LOGISTICS COSTS AS A BARRIER TO TRADE: A CASE STUDY OF ARAB NON-OIL EXPORTS TO BRAZIL

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ABSTRACT: Increasing the international competitiveness of exports is considered one of the main supporters of economic development. Despite many studies focused on how to gain a competitive advantage through cost reduction, no one studied the role of logistics to enhance the competitiveness of products. Therefore, this paper studies the effects of logistics on the competitiveness of non-oil exports from the Arab countries to Brazil; which is considered one of the fastest-growing economies in the world nowadays.

A gravity model for the panel data of the bilateral trade between Arab countries and Brazil for the period 2006-2013 is used. Both theoretical and estimated results confirmed the negative and significant effects of distance as a proxy of transportation costs, the documents to export and the cost of the procedures to export per TEU. The study recommended support having a hub port, adopting of automation of export procedures and having a single window for all the related agencies together to improve the logistics of foreign trade.

Keywords: Logistics costs, Panel data, gravity model and the Arab non-oil exports

INTRODUCTION

The main concern of all countries has become how to gain a competitive advantage in foreign markets, especially with the accelerating trend towards globalization and open markets. And despite the fact that many researchers studied how to gain a competitive advantage in foreign markets, it is rarely to find a study of the impact of reducing logistics costs through improving logistics performance on supporting the foreign competitiveness.

This paper aims to examine the hypothesis that logistics costs works as a barrier to trade that discouraged the competitiveness of The Arab exports to the Brazilian market, which is considered one of the leading emerging economies that the Arab world should develop the relations with. In order to examine its hypothesis, the paper started by studying the structure of Arab trade with Brazil. Second, logistics costs as a barrier to trade is studied. Third, the Gravity model of trade is defined. In the fourth part, the panel econometric model is carried out.

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THE STRUCTURE OF ARAB TRADE WITH BRAZIL

The Brazilian economy is the biggest among South American countries and the second largest in the western hemisphere. It is the world's fifth-largest by both of geographical area and population. According to International Monetary Fund, Brazilian gross domestic product has about 2.4 trillion dollars in 2013 (The 8^{th} in the world, 55% of GDP achieved for South American countries, and 3.1% of GDP achieved worldwide during the same year). The average annual economic growth rate over the period 2008-2013 is about 3.2%, it was 7.1% in 2010, but after 2010 the GDP growth rate decreased because of the government procedures aimed at cooling the economy to reduce the rising inflation coupled with the global economic crisis.

The number of Brazilian population is 199.3 millions in 2013, which represents about 48% of the population of South America, and about 2.8% of the world's population. This makes Brazil one of the largest markets in the world (IMF, 2014).

According to United Nations Commodity Trade Statistics Database, The Brazilian imports of goods in 2013 reached 239.6 billion dollars in 2013 (The twenty third in the world during this year). Its main imports' partners are China, USA, Argentina, Germany and Nigeria with 15.1%, 6.9%, 6.3%, 4% and 3.9% respectively of the Brazilian imports of goods. Its main imports include petroleum (and its products), transport equipment, electrical products, chemical products, fertilizers, gas (natural and manufactured), rubber (and articles thereof), copper (and articles thereof), plastics in primary form, iron and textile (yarn and fabric). As most of these products are available in the Arab world, so it is clear that the potential trade between the Arab world and Brazil is promising.

Regarding the actual trade, surprisingly the Arab countries share of the Brazilian imports of goods was 11.4 billion dollars in 2013 (4.8% of the Brazilian imports). Its main partners in the Arab world are Saudi Arabia, Algeria, Morocco, Kuwait and United Arab Emirates with 1.3%, 1.3%, 0.6%, 0.4 and 0.3% respectively of the Brazilian imports of goods as shown in figure (1).

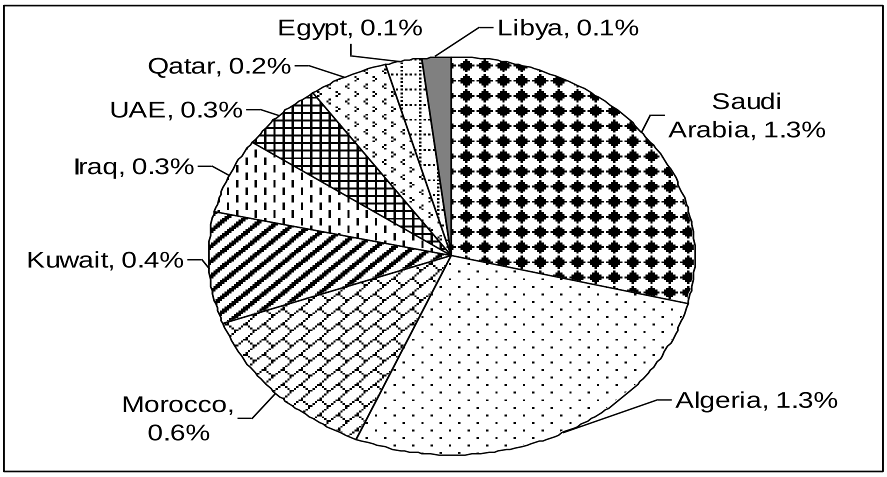

Figure (1) the Arab main exporters to Brazil by country in 2013
Source: Calculated from United Nations Commodity Trade Statistics Database (COMTRADE) data.

Brazilian main imports from the Arab world include mineral oils and products of their distillation, fertilizers, Plastics (and articles thereof), sulphur plastering materials, lime, cement, ships, boats (and floating structures), fish (and crustaceans), electrical machinery (and equipment), glass (and glassware), Inorganic chemicals and rubber (and articles thereof).

From what mentioned above it is clear that although the potential trade between the Arab world and Brazil is promising, the actual trade is very small (4.8% of the Brazilian imports as mentioned above). This increases the importance of studying the reasons for restricting the Arab exports to the Brazilian market.

LOGISTICS COSTS AS A BARRIER TO TRADE

Logistics activities include an integrated group of functional repeated activities during transferring raw material into final goods. These activities can add value to consumers. Hence, the effectiveness of logistics performance has a great effect on the total costs of the traded goods. Logistics costs are considered one of the main measurements of the effectiveness of logistics performance.

There is no a unified accepted definition for logistics costs as there is a huge difference between studies regarding the activities included in logistics (Gonzalez et al., 2008:p.8). In this study, logistics costs is defined as the costs of the supportive activities to the process of production starting from the supply of raw materials and ending up with the arrival of products to the final consumer.

From the previous definition of the logistics costs we can determine the items of logistics costs to trade internationally as the costs of the following activates:

- Transport activities in all modes, whether for material or products.
- Storage activities.
- The value of time spent until delivery.

- Purchasing whether for raw materials or equipments.
- Securing and improving the efficiency of transport, storage, and handling of goods.
- Transmission, recording, analysis and handling of data.
- Packaging and what it needs of any changes required in the form of products.
- Providing integration of information and communication systems.
- Logistical management system.
- Any regulatory procedures required by the contract deals.
- Overcome the contrast of cultures including strengthens the competitive position of products.

Putting into consideration the costs of these activities, logistics costs related to trade accounts for 30-50% on average of the costs of any product in the developed countries (Ross, 1997:p.76; Molnar and Ojada, 2003:p.10). Furthermore, logistics costs accounts for 40-50% of the value added and 7-10% of the value of sales in several industries (Fawcett, 2000:p.373).

So, it is very important to study how to manage logistics costs as a way to encourage the competitiveness abroad. But how to reduce the logistics costs? Despite the importance of studying logistics as an integrated system, substantial reductions in total logistics costs at the national level can be done by working on the individual components of the logistics system ((ESCAP, 2002: p.81). This leads us to analyze most important items of logistics costs, and their effects on the development of international trade.

Total logistics costs, which already mentioned above, can be divided into two main types. The first includes the items that can be directly observed and measured, such as transportation costs, and the cost of holding inventory etc. (Overman et al., 2001: p.2). The second includes items that are more difficult to be observed and measured, such as the costs of obtaining information (Aviat and Coeurdacier, 2004: p.6). Our study will include only the first type of logistics costs. And for the purpose of studying their effects on international trade, logistics costs is divided into four groups, first is transport costs, second includes inventory holding costs, third is the costs of the time spent until delivery, and the fourth is the costs of organizational complexity as barriers to trade.

Transport costs and its effect on international trade

Transport costs represent the largest relative component of logistics costs. This type of costs is related to geographical distances. It includes the total expenditure of transportation and shipping costs for supplying factors of production from its sources to the places of production, and then delivering final products to the end consumer. These costs are divided into fixed costs as the cost of capital assets, and variable costs associated with operational processes.

It is expected that the importance of transportation costs reduced with the revolution in transportation and telecommunication as a requirement of the globalization. But surprisingly several studies (Lengyel et al., 2013:p.12; Gonzalez et al. 2007:p.24; Rahman et al., 2006:p.10; Coe et al., 2007:p.36) found that transportation costs is still one of the major factors affecting trade. This leads (Lengyel et al., 2013; Carrere and Schiff, 2004) to say that distance is still alive and matters as a barrier to trade.

Here it should be noted that the flow of international trade is not affected by the absolute value of the distance between the two states, but also the geographical location of the partner, relative to the rest of the other potential partners. As a result, some studies stated that the contiguous countries start with each other a normal trade bloc (Frankel, 1997: p.41; Linders et al., 2005: p.9).

In an attempt to estimate the negative impact of increasing the geographical distances between countries on international trade flows, it was concluded that the lower the geographical distances between trading partners of 1% (equivalent to 80 kilometers on average worldwide), the increased the flow of trade, equivalent to 1.3% (Wilson et al., 2004: p.12).

Finally, despite the expected decline of the flexibility of trade flows in response to changes in the distance with the expansion of globalization, several studies found that it increases with time (Carrere and Schiff, 2004: p.2 ; Overman et al., 2001: p.9).

Inventory holding costs and its effect on international trade

Inventory holding costs can be defined as total costs results from the maintenance of the stock. The importance of focusing on this type of costs is that any project is facing a trade-off between minimizing the inventory in an attempt to minimize the cost of inventory and to keep the optimum size of the inventory that is sufficient to provide an efficient service to buyers.

Even, putting into consideration that the introduction of Just-in-time (JIT) technique reduces final products stock hold, it requires keeping more of the raw materials needed for production delivery on time. Therefore, storage costs and inventory was and still one of the most important items of logistics costs.

It is expected that the cost of inventory holding is higher in international trade than domestically. This is because in international trade higher quantities of stock are required to be hold than in the domestic trade[d].

The cost of holding inventory increase in developing countries relative to OECD countries (Dod, 2007: p.13). This increases the total cost of the products in developing countries and leads to a decline in the international competitiveness of their products. The increase in the costs of maintaining inventory in developing countries results from the poor infrastructure, especially with regard to transportation. As a result, developing countries try to increase the size of the inventory to avoid the problems with transport (World Bank, 2003: p.264).

[d] In studying the effect of increased costs of inventory holding in international trade, (Hummels, 2001: p.25). found that the estimated value that any project is ready to pay to save one-day delivery of products is about 0.5% (on average) of the value of the product itself. This percentage varies depending on the nature of the product.

The costs of time spent until delivery and its effect on international trade

This type of costs includes logistics costs resulting from the time spent that can directly affect the decisions of storage and transport. These costs include items of interest paid, and susceptibility to damage, and the slow response to changes in external market conditions (Frankel, 1997: p.45).

The effect of time on costs of trade can be analyzed through three mechanisms. These mechanisms are the lead time, the lead time variation, and JIT technique (Nordas et al., 2006: p.8&140). The lead time is the period of time between receiving the purchasing order and delivers the products to the consumer. The lead time variation is the statistical differences between potential suppliers in lead time. JIT is a way to organize production, where the stock retained - whether locally or imported - is minimized.

In order to include the impact of time spent till the delivery, researchers used several proxies for time as an independent variable in the trade models (Hausman *et al.*, 2005:p.6; Hummels, 2001:p.13). These variables include the time to finish the procedures in both of the exporting and the importing countries and the time to finish the documentation. These variables were statistically significant as a barrier to trade in the models.

Costs of regulatory complexity and its effect on international trade

This group includes the costs associated with regulatory factors. It includes costs related to the documentary procedures necessary for trade, examination procedures, determining the size of the sample tested to the total charge, the efficiency of ports, and the extent of the administrative corruption and transparency.

Despite the fact that these forms of regulatory complexity and administrative corruption cannot be considered direct costs of trade, the improvements in the factors generating these costs can enhance international trade more than the ability of removing tariffs (Wilson et al., 2003: p.13).

In order to test the impact of regulatory complexity as barriers to trade, (Hausman et al., 2005: p.12-17; Nordas, 2006: p.158; Gonzalez et al. 2008: p.8; Helble et al., 2007 : p.35) used the total number of documents and signatures required for the completion of trade, the ratio of containers examined to total container involved in the trade, the index of corruption Perception Index as an indicator of the quality of institutions. These logistical indicators were significant and confirm the expected inverse relationship within the models on trade.

THE GRAVITY MODEL OF TRADE

Tinbergen was the first to use the gravity model to study the flow of trade in 1962. He stated that just like the physical principles of gravity stated by Newton, the volume of bilateral trade between any two countries is affected by two opposite forces. The first is the positive relation with economic size of the two countries measured as GDP or national income (Y). The second is the negative relation with a vector of obstacles to trade (z) including distance; contrast cultures and trade policies (Tinbergen, 1962: p. 263). The gravity model has been interpreted as a reflection of supply conditions in the exporting country and demand conditions in the importing country (Head, 2000: p.3; Serlenga, and Shin, 2004: p.3).

$$\ln X_{ij} = \beta_0 + \beta_1 \ln Y_i + \beta_2 \ln Y_j + \sum_{m=1}^{M} \beta_m \ln z_i^l \quad \ldots (1)$$

Several modifications are done in order to support its theoretical roots (Anderson, 1979; Helpman, 1987; Deardorff, 1995; Anderson and Wincoop, 2003). As a result the generalized equation of gravity is derived to include variables to refer to the factor proportion theory, Linder's model, theories and economies of scale and monopolistic competition theory. These variables include:

- The per capita GDP as a proxy of per worker capital in both of the exporting and the importing countries.
- A price index of the exchange rate between the 2 members' currencies.
- Dummy variables for having a common language, religion, history of colonial and common currencies as proxies to the extent of the cultural compatibility as a tool for the promotion of trade.
- A dummy variables for having a preferential trading area.
- Proxies for the quality of institutions and regulatory complexities of the two countries.
- Bilateral FDI.

In general, the variables included in the generalized equation of gravity can be divided into three groups of variables. First variables related to the supply and demand of the two countries, including the GDP, bilateral FDI and population. Second variables refer to restrict trade, like transportation costs, contrast cultural and being landlocked state. And third factors related to the promotion of trade, such as being members of preferential trade agreements and having a common language, religion and borders.

Accordingly, the generalized gravity model of international trade can be shown after adding some variables to refer to the effects of the performance of logistics on trade and converting to logarithms as follow: ... (2)

$$\begin{aligned}\ln X_{ij} = {} & \beta_0 + \beta_1 \ln Y_i + \beta_2 \ln Y_j + \beta_3 \ln y_i + \beta_4 \ln y_j + \beta_5 \ln D_{ij} + \beta_6 Bor_{ij} + \beta_7 Agr + \beta_8 L_{ij} \\ & + \beta_9 R_{ij} + \beta_{10} Col_{ij} + \beta_{11} \ln RER_{ij} + \beta_{12} \ln IQ_i + \beta_{13} \ln IQ_j + \beta_{14} \ln ED_i \\ & + \beta_{15} \ln ID_j + \beta_{16} \ln ECC_i + \beta_{17} \ln ICC_j + u_{ij}\end{aligned}$$

Where X_{ij} is the value of exports from country i to country j at time t, Y_i (Y_j) is the value of GDP in the exporting (importing) country; y_i (y_j) is the value of per capita GDP in the exporting (importing) country; D_{ij} is the geographical distance between the 2 partners, Bor_{ij} is a dummy variable for having a common borders; Agr_{ij} is a dummy variable for having a preferential trade agreement; L_{ij} is a dummy variable for having a common language; R_{ij} is a dummy variable for having a common religion; Col_{ij} is a dummy variable for having a common history of colonial; RER_{ij} is the real exchange rate between the 2 partners at time t referring to the relative prices (Eita, 2008:p.7); IQ_i (IQ_j) is an index for the institutional quality in the exporting (importing) country; ED_i (ID_j) is an index for documents to export (import) in both countries; and ECC_i (ICC_j) is the cost of the procedures to export (import) per TEU.

ESTIMATING THE GRAVITY MODEL OF ARAB NON-OIL EXPORTS TO THE BRAZILIAN MARKET

In estimating the gravity model of Arab non-oil exports[e] to the Brazilian market, data for bilateral trade between 15 of the Arab countries and Brazil for the period 2006-2013 are used.

The estimation procedures employed proceeds as follows: First, the best form of the model is chosen (pooled, fixed effect or random effect). Subsequently, the estimation of the model was carried out.

In our model, the generalized gravity model shown in equation (2) was augmented by eliminating some of the variables that are not applied like L_{ij}, Bor_{ij}, R_{ij}, and Col_{ij}, in addition to the variables of Y_j, y_j, IQ_j, ID_j and ICC_j as the study covers only one partner which is Brazil. Subsequently, the model of the Arab non-oil exports to Brazil can be represented using the following model:

$$\ln NOX_{iB} = \beta_0 + \beta_1 \ln Y_i + \beta_2 \ln y_i + \beta_3 \ln D_{iB} + \beta_4 Agr_{iB} + \beta_5 \ln RER_{iB} + \beta_6 \ln IQ_i + \beta_7 \ln ED_i + \beta_8 \ln ECC_i + u_{iB} \quad (3)$$

Data sources include the International Monetary Fund for Y, y and RER, the sea distance between the major sea ports in Arab countries and Brazil are calculated from the web[f] depending on the way through Strait of Gibraltar or Cape of Good Hope which is lower, countries official websites and reports of the Arab League to have data of Agr, the Worldwide Governance Indicators (WGI) project to have IQ data[g], Doing Business reports for ED, CPX and ECC data.

The best form of the model

Hausman test is used to identify and choose the best form of the model. In doing so, the null hypothesis that the model follows the random effect is accepted as the differences in estimation between fixed effect and random effect models are insignificant.

[e]Oil and its derivatives exports were excluded from the total exports for 2 reasons:

- Oil may lead to biasness in the results through overstate the level of trade between the Arab countries of the region and the rest of the world.
- As a trial to know how to diversify the Arab exports after adopting plans that aims to provide countries with a sustainable base for after-oil economy in most of Arab oil exporting countries.

[f] http://www.sea-distances.org/.

[g] The country's institutional quality is measured as the arithmetic average of the country's scores on all six governance dimensions of the governance infrastructure quality (Linders et. al, 2005).

Estimating the model

In estimating the random effect model, a recursive process of eliminating statistically insignificant variables was carried out in order to derive a more parsimonious description of the model. In doing so, RER_{iB}, IQ_i, y_i and Agr_{iB} were eliminated.

The final estimated equation describing the behavior of Arab non-oil exports to Brazil is set as follow (Estimation results are presented in the appendix):

$$\ln \hat{NOX}_{iB} = 68.67 + 0.97 \ln Y_i - 1.7 \ln ED_i - 1.76 \ln ECC_i - 4.71 \ln D_{iB} \quad \text{... (4)}$$

The efficiency of the estimation was confirmed as there was no sign of significant residual autocorrelation and heteroskedasticty. Also the results of Walt test supported estimation results by proving that ED, ECC and D are jointly cause changes in non-oil Arab exports to Brazil.

Empirical Results

Most of the estimates corroborate the theoretical model prediction since they display the expected signs, and are statistically significant at conventional levels. The GDP in the exporting country has a positive and significant elasticity in the case of Arab non-oil exports because increasing output enhances the potential trade.

On the other hand, results indicate that the performance of the logistical activities worked as a barrier to trade as:

- The sea distance as a proxy for transport costs has negative and significant elasticity. This agreed with (Lengyel et al., 2013:p.12; Gonzalez et al. 2007:p.24; Rahman et al., 2006:p.10; Coe et al., 2007:p.36) that transportation costs is still one of the major factors affecting trade.
- The index for documents to export as costs of regulatory complexity has negative and significant elasticity. This confirms the studies of (Hausman et al., 2005: p.12-17; Nordas, 2006: p.158; Gonzalez et al. 2008: p.8; Helble et al., 2007 : p.35).
- The costs of the procedures to export per TEU have negative and significant elasticity.

CONCLUSIONS AND POLICY IMPLICATIONS

The study highlighted the logistical barriers to trade faced the Arab exports to Brazil. Both theoretical and estimated results stressed the negative and significant effects of distance as a proxy of transportation costs, the documents to export and the cost of the procedures to export per TEU.

The following recommendations are suggested to facilitate exporting to Brazil and enhance the competitiveness of exports as a whole:

- Support having a hub port where small feeder ships discharges containers into giant Ships that can handle large numbers of containers to be traveled to Brazil. Giant ships will later return the empty containers to the hub port, which will then be repositioned primarily to the Arab countries for reloading. This helps to reach the economic size of shipments transported and reduce transport costs.

- Adoption of computerization and automation of export procedures in the Arab countries, to reduce paperwork and can reduce delays especially for exports that are not controlled. In addition, authorities can study giving an export permit from Customs within a specific period of export.
- Speed up the processes and reduce the costs of exporting through having a single window for all the related agencies together.

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Appendix: The results of Estimating the random effect model

Dependent Variable: LOG(NOX_?)
Method: Pooled EGLS (Cross-section random effects)
Date: 11/10/14 Time: 18:11
Sample: 2006 2013
Included observations: 8
Cross-sections included: 14
Total pool (unbalanced) observations: 95
Swamy and Arora estimator of component variances
Cross sections without valid observations dropped

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	68.6692	7.34555	9.348407	0
LOG(GDP_?)	0.966275	0.152603	6.331939	0
LOG(ED_?)	-1.702596	0.621437	-2.73977	0.0074
LOG(ECC_?)	-1.763923	0.61176	-2.88336	0.0049
LOG(DIS_?)	-4.707684	0.682136	-6.90139	0
Random Effects (Cross)				
ALG_BR--C	-0.224154			
BAH_BR--C	0.028657			
EGY_BR--C	0.145009			
JOR_BR--C	-0.13992			
KUW_BR--C	-0.106591			
LEB_BR--C	-0.081404			

MOR_BR--C	0.06753
OMA_BR--C	0.071549
QAT_BR--C	0.089537
SA_BR--C	-0.030132
SYR_BR--C	0.117335
TUN_BR--C	0.106044
UAE_BR--C	-0.050349
YEM_BR--C	0.006889

Effects Specification

	S.D.	Rho
Cross-section random	0.251899	0.0383
Idiosyncratic random	1.262285	0.9617

Weighted Statistics

R-squared	0.545822	Mean dependent var	14.83828
Adjusted R-squared	0.525636	S.D. dependent var	1.890921
S.E. of regression	1.302354	Sum squared resid	152.6514
F-statistic	27.04003	Durbin-Watson stat	1.29315
Prob(F-statistic)	0		

Unweighted Statistics

R-squared	0.611929	Mean dependent var	16.81502
Sum squared resid	157.6883	Durbin-Watson stat	1.251844