Analyzing the Impacts of Mongolia's Trade Costs

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Abstract

The objective of the analysis is to review the current status of Mongolia's trade pattern and carry out an analysis of the trade costs currently incurred by Mongolia. In particular, the authors aim at examining the factors that increase the costs of trade between Mongolia and its trading partners. This analysis employed a gravity model (AvW) to estimate the effects on trade volume. In addition, the study aimed at examining the effects of the accessibility for Mongolian export goods to major trading partner countries via Tianjin port, China. In particular, ten trading partner countries of Mongolia were selected for analysis. The first three sections analyze Mongolia's trade and transport patterns. Section 4 gives information on data collection, and in Section 5 the estimations of the impacts on trade costs using regression functions and the gravity model are described. Finally, Section 6 concludes the paper and gives some policy recommendations.

Keywords: trade costs, gravity model, landlocked country, transport, seaports
JEL classification codes: F13, F14

1. Introduction

In today's globalized world, trade costs matter as a determinant of the pattern of bilateral trade and investment, as well as of the geographical distribution of production. Although tariffs in many countries are now at low levels, overall trade costs remain high especially for landlocked countries such as Mongolia. Trade costs have the following two sources. The first encompasses entirely the bilateral factors of separation between the exporter and the importer, which are geographical distances and were used as a rough proxy for international transportation costs. The other source is the common features between the trading partners, such as a common history and the sharing of a common border. Mongolia has only two neighbors, China and Russia, via which it reaches the rest of the global market.

This separation and remoteness brings with it many logistical conundrums of cost, delay, and reliability, and trade facilitation bottlenecks, such as customs procedures and border control, and transit systems with third countries; international connectivity, such as the existence of regular maritime and air services, and; tariffs and non-tariff measures. Sources of other trade costs also represent significant obstacles to larger export and import volumes, particularly in areas such as poor infrastructure and the dysfunctional transport and logistics services markets.

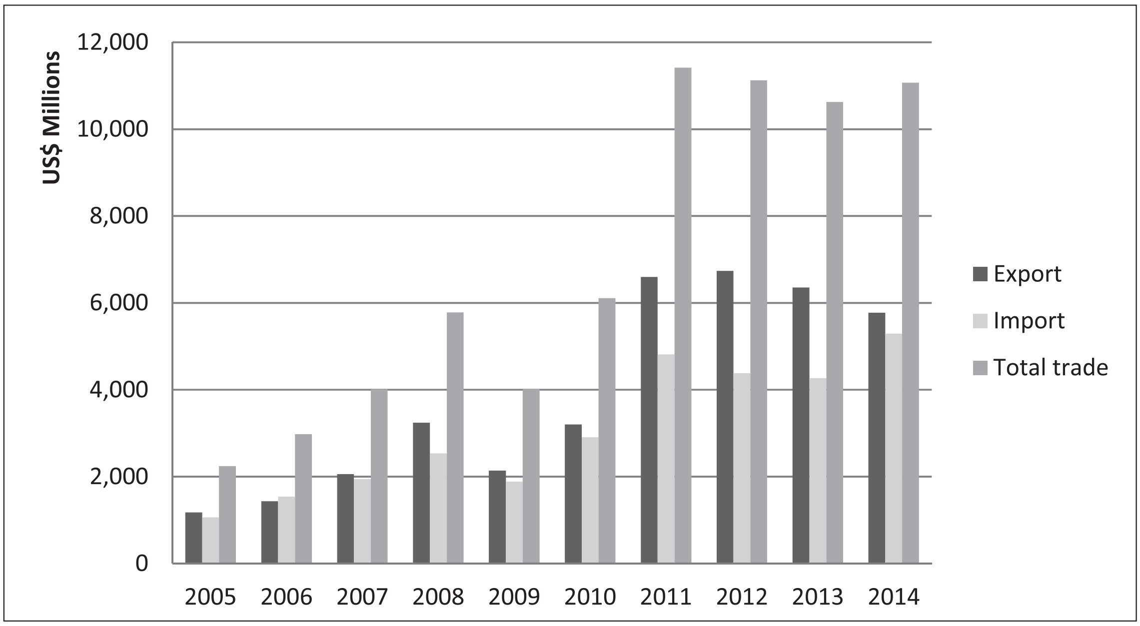
These constraints and logistical problems present Mongolia with many trade challenges. Due to the low accessibility to the sea via the nearest gateways, such as Tianjin port in China, Mongolia is prevented from diversifying its trading partners and still relies on a few export goods. High trade costs and low accessibility to seaports hamper Mongolia from diversifying its trading partners and exporting its goods.

2. Mongolia's Trade Pattern

Mongolia joined the World Trade Organization in 1997. Since then, Mongolia has adopted laws and regulations to bring its legislation in line with the WTO rules. Mongolia bound all its tariffs in *ad valorem* terms, with an average bound rate of 17.3%, but the current average applied rate is maintained at 5% for almost all goods. Mongolia has no commitments on tariff quotas, domestic support, or export subsidies for agricultural products. Mongolia's trade policy was reviewed by the WTO in 2005[1] and 2014[2]. Today Mongolia is pursuing a relatively liberal trade policy. The Mongolian economy is heavily dependent on foreign trade and 37.1% of its GDP is accounted for by exports (Figure 1).

As illustrated in Figure 1, Mongolian foreign trade had deficits for the entire period of 2005–2014. The reasons behind this pattern are assumed to be trade dependency on a few export commodities, the high percentage of raw materials within exports, the heavy dependence on world market prices and the poor supply chain connectivity for Mongolian export goods to foreign markets.

Figure 1: Mongolian Trade Turnover, 2005–2014



Source: Mongolian Customs Department, 2015

China is the predominant destination for Mongolia's exports. In 2014, exports to China accounted for 87.8% of Mongolia's total exports, followed by the United Kingdom (6.9%), and Russia (1.1%), while the share to other countries accounted for 4.2% of the total. Thus, the Mongolian export market is not yet diversified (Table 1).

Mongolian exports are composed of a few items. Namely, minerals and agricultural origin raw materials, fluorspar concentrates, gold, coal, crude oil, natural stones, textiles, and wool, cashmere, hide skins and meat. In 2014, the key export commodities of Mongolia were copper concentrate (44.6%), coal (14.7%), crude oil (11.0%), iron ore and concentrates (7.7%), gold

(7.0%), and cashmere (4.1%). The share of all other items accounted for 10.9% of the total (Table 2).

Table 1: Mongolia's Major Export Destinations in 2014

No.	Country	Export Volume (US$1,000)	Share of Total Exports, %
1	China	5,070,107.4	87.8
2	United Kingdom	398,740.2	6.9
3	Russia	61,607.3	1.1
4	Others	243,876.0	4.2
	Total	5,774,330.9	100.0

Source: Mongolian Customs Department, 2015

Table 2: Mongolia's Key Export Commodities in 2014

No.	Export Goods	Share of Total Exports, %
1	Copper concentrates	44.6
2	Coal	14.7
3	Crude oil	11.0
4	Iron ore and concentrates	7.7
5	Gold	7.0
6	Cashmere	4.1
7	Zinc ore and concentrates	2.0
8	Leucite and fluorspar	1.2
9	Other	7.7
	Total	100.0

Source: Mongolian Customs Department, 2015

Mongolian import sources are more diversified than are its exports. In 2014, 33.0% and 29.6% of total imports were from China and Russia, respectively, while imports from Japan, the ROK, the United States and Germany accounted for 7.0%, 6.7%, 4.4% and 3.0%, respectively. The remaining 16.2% of the total was accounted for by other countries (Table 3).

Table 3: Key Import Source Countries for Mongolia in 2014

No.	Country	Imports (US$1,000)	Share of Total, %
1	China	1,729,610.5	33.0
2	Russia	1,549,318.3	29.6
3	Japan	367,789.5	7.0
4	ROK	352,556.8	6.7
5	USA	229,478.2	4.4
6	Germany	159,158.9	3.0
7	Other	848,755.3	16.2
	Total	5,236,667.4	100.0

Source: Mongolian Customs Department, 2015

In general, the key import products of Mongolia are fuel, vehicles, textiles, heavy machinery, equipment and electrical appliances. In 2014, the major import items were petroleum products (22.0%), vehicles (5.5%), electricity (2.5%), machinery (2.2%), trucks (2.1%), cement (1.7%), electrical appliances (1.6%) and pharmaceuticals (1.3%). The import of all other items accounted for 61.1% of the total. Russia's share in Mongolian imports is almost the same as China's, due to its petroleum exports to Mongolia. Mongolia is almost entirely dependent on petroleum imports from Russia. Japan and the ROK mainly export to Mongolia vehicles, machinery, trucks for mining, electrical appliances, and electronics, while the United States exports mainly consumer goods to Mongolia. Germany is also one of the key sources of Mongolia's imports of vehicles, electrical machinery, appliances, medical equipment, consumer goods and some food items (Table 4).

Table 4: Key Import Items for Mongolia in 2014

No.	Import Goods	Import Share, %
1	Petroleum products	22.0
2	Motor cars / vehicles	5.5
3	Electricity	2.5
4	Machinery	2.2
5	Trucks	2.1
6	Cement	1.7
7	Electrical apparatus	1.6
8	Pharmaceuticals	1.3
9	Other	61.1
	Total	100.0

Source: Mongolian Customs Department, 2015

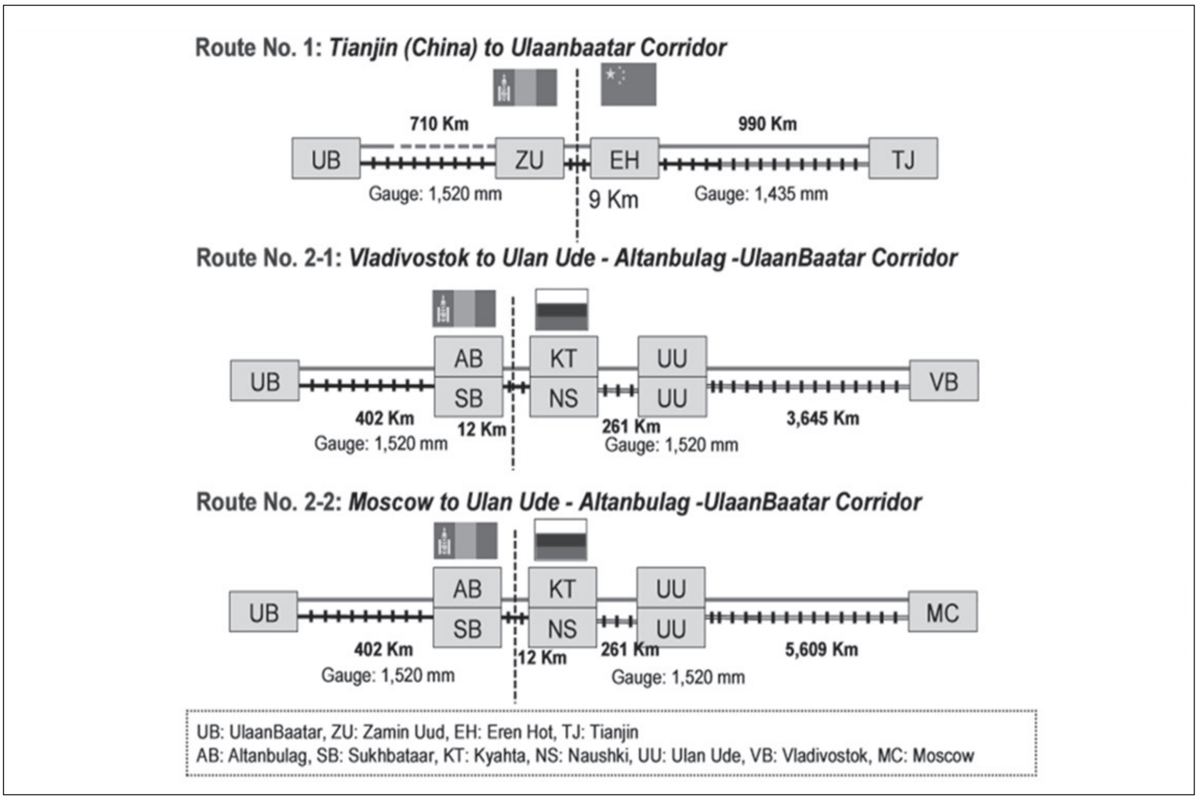
3. Mongolia's Transport Options for International Trade

As a landlocked country, Mongolia has bottlenecks, and the problems of high transport costs, complicated border-crossing procedures, long distances and remoteness from global markets hinder Mongolia from promoting foreign trade, and diversifying export goods and its trading partners. Mongolia is located in the intermediate area between Northeast Asia and Central Asia and surrounded by China and Russia.

Mongolia's main border-crossing points are Zamyn Uud on the border with China (Figure 2: Route No. 1) and Sukhbaatar on the border with Russia (Figure 2: Route Nos. 2.1 and 2.2). The railway borders can be divided into two types according to the transshipment method. Transshipment on the border with Russia is not needed since the two countries have the same railway gauge. However, at the railway border crossing with China transshipment is necessary due to the different railway gauges. Mongolia mainly accesses the sea through Tianjin port in China and uses Vostochny port in Russia infrequently due to its long transportation distance (Figure 2).

The government of Mongolia is trying to diversify gateway ports in order to lower transport costs and secure safe access to the sea. New gateway ports would be those with handling facilities for containers, coal and other minerals, such as iron ore.

Figure 2: Transport Routes of Mongolian Merchandize Trade

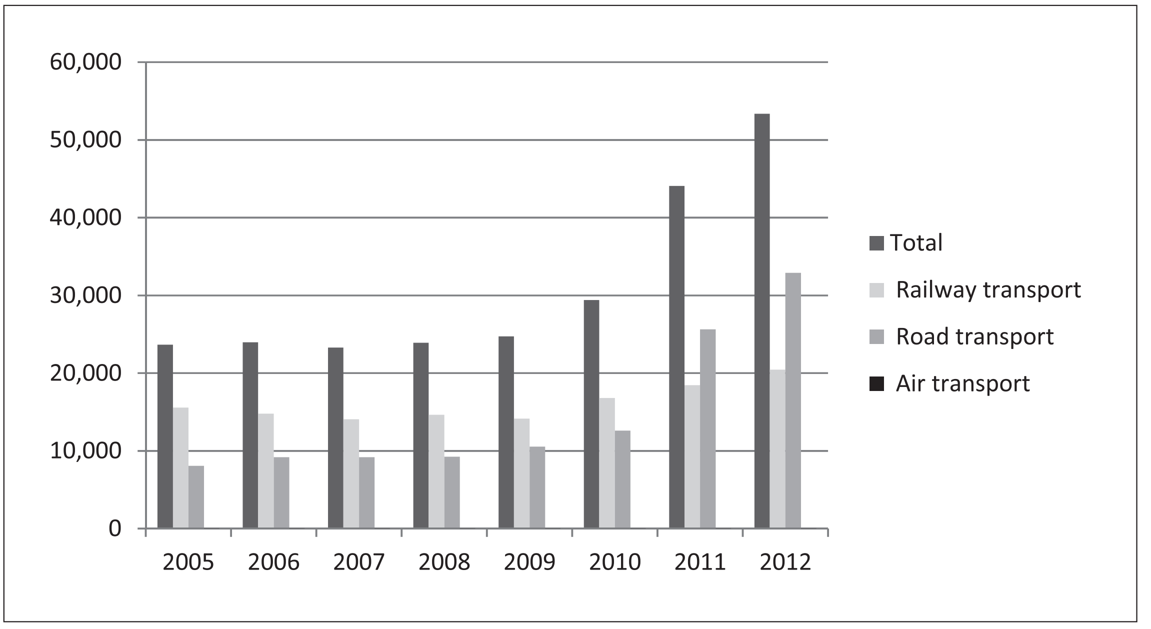


Source: Ministry of Road and Transport Development, 2015

The ports of Dandong, Dalian, Qinhuangdao, Tangshan, Tianjin, and Huanghua in China can be considered as new gateways in Northeast Asia for Mongolian export goods. Meanwhile, Nakhodka, Vladivostok, and Vostochny in Russia could serve as gateway ports to the Pacific region. The main container yards of railway stations in Mongolia are located in Ulaanbaatar and Zamyn Uud. The gateway port for handling Mongolian containers is Tianjin port in China. The logistics pathway of containers for imported goods is comprised of: Tianjin port, railway transport to Erenhot (Erlian) in China, border-crossing into Mongolia, the customs clearance process and transshipment at Zamyn Uud, arrangement of locomotives and wagons by the Mongolian Railway company at Zamyn Uud, and railway transport to Ulaanbaatar in Mongolia. The logistics pathway of export containers is in the opposite direction.

Overall transportation in Mongolia has been increasing during the past ten years and the share of rail transport is more than 60% of the total. This implies that rail transport plays a key role in the transportation of Mongolian export and import goods. Road transport has significantly increased since 2011 due to the increased export of Mongolian coal to China by trucks through a minor port of entry on the Mongolia–China border, Gashuun Sukhait. The role of air transport is minimal for transporting trade goods, except for a minimum amount of cargo (Figure 3).

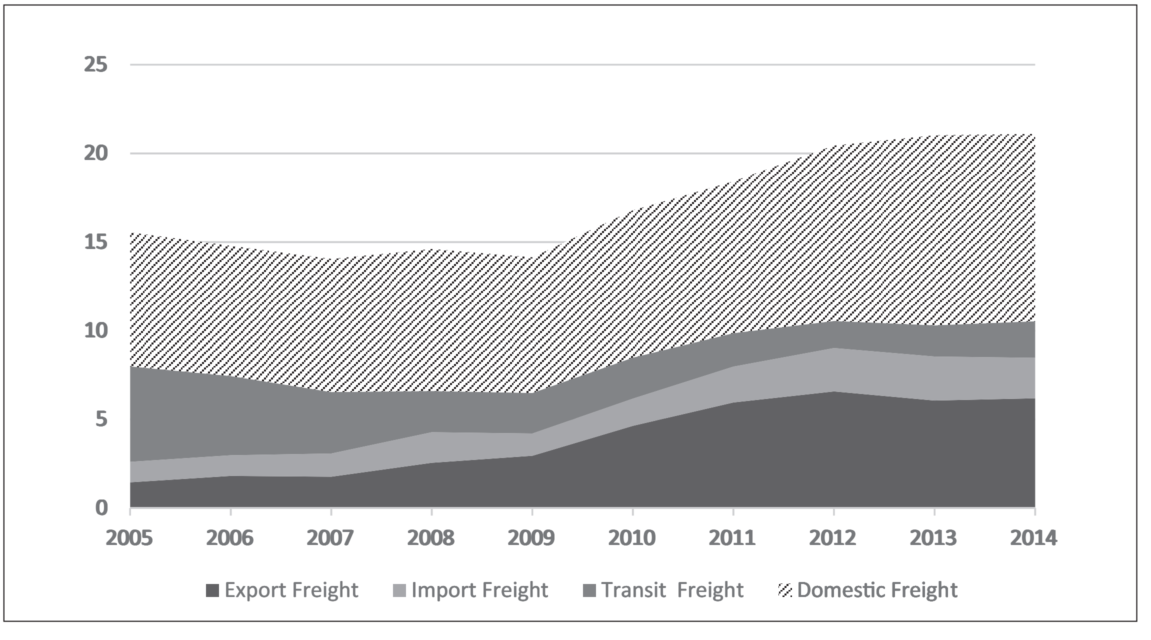
Figure 3: Mongolia's Carried Freight (million tonnes)



Source: Mongolian Customs Department, 2015

In 2014, the transit freight volume by railway dropped to almost a quarter of its 2005 level, while export and import freight was relatively stable. The assumption can be made that Mongolia's transit capacity is worsening due to its logistics and infrastructure conditions and its connecting capacity (Figure 4).

Figure 4: Mongolian Rail Freight Breakdown (million tonnes)



Source: Ulaanbaatar Railway (UBTZ), 2015

4. Data Collection

In this analysis, the authors collected extensive data from various sources to create panel data for estimating the transport and trade costs for Mongolian trade flows. Ten-year time series bilateral trade data for the period 2005–2014 between Mongolia and each of China, Russia, Japan, the ROK, Canada, the United States, the United Kingdom, Germany, India, and Singapore were taken from the Mongolian Customs Department and were used as base panel data for the analysis using a gravity model.

GDP, per capita GDP and population time series data for the ten-year period (2005–2014) were obtained from the World Bank. The other indicators on rail and container shipping were taken from different sources. For example, the International Supply Chain Connectivity indices for the partner countries were taken from the ESCAP (ISCC) Database, trading across border (TAB) indicators are from the World Bank's Doing Business Reports, and the Liner Shipping Connectivity Index (LSCI) is from UNCTAD.

Data relating to freight from Ulaanbaatar to Tianjin was obtained from Ulaanbaatar Railway (Table 3) and average tariff information was taken from the WTO website (Tables 5–11).

Table 5: Mongolia's Exports to Its Top-10 Trading Partners, US$ million

	China	Russia	USA	Britain	Singapore	India	Japan	Germany	ROK	Canada
2005	512.4	27.3	152.5	87.1		1.8	5.8	12.3	65.1	122
2006	1,046.5	45.1	119	38.6	2.3	3.7	7.1	9.2	21.4	171.2
2007	1,406.9	58.5	99.9	22.1	6.1	6.1	15.1	17.8	41.5	178.6
2008	1,633.8	86.3	114.2	165.8	0.4	2.1	27.6	11	29.9	174.6
2009	1,392.3	68.2	13.9	126.9	0.6	1.6	4.6	15.6	15.4	147.5
2010	2,454.4	82.7	6	67.4	2.5	11.9	2.7	22	30.5	141.6
2011	4,404.6	96.3	5	20	3.4	35.3	11	15	37.9	90.8
2012	4,028.5	79.6	3.6	11.9	4.3	31.2	5.6	15.9	12.3	117.3
2013	3,700.3	61.8	3.9	200.7	8.2	5.3	10.5	18.4	13	135.5
2014	5,070.1	61.6	15.4	398.7	14.2	3.1	24.5	15	13.5	1.2

Source: Mongolian Customs Department, 2015

Table 6: Mongolia's Imports from Its Top-10 Trading Partners, US$ million

	China	Russia	USA	Britain	Singapore	India	Japan	Germany	ROK	Canada
2005	291	417.9	37	29.3	16.3	40.5	75.5	37.6	63.7	17.3
2006	353.8	547.8	43.6	16.8	20.7	49.8	97.6	43	82.5	9.9
2007	664.7	745	58.6	24	29.3	30.2	140.2	76.5	119.6	10.6
2008	888.0	1,242.3	84.1	33.7	45.6	25.6	238.5	92.6	194.8	10.8
2009	531.7	772.8	103.7	59.4	27.7	16.8	97.1	70.3	155.1	
2010	956.4	1,046.7	158.9	52.8	51	8.3	196.5	87.2	181.8	22.3
2011	1,978.2	1,624.7	536.0	100.2	69.5	16.9	490.2	273.6	356.7	128.3
2012	1,842.5	1,847.4	535.9	63.6	69.2	20.5	501.6	246.4	467.8	97.2
2013	1,785.8	1,561.9	512.7	62.5	66.6	34.2	444.2	252.2	507.4	80.4
2014	1,729.6	1,549.3	229.5	53.6	52.8	29.4	367.8	159.2	352.6	21.5

Source: Mongolian Customs Department, 2015

Table 7: Selected Indicators for Container Shipment from Ulaanbaatar to Tianjin Port by Rail

Dist_inland[1]	Cont_cost_inland[2]	Time_inland[3]	Time_port[4]
km	$ per 20 ft. container	hours	hours
1,700	2,250	312	120

Notes: 1. UB–Tianjin port railway distance
2. Rail freight rate from UB to Tianjin
3. Transport time from UB to Tianjin
4. Delay in Tianjin port
Source: Ulaanbaatar Railway (UBTZ), 2015

Table 8: Shipment of 20-Ft Containers from Tianjin, China, to Seaports of Top-10 Trading Partners of Mongolia

Country	Seaport	dist_sea[1]	time_sea[2]	container_ cost[3]	Border[4]	trade_ across_ border[5]	Infra_ density[6]	Tariff[7]	supp_con[8]
		5	6	7	8	9	10	11	12
		Km	Hours	$ per 20-ft cont.		Unit	Unit	%	Unit
Canada	Vancouver	9,662.01	732	2,600	0	86.07	6.89	4.2	51.14
China	Tianjin				1	71.68	1.16	9.9	77.59
Germany	Hamburg	20,971.77	796	850	0	87.67	4.18	5.5	66.01
India	Calcutta	8,160.07	314	550	0	65.47	0.11	13.5	32.84
Japan	Tokyo	2,399.97	92	600	0	87.23	3.88	4.9	54.26
ROK	Busan	1,254.31	48	50	0	95.45	0.87	13.3	79.70
Russia	Vostochny	2,179.31	84	810	1	53.58	3.06	9.7	25.88
Singapore	Singapore	5,130.33	197	50	0	96.47	0.35	0.2	94.63
UK	Belfast	20,400.39	738	500	0	88.25	3.34	5.5	65.14
USA	Los Angeles	10,993.52	784	100	0	88.32	7.31	3.4	71.03

Notes: 1. Distance to destination country by sea
2. Shipping time from Tianjin to other seaports
3. Container costs
4. Border dummy for Mongolia
5. Ocean freight rate from Tianjin to the destination port
6. Infrastructure density
7. Customs tariffs imposed by trading partner
8. Supply chain connectivity
Sources: World Bank (2015) and CEPII (2015)

Table 9: GDP of Mongolia and Top-10 Trading Partners (2005–2014), current US$ billion

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Canada	1,164.1	1,310.8	1,457.9	1,542.6	1,370.8	1,614.0	1,788.8	1,832.7	1,839.0	1,786.7
China	2,268.6	2,729.8	3,523.1	4,558.4	5,059.4	6,039.7	7,492.4	8,461.6	9,490.6	10,360.1
Germany	2,857.6	2,998.6	3,435.7	3,746.9	3,413.0	3,412.2	3,751.9	3,533.2	3,730.3	3,852.6
UK	2,412.1	2,582.8	2,963.1	2,791.7	2,309.0	2,407.9	2,592.0	2,614.9	2,678.2	2,941.9
India	834.2	949.1	1,238.7	1,224.1	1,365.4	1,708.5	1,835.8	1,831.8	1,861.8	2,066.9
Japan	4,571.9	4,356.8	4,356.3	4,849.2	5,035.1	5,495.4	5,905.6	5,954.5	4,919.6	4,601.5
ROK	898.1	1,011.8	1,122.7	1,002.2	901.9	1,094.5	1,202.5	1,222.8	1,305.6	1,410.4
Mongolia	2.5	3.4	4.2	5.6	4.6	7.2	10.4	12.3	12.5	12.0
Russia	764.0	989.9	1,299.7	1,660.8	1,222.6	1,524.9	1,904.8	2,016.1	2,079.0	1,860.6
Singapore	127.4	147.8	180.0	192.2	192.4	236.4	275.4	289.9	302.2	307.9
United States	13,093.7	13,855.9	14,477.6	14,718.6	14,418.7	14,964.4	15,517.9	16,163.2	16,768.1	17,419.0

Source: World Bank, 2015

Table 10: GDP per Capita of Mongolia and Top-10 Trading Partners (2005–2014), US$

Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Canada	36,028	40,244	44,328	46,400	40,764	47,464	52,087	52,733	52,305	50,271
China	1,740	2,082	2,673	3,441	3,800	4,515	5,574	6,265	6,992	7,594
Germany	34,651	36,401	41,763	45,633	41,671	41,726	45,868	43,932	46,255	47,627
UK	39,935	42,447	48,320	45,168	37,077	38,362	40,975	41,051	41,777	45,603
India	740	830	1,069	1,042	1,147	1,417	1,503	1,481	1,487	1,631
Japan	35,781	34,076	34,034	37,866	39,323	42,909	46,204	46,679	38,634	36,194
ROK	18,658	20,917	23,102	20,475	18,339	22,151	24,156	24,454	25,998	27,970
Mongolia	999	1,334	1,632	2,136	1,715	2,650	3,780	4,396	4,419	4,170
Russia	5,323	6,920	9,101	11,635	8,563	10,675	13,324	14,079	14,487	12,736
Singapore	29,870	33,579	39,224	39,722	38,577	46,570	53,122	54,578	55,980	56,287
United States	44,308	46,437	48,062	48,401	47,002	48,374	49,781	51,457	52,980	54,629

Source: World Bank, 2015

Table 11: Population of Top-10 Trading Partner Countries of Mongolia (2005–2014), millions

Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Canada	32.3	32.6	32.9	33.2	33.6	34.0	34.3	34.8	35.2	35.5
China	1,303.7	1,311.0	1,317.9	1,324.7	1,331.3	1,337.7	1,344.1	1,350.7	1,357.4	1,364.3
Germany	82.5	82.4	82.3	82.1	81.9	81.8	81.8	80.4	80.6	80.9
United Kingdom	60.4	60.8	61.3	61.8	62.3	62.8	63.3	63.7	64.1	64.5
India	1,127.1	1,143.3	1,159.1	1,174.7	1,190.1	1,205.6	1,221.2	1,236.7	1,252.1	1,267.4
Japan	127.8	127.9	128.0	128.1	128.0	128.1	127.8	127.6	127.3	127.1
ROK	48.1	48.3	48.6	48.9	49.2	49.4	49.8	50.0	50.2	50.4
Mongolia	2.5	2.6	2.6	2.6	2.7	2.7	2.8	2.8	2.8	2.9
Russian Federation	143.6	143.1	142.8	142.7	142.8	142.9	143.0	143.2	143.5	143.8
Singapore	4.3	4.4	4.6	4.8	5.0	5.1	5.2	5.3	5.4	5.5
United States	295.5	298.4	301.2	304.1	306.8	309.3	311.7	314.1	316.5	318.9

Source: World Bank, 2015

5. Gravity Model: Analyzing the Trade Costs of Mongolia

The gravity estimation was conducted by two methods to identify the impacts on Mongolia of its trade with trading partners: i) regression analysis on factors affecting the transport costs of Mongolia; and ii) gravity model analysis on factors affecting Mongolia's trade flows. In this particular case, Mongolia's export route via the Port of Tianjin, China, is considered (Figure 2, Route No.1). Therefore, the distance-related data in this analysis refers to distances between Ulaanbaatar (UB) and partner countries via Tianjin port, China.

i) Regression analysis on factors affecting the transport costs of Mongolia

Transport costs in foreign trade will be decided by the characteristics of each intermodal transport network (Gallup et al, 1999). The ratio of CIF and FOB provides the measure of transport costs for trade between Mongolia and its trading partners, and is used to measure the costs of imports and all charges incurred in placing goods on board a carrier in the exporting port (Limão and Venables, 2001). The other factors for the estimations, all affecting the transport costs for Mongolia, are: the distance of sea transport, the distance of inland transport, the infrastructure density of the partner countries, a border dummy, the container costs, the supply chain connectivity, and the time for shipment.

Hence, the regression function for Mongolian transport costs is expressed as follows:

$$CFR=f\ (DISS, DISL, TIME, INFRA_{density}, Supp_{con\ index}, Con_{cost}, Border)$$

where:

CFR	= transport costs (CIF/FOB)
DISL	= transport distance from UB to Tianjin port
DISS	= shipping distance from Tianjin to port near to main city of trading partner
TIME	= time of transportation from UB to port in trading partner
INFRA_density	= density of infrastructure of trading partner country
Supp_con_index	= International Supply Chain Connectivity index of each country
Con_cost	= container cost of each trading partner country
Border	= dummy variable for border-sharing with Mongolia

This analysis assumes that transport costs for Mongolia can be measured by a log linear function (Limão and Venables, 2001) and the logarithmic function is as below:

$$\mathbf{ln\ CFR_t = \alpha_0 + \alpha_1\ lnDIST + \alpha_2\ ln\ TIME + \alpha_3\ lnCon_{cost} + \alpha_4\ ln\ Indra_{density} + \alpha_5\ ln\ Supp_{conn} + \alpha_6\ Bodrer + e_{ijt}}$$

where:

α1	= distance elasticity coefficient
α2	= time elasticity coefficient
α3	= container cost elasticity coefficient
α4	= infrastructure density elasticity coefficient
α5	= International Supply Chain Connectivity elasticity coefficient
α6	= border dummy

An estimation of the above model is used to analyze the transport costs for Mongolia in its trade with its top-10 trading partners: China, Russia, Japan, the ROK, the United States, Canada, Britain, Germany, India, and Singapore. The estimation is run using Stata 10 by inputting the time series data of these countries for the period 2005–2014.

The model estimation gave statistically significant results as below:

$$\mathbf{ln_{CFR} = 9.7 + 0.13 * ln\ \mathit{DIST} + 0.23 * ln\ \mathit{Time_{imp}} - 0.38 * ln\ \mathit{Con_{cost}} + 0.2 * ln\ \mathit{Infra_{density}} - 2.4 * ln\ \mathit{Supp_{conn}} = 1.6 * \mathit{Bodrder} + \mathit{e}}$$

These results can be explained as follows:

- A one percentage point increase in distance between Mongolia and a trading partner will increase the transport costs for Mongolian international trade by 0.13%;

- The container costs had a negative coefficient for Mongolian transport costs. This means that a one percentage point increase in container costs will reduce transport costs by 0.38%. This was a slightly different result to that assumed by the authors, but will be re-estimated in the next section;
- The border-crossing time is positive for the transport costs of Mongolia. That is, a one percentage point increase in border-crossing time will increase transport costs by 0.23%. This result demonstrates that a reduction of time in border-crossing will significantly facilitate Mongolian trade;
- The International Supply Chain Connectivity index is negative for Mongolian transport costs. That is, a one percentage point improvement in the connectivity index will reduce Mongolian transport costs by 2.4%;
- If partner countries share a common border with Mongolia, then transport costs are 1.6% lower (Table 12).

Table 12: Mongolian Transport Costs Regression Results

```
. reg ln_cfr ln_dist ln_time_imp ln_con_cost_imp ln_infra_density ln_supp_conn_index border

Linear regression                                      Number of obs =      90
                                                       F(  5,    83) =       .
                                                       Prob > F      =       .
                                                       R-squared     =  0.9227
                                                       Root MSE      =  .14648
```

ln_cfr	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
ln_dist	.1328631	.0744202	1.79	0.078	-.0151557	.2808819
ln_time_imp	.2337339	.0598002	3.91	0.000	.1147938	.352674
ln_con_cos~p	-.3826563	.0203673	-18.79	0.000	-.4231659	-.3421466
ln_infra_d~y	.2071822	.0188965	10.96	0.000	.1695978	.2447665
ln_supp_co~x	-2.395573	.0899083	-26.64	0.000	-2.574396	-2.216749
border	-1.570615	.1015618	-15.46	0.000	-1.772617	-1.368612
_cons	9.729292	.3820156	25.47	0.000	8.969478	10.48911

ii) Gravity model analysis of factors affecting the trade volume of Mongolia

Over the years, the gravity model has played an important role in estimating trade patterns. The model has been a success from the empirical point of view. The gravity model was first analyzed by Tinbergen (1962) and Pöyhönen (1963) for estimating bilateral trade flows between EEC countries. Studies such as Anderson (1979), Bergstarnd (1985), Sanso et al (1993), Matyas (1997, 1998) and Anderson and Van Wincoop (2003) have improved upon its theoretical foundations, and these models have been applied in several empirical studies. Thus the goal of our gravity estimation was to investigate and determine the key factors that affect Mongolian trade with its partner countries and that increase transport and trade costs for Mongolia.

As illustrated in Figure 5, there is a positive correlation between Mongolian exports and GDP, while Mongolian exports and distance are adversely correlated. Similarly as in the previous method, the estimation was made using the Stata 10 program to investigate the correlations between Mongolian trade volume and the GDP of trading partners, the time of transport, the infrastructure density, and the supply chain connectivity index.

Figure 5: Correlation between Mongolian Exports and GDP and Distance

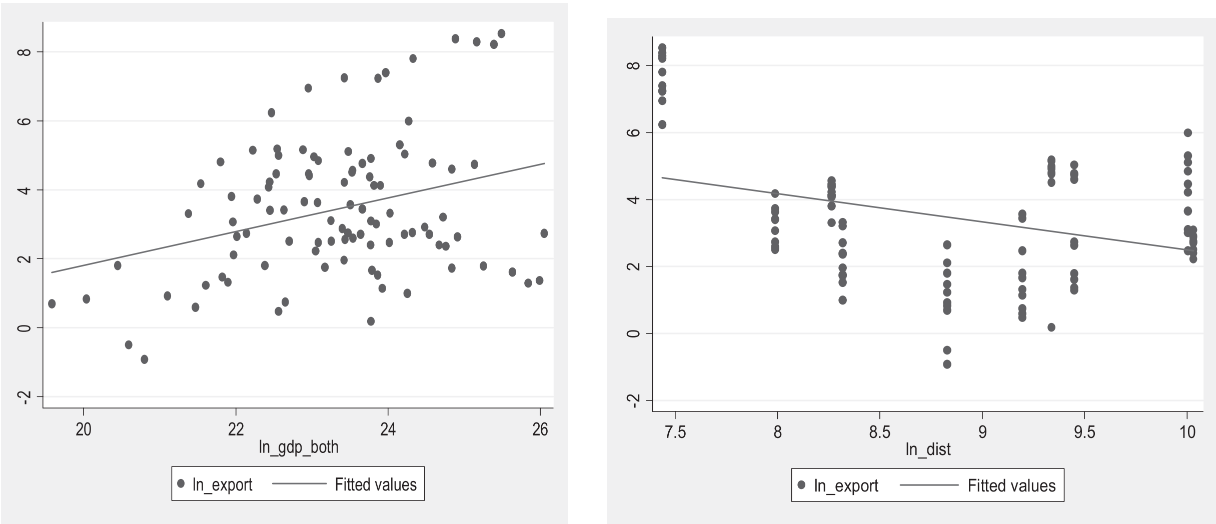


Table 13: The Correlations among Trade Cost-Related Factors

. correlate trade dist_tj_exp gdp_exp gdp_imp time_both infra_density supp_conn_index
(obs=100)

	trade	dist_t~p	gdp_exp	gdp_imp	time_b~h	infra_~y	supp_c~x
trade	1.0000						
dist_tj_exp	-0.3883	1.0000					
gdp_exp	0.2406	0.0000	1.0000				
gdp_imp	0.2296	0.0962	0.1306	1.0000			
time_both	-0.3948	0.8908	-0.0000	0.3252	1.0000		
infra_dens~y	-0.1897	0.3988	0.0000	0.5655	0.7019	1.0000	
supp_conn_~x	0.0783	0.0075	0.0000	0.1519	-0.0053	-0.1527	1.0000

As illustrated in Table 9, the distance to trading partners, transport time, and infrastructure density are negatively correlated with Mongolian trade flows, while the GDP of trading partners has a positive relationship.

First, the standard gravity model was used to investigate whether the income and distance factors affect Mongolia's trade flows with its top-10 trading partner countries. The logarithmic function is set as below:

$$\ln(Trade_{ij}) = \beta_0 + \beta_1 \ln(GDP_i) + \beta_2 \ln(GDP_j) + \beta_3 \ln(Dist_{ij}) + e_{ijt}$$

where:

b1, b2 = income sensitivity

b3 = distance sensitivity

Table 14: The Standard Gravity Model

```
. reg ln_trade ln_gdp_exp ln_gdp_imp ln_dist, robust

Linear regression                                      Number of obs =     100
                                                       F(  3,    96) =   83.17
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.6264
                                                       Root MSE      =  .86777

------------------------------------------------------------------------------
             |               Robust
    ln_trade |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  ln_gdp_exp |   .5580608   .1734615     3.22   0.002     .2137425    .9023791
  ln_gdp_imp |   .5796464   .0532675    10.88   0.000     .4739112    .6853817
     ln_dist |  -1.052848   .0931994   -11.30   0.000    -1.237847   -.8678488
       _cons |   1.365285   1.780645     0.77   0.445    -2.169267    4.899837
------------------------------------------------------------------------------
```

Model Results:

$$\mathbf{ln\ Trade = 1.3 + 0.56\ ln\ gDP_{exp} + 0.58\ ln\ GDP_{imp} - 1.05\ ln\ Dist_{exp,imp}}$$

Std. error	1.8	0.17	0.05	-11.3	
t-stat	0.77	3.2	10.9	0.09	
					R^2 **= 0.87**

The standard gravity model estimation is run using the Stata 10 program. It has revealed significantly good results and they can be explained as follows:

- Mongolian GDP is positively related to Mongolian trade flows. That is, a one percentage point increase in Mongolian GDP will increase Mongolian trade flows by 0.56%;
- The partner country's GDP also has a positive relationship with Mongolian trade flows. That is, a one percentage point increase of the partner country's GDP will increase Mongolian trade flows by 0.58%;
- However, the distance between Mongolia and the partner country is negatively related to Mongolian trade flows. That is, a one percentage point increase in the distance between Mongolia and the partner country may result in reducing Mongolian trade flows by 1.05%.

After estimating the standard gravity model, the authors extended the model to enable investigation of factors affecting Mongolian trade flows (*Gravity with Gravitas*, Anderson and Van Wincoop, 2003).

Broadly defined, trade costs include all the costs incurred in getting a good to another place above the marginal cost of producing the good itself. That is, they include transportation costs (both freight costs and time costs), policy barriers (tariffs and non-tariff barriers), information costs, contract enforcement costs, costs associated with the use of different currencies, legal and regulatory costs, and local distribution costs (wholesale and retail) (Anderson and Van Wincoop, 2004).

As Mongolia is a landlocked country, the authors assume that trade costs are key elements for Mongolia. For this particular estimation, the authors selected the following variables to determine their effects. These are: Mongolian GDP (GDP_exp), partner countries' GDP (GDP_imp), distance (dist), customs applied tariff (Tariff), container costs (con_cost_both), border-crossing time (time_imp), infrastructure density of partner countries (infra_density), the international supply chain connectivity index (supp_con_index), and a dummy for borders (border), which is either 0 or 1 depending on the geographical location.

Hence, the logarithmic function of the gravity model with gravitas is set as illustrated in Table 15. After estimating the model using the Stata 10 program, the model resulted in:

$$\begin{aligned}\textbf{ln Trade} = {} & \mathbf{22.1 + 0.4\ ln\ GDP_{exp} - 0.62\ ln\ GDP_{imp} + 0.39\ ln\ GDP_{pc}} \\ & \mathbf{+ 0.78\ ln\ Dist_{exp\ imp} + 0.42\ ln\ Tariff_{both} - 2.9\ ln\ Con_{cost\ both}} \\ & \mathbf{- 0.89\ ln\ Time_{imp} + 0.48\ ln\ Infra_{density} - 0.02\ ln\ Supp_{conn}} \\ & \mathbf{+ 0.98\ Border}\end{aligned}$$

Table 15: "Gravity with Gravitas" for Mongolian Trade Flows

```
. reg ln_trade ln_gdp_exp ln_gdp_imp ln_gdp_pc ln_dist ln_con_cost_both ln_tariff_imp
> ln_time_imp infra_density supp_conn_index border

Linear regression                                      Number of obs =      90
                                                       F( 10,    79) =  143.82
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.8520
                                                       Root MSE      =  .45488
```

ln_trade	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
ln_gdp_exp	.4051807	.4176251	0.97	0.335	-.4260812	1.236443
ln_gdp_imp	-.6204362	.3589947	-1.73	0.088	-1.334997	.0941249
ln_gdp_pc	.3913795	.2959481	1.32	0.190	-.1976905	.9804495
ln_dist	.7839282	.8228978	0.95	0.344	-.8540089	2.421865
ln_con_cos~h	-2.982313	1.473447	-2.02	0.046	-5.915137	-.0494898
ln_tariff_~p	.42189	.1096199	3.85	0.000	.203697	.640083
ln_time_imp	-.8976493	.6798487	-1.32	0.191	-2.250854	.4555556
infra_dens~y	.4848897	.2209227	2.19	0.031	.045154	.9246254
supp_conn_~x	-.0227569	.0192159	-1.18	0.240	-.0610052	.0154913
border	.9777373	.6214898	1.57	0.120	-.2593072	2.214782
_cons	22.14604	12.88036	1.72	0.089	-3.491679	47.78375

These results can be explained as follows:

- Mongolian GDP is a positive factor for Mongolian trade flows. That is, a one percentage point increase in Mongolian GDP will increase Mongolian trade flows by 0.4%;
- The partner country's GDP is a negative factor for Mongolian trade flows. That is, a one percentage point increase in the partner country's GDP will reduce Mongolian trade flows by 0.62%;

- A one percentage point increase in distance between Mongolia and a partner will increase trade flows by 0.78%. This result differs from the authors' assumption, and perhaps the data quality needs to be improved;
- Tariff reduction is a positive factor. That is, a one percentage point reduction in the average tariff rate by the partner country will increase Mongolian trade turnover by 0.42%;
- Container costs are a negative factor for Mongolian trade flows. That is, a one percentage point increase in container costs by the partner country will reduce Mongolian trade flows by 2.9%. Therefore, container costs are the key factor affecting the trade flows of Mongolia and increasing trade costs;
- Border-crossing time is a negative factor for Mongolian trade flows. That is, a one percentage point reduction in border-crossing time will increase Mongolian trade flows by 0.89%;
- The infrastructure density of partner countries is a positive factor for Mongolian trade flows. That is, a one percentage point improvement in the infrastructure density of partner countries will increase Mongolian trade flows by 0.48%;
- Borders are a positive factor for Mongolian trade flows, meaning that Mongolian trade flows will increase if the partner country shares a common border with Mongolia.

6. Conclusions and Recommendations

Remoteness and isolation from world markets are the major challenge for Mongolia. There are more than 1,700 km to the nearest seaport in China and 4,100 km to the nearest one in the Russian Far East. Despite that, Mongolia is making numerous efforts toward facilitating trade, reducing trade costs and improving railway infrastructure. The results of the gravity model analysis revealed that Mongolia's trade is still facing high trade costs.

Although Mongolia's export volumes have increased significantly during the period 2005–2014, it is worth mentioning that China alone took advantage of importing Mongolian minerals and raw materials and became the major export destination for Mongolia. In 2014, China's share in Mongolia's total exports reached 87.8%, while the shares of Mongolia's exports to other trading partners (seaborne markets) stayed at almost the same level as 1995. This indicates that Mongolia's export route access to seaborne markets via Tianjin port has not yet been sufficiently facilitated, and both sides need to intensify talks on facilitating transit transportation for Mongolian export goods via Chinese territory.

The results of the regression analysis on Mongolian transport costs (Ulaanbaatar–Tianjin port–trading partner seaport) indicated that factors such as distance between Mongolia and the partner country, border-crossing time, and the supply chain connectivity are the factors that most affect cost increases in the rail transportation of Mongolian goods to Tianjin port in China.

In addition, the gravity model trade cost analysis of the impacts on Mongolian trade flows confirmed that factors such as tariffs, the infrastructure density of the partner country, container costs, supply chain connectivity, and border-crossing time are the main factors that affect Mongolia's trade flows and potentially increase the trade costs of Mongolian merchandize exports and imports.

As the results indicated, it is obvious that Mongolian trade faces high trade costs in its trade with trading partners. In both estimations, trade facilitation-related factors, such as border-crossing time and supply chain connectivity, were the key factors increasing transport and trade costs for Mongolian trade.

Consequently, Mongolia could benefit considerably in terms of trade volumes and trade costs from continued efforts in the areas of simplification and harmonization of documents at customs and border-crossing agencies, and the integration of regional and world supply chains.

Furthermore, it is necessary to carefully address these trade cost-related factors within the framework of the trade facilitation policy of Mongolia and develop capacity building activities for customs and border service agencies along with awareness-building activities in the private sector. Moreover, further detailed studies on the impacts of trade facilitation for Mongolia need to be conducted.

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[1] https://www.wto.org/english/tratop_e/tpr_e/tp245_crc_e.htm
[2] https://www.wto.org/english/tratop_e/tpr_e/tp397_e.htm

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