

# Characteristics of International Freight Transport in Landlocked Countries

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Many landlocked countries (LLCs) have difficulty in international trade. Since LLCs have no their own seaport, they have to across at least one border when they access to seaports located in neighbor transit countries (TCs) for trading through maritime transport. Previous researches concluded that LLCs had disadvantage compared to coastal countries in terms of trade and economic activities. LLCs were treated as homogenous because they analyzed the differences between LLCs and non-LLCs. However, each LLC might own different characteristics each other. In this context, this paper focuses on disparity among LLCs and aims to identify the characteristics of international freight transport of each LLC. Firstly, multiple regression analysis has been conducted to clarify important factors affecting on inland freight transport time for accessing to seaports. Effective explanatory variables are transport infrastructure of LLCs and TCs, country risk of LLCs and TCs, and distance to seaport. Secondly, the characteristics of inland freight transport of each LLC have been identified by cluster analysis. LLCs are classified into five groups based on their regional location. Major findings are that the importance of infrastructure condition in TCs to contribute transport time is higher than that in LLCs. In other words, in order to reduce inland transport time from LLCs to seaport in TCs, improvement of infrastructure condition of TCs is better than that of LLCs.

**Key Words :** *landlocked countries, inland freight transport, transport time, cluster analysis*

## 1. INTRODUCTION

There are 43 Landlocked Countries (LLCs) in the world. United Nations reported 31 of them are being called Landlocked Developing Countries (LLDCs). One of the factors of their harsh economic conditions is considered to be difficulty in trade. As LLCs have no their own seaport, they have to across at least one border when they access to the seaports of transit neighbor countries (TC). In case that TC does not have efficient transit facilities or does not allow LLC to conduct cross-border trade without frequent cargo inspection or cumbersome procedures, as well as long inland transportation distance to the seaport, LLC suffers from long transport time and high transport cost. Consequently, several LLCs suffer from high trade cost and low economic development.

Although LLCs have a lot of disadvantages in

terms of trade and economic development, some LLCs in Europe are classified into high income or upper middle income countries by World Bank. This fact can prove that LLCs have chance to realize economic development. From the fact that some

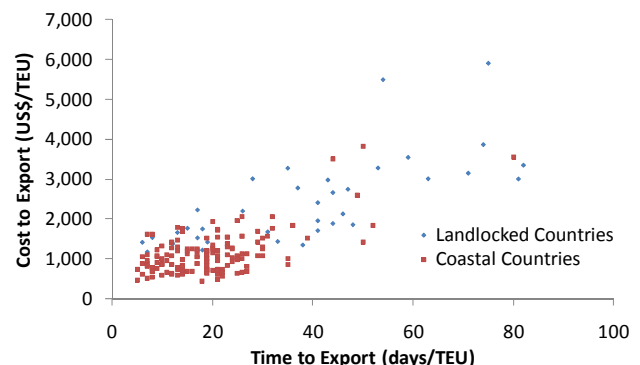


Fig.1 Time and cost to export<sup>7)</sup>.

LLCs are high income and others are not, homogeneity among LLCs should not be true. Although LLCs basically suffer from high cost and long time for export, they are variety among LLCs. In other words, trade environment are much different from each LLC.

Many of the literatures related to LLCs' difficulties so far have tried to identify the impact of being landlocked on transport cost, trade volume and value, and economic growth rate. Radelet and Sachs<sup>1)</sup> and Stone<sup>2)</sup> demonstrated that LLC suffered from heavy burden of transport cost compared with coastal countries. Radelet and Sachs<sup>1)</sup> also proved that transport and insurance costs were twice as high as coastal countries and there was a relation between transport cost and economic growth. Regarding the economic growth of LLCs, MacKellar *et al.*<sup>3)</sup> revealed that LLCs had a 1.5% lower growth for the period between 1960 and 1992. Limao and Venables<sup>4)</sup> stated that being landlocked raises transport cost by approximately 50% for the middle-class landlocked country compared to the middle-class coastal country. In addition to high transport cost, middle-class LLCs only have 30% of the trade volume of the middle-class coastal country<sup>4)</sup>. In the case of Central Asian countries, landlockness reduced trade volume by more than 80%<sup>5)</sup>. An improvement of the level of infrastructure from the median Central Asian countries to the top 25th percentile of other landlocked countries would raise exports (imports) by a modest 6.5% (8.6%)<sup>6)</sup>. An improvement in infrastructure quality to the level of the median coastal country would raise exports (imports) by 14.5% (19.6%)<sup>6)</sup>. Thus, the impact of domestic infrastructure appears limited. By contrast, an improvement in transit-country infrastructure to the level of the best 25th percentile amongst other landlocked countries would raise the countries in Central Asian Countries' exports by 52%. Most previous researches have used landlocked dummy in their regression or gravity model expressing LLCs' disadvantage. The landlocked dummy can show us how much LLCs have difficulties on average in transport, trade and economic activity, but differences among LLCs were not observed. Each country might have different characteristics among LLCs. In this context, this paper focuses on disparity among LLCs and identifies their characteristics using Doing business data 2011<sup>7)</sup> covering the process between the vessel's arrival at the port in TCs and the cargo's delivery at the warehouse in LLCs (for import).

## 2. REGRESSION ANALYSIS

Long inland transport time is one of the most serious problems for LLCs. Taking Uganda for example, inland transportation time from its capital, Kampala to Kenyan seaport, Mombasa (1,187 km) takes 18 days, whereas Kenya (from Nairobi) needs 4 days to complete the transport to Mombasa for 488km distance transport. In comparison with European high income LLC, Austria needs only 2 days for access to German seaport of Hamburg despite the distance of 900km. This difference might be caused by border-crossing time (Uganda needs 6-8 hours to cross the border according to JICA<sup>8)</sup>) and some other factors which are revealed in this chapter.

### (1) Variables

Factors which contribute to inland transport time (*TT*) are analyzed using multiple regression analysis. Transport infrastructure (road and railway), country risk, distance to seaport, and land form of LLCs and TCs are incorporated into regression models as explanatory variable.

#### a) Inland transport time

Average transport time of export and import is used for dependent variable using Doing Business database<sup>7)</sup>. The data covers time duration between departure of cargo at the warehouse in capital of each LLC and arrival at seaport in TCs.

#### b) Transport infrastructure

As LLCs are enforced to depend on more than one TCs for their overseas exports and imports through maritime transportation, in the process of their access to seaport, transport infrastructure quality of LLCs (*LLCInfra*) as well as that of TC (*TCInfra*) must be important. Each LLC's and TC's infrastructure quality are measured by composite variables constructed from three variables (kilometers of road, kilometers of paved road, kilometers of rail, data obtained from CIA<sup>9)</sup>) by Principal Component Analysis (PCA), because these measures are highly correlated among themselves. TCs are selected based on Uprety<sup>10)</sup>. However, this source lacks the data of Central Asian countries. Thus Grigoriou<sup>6)</sup> is referred as supplement of Uprety<sup>10)</sup>. In case that LLC which has more than one TC like Central Asian countries and European countries, average value of them are used as *TCInfra*.

#### c) Country risk

Efficiency in bureaucracies of LLCs and TCs are considered to exert an influence on border-crossing time and frequency of cargo inspection. Database named "Euromoney Country Risk<sup>11)</sup>" which shows the government stability, regulatory environment, non-payment of loans, dividends, trade-related finance, non-preparation of capital, corruption, perception and information access, transparency.

Here, higher the scores, more efficient bureaucracies the countries have.

#### d) Distance to seaport in TCs

Distance to seaport from the capitals of LLCs to seaport (*Dist*) data of which are quoted from UNCTAD<sup>12)</sup> are incorporated into regression models, since importance of distance for transport time is obvious. Data of LLCs lacking in the literature are based on the list of transship seaport for LLCs in “The Transit Regime For Landlocked States” by United Nations and road distance from the capital of each LLC to seaport are calculated.

#### e) Geographic conditions

Many LLCs suffer from their geographic characteristics. Most of these states are quasi-deserts, deserts or mountainous areas. Most European LLCs are on the Alpine Arc, most of those in Africa lie in the Sahel region or on the continental ridge and the Central Asian LLCs are at the heart of the world’s largest endoreic basin, which mostly semi-desert<sup>5)</sup>. There is a possibility that some LLCs’ freight transport suffer from difficulty in geographic conditions. Especially mountainous condition might influence on transport time, because it can make transport distance longer and speed of transport would be lower. Hence latitude of capitals in LLCs (*Latitude*) and forest area (percentage of land area) (*LLC forest*, *TC forest*) are used as variable indicating mountainous land form. Data source of

Latitude is GPS Visualizer<sup>13)</sup>, and that of *LLC forest* and *TC forest* are FAO<sup>14)</sup>.

#### (2) Regression models and estimation results

The variables of *LLCInfra*, *TCInfra*, *LLCCR*, *TCCR* are highly correlated among themselves, hence these variables are separately incorporated into each regression model to avoid multicollinearity.

**Table.1** Coefficient of correlation among explanatory variables.

	<i>LLCInfra</i>	<i>TCInfra</i>	<i>LLCCR</i>	<i>TCCR</i>
<i>LLCInfra</i>	1			
<i>TCInfra</i>	0.925718	1		
<i>LLCCR</i>	0.795664	0.769989	1	
<i>TCCR</i>	0.679597	0.744667	0.644349	1

- 1)  $TT = f(Dist, LLCInfra, Latitude, LLCforest, TCforest)$
- 2)  $TT = f(Dist, TCInfra, Latitude, LLCforest, TCforest)$
- 3)  $TT = f(Dist, LLCCR, Latitude, LLCforest, TCforest)$
- 4)  $TT = f(Dist, TCCR, Latitude, LLCforest, TCforest)$

From the result, Distance to seaport from the capitals of LLCs to seaport in TCs (*Dist*), transport infrastructure quality of LLCs (*LLCInfra*) and TC (*TCInfra*), country risk of LLCs (*LLCCR*) and TCs

**Table.2** Estimation result 1.

	1)		2)		3)		4)	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
<i>Constant</i>	4.062	0.773	5.031	0.971	14.100	2.432	11.950	1.345
<i>Dist</i>	0.009	4.889	0.008	4.787	0.007	4.620	0.008	3.944
<i>LLC Infra</i>	-2.572	-1.559						
<i>TC Infra</i>			-3.299	-1.994				
<i>LLC CR</i>					-0.733	-3.390		
<i>TC CR</i>							-0.487	-1.472
<i>Latitude</i>	-0.001	-0.347	-0.001	-0.558	-0.001	-0.001	0.000	0.067
<i>LLC forest</i>	-0.037	-0.456	-0.017	-0.203	-0.023	-0.325	-0.028	-0.331
<i>TC forest</i>	0.006	0.049	-0.026	-0.197	-0.004	-0.039	0.002	0.012
<i>Adjusted R2</i>	0.512		0.534		0.616		0.508	
<i>Observations</i>	37		37		37		37	

**Table.3** Estimation result 2.

	5)		6)		7)		8)	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
<i>Constant</i>	2.085	0.921	2.458	1.100	12.054	3.393	11.542	1.873
<i>Dist</i>	0.009	5.977	0.009	5.827	0.008	5.531	0.008	4.570
<i>LLC Infra</i>	-2.341	-1.730						
<i>TC Infra</i>			-2.902	-2.163				
<i>LLC CR</i>					-0.712	-3.617		
<i>TC CR</i>							-0.510	-1.770
<i>Adjusted R2</i>	0.548		0.568		0.645		0.550	
<i>Observations</i>	37		37		37		37	

(*TCCR*) are confirmed to be the factors influencing on inland transportation of LLCs. But Latitude of capitals in LLCs (*Latitude*), Forest area (*LLC forest*, *TC forest*) could not be significant variables. This result possibly is contributed that data used indicating land form were not appropriate or land form doesn't affect transportation time.

- 5)  $TT = f(Dist, LLCInfra)$
- 6)  $TT = f(Dist, TCInfra)$
- 7)  $TT = f(Dist, LLCCR)$
- 8)  $TT = f(Dist, TCCR)$

After removing the variables of *Latitude*, *LLCforest*, *TCforest*, accuracy of models are improved and Model 7) is the best model with highest adjusted coefficients of determination. What should be emphasized here is the value of coefficient and t-value of *LLCInfra* is less than *TCInfra*. This result indicates the importance of infrastructure of TCs for LLCs and LLCs are highly dependent of TC's condition.

### 3. CHARACTERISTICS OF INLAND TRANSPORT CONDITIONS OF LLCs

Based on the factors confirmed by regression analysis in chapter 2, characteristics of inland transport condition are extracted by cluster analysis (Ward method). Transport infrastructure, country risk of LLC and TC, and distance to seaport are used as variables. Cluster 4 and 5 are in difficult condition among LLCs. Cluster 4 consists of African and Asian countries, which infrastructure developments are the worst. In Cluster 5, all countries are Central Asian countries. They suffer from long distance to seaport,

**Table.4** Comparison of average value of each cluster.

	<i>Dist</i>	<i>LLCInfra</i>	<i>TCInfra</i>	<i>LLCCR</i>	<i>TCCR</i>
Cluster 1	-0.58	2.02	1.98	1.85	1.59
Cluster 2	-0.62	0.23	0.25	0.05	0.10
Cluster 3	-0.67	-0.58	-0.36	-0.54	0.62
Cluster 4	0.17	-0.67	-0.70	-0.33	-0.74
Cluster 5	2.39	-0.01	-0.26	-0.77	-1.04

**Table 5** Comparison of average value of each cluster.

	LLCs	Good condition	Bottleneck
Cluster 1	Austria, Switzerland, Czech Republic, Luxembourg, Hungary, Slovakia	<i>LLCInfra</i> , <i>TCInfra</i> , <i>LLCCR</i> , <i>TCCR</i> , <i>Dist</i>	
Cluster 2	Armenia, Azerbaijan, Belarus, Macedonia, Moldova, <u>Bhutan</u>	<i>Dist</i>	
Cluster 3	Zimbabwe, Lesotho, Swaziland, Botswana, <u>Laos</u> , <u>Nepal</u> , <u>Bolivia</u>	<i>Dist</i> , <i>TCCR</i>	<i>LLCInfra</i> , <i>TCInfra</i> , <i>LLCCR</i>
Cluster 4	Burkina Faso, Mali, Niger, Uganda, Ethiopia, Malawi, Zambia, Burundi, Central African Republic, Chad, Rwanda, <u>Paraguay</u> , Afghanistan, <u>Mongolia</u>		<i>LLCInfra</i> , <i>TCInfra</i> , <i>TCCR</i>
Cluster 5	Kyrgyzstan, Tajikistan, Uzbekistan, Kazakhstan		<i>Dist</i> , <i>TCInfra</i> , <i>LLCCR</i> , <i>TCCR</i>

bad condition of TCs and have poor infrastructure and inefficient bureaucracies. Countries in Cluster 1 are in the best condition among LLCs. They are all high income European countries and have few bottlenecks on freight transport. Cluster 2 consists of second best LLCs. Except Bhutan, middle income European countries are included in this group. Cluster 3 is exceptional considering region and their transport environment are relatively in good condition among landlocked developing countries.

Basically LLCs are classified by region in this analysis, but there are some exceptions. Difference between Paraguay (Cluster 4) and Bolivia (Cluster3) in South America is due to the distance to seaport and country risk of their TCs. These factors also make East Asian countries, Mongolia (Cluster 4) and Laos (Cluster 2) classified in different clusters.

Bhutan (Cluster 2) and Nepal (Cluster 3) are in the different group, and transport environment of Bhutan is better than that of Nepal. In fact inland transport time for export of Bhutan is 13days, while that of Nepal is 19days, in spite of common TC, India. This difference is because of the difference of distance to seaport (Kolkata in India) and each own country risk which can influence on relationship with India. Especially difference of each country risk is notable and can be linked with transit agreement with India. Although they both signed transit trade agreement with India, there is difference of its history. India allows Bhutanese transit trade to be conducted under the supervision of Bhutanese customs, yielding little administrative hassle. In contrast, Nepal's relations with India have frequently been strained, with India often seen to have more influence in the negotiation of treaties and disputes<sup>15)</sup>. This case shows relationship between LLCs and TCs influences on inland transportation especially in case LLCs do not have more than one transit country.

### 4. CONCLUSION AND DISCUSSION

This study clarified the determinants of LLCs' long inland transport time and characteristics of bottlenecks of each LLC. The results can conclude that LLCs do not have homogeneity and they each have their inherent problems.

This research clarified the important factors which influence on transport time of LLCs' access to seaport in TCs. The result proved the importance of transport infrastructures in LLCs themselves and that of TCs, better bureaucracies and distance to the seaport. And condition of LLCs and TCs are intimately interrelated each other and they both have impact on transport time. This result showed LLCs' developments were similar to that of TC and LLCs

heavily depended on TCs.

This research also showed the disparity among LLCs. Difference among LLCs is quite noticeable between European LLCs and LLCs in other region especially in Central Asia and Central Africa. Central Asian LLCs most suffer from long distance to seaport in TCs. Central African LLCs are affected by both domestic condition and poor neighbors. And from the case of difference between Nepal and Bhutan, importance of relationship and alliance with TCs are clarified.

This paper could not evaluate the quality of border (waiting time, dry port, procedure system and so on) between each LLC and each TC. Border quality is closely related to relationship with TC. Country to country relations are very complex problems influenced by historical background, political problems and so on, hence it is difficult to be quantified. However, evaluating the relationship with TCs is required to find out the solution for LLCs.

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