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Land-locked Country and Port Accessibility
- Mongolian Case -

Yong-an Park

ABSTRACT

Land-locked countries tend to have bottlenecks and problems of high transport costs, complicated cross border procedures, long distance and remoteness to the global market, and limited accessibility to the sea.

Mongolia as a land-locked country recorded comparatively low economic growth rate in the 1980s and 1990s but it could obtain a new momentum of economic growth from the late 2000s due to a continual price increase of mineral resources and other export goods. However, high transport costs and low accessibility to the sea prevent Mongolia from diversifying its trading partners and export goods. This paper examines elemental factors of transport costs between Mongolia and trading partner countries through regression of transport costs, particularly using the ratio of cost, insurance and freight (CIF) amounts to free on board (FOB) amounts and container transport costs. This also scrutinizes the deciding variables of trade volume between Mongolia and trading partner countries by using the gravity model.

In a transport cost analysis, transport costs of less than container load (LCL) cargo are affected directly by the distance of land transport and shipping transport, and common border sharing with Mongolia. The effects from the density of transport infrastructures in a transit country and a partner country which were thought to be decisive in the paper by Limao and Venables (2001) are not clear in the analysis. In the gravity model on trade volume between Mongolia and trading partners, decisive factors are Gross Domestic Product (GDP) of a trading partner, and distance from Mongolia to trading partners.

Key words: Land-locked country, transport costs, accessibility, port, gravity model, trade

Journal of Economic Literature classification: Q2, O1, R3

* Research Fellow, Korea Maritime Insitute, Seoul, Korea. E-mail: yapark@kmi.re.kr, Tel.: +82-2-2105-2789

1. Introduction

Land-locked countries have bottlenecks and problems of high transport costs, complicated cross border procedures, long distance and remoteness to the global market which hinder these countries from promoting foreign trade and diversifying traded goods and trading partners. Nearly all of the land-locked countries except Western and Central Europe are poor and face high transport costs with low port accessibility (Gallup *et al*., 1999). On the contrary, coastal regions and coastal countries with geographic advantages could enjoy high economic growth due to low transport costs of export and import goods. The coastal regions are widely exposed to the trend of globalization and containerisation, and can get advantage of low transport cost from the competition among regional ports.

Mongolia is located at the intermediate area between North-East Asia and Europe and surrounded with China and Russia. Since Mongolia should transport its mining resources and traded goods to third countries via transit routes in China and Russia, transport costs and trade volume of Mongolia seem to be affected by transport infrastructure of China and Russia due to its geographical landlockedness. After the adoption of free market system in 1991, Mongolia has tried to raise its economic potential through diversification of export goods and trading partners. Due to the low accessibility to the sea with a few gateways such as Tianjin in China and Vostochny in Russia, Mongolia is barred from diversifying her trading partners and prolonging spatial range of export goods.

Mongolia needs new types of international cooperation and partnership in order to diversify its traded goods and trading partners. It also could propel maritime conventions with other nations as a mid and long term cooperation strategy in order to improve port accessibility in China and Russia. Especially, it needs close discussion and knowledge sharing on logistics policy development with the North-East countries.

This paper aims to examine the effects of accessibility of land-locked countries to a port through analysing transport costs of foreign trade in Mongolia, using the gravity model for explaining trade amounts and contents with trading partners, and adopting the models of Limao and Venables (2001) and Celine and Christopher (2008).

The next section of this paper reviews the disadvantage and economic barriers in land-locked countries, addresses main features of Mongolian trade, logistics system and transport characteristics. The section three presents data collection on foreign trade statistics and transport costs of Mongolia trade, and addresses regressions on transport costs and trade volume. When analysing effects of transport characteristics on transport costs, this uses different types of transport costs: the ratio of cost, insurance and freight (CIF) to free on board (FOB) by the foreign trade statistics of the International Monetary Fund (IMF), which informs transport costs of trade including all types of cargoes; the transport costs of less than container load (LCL) cargo between Mongolia and trading partners, which measures per ton costs for general cargoes and container cargoes. This also adopts the

gravity model in order to estimate the effects on trade volume between Mongolia and trading partners from GDP of partner countries, distance from Mongolia to partner countries, and other variables. The section four concludes this paper.

This tries to investigate a significant implication of port accessibility and its role for land-locked countries. This can also give answer to basic questions about the function of a port in a region. The effects and changes of port accessibility improvement of a land-locked country may bring broad positive effects into the country.

2. Challenges of Mongolia as a land-locked country

2.1 Background

Transport is essential to link countries and regions in spatial distance, and various economic activities. The flow of goods in transport networks is promoted by economic factors such as GDP, population, employment, and facilities; it is hindered by impediments, i.e., distance, transshipment between various transport modes, and additional processing for border crossing (Hesse and Rodrigue, 2004; Ng and and Gujar, 2009). Hence transport costs are affected by the characteristics of transport activity from origin to destination. Even though transport development promotes supply and demand, and enlarges accessibility to markets and opportunities for employment and business, it puts burden of costs for transporting goods and passengers.

The land-locked countries such as Nepal, Mongolia, and Swiss do not have coastal areas where a port can be built. Since they are blocked by other countries from approaching the sea, the United Nations Convention on the Law of the Sea (UNCLOS, 1982) defines the right of access of land-locked countries to and from the sea and freedom of transit transport.

Nevertheless, many land-locked countries have a few foreign ports and transit corridors for them. Generally, land-locked countries have lower accessibility to the global market due to the blockade to the sea, which burdens additional transport costs and border crossing costs on them, and also limits the usage of marine resources (Sarup, 1972; Bowen, 1986; Gallup *et al*., 1999; Rodrigue and Notteboom, 2010). The non-existence of port facilities prevents them from moving traded cargoes through the maritime transport, the cheapest form of international transportation, and reaching various markets (Bowen, 1986). From the view of neoclassical theory, the landlockness is thought to raise the price of imports, reduce the price of exports net of transaction costs, and deteriorate the terms of trade of land-locked countries (MacKellar *et al*., 2000). In addition, irregularity of delivery time in transit transport may bar the potential customers from concluding long-term export contracts and foreign investors from establishing plants in land-locked countries (MacKellar

et al., 2000). A small and land-locked country has the characteristics of inability to exploit economies of scale in production, vulnerability to external economic fluctuation, low accessibility to the global market, and difficulties in obtaining private foreign capital (Srinivasan, 1986).

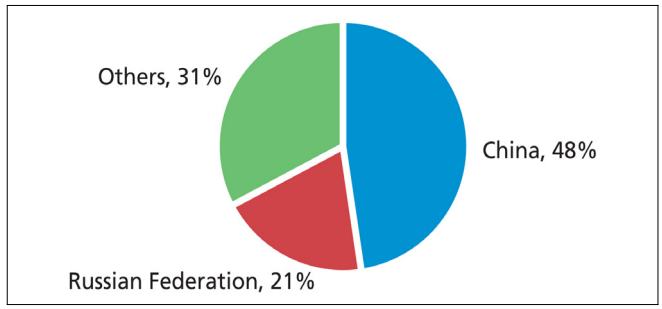
If a land-locked country is so remote from the sea, it would be hard to expect service quality competition by container ports in transit countries for enlarging their hinterlands (Rodrigue and Notteboom, 2010; Ferrari *et al*, 2011). Though a land-locked country with high density of population in a region may face high demand of agricultural products and low income level, a coastal country with population density can enjoy high income due to its reliance on foreign trade (Bloom *et al*., 2000).

However, remoteness and landlockedness may give an advantage of agglomeration to domestic firms, protecting them from the challenge of foreign firms through building an entry barrier due to higher transport costs (Behrens, 2006). The regional accessibility to the global market affects on the volume of trade and firm's location decision (Behrens, 2006). Improvements of the transport infrastructures in land-locked countries and transit countries will increase bilateral trades between land-locked country and trading partners (Limao and Venables, 2001; Celine and Christopher, 2008).

Differently from the existing papers, this paper tries to focus on examination of effects of transport characteristics − especially port accessibility − on transport costs and trade volume in Mongolia, which is a land-locked country in North-East Asia. This considers port accessibility of Mongolia as the inland distant from Mongolia to a main and exclusive gateway − the port of Tianjin-, adding the inland distance from a port in a trading partner country to the main city of the country. Even though the basic approach to the analysis of effects of landlockedness in this paper starts from the model by Limao and Venables (2001), this particularly focuses on the transport costs and volume of Mongolian foreign trade, while considering its excessive reliance of trading on China and Russia.

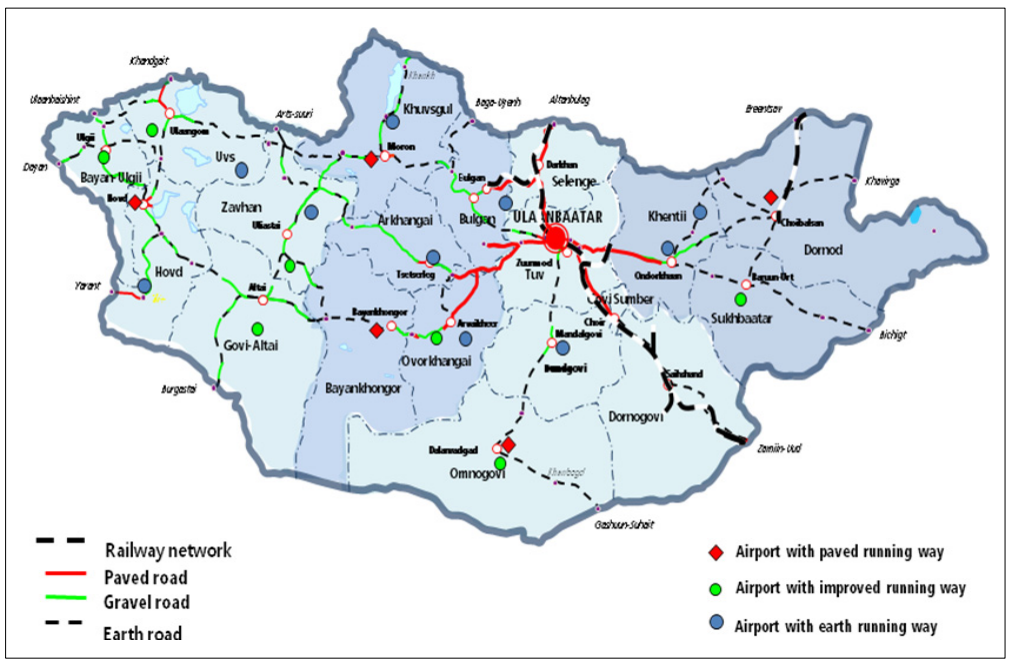
2.2 Main features of Mongolian trade

Total amount of Mongolian trade is about 4 billion US dollar in 2009, composed of 1.9 billion US dollar of export and 2.1 billion US dollar of import. Mongolia main trading partners are China and Russia, sharing about 70% of Mongolian total trade amounts (Customs General Administration of Mongolia, 2009). China shares 74% of Mongolian export; 25% of Mongolian import. Russia, which was the biggest trading partner of Mongolian in the 1990s, shares about 8% of Mongolian export; 36% of Mongolian import. Previously the shares of Russia for Mongolia export and import were respectively about 78% in 1990 (Kim and Yoon, 2010). After the adoption of market system in economy in 1991, Mongolia has tried to diversify its trading partners and to secure access to the sea through China and Russia (Jargalsaikhan, 2008).



Source: Customs General Administration of Mongolia (2009) International Merchandise Statistics.

Figure 1. Trading partner countries of Mongolian (2009)



Source: Ministry of Road, Transport, Construction and Urban Development of Mongolia, Road and Transport Sector (2010) Regional Cooperation in Road, Transport Sector.

Figure 2. Transport networks in Mongolia

The main export goods of Mongolia are mineral products including copper concentrate, coal, iron ore, and molybedenum concentrate, and main importing countries for Mongolian exports are China, Russia, U.K., USA, and Canada; the main import goods are petroleum products, gasoline, machinery and mechanical appliances, vehicles, aircrafts and parts of thereof, prepared foodstuffs, base metals and articles, products of the chemical or allied industries, vegetable products, and others from China, Russia, Korea, USA, Japan,

Germany, and other countries (Customs General Administration of Mongolia, 2009)

2.3 Logistics system and transport characteristics

Mongolia has key borders such as Zamyn Uud for China, Suhbaatar and Altanbulag for Russia, and minor borders i.e. Tseg and Gantsmaodao for coal export to China, and Chuluunhoroot for Russia. Zamyn Uud, Suhbaatar, and Chuluunhoroot have railway linkage with neighboring countries (Park, 2011). Railway borders can be divided into two types according to transshipment methods. It does not need to transship between the borders with Russia since two countries have the same size of railway tracks. However, the railway borders for Mongolia with China need transshipment due to the different sizes of railway racks.

Mongolia has access to the sea mainly through Tianjin port in China and seldom through Vostochny port in Russia. Mongolia government has tried to diversify gateway ports in order to lower transport costs and to secure the safety of access to the sea. New gateway ports would be those with handling facilities for containers, coal and others such as iron ore. Dandong, Dalian, Qinghuangdao, Tangshan, Tianjin, and Huanghua port in China can be considered as new gateways in North-East Asia for traded Mongolian goods. Meanwhile, Nakhodka, Vladivostok, and Vostochny of Russia, and Najin-Sunbong in North Korea could serve as gateway ports for the Pacific region.

The trunk line in Mongolia is composed of railway links. Through railways, shippers of Mongolia move container, coal, iron ore, copper concentrate, molybdenum concentrate, and other import and export goods (Park, 2011). In Mongolia, major railway stations are scattered along mining deposits: Erdenet station for copper, molybdenum, carpet, and other export goods; Baganuur station for domestically consumed coal; Eruu gol station at Selenge region for iron ore; Choyr station for coal from surrounding areas (Park, 2011).

The main container yards of railway station in Mongolia are located at Ulaanbaatar and Zamyn Uud. The gateway port for handling the containers of Mongolia is Tianjin port in China. The logistics paths of containers for imported goods entail Tianjin port, railway transport to Erenhot in China, border crossing to Mongolia, customs clearance process and transshipment at Zamyn Uud, allotment of locomotives and wagons by Mongolian railway company at Zamyn Uud, and railway transport to Ulaanbaatar in Mongolia; the logistics paths of export containers are vice versa. Most of the imported containers in Mongolia are stored at the container yards around the Ulaanbaatar railway station. Repositioning points of containers are scattered around the port of Tianjin. Almost 90% of empty import containers should be repositioned to Tianjin. The throughput at Zamyn Uud station in 2008 is about 98 thousand twenty -foot equivalent unit (TEU) as shown

in the table 1 including transit containers of trading goods between China and Russia (KMI, 2009).

Table 1. Container movement of Railway transport at Mongolian borders

(unit: TEU)

Item	Trading partner countries	Border Station	2007		2008	
			Inbound (Transit)	Outbound (Transit)	Inbound (Transit)	Outbound (Transit)
Mongolia	China	Zamyn Uud-Erenhot	28,892	27,221	47,451 (511)	50,531 (401)
	Russia	Suhbaatar-Naushki	4,045	2,994	4,270 (401)	1,948 (511)

Note: Including empty containers

Source: 1) Korea Maritime Institute (2009) Operationalization of International Intermodal Transport Corridors in North-East and Central Asia.

2) Chinese Ministry of Railways and Economic & Planning Research Institute (2009) The Latest Development of International Railway Transport Corridors in China, Expert Group Meeting on Operational International Intermodal Transport Corridor in North-East and Central Asia 4-5 November 2009, Kyrkyzstan.

The Erdenet Station is a key railway facility for export of copper concentrate, molybedenum concentrate, and other goods (Park, 2011). The Erdenet Mining Company gathers copper raw ores from strip mining and concentrates the ores from 0.5% purity to 20-25% purity. The company packs copper concentrate into a bag container on the open top wagons; it packages molybedenum concentrate into an wooden boxes and a bag container, and loads boxes and bag containers in a container. The final destination stations in Mongolia are different according to importing countries: Zamyn Uud for China and the third countries such as Korea, Japan, and Canada, and Suhbaatar for Russia. The foreign border stations of railway transport are Erenhot in China and Nauski in Russia. In 2009, Mongolia exported 5.0 thousand tons of molybedenum concentrate and ores to China; 1.5 thousand tons to Korea; and 126 tons to Germany[1].

The Eruu gol railway station at Selenge region is the main departing station for exporting iron ores. The Ulaanbaatar Railway Joint Venture transports iron ores from the Eruu gol railway station to Erenhot in China via the Zamyn Uud station. At the Erenhot station the iron ore is discharged and transshipped to Chinese railway wagons and lorries. In 2009, Mongolia exported 1.60 million tons of iron ore to China and 0.3 tons to Australia.[2]

Lorry and trailer carry cargoes in short distance and export coal from the Southern Gobi Desert to Chinese cities. Main borders for export coal are Tseg and Gantsmaodao.

1 Customs General Administration (2010) International Merchandise Trade Statistics 2009.

2 Op. cit.

3. Regression of transport costs and trade volume

3.1 Data collection and input

3.1.1 Data collection

IMF's Direction of Trade Statistics Yearbook (IMF, 2010(a)) informs us records of exports and imports of each country in the world. Exports are based on the term of free on board (FOB); imports on the basis of cost, insurance and freight (CIF). However, the statistics of Mongolian exports and imports and the corresponding record of imports and exports in trading partner countries are widely different in some cases.

The data of LCL transport costs from the main city or main port of other 31 countries to Ulaanbatar, capital city of Mongolia is supplied by the Korean forwarding company which supplies shippers with intermodal logistics services for Mongolia export and import goods. However these costs are calculated on the assumption of intermodal transport for LCL cargo by combining inland transport from Ulaanbatar of Mongolia and Tianjin of China, shipping from Tianjin to Busan in Korea, and then shipping to main ports in the world. Since there is no available data on the ratio of LCL and full container load (FCL) cargoes in Mongolia, this paper uses these transport costs for LCL cargo as proxies for transport costs of FCL and general cargoes. In addition, the costs for China and Russia should be recalculated due to efficient and direct logistics paths from Mongolia to the two countries. Since the regression model of LCL transport costs without considering the optimal routes for China and Russia which can transport cargoes through directly crossing borders, not using Busan port as a transhipment hub, has lower explanation power and is unrealistic, this analysis adjusts the transport costs for China and Russia through calculating transport costs of LCL cargo for the two countries as being half of the LCL transport costs for Korea.

We also use the data of population and gross domestic products (GDP) from the IMF (IMF, 2010(b)). The data on transport infrastructure such as length of paved road and railway length is collected from the transportation information at the web site of the Central Intelligence Agency (CIA). The mileage distance is calculated by the information of Maritime Distance Table (Japan Navigation Officer's Association, 1982). The density of transport infrastructure in each country is calculated as an average of the density of the paved road network and the railway network per person (Limao and Venables, 2001)

3.1.2 Input data

The trading partner countries on the list of the LCL transport costs by the Korean forwarding company could be main partners for Mongolia. Therefore, this chooses 31 countries as main trading partner countries for Mongolia. However the three countries among

the main trading partners-Portugal, Norway and Vietnam- don't have trade statistics with Mongolia as shown in the table 2.

The ratio of CIF to FOB ranges from 0.4 for Romania to 5.3 for Thailand, and is less than one at those countries: Belgium, Czech Republic, Japan, Korea, Singapore, Switzerland, and China.

The transport costs of LCL cargo between trading partner and Mongolia measures transport costs per ton from main ports or main cities of trading partners to Ulaanbatar via Busan port in Korea and Tianjin port in China. The transport costs ranges from 95 US dollar for China and Russia to 330 US dollar for Romania.

The shipping distance and the inland distance between its trading partners and Mongolia are measured from the gateway port, Tianjin port, to the departure port, from Ulaanbatar to Tianjin, and from the origin to the departure port. The longest shipping distance is 19,037 km for Hungary; the shortest is 507 km for Korea. The inland distances vary from 1700 km for those countries such as Korea, France, Italy, Germany, and Japan to 3,560 km for Romania.

The transport infrastructure density per person ranges from 0.11 in India to 31.6 in Sweden.

Table 2. Major transport characteristics of trading partner countries (2009)

Country / Item	CIF / FOB	Freight (US$ / ton)	Shipping Distance (km)	Inland Distance (km)	Transport Infrastructure Density
Austria	2.28	275	18,825	2,643	6.79
Belgium	0.60	245	17,849	1,700	5.74
Finland	1.20	250	19,386	3,204	5.32
France	1.70	240	11,338	1,700	8.47
Germany	1.26	275	18,243	1,700	4.18
Italy	1.27	260	14,355	1,700	4.24
Netherlands	1.09	220	17,882	1,700	4.21
Portugal	-	280	15,183	1,700	3.46
Austraila	1.91	250	18,785	1,700	8.91
Canada	1.87	235	9,173	1,700	6.89
Czech Republic	0.89	275	18,606	2,424	6.66
Denmark	1.10	250	18,329	1,786	6.93
Japan	0.92	190	2,311	1,700	3.88
Korea	0.93	190	507	1,700	0.87
New Zealand	1.19	255	10,034	1,700	7.73
Norway	-	245	18,603	2,421	7.92
Singapore	0.54	190	4,505	1,700	0.35

Sweden	1.20	260	18,680	2,498	31.60
Switzerland	0.62	275	18,413	2,231	5.04
United Kingdom	1.78	240	18,180	1,700	3.34
United States	2.53	315	10,085	1,700	7.31
China,P.R.: Mainland	0.50	190	-	1,700	1.16
India	2.89	275	8,441	1,700	0.11
Thailand	5.30	185	4,677	1,700	1.36
Vietnam	-	195	3,717	1,700	0.73
Bulgaria	2.17	320	14,616	3,701	2.90
Hungary	1.57	270	19,037	2,855	4.21
Poland	1.03	275	19,014	2,832	4.17
Romania	0.40	330	14,481	3,566	1.82
Turkey	0.99	250	13,879	1,700	2.15
Russia	1.18	175	-	1,700	3.06

Source: IMF (2010a) Direction of Trade Statistics Yearbook.
IMF (2010b) International Financial Statistics Yearbook.
Japan Navigation Officer's Association (1982) World-wide distance chart, Tokyo.

3.2 Transport costs

3.2.1 IMF's transport costs – the ratio of CIF to FOB

Transport costs in foreign trade will be decided by the characteristics of each intermodal transport network (Gallup *et al*., 1999), composed of the corridors from a factory in a country to another factory in a trading partner country. Specifically, this uses respectively the ratio of CIF to FOB for Mongolia and her trading partners and the transport cost of LCL cargo from trading partners to Mongolia as indicators of transport costs.

The ratio of CIF to FOB provides the measure of transport costs on trade between Mongolia and each trading partner country, and is used to measure the costs of the imports and all charges incurred in placing the goods abroad a carrier in the exporting port (Limao and Venables, 2001). The amounts of export and import at the statistics of trading partners for Mongolia do not exist at some cases due to the small portion and ratio of Mongolian trade from the view of trading partner countries (IMF, 2010(a)). Generally, the amounts of CIF term will be more than that of FOB. Nevertheless, the rates of CIF to FOB for Mongolian imports are less than one for some countries: Korea, Japan, Singapore, and others as presented in the table 2.

Hence the regression between the ratio of CIF to FOB and the transport characteristics such as distance of sea transport, distance of land transport, and border sharing with Mongolia could have lower explanation power. As a result of the regression, the distance of inland transport from Ulaanbatar to Tianjin and from the port near the

capital city to the capital city of trading partner country represents a proxy for port accessibility of Mongolia.

The function of transport costs is as in the following:

$$CFR = f(DISS, DISL, INFP, INFT, BOR) \quad (1)$$

Where:
CFR: ratio of CIF to FOB
DISS: shipping distance from Tianjin of China to the port near the main city of trading partner country
DISL: distance of inland transport from Ulaanbatar to Tianjin and from the port near the main city to the main city of trading partner country
INFP: density of transport infrastructures of trading partner country
INFT: density of transport infrastructures of transit country, China
BOR: dummy variable of border sharing with Mongolia: BOR =1 if the trading partner country is China or Russia, which is sharing boarders with Mongolia

This paper assumes that the ratio of CIF to FOB (CFR) can be measured by log linear function (Limao and Venables, 2001) and linear function.

The Model 1 is the log linear function as in the following,

$$\ln CFR = a1 + a2 \ln DISS + a3 \ln DISL + a4 \ln INFP + a5 \ln INFT + a6 \ln BOR \quad (2)$$

Specifically, the second estimation equation for Model 2 is,

$$CFR = a1 + a2\ DISS + a3\ DISL + a4\ INFP + a5\ INFT + a6\ BOR \quad (3)$$

The estimation equation of Model 3 is,

$$CFR = a1 + a2\ DISS + a3\ DISL + a4\ INFT + a5\ BOR \quad (4)$$

The regression models of bilateral transport costs factor between Mongolia and trading partners are estimated with the data in 2009.

Regressions of Model 1, 2, and 3 have very weak explanation power with low R^2 as shown in the table 3. Furthermore, the signs for shipping distance and for distance of inland transport are negative and they are statistically insignificant. In addition, the coefficients of all independent variables having low t-statistics are statistically insignificant. These are caused by the incorrect ratios of CIF to FOB for Mongolia and trading partners.

Table 3. Regression results of bilateral transport costs factor between Mongolia and trading partner (2009)

Variable / Model	1	Variable / Model	2	3
Constant	2.56	Constant	1.80 (1.55)	1.80 (1.58)
Ln DISS	0.06 (0.35)	DISS	-0.00004 (-0.99)	-0.00004 (-1.09)
Ln DISL	-0.39 (-0.83)	DISL	-0.00006 (-0.17)	-0.00005 (-0.17)
Ln INFP	-0.02 (-0.19)	INFP	-0.002 (-0.06)	
Ln INFT	1.25 (0.92)	INFT	0.34 (0.45)	0.34 (0.46)
BOR (Dummy)	-0.87 (-1.20)	BOR (Dummy)	-1.57 (-1.37)	-1.56 (-1.40)
Sample Size	28	Sample Size	28	28
R^2 F	0.12 0.63	R^2 F	0.11 0.52	0.16 0.67

3.2.2 Transport costs between Mongolia and trading partners

The LCL cost per ton is calculated for LCL cargo and is based on the assumption that LCL cargo would be transshipped at the port of Busan in Korea.

We can assume that the transport costs per ton are dependent on transport characteristics of international logistics paths from Mongolian to trading partners.

The function of transport costs is as in the following:

$$LC = f\ (DISS,\ DISL,\ INFP,\ INFT,\ BOR) \quad (5)$$

Where:

LC: transport costs per ton from trading partners to Mongolia

DISS: shipping distance from Tianjin port in China to the ports near the main city of trading partner country

DISL: distance of inland transport from Ulaanbatar to Tianjin and from a port near the main city to the main city of trading partner country

INFP: density of transport infrastructures of trading partner country

INFT: density of transport infrastructures of transit country, China

BOR: dummy variable of border sharing with Mongolia

The transport costs per ton from trading partners to Mongolia can be estimated by log linear function and linear function. First, we can adopt the following log linear function:

$$LC = a1\ DISS^{a2}\ DISL^{a3}\ INFP^{a4}\ INFT^{a5} \quad (6)$$

The natural logarithm function adding dummy variable is used for regression,

$$\ln LC = a1 + a2 \ln DISS + a3 \ln DISL + a4 \ln INFP + a5 \ln INFT + a6\ BOR \quad (7)$$

Then this assumes that transport costs can be estimated by linear function (Limao and Venables, 2001) as shown in the equation 8.

$$LC = a1 + a2\ DISS + a3\ DISL + a4\ INFP + a5\ INFT + a6\ BOR \quad (8)$$

By selecting different combinations of independent variables, there are three models of the log linear functions: Model 1, 2, 3; one linear function: Model 4, as shown in the table 4.

In all models, transport costs are strongly affected by the distance of inland transport from Ulaanbatar to Tianjin and from a port near the main city to the main city of trading partner country (DISL). And Model 1 shows us the ranges of effects serially by DISL, DISS, BOR, INFT, and INFP. In Model 2 excluding the variable of INFP, regression results are similar to those of Model 1. In Model 3, transport costs are estimated by DISL, DISS, and BOR. In this model, the sign of coefficient of BOR is consonant with intuition. All log linear models have explanation power with R^2 over 0.8 as shown in the table 4. Model 4 in linear function has lower R^2 than the log linear models.

Table 4. Regression results of transport costs between Mongolia and trading partner (2009)

Variable / Model	1	2	3	Variable / Model	4
Constant	2.97 (4.82)***	3.02 (5.07)***	5.17 (66.3)***	Constant	165 (5.08)***
ln DISS	0.11 (3.57)***	0.10 (3.92)***	0.00001 (3.19)***	DISS	0.003 (2.46)**
ln DISL	0.20 (2.35)**	0.20 (2.39)**	0.00009 (2.28)**	DISL	0.03 (2.48)**
ln INFP	-0.009 (-0.42)	-	-	INFP	-0.33 (-0.31)
ln INFT	0.009 (0.06)	0 0	-	INFT	0.33 (0.02)
BOR (Dummy)	0.09 (0.30)	0.04 (0.15)	-0.76 (-7.9)***	BOR (Dummy)	-111 (-3.44)***
Sample Size	31	31	31	Sample Size	31
R^2 F	0.88 35.8	0.88 46.2	0.86 54.6	R^2 F	0.75 15.1

Note: ** significant at the 5 percent level; *** significant at the 1 percent level.

All models imply that the distance of shipping routes has lower effect on transport costs than the inland distance (Cullinane, 2005). Hence, the easier access to the sea for a land-locked country plays a decisive role in lowering the transport costs for the foreign trade with the third countries except transit countries sharing common borders.

However, the effect from the level of infrastructure density in partner countries and transit countries is a little uncertain. At the Model 1 and 4, the estimators for the level of infrastructure densities in partner countries and transit countries are not significant and the estimators for the transit countries have adverse signs to intuition.

3.3 Trade volume

When we consider cargo flows between two countries and among countries, transport costs between the two countries and from an origin country to a destination country can affect the amounts of foreign trade: export and import (Gallup *et al*., 1999; Ng and Gujar, 2009). Economic indicators also vary trade amounts. This also examines the effects of GDP of partner countries, distance from Mongolia to partner countries, and per capita GDP of partner countries, common borders with partner countries, density of transport infrastructure in partner countries, and density of transport infrastructure in transit countries on trade volume between Mongolia and trading partners, using gravity model (Limao and Venables, 2001; Malo, 2008; Ferrari *et al*, 2011).

The gravity model of estimating trade volumes between Mongolia and trade partners will use variables GDP, per capita GDP, density of transport infrastructure, and common border as attractive variables, and distance from Mongolia to trading partners as disadvantageous variable.

Hence, the function of trade volume between Mongolia and trading partners will be as in the following,

$$M_{jm} = g(GDP, DIS, INFP, INFT, CGDP, BOR) \quad (9)$$

where,

M_{jm}: trade volume in thousand dollars between country j and Mongolia
GDP: GDP of country j
DIS: distance of inland and shipping from Mongolia to country j
INFP: density of transport infrastructure of country j
INFT: density of transport infrastructure of transit country, China
CGDP: per capita GDP of country j
BORD: dummy of common border

We can build the following log linear function, adopting the model by Limao and Venables (2001):

$$M_{jm} = a1\ GDP^{a2}\ DIS^{a3}\ INFP^{a4}\ INFT^{a5}\ CGDP^{a6} \quad (10)$$

After including dummy variable, we get the log linear function:

$$\ln M_{jm} = a1 + a2 \ln GDP + a3 \ln DIS + a4 \ln INFP + a5 \ln INFT + a6 \ln CGDP + a7\ BORD \quad (11)$$

The table 5 gives us four models: Model 1 including all variables; Model 2 excluding variable of INFP, INFT, and CGDP; Model 3 excluding INFP, INFT, CGDP, and BOR; Model 4 excluding INFT and CGDP.

Table 5. Regression results of trade volume between Mongolia and trading partner (2009)

Variable/Model	1	2	3	4
Constant	6.09 (1.35)	-0.86 (-0.18)	1.06 (0.24)	6.42 (1.48)
ln GDP	0.86 (4.98)***	0.87 (5.59)***	0.89 (5.69)***	0.84 (5.01)***
ln DIS	-0.90 (-2.53)**	-0.78 (-2.54)**	-1.03 (-4.41)***	-0.88 (-2.55)**
ln INFP	0.04 (0.14)	-	-	0.13 (0.66)
ln INFT	1.39 (0.88)	-	-	-
ln CGDP	0.02 (0.42)	-	-	-
BOR (Dummy)	0.36 (0.26)	1.22 (1.17)		1.11 (1.05)
Sample Size	28	28	28	28
R^2 F	0.78 13.8	0.77 26.6	0.76 38.7	0.77 19.6

Note: ** significant at the 5 percent level; *** significant at the 1 percent level.

The third and fourth columns in the table 4 show us coefficients of GDP of trading partner country j (GDP) and distance in km of inland transport and shipping from Mongolia to country j (DIS). The positive effects from GDP of partner countries and border sharing would be reasonable as expected by intuition. Also the negative effects from distance from Mongolia and trading partners can be accepted. The signs of other three variables - INFP,

INFT, and CGDP - are consonant with intuition but statistically insignificant. All models have explanation power with R^2 over 0.75 as shown in the table 5.

4. Conclusion

Mongolia, an economy of small economic scale and land-locked country, has been trying to diversify trading partners and traded goods. Mongolia suffered from comparatively low economic growth and even economic recession in the 1990s after the adoption of market economy. The higher transport costs between Mongolia and the third countries not sharing common borders hinders trade volume from growing and expansion in trading partner countries.

Following the context of effects of landlockedness to a country, this specifically tries to examine the effects of remoteness of Mongolia on transport costs and foreign trade. This uses two different transport costs: the ratio of CIF to FOB for all types of cargoes; the transport costs for general cargo and LCL cargo. In the analysis of the ratio of CIF to FOB, we found that the regressions have very weak explanation power due to the incorrect ratios of CIF to FOB for Mongolia and trading partners. In the regression models of transport costs for LCL cargo of Mongolia import, the distance in inland transport has higher average effect on transport costs than the shipping distance. Hence we can surmise that the access to the sea for land-locked country plays a decisive role in lowering the transport costs of foreign trade with the third countries except transit countries. Differently from the results of the other papers on transport costs of land-locked countries, the effect of the level of infrastructure density in partner countries and transit countries is not statistically significant. The factor of border sharing with trading partners lowers transport costs at the two models.

At the gravity model for trade volume, the positive effects from GDP of partner countries would be reasonable as expected by intuition. The negative effects from distance between Mongolia and trading partners can be acceptable. Other variables have sometimes adverse signs to intuition and are statistically insignificant.

Even though the improvement of accessibility of land-locked countries to the sea gives them new opportunity to approach the global market, they can face high transport costs for export goods. Hence the access to the sea should be accompanied with the efficiency improvement of transport networks, border crossing process, and transit transport toward the sea.

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