

Impact of Seaport Infrastructure, Logistics Performance, and Shipping Connectivity on Merchandise Exports

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Summary

The aim of this paper is to study the determinants of merchandise exports of maritime countries based on panel data models during the period from 2007 to 2014. We investigate particularly the relationship between countries' merchandise exports and quality logistics performance, seaport infrastructure quality, and liner shipping connectivity. Regarding to the existing literature of merchandise exports this paper has the originality to introduce some logistics and infrastructure variables in addition to the traditional used factors, such as: cost to export, the official exchange rate, consumer price index, and gross of domestic product. Results suggest that the quality of seaport infrastructure, customs clearance processes, as well as time to export and maritime connectivity, could be explanatory factors of countries' merchandise exports. The empirical results confirm that there exists a significant relationship among the merchandise exports and the aforementioned variables except the cost to export.

Key words:

Seaports infrastructures, logistics performance, shipping connectivity, customs clearance processes, time to export, Merchandise exports.

1. Introduction

The merchandise exports are considered as one of the main levers on which countries expect to rely for sustainable economic development. The development of exports increases the efficiency of producers, allows a better use of resources and for the developing countries to obtain hard currency. Thus, governments attempt to provide all the appropriate conditions to promote their merchandise exports.

The analysis of the determinants of merchandise exports should be viewed as a necessity in the context of contemporary trends of liberalization of trade. The literature studying the merchandise exports shows that the principal factors analyzed in the issue of determinants of merchandise exports where the exchange rate, the gross domestic product, consumer price index, and cost of the export. Other variables have recently attracted the attention of countries' economic decision-makers and economic analysts as determinants of merchandise exports such as the quality of seaport infrastructure, the quality of performance logistics and the shipping connectivity.

Several governments were focused on the development of their seaports infrastructures on the grounds that seaports present the necessary condition to merchandise exports especially for voluminous and heavy merchandise. According to the United Nations Conference on Trade and Development [22], nearly 80% of world trade by volume is carried by the international shipping industry and are handled by seaports worldwide. Such a percentage suggests that without seaports the exchange of merchandise for the world would not be possible. [9] revealed that seaports infrastructure investment seems to be even more beneficial to services sector more especially to foreign trade. However, this does not mean that the existence of seaports alone is sufficient to motivate world trade. Seaports present the necessary condition, but not suffusing its self, to motive on the merchandise exports worldwide. Other factors were interested governments as determinants factors to merchandise exports such as, liner shipping connectivity, and logistics performance (customs clearance process, time to export). It is widely believed that low liner shipping connectivity, and low logistics performance are frequently considered as major obstacles for merchandise exports. The level of liner shipping connectivity determines the country's ability to participate global seaborne trade. The map of the world's liner shipping connectivity reflects the map of world seaborne trade. The complexity customs formalities and delays at borders could be considered as informal trade barriers. Yet, evidence was confirmed from studies consider each factor separately, but these factors often influence each other and it is necessary to analyse their impact on merchandise exports at once time. [15] analysed the impacts of port infrastructure quality and logistics performance on seaborne trade. [14] estimated the effects of custom delays at the time of export and the impact of the latter on Uruguayan firms' exports. [24] were studied in the impact of the liner shipping connectivity and port infrastructure quality on the export cost and the impact of the latter on merchandise exports. It is noted, that these studies were investigated the relationship between the liner shipping connectivity and customs clearance process as factors that affecting merchandise exports indirectly. As far as we know, there is no study that took all these factors in account at once. The literature and writings that discuss the impact of the

aforementioned variables on the merchandise exports were not homogenous and separately studying. Therefore, this study attempts to examine the impact of all aforementioned variables on merchandise exports. We attempt to fill the gap in the literature by estimating the extent of the impact of liner shipping connectivity, logistics performance (time to export, customs clearance process), and quality of seaports infrastructure on merchandise exports. Moreover, this article has great significance in the trade policy formulation and export promotion.

This paper discusses the effect of the quality of seaport infrastructure, the level of maritime connectivity, the efficiency of customs clearance processes, and time to export on merchandise exports in 82 maritime countries. The objective of this paper is to produce reliable estimates of the impact of the aforementioned variables on the merchandise exports of maritime countries worldwide. Our finding is that those factors were importance to developing merchandise export. The originality of this study that it taking a closer look at the determinants of merchandise exports outside of habitual influential variables such as the exchange rate, the gross domestic product, consumer price index, and cost of the export.

The rest of the paper was organized as follows. The second section presents a literature review on the issue of the role of maritime infrastructure and logistics performance on the merchandise exports. Section 3 was reserved to the theoretical framework and hypotheses. Data were presented in section 4. Section 5 presents the results and discussion. Section 6 was devoted to concluding.

2. Literature review

The literature shows many studies which have emphasized the determinants of international trade. Our literature review limits itself to the studies interested in merchandise export and focuses on variables closely related to our research. These include quality of seaport infrastructure, logistics performance, liner shipping connectivity, documents to export, the efficiency of the customs clearance process, and time to export.

[3] was examined the relationship between port efficiency, maritime transport costs, and bilateral trade. They concluded that bad ports are equivalent to being 60% farther away from markets for the average country. In Chile, [23] evaluate the impact of the drop of the quality of port infrastructure, generated by the earthquake that took place in this country in 2010, on the exporting firms-level. They find that the diminution in access to ports had a significant negative impact on firms' exports. [4] examine the effect of seaport infrastructure on exporter behaviour. They tested the impacts of port new facilities on future export growth. They find no significant impact of port's

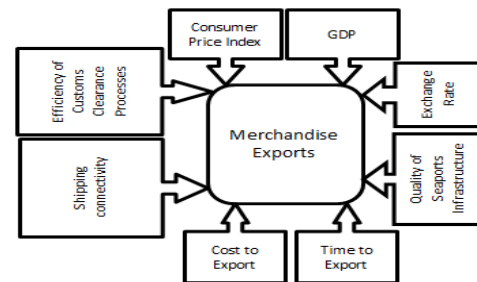
new facilities on companies' export performance. [17] confirm that promoting of the logistics performance may improve countries' ability to trade competition in international markets. [12] have examined the effect that each of customs procedures, logistics costs and the quality of the infrastructure for sea and land transport has on the trade. Also, they attempt to identify possible advances in logistics in developing countries. They reveal that amelioration in any of the components of the logistics performance index can take to significant growth in a country's trade flows. Specifically, logistics performance index components are becoming increasingly important for international trade in many countries in Africa, South America, and Eastern Europe. [15] analysed the impacts of port infrastructure quality and logistics performance on seaborne trade, their results revealed that it is vital for developing countries to continuously improve the quality of port infrastructure and logistics performance to increase seaborne trade. [14] estimated the effect of custom related delays on the Uruguayan firms' exports; their results suggested that delays have a significant negative impact on firms' exports, especially in sales to newer buyers. [6] were examined the relationship between bilateral liner shipping connectivity and exports in containerisable goods; their findings showed that lacking of a direct maritime connection with a trade partner is associated with lower values of exports. [24] were analysed the impact of port infrastructure and liner shipping connectivity on intra-Caribbean freight rates; their findings showed that the structure of liner shipping services, port infrastructure endowment and liner shipping freight rates are closely related to each other. [2] examined the relationship between the exchange rate and exports of major South-Asian and Southeast Asian Economies, and they confirmed the existence of a relationship between exchange rate and exports in the long run in several countries studied. Also, in the short run there is no a significant relationship between the aforementioned variables in the majority of the sample countries. [8] were identified the formal and informal institutional factors in customs procedures and their impact on the performance of small and medium-sized enterprises that involved in international trade in Kosovo. Their findings showed that there is a positive and significant effect for the formal custom instruments that facilitate the trade especially for imported goods. [10] confirmed that delays due to inefficient customs and administrative procedures have become a leading non-tariff barrier that restricts international trade. They confirmed that a long time delay at the border could significantly decrease highly perishable agricultural products' quality and price. [7] has tested the communal idea that global shipping lines entered north-south markets to supply more freight on their established east-west services. The author concludes that global shipping lines

have significant positive effects on the South American market through the services setting up having reinforced trade between North and South America. [20] evaluated the impact of trade times (time to export and to import) for import and export performance at the firm level using data from 11 industries in 85 developing countries. The author finds that firms export more of their production if border clearance times are shorter, but tend to use third-party distributors more if clearance times are longer [21] investigated the impact of the Logistic Performance on foreign trade. They used the Logistic Performance Index as an explanatory variable of international trade. They confirm the positive effect that country's logistics performance has on its international trade, more especially for exporting countries. They confirm that high-quality logistics services improve certainly the competitiveness of a country's exports via the reducing of freight rate. Authors confirm also that numerous and complex customs documents increase freight rate as will the export time. By using three variables [11] investigated in a first step the effect of maritime networks, services structure, and port infrastructure variables on maritime freight rates. In a second step, they investigated the relationship between freight rates and trade, particularly on Spanish exports by applying a gravity model for sectorial exports. Their findings indicate that a reduction of the freight rate could act as a facilitator of exports by increasing the competitiveness. [1] estimated the impacts of trade facilitation on export diversification. Their findings show a positive impact of trade facilitation on the extensive margins of trade. By using the number of days needed to export, [18] investigate the effects of trade facilitation on homogeneous and differentiated products. She finds that trade facilitation has a higher impact (increases by 0.7%) on differentiated products and little less of homogeneous products (by 0.4%). [5] investigated what constrain Africa's exports using three important components of trade facilitation (transit times, documentation, and ports and customs) on exports. The authors' findings confirm that among mentioned components, transit delays have the most economically and statistically significant effect on exports. They indicate that long delays in goods pre-routing explain much of Africa's weak export performance. [16] examined the impact of transit time on the international trade for 16 Arab countries over the period 2005 to 2011. She concluded that reduce of leads to transit time (generated by the development of information and communication technology) has an important role in increasing the value of merchandise exports and imports. [13] investigated the effects of domestic and foreign demand, real effective exchange rate, industrial production, labor cost and economic crisis on manufacturing industry exports' using the panel data analysis. Their results confirm the positive and significant impact of both

industrial production and domestic demand for total manufacturing exports. They also proved that foreign demand has a positive impact on total manufacturing exports. For New Zealand firms [19] presented the impact of exchange rates on firm-level export behaviour. Its results suggest that firms have limited ability to respond to exchange rate changes.

3. Theoretical framework and hypotheses

Previous studies suggest various determinants of merchandise exports. Nevertheless, the literature did not present a study which focused on several factors. The present study has the particularity to regroup several factors in the same model to explain the determinants of merchandise export in the world. It has the originality to discuss the relationship between merchandise exports and the following factors: logistics performance quality (represented by two variables which are: customs clearance process and time to export), quality of seaports infrastructure, and shipping connectivity.



Source: Author compilation

Figure1. Determinants of merchandise exports

This study hypothesized that the explanatory variables have a linear relationship with the merchandise exports worldwide. The hypothesis of this study could be presented as follows: H1: It has a significant positive relationship between customs clearance processes and merchandise exports. H2: It has a positive relationship between quality of seaports infrastructure and merchandise exports. H3: It has a positive relationship between shipping connectivity and merchandise exports. H4: It has a negative relationship between time to export and merchandise exports.

To test the previous hypotheses, we proposed to determine the impact of the logistics performance quality (efficiency of customs clearance processes and time to export), quality of port infrastructure, and the shipping connectivity using panel data model as expressed by the following equation:

$$ME_{it} = \beta_0 + \beta_1 QPI_{it} + \beta_2 LSC_{it} + \beta_3 ECCP_{it} + \beta_4 TE_{it} + \beta_5 CE_{it} + \beta_6 OER_{it} + \beta_7 CPI_{it} + \beta_8 GDP_{it} + \varepsilon_{it} \quad (1)$$

Where:

- ME designates the Free On Board (F.O.B) value of merchandise exports valued in current U.S. dollars.
- QPI signifies the quality of seaport infrastructure, measures business executives' perceptions of their country's port facilities. The rating ranges from extremely underdeveloped port infrastructure (1) to well-developed port infrastructure and efficient by international standards (7).
- LSC designates the liner shipping connectivity, show how well countries are connected to global shipping networks based on the status of their maritime transport sector.
- ECCP denotes the efficiency of customs clearance processes such as speed, simplicity, and predictability of formalities, the rating ranging from very low (1) to very high (5).
- TE represents the time to export recorded in calendar days and reflects the time necessary to complete all procedures required to export goods.
- CE denotes the cost to the export of a 20-foot container in U.S. dollars. It includes all the fees associated with completing the procedures to export the goods such as administrative fees for customs clearance and technical control; terminal handling charges; costs for documents; customs broker fees, and inland transport.
- OER represents the official exchange rate, measures the annual average exchange rate determined by national authorities (local currency units relative to the U.S. dollar).
- CPI denotes the consumer price index, reflects changes in the cost to the average consumer of acquiring a basket of goods and services.
- GDP designates the gross domestic product (constant LCU).
- The subscript *i* indexes country and N, the number of maritime countries studied, *t* indexes year and T are the number of years studied. The exponent's $\beta_1, \beta_2, \dots; \beta_8$ are the parameters of exogenous variables, β_0 is the intercept coefficient that shows the rate at which merchandise exports will change independently of stated explanatory variables. Finally, ε is the error term in the model.

To reduce the impact of the asymmetric distributions (scores, day, dollars, number) equation (1) was exposed to a logarithmic transformation. The empirical model to be estimated is derived as:

$$Ln(ME_{it}) = \beta_0 + \beta_1 Ln(QPI_{it}) + \beta_2 Ln(LSC_{it}) + \beta_3 Ln(ECCP_{it}) + \beta_4 Ln(TE_{it}) + \beta_5 Ln(CE_{it}) + \beta_6 Ln(OER_{it}) + \beta_7 Ln(CPI_{it}) + \beta_8 Ln(GDP_{it}) + \varepsilon_{it}$$

$1 = 1, \dots, N \quad t = 1, \dots, T$ (2)

Where: (Ln) denotes natural logarithms.

The equation (2) could be estimated for 82 maritime nations by the technical of the panel data.

4. Data

We use a sample of 82 maritime nations (Algeria, Australia, Bahrain, Belgium, Benin, Brazil, Bulgaria, Cambodia, Cameroon, Canada, Chile, China, Colombia, Costa Rica, Cote d'Ivoire, Croatia, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Finland, France, Gambia, Georgia, Germany, Ghana, Greece, Guatemala, Guyana, Honduras, Hong Kong, Iceland, India, Indonesia, Italy, Jamaica, Japan, Jordan, Kenya, Korea, Kuwait, Latvia, Lithuania, Madagascar, Malaysia, Mexico, Namibia, Netherlands, New Zealand, Nigeria, Norway, Oman, Pakistan, Panama, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russian Federation, Saudi Arabia, Senegal, Singapore, Slovenia, South Africa, Spain, Suriname, Sweden, Tanzania, Thailand, Tunisia, Turkey, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay, Venezuela, Vietnam) during the period from 2007 to 2014. The data consists of the different variables, which are: merchandise exports (ME), quality of seaports infrastructure (QPI), liner shipping connectivity (LSC), efficiency of customs clearance processes (ECCP), time to export (TE), cost to export (CE), the official exchange rate (OER), consumer price index (CPI), and the gross domestic product (GDP). The data are collected from the UNCTAD's database. Missing data concerning the efficiency of customs clearance processes was completed by the mean between the last and the previous observations. Concerning Belgium, Germany, Ireland, Greece, Spain, France, Italy, Luxembourg, the Netherlands, Austria, Portugal and Finland, the World Bank database does not show a specific exchange rate. For these countries the euro exchange rate was adopted as the official exchange rate. Table 1 summarizes the values of various studied variables.

Table 1: Summary Statistics

Variable	Mean	Standard Deviation	Min	Max
ME	1.62E+11	3.00E+11	1.05E+09	2.34E+12
QPI	4.425425	1.148631	1.97166	6.830574
LSC	31.57023	28.88442	0.53	165.0498
ECCP	2.821019	0.5933224	1.6	4.20779
TE	16.74368	8.556937	6	68
CE	1044.899	440.8984	214.5	3490
OER	620.4208	2665.256	0.268828	25941.66
CPI	103.5123	17.76701	61.38666	348.1676
GDP	1.48E+14	8.09E+14	7.96E+09	8.57E+15

5. Empirical Results

The considered model is expressed by the equation (2) above. Table 3 presents results of the estimated impact of the potential determinants of merchandise export in the 82 maritime countries during the period from 2007 to 2014.

Empirical results in table 2 show a significant relationship between the most explanatory variables and the merchandise exports. Indeed, the low values (under 0.05) of p-values indicate that merchandise export is statistically affected by QPI, ECCP, TE, OER, CPI, GDP and LSC. While the variable CE is the only variable has not significant effect on the dependent variable.

Table 2: Regression results; dependent variable: merchandise exports

Variables	Coef.	Std. Err.	P> t
constant	2.140408**	1.010455	0.0340
QPI	0.27811***	0.076336	0.0000
LSC	0.062212**	0.025215	0.0140
ECCP	0.305***	0.077758	0.0000
TE	-0.18541***	0.064138	0.0040
CE	0.015165	0.042674	0.7220
OER	-0.70482***	0.038287	0.0000
CPI	0.695221***	0.051951	0.0000
GDP	0.733082***	0.035647	0.0000
R2	Within	Between	Overall
	0.5758	0.7767	0.7762
FE vs RE	118.10	(Prob)	(0.000)
Haus.chi2	34.17	(Prob)	(0.000)

(**), and (***) indicate that the parameter is statistically significant at levels of 5 and 1%, respectively.

Such empirical results approve that for maritime countries studied the majority of explanatory variables have a positive impact on the merchandise exports. Concerning logistics performance quality variables', a positive and statistically significant relationship were found between ECCP and the merchandise exports; while that, TE has a significant negative impact. Thus, H1 and H4 could be accepted. The significance of QPI and LSC supports the acceptance of H2 and H3.

6. Conclusion

Often countries try to promote their merchandise exports for achieving long-term sustainable economic growth. Formerly, the considered influential factors on the merchandise exports are the exchange rate, the gross domestic product, consumer price index, and cost of the export. Actually, some other variables have appeared on the economic sphere as new explanatory variables of merchandise exports. Hence, this paper takes a closer look at the determinants of merchandise exports outside of habitual influential variables.

By adding additional explanatory variables such as quality of seaport infrastructure, liner shipping connectivity, efficiency of customs clearance processes, and time to

export to habitual determinants of merchandise exports our paper provides some new empirical evidence. Regarding to the estimated parameters, the analysis shows that the four aforementioned variables are statistically significant and have major impact on the merchandise exports in studied maritime countries.

Firstly, the results showed an inverse relationship between merchandise exports and time to export, when the time to export increases, the volume of merchandise exports is negatively affected. This result is in line with the result obtained by [14]. Secondly, results showed an inverse relationship between merchandises export and exchange rate, in other words the volume of merchandise exports are negatively affected as the exchange rate rises, and this result consistent with the result obtained by [19] and [2]. Thirdly, results confirmed that the quality of seaports infrastructure has significant positive impact on merchandise exports; a positive relationship was confirmed and this finding matches result obtained by [15]. Similar to the findings of [6] the present findings' study shows a positive and significant impact of liner shipping connectivity on merchandise exports. Whenever the export customs clearance procedures are easy and simplified this serves exporting companies and contribute to raise the volume of merchandise exports, this finding is well consistent with the results confirmed by [8].

This result in able to say that to attain a higher level of merchandise exports, countries should give the highest priority to their logistics performance by improving operational performance factors like customs clearance processes and time to export. The quality of seaport infrastructure could have the same priority, that results approved the positively influence on merchandise exports. The maritime connectivity less contributes to merchandise exports and required to make most attention from deciders-makers.

The study makes significant contributions to the maritime economics literature. Results provided relatively an empirical framework that supports the view that the quality logistics performance, the quality of seaport and infrastructure related and maritime connectivity are essential to the development of merchandise exports.

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