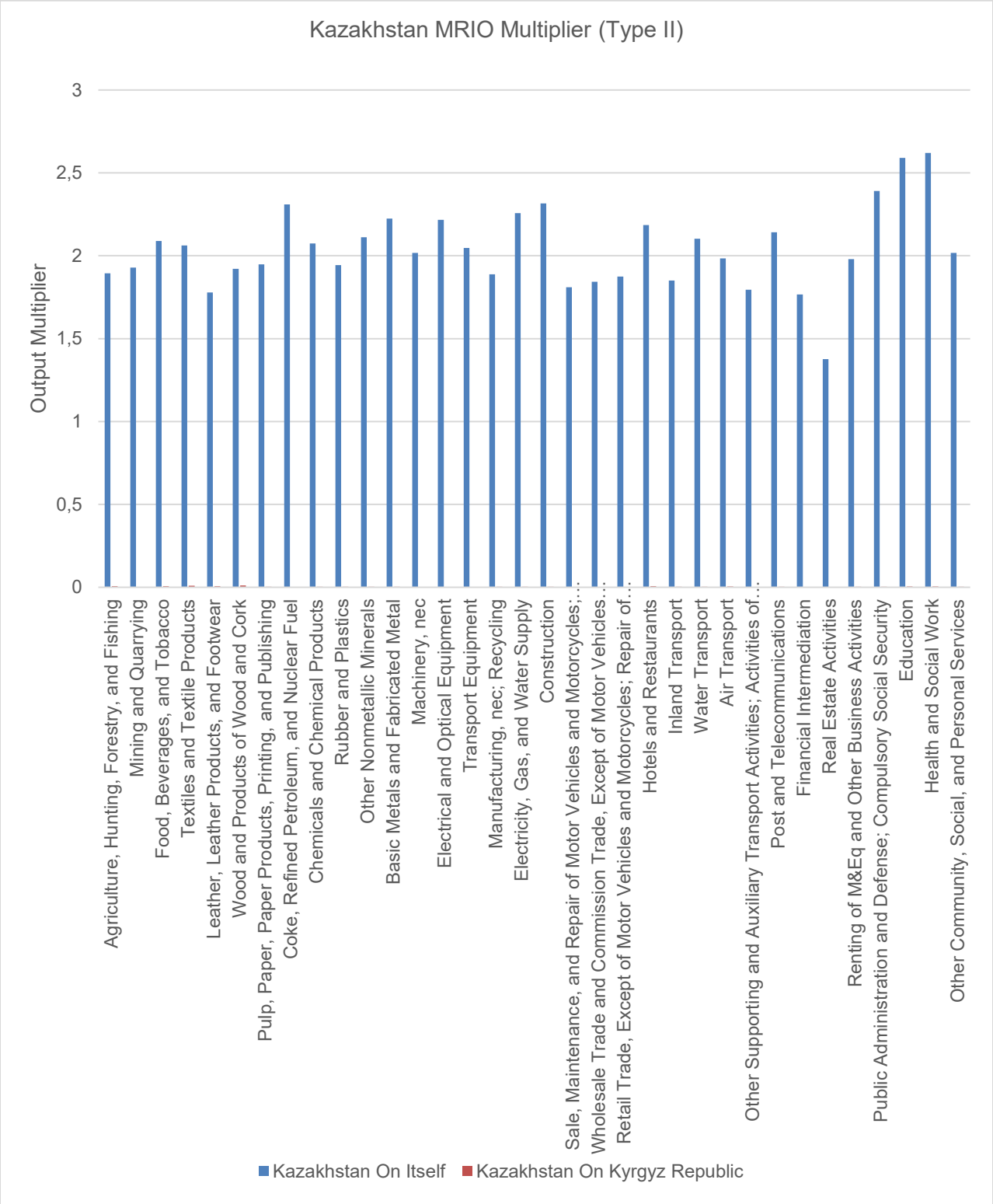
Table 3: Industry Detail

ADB I-O Model Industry		**Industry Detail**
Agriculture, hunting, forestry, and fishing	c1	Agriculture, forestry and fishing
Mining and quarrying	c2	Mining and quarrying
Food, beverages, and tobacco	c3	Manufacturing
Textiles and textile products	c4	
Leather, leather products, and footwear	c5	
Wood and products of wood and cork	c6	
Pulp, paper, paper products, printing, and publishing	c7	
Coke, refined petroleum, and nuclear fuel	c8	
Chemicals and chemical products	c9	
Rubber and plastics	c10	
Other nonmetallic minerals	c11	
Basic metals and fabricated metal	c12	
Machinery, nec	c13	
Electrical and optical equipment	c14	
Transport equipment	c15	
Manufacturing, nec; recycling	c16	
Electricity, gas, and water supply	c17	Electricity, gas, steam and air conditioning supply
	c17	Water supply; sewerage, waste management and remediation activities
Construction	c18	Construction
Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel	c19	Wholesale and retail trade; repair of motor vehicles and motorcycles
Wholesale trade and commission trade, except of motor vehicles and motorcycles	c20	
Retail trade, except of motor vehicles and motorcycles; repair of household goods	c21	
Hotels and restaurants	c22	Accommodation and food service activities
Inland transport	c23	Transportation and storage
Water transport	c24	
Air transport	c25	
Other supporting and auxiliary transport activities; activities of travel agencies	c26	
Post and telecommunications	c27	Information and communication
Financial intermediation	c28	Financial and insurance activities
Real estate activities	c29	Real estate activities

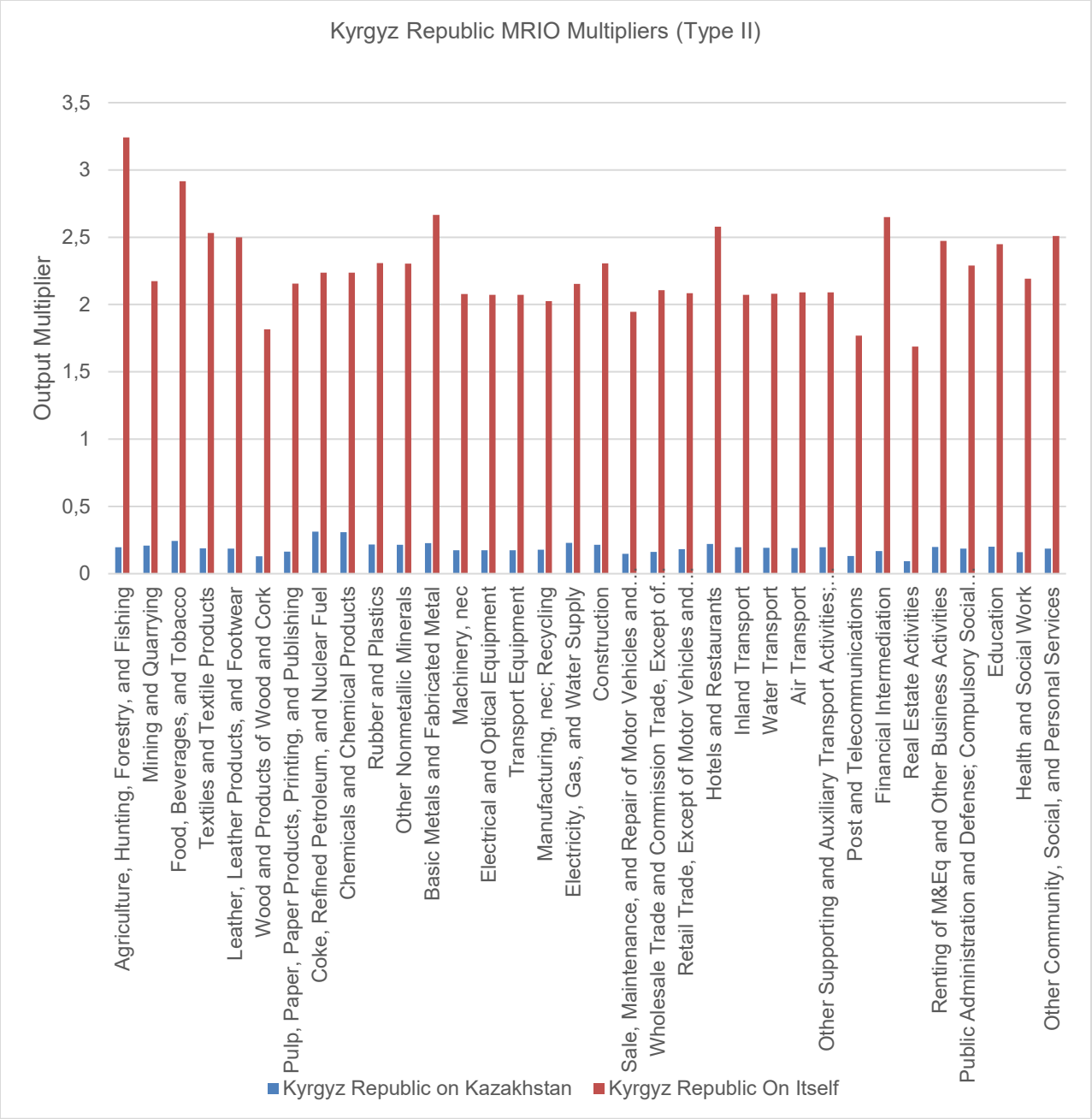
ADB I-O Model Industry		Industry Detail
Renting of M&Eq and other business activities	c30	Professional, scientific and technical activities
	c30	Administrative and support service activities
Public administration and defense; compulsory social security	c31	Public administration
Education	c32	Education
Health and social work	c33	Human health and social work activities
Other community, social, and personal services	c34	Arts, entertainment and recreation
	c34	Other service activities
Private households with employed persons		Activities of households as employers

When we include this data into the model, and re-compute the Leontief Inverse to produce multipliers, we get an estimate of the Type II (Total) Multipliers – which are inclusive of the Type I Multipliers plus induced effects (see Figure 2).

Figure 2: MRIO Multipliers (Type II) for Kazakhstan and the Kyrgyz Republic



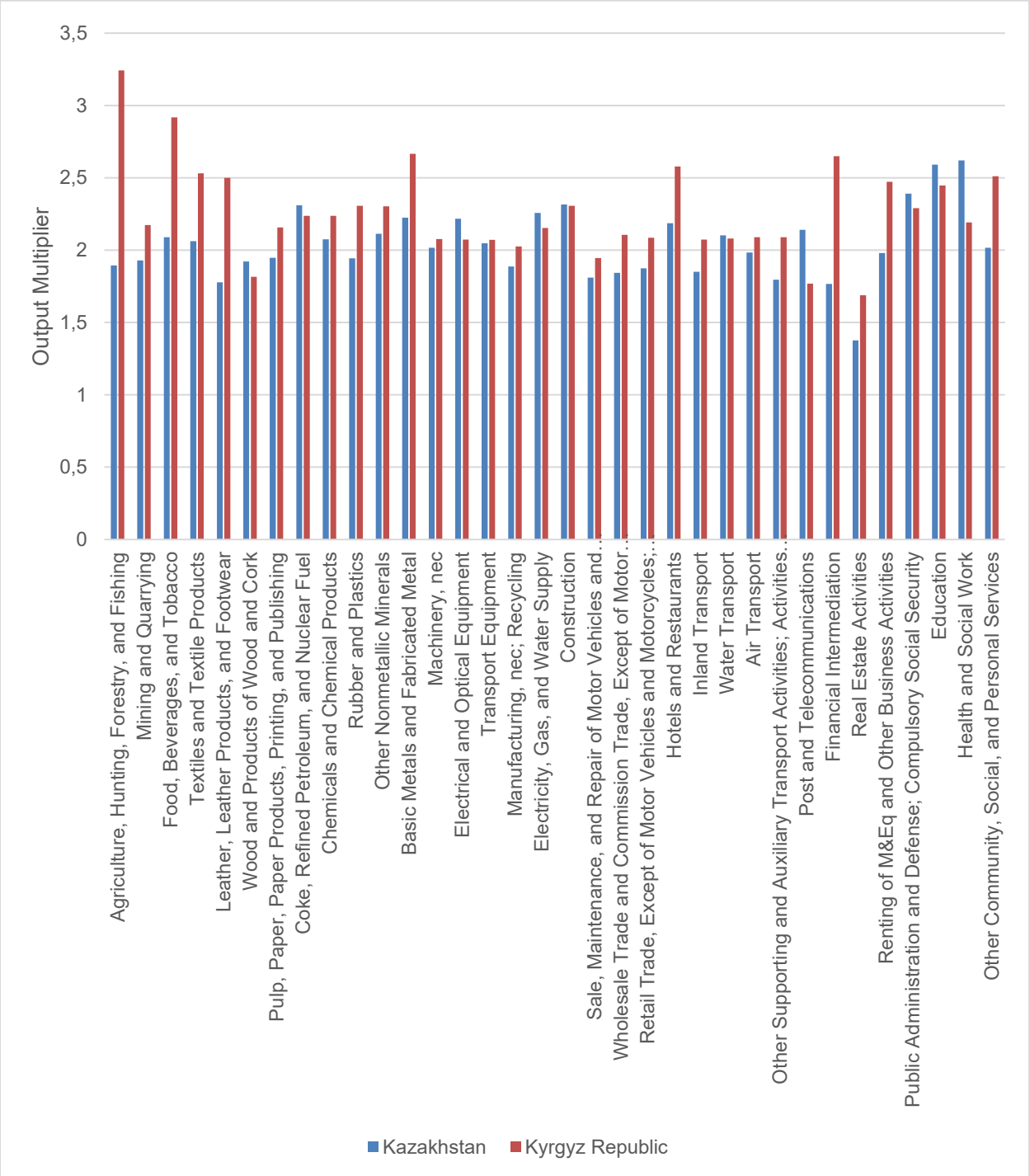
Source: Consultant team



Source: Consultant team

Because the data on compensation for the Kyrgyz Republic was estimated based on a series of assumptions, we compared the relative Type II multipliers on a sector-by-sector basis between countries to gauge the reasonableness of economic response between Kazakhstan and the Kyrgyz Republic as a validation of the assumptions (see Figure 3).

Figure 3: Relative Magnitude of Type II Multipliers by Country



Source: Consultant team

While some Kyrgyz sectors produce noticeably higher Type II multipliers when compared to Kazakhstan, they are reasonable in their overall magnitudes – with the obvious exception of the financial sector, which was governed, but also not used in this analysis. On this basis, we concluded that the estimation process was reasonable in its outputs, and able to be used as a means of gauging economic response.

1.4 ADB Industry – Harmonized System (HS)[2] Commodity Synopsis

I - O Model Industry Sectoring		HS - Code	
c1	Agriculture, hunting, forestry, and fishing	1	Animals; live
c1	Agriculture, hunting, forestry, and fishing	2	Meat and edible meat offal
c1	Agriculture, hunting, forestry, and fishing	3	Fish and crustaceans, mollusks and other aquatic invertebrates
c1	Agriculture, hunting, forestry, and fishing	4	Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere
c1	Agriculture, hunting, forestry, and fishing	5	Animal originated products; not elsewhere specified or included
c1	Agriculture, hunting, forestry, and fishing	6	Trees and other plants, live; bulbs, roots and the like; cut flowers and ornamental foliage
c1	Agriculture, hunting, forestry, and fishing	7	Vegetables and certain roots and tubers; edible
c1	Agriculture, hunting, forestry, and fishing	8	Fruit and nuts, edible; peel of citrus fruit or melons
c1	Agriculture, hunting, forestry, and fishing	9	Coffee, tea, mate and spices
c1	Agriculture, hunting, forestry, and fishing	10	Cereals
c1	Agriculture, hunting, forestry, and fishing	11	Products of the milling industry; malt, starches, inulin, wheat gluten
c1	Agriculture, hunting, forestry, and fishing	12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit, industrial or medicinal plants
c1	Agriculture, hunting, forestry, and fishing	13	Lac; gums, resins and other vegetable saps and extracts
c1	Agriculture, hunting, forestry, and fishing	14	Vegetable plaiting materials; vegetable products not elsewhere specified or included
c1	Agriculture, hunting, forestry, and fishing	15	Animal or vegetable fats and oils and their cleavage products; prepared animal fats; animal
c1	Agriculture, hunting, forestry, and fishing	16	Meat, fish or crustaceans, mollusks or other aquatic invertebrates; preparations thereof
c3	Food, beverages, and tobacco	17	Sugars and sugar confectionery
c3	Food, beverages, and tobacco	18	Cocoa and cocoa preparations
c3	Food, beverages, and tobacco	19	Preparations of cereals, flour, starch or milk; pastrycooks' products
c3	Food, beverages, and tobacco	20	Preparations of vegetables, fruit, nuts or other parts of plants
c3	Food, beverages, and tobacco	21	Miscellaneous edible preparations
I - O Model Industry Sectoring		HS - Codes	
c3	Food, beverages, and tobacco	22	Beverages, spirits and vinegar
c3	Food, beverages, and tobacco	23	Food industries, residues and wastes thereof; prepared animal fodder
c3	Food, beverages, and tobacco	24	Tobacco and manufactured tobacco substitutes

[2] Standardized international commodity code classification system

I - O Model Industry Sectoring		HS - Code	
c2	Mining and quarrying	25	Salt; Sulphur; earths, stone; plastering materials, lime and cement
c2	Mining and quarrying	26	Ores, slag and ash
c8	Coke, refined petroleum, and nuclear fuel	27	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes
c9	Chemicals and chemical products	28	Inorganic chemicals; organic and inorganic compounds of precious metals; of rare earth metals
c9	Chemicals and chemical products	29	Organic chemicals
c9	Chemicals and chemical products	30	Pharmaceutical products
c9	Chemicals and chemical products	31	Fertilizers
c9	Chemicals and chemical products	32	Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other coloring matter
c9	Chemicals and chemical products	33	Essential oils and resinoids; perfumery, cosmetic or toilet preparations
c9	Chemicals and chemical products	34	Soap, organic surface-active agents; washing, lubricating, polishing or scouring preparations
c9	Chemicals and chemical products	35	Albuminoidal substances; modified starches; glues; enzymes
c9	Chemicals and chemical products	36	Explosives; pyrotechnic products; matches; pyrophoric alloys; certain combustible preparations
c9	Chemicals and chemical products	37	Photographic or cinematographic goods
c9	Chemicals and chemical products	38	Chemical products n.e.c.
c10	Rubber and plastics	39	Plastics and articles thereof
c10	Rubber and plastics	40	Rubber and articles thereof
c5	Leather, leather products, and footwear	41	Raw hides and skins (other than furskins) and leather
c5	Leather, leather products, and footwear	42	Articles of leather; saddlery and harness; travel goods, handbags and similar containers;
c5	Leather, leather products, and footwear	43	Furskins and artificial fur; manufactures thereof
c6	Wood and products of wood and cork	44	Wood and articles of wood; wood charcoal
c6	Wood and products of wood and cork	45	Cork and articles of cork
c6	Wood and products of wood and cork	46	Manufactures of straw, esparto or other plaiting materials; basketware and wickerwork

I - O Model Industry Sectoring		HS - Code	
c7	Pulp, paper, paper products, printing, and publishing	47	Pulp of wood or other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard
c7	Pulp, paper, paper products, printing, and publishing	48	Paper and paperboard; articles of paper pulp, of paper or paperboard
c7	Pulp, paper, paper products, printing, and publishing	49	Printed books, newspapers, pictures and other products of the printing industry; manuscripts
c4	Textiles and textile products	50	Silk
c4	Textiles and textile products	51	Wool, fine or coarse animal hair; horsehair yarn and woven fabric
c4	Textiles and textile products	52	Cotton
c4	Textiles and textile products	53	Vegetable textile fibers; paper yarn and woven fabrics of paper yarn
c4	Textiles and textile products	54	Man-made filaments; strip and the like of man-made textile materials
c4	Textiles and textile products	55	Man-made staple fibers
c4	Textiles and textile products	56	Wadding, felt and nonwovens, special yarns; twine, cordage, ropes and cables and articles thereof
c4	Textiles and textile products	57	Carpets and other textile floor coverings
c4	Textiles and textile products	58	Fabrics; special woven fabrics, tufted textile fabrics, lace, tapestries, trimmings, embroidery
c4	Textiles and textile products	59	Textile fabrics; impregnated, coated, covered or laminated; textile articles of a kind suitable for industrial use
c4	Textiles and textile products	60	Fabrics; knitted or crocheted
c4	Textiles and textile products	61	Apparel and clothing accessories; knitted or crocheted
c4	Textiles and textile products	62	Apparel and clothing accessories; not knitted or crocheted
c4	Textiles and textile products	63	Textiles, made up articles; sets; worn clothing and worn textile articles; rags
c5	Leather, leather products, and footwear	64	Footwear; gaiters and the like; parts of such articles
NA		65	Headgear and parts thereof
NA		66	Umbrellas, sun umbrellas, walking-sticks, seat sticks, whips, riding crops; and parts thereof
NA		67	Feathers and down, prepared; and articles made of feather or of down; artificial flowers;
c11	Other nonmetallic minerals	68	Stone, plaster, cement, asbestos, mica or similar materials; articles thereof
NA		69	Ceramic products
NA		70	Glass and glassware
NA		71	Natural, cultured pearls; precious, semi-precious stones; precious metals, metals clad with precious metal
c12	Basic metals and fabricated metal	72	Iron and steel
c12	Basic metals and fabricated metal	73	Iron or steel articles
I - O Model Industry Sectoring		HS - Codes	
c12	Basic metals and fabricated metal	74	Copper and articles thereof
c12	Basic metals and fabricated metal	75	Nickel and articles thereof

I - O Model Industry Sectoring		HS - Code	
c12	Basic metals and fabricated metal	76	Aluminum and articles thereof
c12	Basic metals and fabricated metal	78	Lead and articles thereof
c12	Basic metals and fabricated metal	79	Zinc and articles thereof
c12	Basic metals and fabricated metal	80	Tin; articles thereof
c12	Basic metals and fabricated metal	81	Metals; n.e.c., cermets and articles thereof
c16	Manufacturing, nec; recycling	82	Tools, implements, cutlery, spoons and forks, of base metal; parts thereof, of base metal
c12	Basic metals and fabricated metal	83	Metal; miscellaneous products of base metal
c13	Machinery, nec	84	Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof
c14	Electrical and optical equipment	85	Electrical machinery and equipment and parts thereof; sound recorders and reproducers;
c15	Transport equipment	86	Railway, tramway locomotives, rolling-stock and parts thereof; railway or tramway track fixtures
c15	Transport equipment	87	Vehicles; other than railway or tramway rolling stock, and parts and accessories thereof
c15	Transport equipment	88	Aircraft, spacecraft and parts thereof
c15	Transport equipment	89	Ships, boats and floating structures
c14	Electrical and optical equipment	90	Optical, photographic, cinematographic, measuring, checking, medical or surgical instruments
c14	Electrical and optical equipment	91	Clocks and watches and parts thereof
c16	Manufacturing, nec; recycling	92	Musical instruments; parts and accessories of such articles
c16	Manufacturing, nec; recycling	94	Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; lamps
c16	Manufacturing, nec; recycling	95	Toys, games and sports requisites; parts and accessories thereof
c16	Manufacturing, nec; recycling	96	Miscellaneous manufactured articles
c16	Manufacturing, nec; recycling	97	Works of art; collectors' pieces and antiques
c16	Manufacturing, nec; recycling	99	Commodities not specified according to kind

2. MRIO Model Input Data

The MRIO model requires various types of input data prepared by the consultant team for the purpose of the economic modeling.

- The road construction costs and information about the construction period for all alignments (see Chapters 3.4, 3.5 and 3.6 of the Almaty-Issyk-Kul Alternative Road Economic Impact Assessment).
- Traveler cost information per alignment (see paragraph 100 in the Almaty-Issyk-Kul Alternative Road Economic Impact Assessment).
- Travel characteristics per scenario and year (2030, 2040), by alignment.
- Additional tourist spending (see paragraph 131).
- Additional hotel construction (see paragraph 131).
- Other Additional Tourist Infrastructure Construction (see paragraph 131).

Alignments included in the economic impact calculations in Chapter 5 and 6 are marked in yellow.

Road Construction

		West					**Direct**	**East**
		New pass	Kastek	Masanchi		Tunnel		
		Gravel	Asphalt	Gravel	Asphalt			
Construction Cost	$M	81.23	93.81	92.51	112.79	482.23	586.63	467.77
Maintenance cost (1.5%)	$M/a	1.22	1.41	1.39	1.69	7.23	8.80	7.02
Start of construction	year	2025	2025	2025	2025	2025	2025	2025
End of construction	year	2028	2028	2028	2028	2032	2033	2031
Start of operation	year	2029	2029	2029	2029	2033	2034	2032
Construction cost on Kazakh territory		90%	96%	90%	96%	55%	5%	55%
Construction cost on Kyrgyz territory		10%	4%	10%	4%	45%	95%	45%

Traveler Costs per Trip

		Existing		**West**					**Direct**	**East**
				New Kastek		Masanchi		Tunnel		
				Gravel	Asphalt	Gravel	Asphalt			
User Cost per trip		Korday	Karkyra							
Travel time (including BCP)	min	445	415	258	239	324	287	218	111	201
Distance	km	460	470	291	291	351	351	260.1	85.5	216
VOT	$/vehicle	111.25	103.75	64.50	59.75	81.00	71.75	54.50	27.75	50.25
VOC	$/vehicle	46.00	47.00	32.01	29.10	38.61	35.10	26.01	8.55	21.60
Travel cost Almaty - IK	$/vehicle	157.25	150.75	96.51	88.85	119.61	106.85	80.51	36.30	71.85
Value of time	$/h	5								
Vehicle operation cost	$/km	0.1								
Vehicle operation cost	$/km	0.11								

Vehicle occupancy	persons/ vehicle	3	

Travel Characteristics Scenario II, 2030

Trips on Alternative Road

	West					Direct	East
	New Kastek pass		Masanchi		Tunnel		
	Gravel	Asphalt	Gravel	Asphalt			
vehicles trips on alternative road / year	215,353	228,423	176,021	197,794	408,561	499,244	428,258
existing but diverted demand	111,795	111,795	111,795	111,795	111,795	192,044	192,044
Induced / newly generated demand	103,558	116,628	64,227	86,000	296,766	307,200	236,214

Existing Demand Diverted to Alternative Road

	West					Direct	East
	New Kastek pass		Masanchi		Tunnel		
	Gravel	Asphalt	Gravel	Asphalt			
change in vehicle km per year (million km)	-18.89	-18.89	-12.19	-12.19	-22.35	-71.92	-46.86
change in travel time cost per year ($M)	-5.23	-5.76	-3.38	-4.42	-6.34	-16.04	-11.71
change in vehicle operation cost per year ($M)	-1.56	-1.89	-0.83	-1.22	-2.23	-7.19	-4.69
change in travel cost per year ($M)	-6.79	-7.65	-4.21	-5.63	-8.58	-23.23	-16.40

Induced and Newly Generated Development Demand on Alternative Road

	West					Direct	East
	New Kastek		Masanchi		Tunnel		
	Gravel	Asphalt	Gravel	Asphalt			
change in vehicle km per year (million km)	30.14	33.94	22.54	30.19	77.19	26.27	51.02
change in travel time cost per year ($M)	6.68	6.97	5.20	6.17	16.17	8.52	11.87
change in vehicle operation cost per year ($M)	3.31	3.39	2.48	3.02	7.72	2.63	5.10
change in travel cost per year ($M)	9.99	10.36	7.68	9.19	23.89	11.15	16.97

Travel Characteristics Scenario II, 2040

Trips on Alternative Road

	West					Direct	East
	New Kastek		Masanchi		Tunnel		
	Gravel	Asphalt	Gravel	Asphalt			
vehicles trips on alternative road / year	250,500	265,704	204,750	230,076	475,241	580,725	498,153
existing but diverted demand	130,041	130,041	130,041	130,041	130,041	223,387	223,387
Induced / newly generated demand	120,459	135,663	74,709	100,035	345,201	357,338	274,766

Existing Demand Diverted to Alternative Road

	West					Direct	East
	New Kastek		Masanchi		Tunnel		
	Gravel	Asphalt	Gravel	Asphalt			
change in vehicle km per year (million km)	-21.98	-21.98	-14.17	-14.17	-26.00	-83.66	-54.51
change in travel time cost per year ($M)	-6.08	-6.70	-3.93	-5.14	-7.38	-18.65	-13.63
change in vehicle operation cost per year ($M)	-1.82	-2.20	-0.96	-1.42	-2.60	-8.37	-5.45
change in travel cost per year ($M)	-7.90	-8.89	-4.89	-6.55	-9.98	-27.02	-19.08

Induced and Newly Generated Development Demand on Alternative Road

	West					Direct	East
	New Kastek		Masanchi		Tunnel		
	Gravel	Asphalt	Gravel	Asphalt			
change in vehicle km per year (million km)	35.05	39.48	26.22	35.11	89.79	30.55	59.35
change in travel time cost per year ($M)	7.77	8.11	6.05	7.18	18.81	9.92	13.81
change in vehicle operation cost per year ($M)	3.86	3.95	2.88	3.51	8.98	3.06	5.93
change in travel cost per year ($M)	11.63	12.05	8.94	10.69	27.79	12.97	19.74

Travel Characteristics Scenario III, 2030

Trips on Alternative Road

	West					Direct	East
	New Kastek		Masanchi		Tunnel		
	Gravel	Asphalt	Gravel	Asphalt			
vehicles trips on alternative road / year	467,426	512,312	332,357	407,128	944,872	1,247,009	1,003,233
existing but diverted demand	111,795	111,795	111,795	111,795	111,795	192,044	192,044
Induced / newly generated demand	355,631	400,517	220,563	295,334	833,077	1,054,965	811,189

Existing Demand Diverted to Alternative Road

	West					Direct	East
	New Kastek		Masanchi		Tunnel		
	Gravel	Asphalt	Gravel	Asphalt			
change in vehicle km per year (million km)	-18.89	-18.89	-12.19	-12.19	-22.35	-71.92	-46.86
change in travel time cost per year ($M)	-5.23	-5.76	-3.38	-4.42	-6.34	-16.04	-11.71
change in vehicle operation cost per year ($M)	-1.56	-1.89	-0.83	-1.22	-2.23	-7.19	-4.69
change in travel cost per year ($M)	-6.79	-7.65	-4.21	-5.63	-8.58	-23.23	-16.40

Induced and Newly Generated Development Demand on Alternative Road

	West					Direct	East
	New Kastek		Masanchi		Tunnel		
	Gravel	Asphalt	Gravel	Asphalt			
change in vehicle km per year (million km)	103.49	116.55	77.42	103.66	216.68	90.20	175.22
change in travel time cost per year ($M)	22.94	23.93	17.87	21.19	45.40	29.28	40.76
change in vehicle operation cost per year ($M)	11.38	11.66	8.52	10.37	21.67	9.02	17.52
change in travel cost per year ($M)	34.32	35.59	26.38	31.56	67.07	38.30	58.28

Travel Characteristics Scenario III, 2040

Trips on Alternative Road

	West					Direct	East
	New Kastek		Masanchi		Tunnel		
	Gravel	Asphalt	Gravel	Asphalt			
vehicles trips on alternative road / year	543,713	595,925	386,601	473,575	1,099,083	1,450,532	1,166,969
existing but diverted demand	130,041	130,041	130,041	130,041	130,041	223,387	223,387
Induced / newly generated demand	413,673	465,885	256,560	343,534	969,043	1,227,145	943,582

Existing Demand Diverted to Alternative Road

	West					Direct	East
	New Kastek		Masanchi		Tunnel		
	Gravel	Asphalt	Gravel	Asphalt			
change in vehicle km per year (million km)	-21.98	-21.98	-14.17	-14.17	-26.00	-83.66	-54.51
change in travel time cost per year ($M)	-6.08	-6.70	-3.93	-5.14	-7.38	-18.65	-13.63
change in vehicle operation cost per year ($M)	-1.82	-2.20	-0.96	-1.42	-2.60	-8.37	-5.45
change in travel cost per year ($M)	-7.90	-8.89	-4.89	-6.55	-9.98	-27.02	-19.08

Induced and Newly Generated Development Demand on Alternative Road

	West					Direct	East
	New Kastek		Masanchi		Tunnel		
	Gravel	Asphalt	Gravel	Asphalt			
change in vehicle km per year (million km)	120.38	135.57	90.05	120.58	252.05	104.92	203.81
change in travel time cost per year ($M)	26.68	27.84	20.78	24.65	52.81	34.05	47.42
change in vehicle operation cost per year ($M)	13.24	13.56	9.91	12.06	25.20	10.49	20.38
change in travel cost per year ($M)	39.92	41.39	30.69	36.71	78.02	44.55	67.80

Additional Tourist Spending

Scenario II, 2030

		West					Direct	East
		New Kastek		Masanchi		Tunnel		
		Gravel	Asphalt	Gravel	Asphalt			
Additional tourists per year	Kazakhstan	99,408	111,955	61,653	82,554	284,875	294,891	226,749
	The Kyrgyz Republic	270,130	304,224	167,535	224,329	774,111	801,329	616,162
Spending per tourist (without road trip)	Kazakhstan	122.40	122.40	122.40	122.40	122.40	122.40	122.40
	The Kyrgyz Republic	188.92	188.92	188.92	188.92	188.92	188.92	188.92
Additional spending per year ($M)	Kazakhstan	12.17	13.70	7.55	10.10	34.87	36.09	27.75
	The Kyrgyz Republic	51.03	57.47	31.65	42.38	146.25	151.39	116.41

Scenario II, 2040

		West					Direct	East
		New Kastek		Masanchi		Tunnel		
		Gravel	Asphalt	Gravel	Asphalt			
Additional tourists per year	Kazakhstan	115,633	130,227	71,716	96,027	331,369	343,020	263,757
	The Kyrgyz Republic	314,217	353,876	194,878	260,941	900,453	932,113	716,725
Spending per tourist (without road trip)	Kazakhstan	122.40	122.40	122.40	122.40	122.40	122.40	122.40
	The Kyrgyz Republic	188.92	188.92	188.92	188.92	188.92	188.92	188.92
Additional spending per year ($M)	Kazakhstan	14.15	15.94	8.78	11.75	40.56	41.99	32.28
	The Kyrgyz Republic	59.36	66.85	36.82	49.30	170.11	176.09	135.40

Scenario III, 2030

		West					Direct	East
		New Kastek		Masanchi		Tunnel		
		Gravel	Asphalt	Gravel	Asphalt			
Additional tourists per year	Kazakhstan	341,381	384,469	211,725	283,500	799,697	1,012,694	778,686
	The Kyrgyz Republic	927,659	1,044,744	575,335	770,374	2,173,073	2,751,867	2,115,979
Spending per tourist (without road trip)	Kazakhstan	122.40	122.40	122.40	122.40	122.40	122.40	122.40
	The Kyrgyz Republic	188.92	188.92	188.92	188.92	188.92	188.92	188.92
Additional spending per year ($M)	Kazakhstan	41.79	47.06	25.92	34.70	97.88	123.95	95.31
	The Kyrgyz Republic	175.25	197.37	108.69	145.54	410.54	519.88	399.75

Scenario III, 2040

		West					Direct	East
		New Kastek		Masanchi		Tunnel		
		Gravel	Asphalt	Gravel	Asphalt			
Additional tourists per year	Kazakhstan	397,097	447,217	246,280	329,769	930,214	1,177,975	905,774
	The Kyrgyz Republic	1,079,061	1,215,255	669,235	896,106	2,527,738	3,200,995	2,461,325
Spending per tourist (without road trip)	Kazakhstan	122.40	122.40	122.40	122.40	122.40	122.40	122.40
	The Kyrgyz Republic	188.92	188.92	188.92	188.92	188.92	188.92	188.92
Additional spending per year ($M)	Kazakhstan	48.60	54.74	30.14	40.36	113.86	144.18	110.87
	The Kyrgyz Republic	203.86	229.59	126.43	169.29	477.54	604.73	464.99

Additional Hotel Construction

Scenario II, 2030

Occupancy Almaty 2018	30%	(Statistics)	West					Direct	East
Room Occupancy	1.5		New Kastek		Masanchi		Tunnel		
Cost per bed:	30,000	$	Gravel	Asphalt	Gravel	Asphalt			
Capacity Hotels 2018 (beds)		Almaty	15,000	15,000	15,000	15,000	15,000	15,000	15,000
		Issyk-Kul	23,000	23,000	23,000	23,000	23,000	23,000	23,000
Additional Demand Hotels (bed-nights)		Almaty	124,159	139,830	77,004	103,108	355,803	368,313	283,205
		Issyk-Kul	721,823	812,928	447,675	599,438	2,068,530	2,141,261	1,646,469
Additional Hotel Beds Needed		Almaty	-	-	-	-	-	-	-
		Issyk-Kul	-	-	-	-	109	514	-
Construction Spending ($M)		Almaty	-	-	-	-	-	-	-
		Issyk-Kul	-	-	-	-	3.28	15.41	-

Scenario II, 2040

Occupancy Almaty 2018	30%	(Statistics)	West					Direct	East
Room Occupancy	1.5		New Kastek		Masanchi		Tunnel		
Cost per bed:	30,000	$	Gravel	Asphalt	Gravel	Asphalt			
Capacity Hotels 2018 (beds)		Almaty	15,000	15,000	15,000	15,000	15,000	15,000	15,000
		Issyk-Kul	23,000	23,000	23,000	23,000	23,000	23,000	23,000
Additional Demand Hotels (bed-nights)		Almaty	144,423	162,651	89,571	119,936	413,873	428,425	329,427
		Issyk-Kul	839,631	945,605	520,740	697,271	2,406,132	2,490,733	1,915,187
Additional Hotel Beds Needed		Almaty	-	-	-	-	-	-	-
		Issyk-Kul	-	-	-	-	1,985	2,455	-
Construction Spending ($M)		Almaty	-	-	-	-	-	-	-
		Issyk-Kul	-	-	-	-	59.55	73.65	-

Scenario III, 2030

Occupancy Almaty 2018	30%	(Statistics	West					Direct	East
Room Occupancy	1.5		New Kastek		Masanchi		Tunnel		
Cost per bed:	30,00	$	Gravel	Asphalt	Gravel	Asphalt			
Capacity Hotels 2018 (beds)		Almaty	15,000	15,000	15,000	15,000	15,000	15,000	15,000
		Issyk-Kul	23,000	23,000	23,000	23,000	23,000	23,000	23,000
Additional Demand Hotels (bed-nights)		Almaty	426,378	480,193	264,440	354,086	998,805	1,264,83	972,563
		Issyk-Kul	2,478,83	2,791,69	1,537,37	2,058,54	5,806,74	7,353,36	5,654,18
Additional Hotel Beds Needed		Almaty	-	-	-	-	-	-	-
		Issyk-Kul	2,389	4,127	-	54	20,877	29,470	20,030
Construction Spending ($M)		Almaty	-	-	-	-	-	-	-
		Issyk-Kul	71.67	123.81	-	1.62	626.32	884.09	600.89

Scenario III, 2040

Occupancy Almaty 2018	30%	(Statistic	West					Direct	East
Room Occupancy	1.5		New Kastek		Masanchi		Tunnel		
Cost per bed:	30,00	$	Gravel	Asphalt	Gravel	Asphalt			
Capacity Hotels 2018 (beds)		Almaty	15,000	15,000	15,000	15,000	15,000	15,000	15,000
		Issyk-Kul	23,000	23,000	23,000	23,000	23,000	23,000	23,000
Additional Demand Hotels (bed-nights)		Almaty	495,967	558,565	307,599	411,875	1,161,81	1,471,26	1,131,29
		Issyk-Kul	2,883,39	3,247,32	1,788,28	2,394,51	6,754,45	8,553,49	6,576,99
Additional Hotel Beds Needed		Almaty	-	-	-	-	-	750	-
		Issyk-Kul	4,637	6,658	-	1,921	26,142	36,137	25,157
Construction Spending ($M)		Almaty	-	-	-	-	-	22.51	-
		Issyk-Kul	139.10	199.75	-	57.62	784.27	1,084.11	754.70

Other Additional Tourist Infrastructure Construction

(Like restaurants, cafes, bars – assumed to be 20% of hotel infrastructure cost)

$ million			West					Direct	East
			New Kastek		Masanchi		Tunnel		
			Gravel	Asphalt	Gravel	Asphalt			
Scenario II	**2030**	Almaty	-	-	-	-	-	-	-
		Issyk-Kul	-	-	-	-	0.66	3.08	-
	2040	Almaty	-	-	-	-	-	-	-
		Issyk-Kul	-	-	-	-	11.91	14.73	-
Scenario III	**2030**	Almaty	-	-	-	-	-	-	-
		Issyk-Kul	14.33	24.76	-	0.32	125.26	176.82	120.18
	2040	Almaty	-	-	-	-	-	4.50	-
		Issyk-Kul	27.82	39.95	-	11.52	156.85	216.82	150.94

Total Additional Tourist Infrastructure Construction

$ million			West					Direct	East
			New Kastek		Masanchi		Tunnel		
			Gravel	Asphalt	Gravel	Asphalt			
Scenario II	**2030**	Almaty	-	-	-	-	-	-	-
		Issyk-Kul	-	-	-	-	3.94	18.49	-
	2040	Almaty	-	-	-	-	-	-	-
		Issyk-Kul	-	-	-	-	71.46	88.38	-
Scenario III	**2030**	Almaty	-	-	-	-	-	-	-
		Issyk-Kul	86.00	148.57	-	1.94	751.58	1,060.91	721.07
	2040	Almaty	-	-	-	-	-	27.02	-
		Issyk-Kul	166.91	239.70	-	69.14	941.13	1,300.93	905.63

3. EIA Results

3.1 Sources of Cost Factors for Traveler Benefits

Travel time and vehicle operating cost savings are considered as traveler benefits (see Chapter 5.2.1 in the Almaty-Issyk-Kul Alternative Road Economic Impact Assessment). To value travel time and vehicle costs, specific unit values are needed that reflect cost of living and wages in Kazakhstan and the Kyrgyz Republic.

Table 4: Cost factors and occupancy

Assumption		Value	Source
Value of time (VOT)		5 $/h*pers.	Dornier, 2016
Vehicle operating costs (VOC) [3]	Asphalt	0.1 $/vehicle-km	Consultant Team estimation
	Gravel	0.11 $/vehicle-km (+10%)	NCAT, 2015
Occupancy		3 pers. / passenger car	Ak-Jol BCP statistical data 2018
		30 pers. / bus	

3.2 Economic Impact Results

The economic impacts calculated by the MRIO model are described in Chapter 5.2.2 of the Almaty-Issyk-Kul Alternative Road Economic Impact Assessment. Not all alignment/scenario combinations could be shown there in all detail as this would have added significantly to the Almaty-Issyk-Kul Alternative Road Economic Impact Assessment. Instead, a selection of representative alignment/scenario combinations is presented in Economic Impact Assessment. All eight combinations are shown here, both for cumulative value-added impacts for a 20-year period and for impacts for a single year (2045).

[3] Including fuel: in August 2019, 1 liter of gas (A-92) cost approximately 40 KGS ($0.51), 1 liter of diesel 45 KGS ($0.57)

Cumulative Value-Added Impacts by Impact Type (2025-2045), $ million
(see Chapter 5.2.2 in the Almaty-Issyk-Kul Alternative Road Economic Impact Assessment, Table 7)

Table 5: Western Alignment – New Kastek Pass (Asphalt), Policy Scenario II

Cumulative Value Added (GDP) Impacts (2025 - 2045), $ million									
Impact Type	Kazakhstan				Kyrgyz Republic				Total
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total	
Highway Construction	53	47	45	145	1	1	1	4	149
Travel Cost Savings: Existing	-21	-8	-10	-39	-1	0	0	-1	-40
Travel Cost Savings: Induced	38	15	17	70	2	0	1	2	72
Tourism Demand	151	124	169	444	451	240	370	1,061	1,505
Hotel Construction	0	0	0	0	0	0	0	0	0
Supporting Construction	0	0	0	0	0	0	0	0	0
Total Impact	220	178	221	620	453	241	372	1,066	1,686
Average Annual Impact	11	9	11	31	23	12	19	53	84
% of 2017 GDP, by Country				0.02%				0.81%	

Table 6:Western Alignment – Tunnel, Policy Scenario II

Cumulative Value Added (GDP) Impacts (2025 - 2045), $ million									
Impact Type	Kazakhstan				Kyrgyz Republic				Total
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total	
Highway Construction	152	149	147	448	83	62	79	224	672
Travel Cost Savings: Existing	-11	-5	-6	-22	-9	-1	-4	-14	-36
Travel Cost Savings: Induced	39	17	21	76	31	4	14	48	125
Tourism Demand	302	249	338	889	903	481	741	2,124	3,014
Hotel Construction	0	4	6	11	27	20	25	72	83
Supporting Construction	0	1	1	2	5	4	5	14	17
Total Impact	481	415	507	1,404	1,040	570	860	2,470	3,874
Average Annual Impact	24	21	25	70	52	28	43	123	194
% of 2017 GDP, by Country				0.05%				1.88%	

Table 7: Direct Alignment, Policy Scenario II

Cumulative Value Added (GDP) Impacts (2025 – 2045), $ million									
Impact Type	Kazakhstan				Kyrgyz Republic				Total
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total	
Highway Construction	17	49	63	129	213	158	200	571	700
Travel Cost Savings: Existing	-3	-4	-7	-14	-56	-7	-25	-88	-103
Travel Cost Savings: Induced	1	1	3	5	20	3	9	32	37
Tourism Demand	291	240	325	856	869	463	713	2,044	2,900
Hotel Construction	0	5	7	12	32	24	30	85	97
Supporting Construction	0	1	1	2	6	5	6	17	19
Total Impact	305	293	393	991	1084	645	933	2,661	3,652
Average Annual Impact	15	15	20	50	54	32	47	133	183
% of 2017 GDP, by Country				0.03%				2.03%	

Table 8: Eastern Alignment, Policy Scenario II

Cumulative Value Added (GDP) Impacts (2025 - 2045), $ million									
Impact Type	Kazakhstan				Kyrgyz Republic				Total
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total	
Highway Construction	148	145	143	437	81	61	77	219	656
Travel Cost Savings: Existing	-25	-11	-14	-49	-20	-3	-9	-31	-81
Travel Cost Savings: Induced	27	12	15	54	22	3	10	34	88
Tourism Demand	257	212	288	757	768	409	631	1,808	2,565
Hotel Construction	0	0	0	0	0	0	0	0	0
Supporting Construction	0	0	0	0	0	0	0	0	0
Total Impact	407	358	432	1,198	851	470	708	2,030	3228
Average Annual Impact	20	18	22	60	43	24	35	101	161
% of 2017 GDP, by Country				0.04%				1.55%	

Table 9: Western Alignment – New Kastek Pass (Asphalt), Policy Scenario III

Cumulative Value Added (GDP) Impacts (2025 - 2045), $ million									
Impact Type	Kazakhstan				Kyrgyz Republic				Total
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total	
Highway Construction	53	47	45	145	1	1	1	4	149
Travel Cost Savings: Existing	-21	-8	-10	-39	-1	0	0	-1	-40
Travel Cost Savings: Induced	129	51	60	240	5	1	3	8	249
Tourism Demand	518	427	580	1,525	1,548	825	1271	3,643	5,167
Hotel Construction	0	12	17	29	73	54	69	196	225
Supporting Construction	0	2	3	6	15	11	14	39	45
Total Impact	679	532	695	1,905	1,641	891	1,357	3,890	5,795
Average Annual Impact	34	27	35	95	82	45	68	194	290
% of 2017 GDP, by Country				0.07%				2.96%	

Table 10: Western Alignment – Tunnel, Policy Scenario III

Cumulative Value Added (GDP) Impacts (2025 - 2045), $ million									
Impact Type	Kazakhstan				Kyrgyz Republic				Total
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total	
Highway Construction	152	149	147	448	83	62	79	224	672
Travel Cost Savings: Existing	-11	-5	-6	-22	-9	-1	-4	-14	-36
Travel Cost Savings: Induced	109	47	58	214	86	11	39	136	350
Tourism Demand	848	699	949	2,496	2,534	1,350	2,080	5,964	8,460
Hotel Construction	0	43	62	105	266	197	250	713	818
Supporting Construction	0	9	12	21	53	39	50	143	164
Total Impact	1,097	942	1,222	3,261	3,013	1,658	2,494	7,166	10,427
Average Annual Impact	55	47	61	163	151	83	125	358	521
% of 2017 GDP, by Country				0.11%				5.46%	

Table 11: Direct Alignment, Policy Scenario III

Cumulative Value Added (GDP) Impacts (2025 - 2045), $ million									
Impact Type	Kazakhstan				Kyrgyz Republic				Total
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total	
Highway Construction	17	49	63	129	213	158	200	571	700
Travel Cost Savings: Existing	-3	-4	-7	-14	-56	-7	-25	-88	-103
Travel Cost Savings: Induced	4	5	9	18	70	9	32	111	129
Tourism Demand	998	823	1117	2938	2983	1589	2449	7021	9959
Hotel Construction	15	73	97	186	364	271	343	978	1164
Supporting Construction	3	15	19	37	73	54	69	196	233
Total Impact	1034	961	1299	3294	3647	2074	3067	8788	12083
Average Annual Impact	52	48	65	165	182	104	153	439	604
% of 2017 GDP, by Country				0.11%				6.69%	

Table 12: Eastern Alignment, Policy Scenario III

Cumulative Value Added (GDP) Impacts (2025 - 2045), $ million									
Impact Type	Kazakhstan				Kyrgyz Republic				Total
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total	
Highway Construction	148	145	143	437	81	61	77	219	656
Travel Cost Savings: Existing	-25	-11	-14	-49	-20	-3	-9	-31	-81
Travel Cost Savings: Induced	94	40	51	185	74	9	34	118	302
Tourism Demand	883	728	988	2,599	2,638	1,405	2,166	6,209	8,808
Hotel Construction	0	41	59	101	256	190	241	687	788
Supporting Construction	0	8	12	20	51	38	48	137	158
Total Impact	1,100	953	1,239	3,292	3,081	1,701	2,557	7,339	10,630
Average Annual Impact	55	48	62	165	154	85	128	367	532
% of 2017 GDP, by Country				0.11%				5.59%	

Economic Impacts for a Single Year (2045), $ million

(see Chapter 5.2.2 in the Almaty-Issyk-Kul Alternative Road Economic Impact Assessment, Table 8)

Table 13: Western Alignment – New Kastek Pass (Asphalt), Policy Scenario II

	Kazakhstan				Kyrgyz Republic			
	Employ-ment	**Income ($M)**	**Value Added ($M)**	**Output ($M)**	**Employ-ment**	**Income ($M)**	**Value Added ($M)**	**Output ($M)**
Direct	972	4.5	11.6	20.1	12,269	28.2	29.7	71.7
Indirect	474	2.9	9.2	15.8	2,601	12.2	15.8	40.3
Induced	699	3.6	12.1	19.9	4,742	19.5	24.4	61.1
Total	2,146	11.0	32.9	55.8	19,612	59.9	69.8	173.1
% of 2017 Economy:	**0.02%**		**0.02%**	**0.02%**	**0.82%**		**1.06%**	**1.08%**
2017 Economy	8,585,153		145,488.9	244,844.4	2,377,700		6,567.8	16,084.2

Table 14: Western Alignment – Tunnel, Policy Scenario II

	Kazakhstan				Kyrgyz Republic			
	Employ-ment	**Income ($M)**	**Value Added ($M)**	**Output ($M)**	**Employ-ment**	**Income ($M)**	**Value Added ($M)**	**Output ($M)**
Direct	2,471	11.4	29.3	51.0	32,128	75.7	80.3	194.8
Indirect	1,231	7.5	23.9	41.2	7,007	33.0	42.7	108.8
Induced	1,826	9.5	31.7	52.0	12,773	52.6	65.6	164.7
Total	5,527	28.5	85.0	144.3	51,908	161.4	188.5	468.2
% of 2017 Economy:	**0.06%**		**0.06%**	**0.06%**	**2.18%**		**2.87%**	**2.91%**
2017 Economy	8,585,153		145,488.9	244,844.4	2,377,700		6,567.8	16,084.2

Table 15: Direct Alignment, Policy Scenario II

	Kazakhstan				Kyrgyz Republic			
	Employ-ment	**Income ($M)**	**Value Added ($M)**	**Output ($M)**	**Employ-ment**	**Income ($M)**	**Value Added ($M)**	**Output ($M)**
Direct	2,294	10.1	26.1	45.1	32,782	76.5	79.5	199.0
Indirect	1,177	7.0	22.3	38.5	7,344	34.7	44.7	113.7
Induced	1,727	9.1	30.1	49.5	13,055	53.8	67.0	168.3
Total	5,198	26.1	78.5	133.1	53,181	164.9	191.2	481.0
% of 2017 Economy:	**0.06%**		**0.05%**	**0.05%**	**2.24%**		**2.91%**	**2.99%**
2017 Economy	8,585,153		145,488.9	244,844.4	2,377,700		6,567.8	16,084.2

Table 16: Eastern Alignment, Policy Scenario II

	Kazakhstan				Kyrgyz Republic			
	Employ-ment	**Income ($M)**	**Value Added ($M)**	**Output ($M)**	**Employ-ment**	**Income ($M)**	**Value Added ($M)**	**Output ($M)**
Direct	1,913	8.7	22.0	38.7	25,055	58.0	61.1	148.3
Indirect	953	5.7	18.4	1.7	5,379	25.3	32.7	83.3
Induced	1,398	7.3	24.3	39.8	9,780	40.3	50.2	126.1
Total	4,264	21.8	64.7	110.2	40,214	123.6	144.0	357.7
% of 2017 Economy:	**0.05%**		**0.04%**	**0.05%**	**1.69%**		**2.19%**	**2.22%**
2017 Economy	8,585,153		145,488.9	244,844.4	2,377,700		6,567.8	16,084.2

Table 17: Western Alignment – New Kastek Pass (Asphalt), Policy Scenario III

	Kazakhstan				Kyrgyz Republic			
	Employ-ment	**Income ($M)**	**Value Added ($M)**	**Output ($M)**	**Employ-ment**	**Income ($M)**	**Value Added ($M)**	**Output ($M)**
Direct	3,375	15.7	41.8	71.1	42,738	99.5	104.8	255.3
Indirect	1,646	10.0	31.9	54.8	9,261	43.6	56.3	143.5
Induced	2,453	12.8	42.6	69.8	16,804	69.2	86.3	216.6
Total	7,474	38.5	116.2	195.7	68,802	212.3	247.4	615.4
% of 2017 Economy:	**0.09%**		**0.08%**	**0.08%**	**2.89%**		**3.77%**	**3.83%**
2017 Economy	8,585,153		145,488.9	244,844.4	2,377,700		6,567.8	16,084.2

Table 18: Western Alignment – Tunnel, Policy Scenario III

	Kazakhstan				Kyrgyz Republic			
	Employ-ment	**Income ($M)**	**Value Added ($M)**	**Output ($M)**	**Employ-ment**	**Income ($M)**	**Value Added ($M)**	**Output ($M)**
Direct	6,743	30.9	80.7	138.7	90,018	211.7	224.8	542.9
Indirect	3,355	20.2	64.6	111.3	19,481	91.8	118.6	302.4
Induced	4,991	26.1	86.7	142.4	35,642	146.8	183.0	459.5
Total	15,089	77.2	232.1	392.4	145,141	450.3	526.5	1,304.8
% of 2017 Economy:	**0.18%**		**0.16%**	**0.16%**	**6.10%**		**8.02%**	**8.11%**
2017 Economy	8,585,153		145,488.9	244,844.4	2,377,700		6,567.8	16,084.2

Table 19: Direct Alignment, Policy Scenario III

	Kazakhstan				Kyrgyz Republic			
	Employ-ment	**Income ($M)**	**Value Added ($M)**	**Output ($M)**	**Employ-ment**	**Income ($M)**	**Value Added ($M)**	**Output ($M)**
Direct	7,974	35.2	91.2	157.6	113,186	264.8	279.1	681.4
Indirect	4,056	24.1	76.9	132.9	24,700	116.4	150.3	383.0
Induced	5,974	31.4	104.0	171.2	44,766	184.4	229.9	577.1
Total	18,005	90.7	272.1	461.6	182,651	565.6	659.3	1,641.5
% of 2017 Economy:	**0.21%**		**0.19%**	**0.19%**	**7.68%**		**10.04%**	**10.21%**
2017 Economy	8,585,153		145,488.9	244,844.4	2,377,700		6,567.8	16,084.2

Table 20: Eastern Alignment, Policy Scenario III

	Kazakhstan				Kyrgyz Republic			
	Employ-ment	**Income ($M)**	**Value Added ($M)**	**Output ($M)**	**Employ-ment**	**Income ($M)**	**Value Added ($M)**	**Output ($M)**
Direct	6,443	29.2	76.1	131.0	87,334	204.8	216.9	525.6
Indirect	3,224	19.3	61.8	106.6	18,933	89.2	115.2	293.7
Induced	4,779	25.0	83.1	136.5	34,527	142.2	177.3	445.1
Total	14,445	73.6	220.9	374.1	140,793	436.2	509.4	1,264.5
% of 2017 Economy:	**0.17%**		**0.15%**	**0.15%**	**5.92%**		**7.76%**	**7.86%**
2017 Economy	8,585,153		145,488.9	244,844.4	2,377,700		6,567.8	16,084.2

3.3 Comprehensive Internal Rate of Return (CIRR)

Methodology and Assumptions

The "comprehensive internal rate of return" (CIRR) is used to estimate the relative "economic rate of return" associated with each of the alignment for which economic impacts were estimated (Chapter 5.2.2) under both policy scenario conditions. We refer to this as a "comprehensive" measure because it is a composite of both the regional economic development (GDP growth) impact and the social welfare value of time and cost savings to travelers (which does not add to GDP). However, it is referred to as an "internal" rate of return because it does not account for "external" economic factors such as the cost of capital. All numbers in this study are based on constant (inflation adjusted) dollars.

The CIRR is calculated as the discount rate that makes the net present value (NPV) of all benefits and costs equal to zero. CIRR calculations rely on the same formula as NPV does.

$$0 = \text{NPV} = \sum_{t=1}^{T} \frac{C_t}{(1+IRR)^t} - C_0$$

Where:
C_t = Net cash inflow during the period t
C_0 = Total initial investment costs
IRR = Internal Rate of Return
T = Number of time periods

The following components are included in the calculation of the net present value:

- Benefits (positive):
  - Traveler benefits (see Chapter 5.2.1 of the Almaty-Issyk-Kul Alternative Road Economic Impact Assessment) for existing travelers, dynamically growing on the basis of a CAGR determined for existing traffic (1.6% per year, see paragraph 129 of the Almaty-Issyk-Kul Alternative Road Economic Impact Assessment)
  - Value added economic impacts from the following activities:
    - GDP growth enabled by the project (including visitor spending and inward investment)
    - Traveler welfare benefits (value of travel time and cost savings for induced travelers)
- Costs (negative):
  - Construction costs (see Chapter 3.6 of the Almaty-Issyk-Kul Alternative Road Economic Impact Assessment)
  - Operation and maintenance cost, starting in the first year of operation (see Chapter 3.5 of the Almaty-Issyk-Kul Alternative Road Economic Impact Assessment)
- The CIRR is the discount rate, at which the sum of discounted benefits and costs over the course of the considered time span (10 years of operation after the construction phase) equal zero (NPV=0).

Undiscounted Impacts and Total Discounted at CIRR Rate, $ million per year
(see Chapter 6.2 in the Almaty-Issyk-Kul Alternative Road Economic Impact Assessment, CIRR from Table 11)

Table 21: Western Alignment – New Kastek Pass (Asphalt), Policy Scenario II

West New Kastek - Asphalt	Scenario II	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Traveler Benefit						7.5	7.7	7.8	7.9	8.0	8.2	8.3	8.4	8.5	8.7	8.8	9.0	9.1	9.3	9.4
Economic Impact						81.9	83.3	84.6	86.0	87.3	88.4	90.0	91.4	92.8	94.1	100.2	101.6	103.0	104.4	105.9
Construction Cost	93.8	-93.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
O&M Cost						-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4
Total		-93.8	0.0	0.0	0.0	88.0	89.5	91.0	92.5	93.9	95.1	96.9	98.4	99.9	101.4	107.6	109.2	110.7	112.2	113.9
Total Discounted	370.2	-93.8	0.0	0.0	0.0	62.4	58.2	54.2	50.6	47.1	43.8	40.9	38.1	35.5	33.1	32.2	30.0	27.9	25.9	24.1
CIRR	36.5%																			

Table 22: Western Alignment – Tunnel, Policy Scenario II

West - Tunnel	Scenario II	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Traveler Benefit										9.0	9.1	9.3	9.4	9.6	9.7	9.9	10.1	10.2	10.4	10.5
Economic Impact						0.0	0.0	0.0	0.0	227.2	230.6	234.1	237.5	240.9	244.4	247.8	251.2	254.7	258.1	275.2
Construction Cost	517.7	-517.7								0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
O&M Cost										-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8
Total		-517.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	228.4	232.0	235.6	239.2	242.7	246.4	249.9	253.5	257.2	260.7	278.0
Total Discounted	332.0	-517.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	114.6	106.8	99.5	92.7	86.3	80.4	74.8	69.6	64.8	60.2	58.9
CIRR	13.7%																			

Table 23: Direct Alignment, Policy Scenario II

Direct	Scenario II	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Traveler Benefit											24.8	25.1	25.6	26.0	26.4	26.8	27.2	27.7	28.1	28.6
Economic Impact						0.0	0.0	0.0	0.0	0.0	232.4	235.9	239.3	242.8	246.2	249.7	253.1	256.6	260.1	263.5
Construction Cost	586.6	-586.6									0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
O&M Cost											-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8
Total		-586.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	248.4	252.2	256.1	260.0	263.8	267.7	271.5	275.5	279.4	283.3
Total Discounted	260.6	-586.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	114.3	106.6	99.2	92.4	86.0	80.1	74.5	69.4	64.6	60.0
CIRR	12.2%																			

Table 24: Eastern Alignment, Policy Scenario II

East	Scenario II	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Traveler Benefit									16.9	17.2	17.5	17.8	18.0	18.3	18.6	18.9	19.2	19.5	19.8	20.2
Economic Impact						0.0	0.0	0.0	171.8	174.6	177.3	180.0	182.7	185.4	188.1	190.8	193.6	196.3	209.3	212.2
Construction Cost	467.8	-467.8							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
O&M Cost									-7.0	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0
Total		-467.8	0.0	0.0	0.0	0.0	0.0	0.0	181.7	184.8	187.8	190.7	193.7	196.7	199.7	202.7	205.8	208.8	222.1	225.3
Total Discounted	271.3	-467.8	0.0	0.0	0.0	0.0	0.0	0.0	99.4	92.7	86.4	80.6	75.1	69.9	65.1	60.7	56.5	52.6	51.3	47.8
CIRR	13.7%																			

Table 25: Western Alignment – New Kastek Pass (Asphalt), Policy Scenario III

West New Kastek - Asphalt	Scenario III	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Traveler Benefit						7.5	7.7	7.8	7.9	8.0	8.2	8.3	8.4	8.5	8.7	8.8	9.0	9.1	9.3	9.4
Economic Impact						304.7	309.4	299.2	303.9	308.5	313.2	317.9	322.5	327.2	331.9	353.1	358.0	362.9	367.8	372.7
Construction Cost	93.8	-93.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
O&M Cost						-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4
Total		-93.8	0.0	0.0	0.0	310.8	315.6	305.6	310.4	315.1	319.9	324.8	329.5	334.3	339.2	360.5	365.6	370.6	375.6	380.7
Total Discounted	1483.4	-93.8	0.0	0.0	0.0	220.2	205.1	182.2	169.8	158.1	147.3	137.2	127.7	118.9	110.6	107.9	100.4	93.3	86.8	80.7
CIRR	69.0%																			

Table 26: Western Alignment – Tunnel, Policy Scenario III

West - Tunnel	Scenario III	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Traveler Benefit										9.0	9.1	9.3	9.4	9.6	9.7	9.9	10.1	10.2	10.4	10.5
Economic Impact										637.7	647.4	657.0	666.7	676.3	686.0	695.6	705.2	714.9	724.5	772.5
Construction Cost	517.7	-517.7								0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
O&M Cost										-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8
Total		-517.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	638.9	648.8	658.5	668.4	678.1	688.0	697.7	707.5	717.4	727.1	775.3
Total Discounted	1856.1	-517.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	320.7	298.7	278.2	259.0	241.1	224.4	208.8	194.2	180.7	168.0	164.4
CIRR	24.6%																			

Table 27: Direct Alignment, Policy Scenario III

Direct	Scenario III	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Traveler Benefit											24.8	25.1	25.6	26.0	26.4	26.8	27.2	27.7	28.1	28.6
Economic Impact											801.5	813.3	825.2	837.1	849.0	860.8	872.7	884.6	896.5	908.4
Construction Cost	586.6	-586.6									0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
O&M Cost											-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8
Total		-586.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	817.5	829.6	842.0	854.3	866.6	878.8	891.1	903.5	915.8	928.2
Total Discounted	2196.4	-586.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	376.4	350.5	326.3	303.7	282.7	263.0	244.6	227.6	211.6	196.8
CIRR	23.5%																			

Table 28: Eastern Alignment, Policy Scenario III

East	Scenario III	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Traveler Benefit									16.9	17.2	17.5	17.8	18.0	18.3	18.6	18.9	19.2	19.5	19.8	20.2
Economic Impact									607.6	616.9	626.3	635.6	644.9	654.2	663.6	672.9	682.2	691.5	737.4	747.2
Construction Cost	467.8	-467.8							0	0	0	0	0	0	0	0	0	0	0	0
O&M Cost									-7.02	-7.02	-7.02	-7.02	-7.02	-7.02	-7.02	-7.02	-7.02	-7.02	-7.02	-7.02
Total		-467.8	0.00	0.00	0.00	0.00	0.00	0.00	617.5	627.1	636.8	646.3	655.9	665.5	675.2	684.8	694.4	704.0	750.2	760.3
Total Discounted	2034.84	-467.8	0.00	0.00	0.00	0.00	0.00	0.00	337.8	314.7	293.2	273.0	254.2	236.6	220.2	204.9	190.6	177.3	173.4	161.2
CIRR	28.3%																			