Centre for
Management **P**ractice
Discussion **S**eries
(CMPDS)

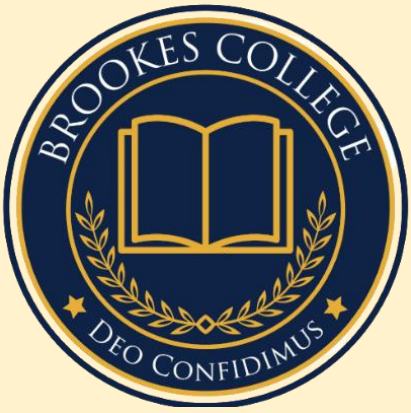
Centre for
Management
Practice
(CMP)

THE EFFECTS OF LOGISTICS PERFORMANCE INDEX ON INTERNATIONAL TRADE: A GRAVITY MODEL APPROACH

Alassane D., Yeo, Aiming Deng, and Eugenie M., Nyandwe

September 2021

CMPDS – 1
September 2021
ISSN: 2563-8866 (Online)
Published Quarterly



Centre for Management Practice (CMP) consists of students, faculty, alumni, and associates of Brookes College who are working on research on Business Management Practices. CMP undertakes original management research focused on cutting-edge practical research to help practitioners across all industrial settings namely Healthcare, Retail, Oil and Gas, Real Estate, and many others.

CMP also produces the Brookes College – Centre for Management Practice Discussion Series (CMPDS) with a mandate to publish high-quality papers every quarter. Moreover, members of the research group regularly publish in general management, economics, and other specialized journals.

It runs workshops and conferences that bring together academics and practitioners to explore and discuss the important management issues of the day. The research group also provides training courses for Government departments and industries in various areas of management.

Enquiries:

Acting Director of CMP and Editor of CMPDS
Pinkal Shah
CMP
Brookes College
Address : #250, 6424 36 St NE Calgary, AB T3J 4C8
Contact no. : +1 (403) 800-6613
Email : research@brookescollege.ca
Website : www.cmp.brookescollege.ca

The 1st International Conference on Global Business Practices

Centre of Management Practice

Brookes College, Canada

THE EFFECTS OF LOGISTICS PERFORMANCE INDEX ON INTERNATIONAL TRADE: A GRAVITY MODEL APPROACH

Alassane D., Yeo[1*], Aiming Deng[1], and Eugenie M., Nyandwe[2]

[1] *School of Economics and Trade, Hunan University, Changsha, China*

[2] *School of Resources and Safety Engineering, Central South University, Changsha, China*

Abstract.

This paper examined the impact of logistics performance and its components on trade using the augmented gravity model. A comparative analysis for the years 2010,2012, 2014,2016, and 2018 has been done using the Poisson estimation technique. The results show that the logistics performance index has a significant impact on trade; therefore, logistics performance was more important for importing nations than exporting nations. The results also show that upper-middle income countries are far ahead of lower-middle income countries in terms of trade facilitation. Therefore, lower-middle-income countries must focus on improving their infrastructure and customs processes in order to be trade efficient.

Keywords: logistics performance, augmented gravity model, Poisson estimation technique.

1. Introduction

According to The World Bank's Logistics Performance Index (LPI) (2018), logistics performance is an interactive benchmarking tool created to help countries identify the challenges and opportunities they face in their performance on trade logistics and what they can do to improve their performance. Benchmarking can be described as searching for the best practices leading to a company's superior performance (Korpela & Tuominen, 1996). Therefore, it is essential to identify the critical success factors that will enable the company to achieve its logistics performance objectives to determine its strengths, weaknesses, and problems. Indeed, each country must implement a national strategy to develop logistics competitiveness and provide the necessary answers to the development of logistics and adequate solutions to goods flow management problems.

LPI then emerges as a tool used by companies to identify challenges and opportunities related to the host country's transport infrastructure, logistics competence, and the availability of efficient supply chains. Therefore, the LPI is an important indicator in a country for trade logistics and is also a benchmark when selecting sites for different operations types. As reported by Arvis et al. (2014), the Logistics Performance Index refers to a country's evaluations of its logistics in terms of customs clearance efficiency, top quality of related transportation infrastructure, ability to arrange competitively valued shipments, high quality of transport infrastructure, ability to track and map deliveries, and frequency.

The higher score reflects a better situation of the country's logistics situation. The Logistics Performance Index (LPI) measures the efficiency with which countries move goods within and across borders. Cooper, Browne, and Peter (1990) focus on performance indicators and found

significant logistics efficiency varies depending upon which performance indicators were used. The efficiency with which goods can transit through the systems of transportation, storage, brokerage, express delivery, terminal operations, and data and information management to their final destination is a key determinant of a country's business opportunities.

Besides, most countries tend to focus on ranking rather than improving the actual values of LPI indicators. Several countries have announced specific LPI score or ranking targets in their strategic development plans. The choice of indicators is very important in determining countries' ranking; however, all of these indicators are important to each other and are used to rank countries and assess the level of development of those countries in terms of infrastructure and competitiveness. According to the World Bank Group's report, published on July 24, 2018, most countries implement reforms or investments in infrastructure to facilitate transport and trade and promote modern and efficient services. In this regard, advanced economies quickly realized the benefits of improved logistics services and continued to increase investments in this area. Recently, emerging countries have not stopped growing investments in this sector, and their ranking perceives this in the world ranking, which is only getting better. Such is China's case, which allocates 1.14 trillion yuan ($0.17 trillion U.S. dollars) in public spending on transportation infrastructure in 2019. Indeed, policy decisions, directly and indirectly, affect a region or country's attractiveness regarding business location decisions and foreign direct investment (FDI) (Contractor et al, 2020). For example, thanks to its good logistics performance in recent years, Côte d'Ivoire has attracted many companies to its territory. Through its transport network, one of the best in Africa, the country has experienced immense economic performance. The transport infrastructure has a significant impact on companies' productivity and cost structure (Haughwout, 2001). Indeed, the Logistics Performance Index (LPI) enables governments to better analyze the relationship between logistics and trade and take appropriate action.

The sixth edition of the connecting to compete (Arvis et al., 2018) report states that a country's economic growth and competitiveness depend on its logistics performance. When logistics is inefficient, the cost of doing business increases, and the prospects for integration into global value chains decline. The consequences can be particularly severe for developing countries seeking to gain a position in the global market. The performance of the logistics sector, therefore, has a direct impact on almost all economic activities.

International trade relies on logistics services. According to Caroline Freund (Djankov, Freund & Pham, 2010), with the increasing dispersion of supply chains worldwide, a country's participation in the global economy depends on the quality of its logistics services. Many researchers have justified this assertion (Gani, 2017; Hausman, Lee, and Subramanian, 2013). By examining data on overall logistics performance and disaggregated logistics specifics for a large sample of countries, they found that overall logistics performance is positively and statistically significantly correlated with exports and imports. Finally, they conclude that logistics specificities mattered for international trade.

A country that improves its logistics system is in an excellent position to exploit new market opportunities, especially the growing trade sector. Such is Croatia's case, which has had a significant opportunity for its economic growth after increasing its participation in European supply chains. Indeed, Bentyn, Luetić & Šerić (2020) highlighted that the logistics infrastructure and other sub-factors included the support offered to trade activities and the country's increased preparedness for a new upswing in logistics services have enabled the countries to explore new opportunities for trade development. Logistics service providers are

important to the competitive advantage of business entities directly involved in buying and selling in foreign trade (Skender, Host, Nuhanovic, 2016). Therefore, logistics is presented in different forms and under different names; however, its main purpose remains to help businesses transport, store, ship, and distribute goods more effectively and efficiently.

Logistics performance is nowadays a decisive factor in export competitiveness. Although many recent studies have focused on the impact of logistics on international trade, Mendes dos Reis et al. (2020) paper deals with the impact of logistics performance on agricultural commodities. They applied an extended gravity model to examine whether the World Bank logistics performance index (LPI) indicators, adopted as a proxy of logistics efficiency, are an important determinant of bilateral soybean exports among Argentina, Brazil, the US, and their trading partners from 2012-2018. As a result, logistics infrastructure has a positive and significant correlation with the soybean trade. However, the results conclude that different logistical aspects may affect trade in goods in different ways. Nevertheless, excellent logistics facilities attract the manufacturing industry's future development (Bakear & Jarafar, 2016).

Researchers employed several gravity equations where LPI and its components were used as proxy variables characteristic of trade facilitation Puertas, Marti, and Garcia (2014) assessed the gravity model utilizing the two-stage Heckman model for all 26 EU countries. They wrapped up that logistics was more important for exporting countries than importing nations in 2005 and 2010, enhancing the paper's exporter side's passion. Additionally, Marti, Puertas, and also Garcia 2014 research studies tried to find feasible advantage in logistics in establishing nations, which are organized in five areas (Africa, South America, Far East, Middle East, and Eastern Europe) by comparing the LPI data in the exact same years (2005 and 2010). Here, a gravity model was initially estimated for each of the geographical regions. All countries considered taking the LPI as an indicator of the impact of trade facilitation on export. The results revealed that improvements in any of the LPI components could significantly grow its trade flows.

Our study follows that of Marti, Puertas and Gracia (2014), with a focus on lower and upper-middle-income countries. The This study analyses the impact of LPI on trade in the selected countries, especially in the lower and upper-middle-income countries, using a gravity model. Furthermore, the study aims to compare each component's impact in 2010, 2012,2014, 2016, and 2018. This paper is organized as follows: Section 2 explains the model used in the study. Section 3 details the sample and sources of the variables used. Section 4 presents the results of estimating the gravity model, and finally, section 5 concludes.

2. The gravity equation

The English economist Adam Smith pointed out in the book "The Wealth of Nation" published in 1776 that countries should specialize in producing goods that have an absolute advantage, then trade with others and all benefit from international trade. However, this theory of absolute advantage cannot explain why countries that do not have an absolute advantage always benefit from international trade. Thus, David Ricardo, another English economist, proposed the theory of comparative advantage in response to Adam Smith's theory. Indeed, this theory states that a nation, like a person, benefits from trade by exporting the goods or services for which it has the greatest comparative advantage in terms of productivity and by importing those for which it has the least comparative advantage (Lindert, 1991).

Based on David Ricardo's theory's limitations, Eli Hecksher and Bertil Ohlin, two Swedish

economists, proposed the Heckscher-Ohlin model. This more complete model adds capital and land to labor and the fundamental factors. The Heckscher-Ohlin model states that a country exports product for which production requires intensive use of abundant factors and imports products for which production requires intensive use of scarce factors. Until then, the main international trade models were the Ricardian model, which relies on technological differences between countries to explain trade patterns, and the Heckscher-Ohlin (HO) model, which relies on differences in factor endowments between countries as a basis for trade.

These classical theories of trade were incapable to describe the big percentage of trade between countries with comparable endowments and also intra-industry trade, which dominate the trade of established economies. This encourages the new trade theories developed in the 1980s that try to give a basis for gravity. These new trade theories discuss world trade based on economies of scale, imperfect competitors, and item differentiation, therefore relaxing the timeless concept's rigorous assumptions (Krugman and Obstfeld, 2005).

2.1 Newton's gravity model

Traditionally, the gravity model of international trade is based on Newton's gravity model of trade flows. This model's intuition is that the more two geographic zones are close and "massive" (in population, wealth), the more these two zones will trade with each other.

The basic theoretical type of trade gravity between two countries (i and j) is stated as follows:

$$F_{ij} = G * \frac{M_i * M_j}{D_{ij}} \qquad (1)$$

Fij is trade flow between countries i and j, M represents the size of the nation in a broader sense, the economic size of the nation is measured in terms of gross national product (GDP). The number of inhabitants can also sometimes be used as a second variable. The distance between countries i and j is measured in terms of the geographic distance in kilometers (Dij). G is a variable that does not rely on i or j such as the degree of worldwide liberalization. The simplest theoretical proposal of the gravity model is that: Bilateral trade flows among 2 nations are generally straight symmetrical to the product of the particular GDPs and vice versa symmetrical to the distance measure. In other words, the higher the GDP ratio, the greater the trade volume, and vice versa. In some empirical studies, using a gravity model, it has been observed that nations focusing on the same income levels have been found to have more trade and the distance is often large.

2.2 Tinbergen's gravity equation (1962)

All begin with the founding work of Jan Tinbergen (1962) who stipulates that just as planets are mutually attracted in proportion to their size and proximity, countries trade in proportion to their GDP and their respective proximity. Thus, a law called "gravity equation" was born by analogy with the Newtonian theory of gravitation. Tinbergen's (1962) gravity equation related exports Y from country i to country j, with respective GNPs, the distance between trading partners (Dist, in thousands of nautical miles), an indicator variable informing about the presence of a border (Front) and a trade policy indicator variable (Pref) depending on whether country i's goods received preferential treatment by country j:

$$\ln(Y_{ij}) = \alpha + \beta_1 \ln(\text{GNP}_i) + \beta_2 \ln(\text{GNP}_j) + \beta_3 \ln(\text{Dist}_{ij}) + \beta_4 Bord_{ij} + \beta_5 \text{Pr}ef_{ij} + \varepsilon_{ij} \qquad (2)$$

This is referred to as an "intuitive" gravity model in that the equation does not rely on a priori theoretical foundations but on the following intuitions: (i) the integration of an economy in international trade is a function of its economic weight (measured mainly by its GDP or GNP) and (ii) the intensity of trade between two economies is a function of their geographical proximity. The Tinbergen equation has a high explanatory power, but it has several limitations:

The lack of a variable describing the relationship between the exporter (importer) and the rest of the world does not allow for the incorporation of the effect of an increase or decrease in trade costs with third countries.

A change in the level of exports can occur without changing bilateral trade costs relative to the rest of the world. In general, the absence of exporter/importer fixed effects does not capture the variation in cross-sectional factors that affect overall trade.

Thus, the work of Anderson (1979) made the first important attempt to provide a theoretical basis for gravity models in the context of a model where goods are differentiated by country of origin (the so-called Armington hypothesis) and consumers have defined preferences over all differentiated products. This structure would imply that, regardless of price, a country will consume at least some of each good from each country. All goods are traded, all countries trade, and in equilibrium, national income is the sum of domestic and foreign demand for the single good that each country produces. This is why large countries import and export more.

Subsequently, a series of justifications of the theoretical foundations of the gravity model will follow. Bergstrand (1985 and 1989) shows that a gravity model directly implies a trade model based on monopolistic competition developed by Paul Krugman (1980). Under this model, same countries trade differentiated goods as consumers prefer a variety of goods. The location of firms is endogenously determined and countries are specialized in producing different sets of goods. Eaton and Kortum (2002) obtain a gravity equation from a Ricardian-type model. Meanwhile, Helpman et al (2008) and Chaney (2008) derive it from a theoretical model of international trade in differentiated goods with firm heterogeneity.

2.3 Anderson and van Wincoop's gravity equation (2003)

Recent research on the gravity equation's theoretical basis emphasizes the importance of deriving the specifications and variables used in the gravity model from economic theory to draw the right conclusions from estimates using the gravity equation. In this regard, the Anderson and van Wincoop (2003) paper's contribution was particularly important, as it shows that controlling for relative trade costs is crucial for a well-specified gravity model. Their theoretical results show that relative trade costs determine bilateral trade, i.e., country j's propensity to import from country i is determined by country j's trade cost to i relative to its overall "resistance" to imports (weighted average trade costs) and the average "resistance" faced by exporters in country I; not simply by the absolute trade costs between countries i and j (Anderson and van Wincoop, 2003). Anderson and Wincoop derive the gravity equation from a constant elasticity of substitution demand function with origin-differentiated goods, based on Armington's (1969) assumption of imperfect substitutability between local and imported goods. In this framework, the utility function of the consumer (importing country, j) is the following:

$$\Phi_i = \left[\sum_k \frac{GDP_k}{GDP} (\Phi_k^{\sigma-1} \tau_{ki}^{1-\sigma} \right]^{\frac{1}{1-\sigma}} \qquad (3)$$

Where, $\sigma > 1$ is the constant elasticity of substitution between varieties of goods (under the Armington assumption, goods are differentiated by their source), α is the preference parameter or propensity to consume a variety of goods, and c is the consumption of country j from country i. The consumer maximizes this utility function under budget constraint. The authors show that exports Yij are written:

$$Y_{ij} = \frac{GDP_i GDP_j}{GDP} \left(\frac{\tau_{ij}}{\Phi_i \Phi_j} \right)^{1-\sigma} \qquad (4)$$

Exports depend on a term related to the relative economic size of the partners ($\frac{GDP_i GDP_j}{GDP}$), and a term aggregating all trade costs $\left(\frac{\tau_{ij}}{\Phi_i \Phi_j} \right)^{1-\sigma}$. τij represents the barriers to trade between two partners (historical ties, common language, common border, etc.) similar to the Tinbergen equation. Two new variables are added, called by the authors "multilateral resistance terms": Φj here represents the multilateral resistance imposed on the importer, Φi that of the exporter. Thus, the first part of the equation describes a frictionless world. In contrast, the second part of the equation sheds light on bilateral trade costs (which describe the partners' relationship-specific barriers) and multilateral costs (which are the barriers accounting for all bilateral costs with third countries). These resistance terms are written as follows:

They depend on the bilateral trade costs of i and j with all trading partners τk, $[i,j]$, the weights of all trading partners as well as their multilateral resistance. The multilateral resistance terms $\Phi i,j$ further depend on the bilateral trade costs between economies k, l, via the multilateral resistance terms Φk, $k = 1. . n$. Thus, a change in trade costs between any two economies k, l affects the trade relationship between i and j. The resistances Φ are increasing functions of τ: when bilateral trade costs increase with third countries, the resistance terms increase and the trade between i and j also increases ($\frac{\partial_y}{\partial_\Phi} > 0$), as the relative trade costs between i and j fall.

The log-linearization of (4) yields the following equation:

$$\ln(Y_{ij}) = -\ln(\text{GDP}) + \ln(\text{GDP}_i) + \ln(\text{GDP}_j) + (1-\sigma)(\ln(\tau_{ij}) - \ln(\Phi_j) - \ln(\Phi_i) + \varepsilon_{ij} \qquad (5)$$

Multilateral Resistance Terms are weak if a country is distant from world markets. The remoteness is determined by physical factors such as physical distance to major markets as well as political factors such as high tariff barriers or other trade costs. This result highlighted the limitations of the intuitive gravity model in which bilateral trade flows between two nations are generally directly proportional to the product of particular GDPs and inversely proportional to the measure of distance and omits variables, leaving serious consequences (bias and inconsistency). The important contribution of Anderson and Van Wincoop's work was to emphasize that relative trade costs determine bilateral trade.

3. Empirical analysis

3.1 Model

The present paper employs the gravity model of international trade to examine the logistics performance index's impact on trade. The gravity model has recently been an empirical success in accurately predicting the trade flows between countries of many goods and services (Chan-Hyun Sohn,2005; Van Bergeijk and Brakman, 2010). They have used the gravity model to explain bilateral trade and give practical policy implications. Batra (2006) used an augmented gravity model equation to analyze the world trade flow using a sample of 146 countries. In this study, we consider an augmented gravity model to explore the impact of overall logistics performance index on the export, where all variables (except the crisis dummy) are natural logarithms:

$$Log\left(X_{ij}\right) = b_0 + b_1 Log\left(Y_i\right) + b_2 Log\left(Y_j\right) + b_3 Log\left(P_i\right) + b_4 Log\left(P_j\right) + b_5 Log\left(D_i\right)$$
$$+ b_6 Log\left(LPI_i\right) + b_7 Log\left(LPI_j\right) + \sum_h \rho_h S_{ijh} + u_{ij} \quad (6)$$

where:

Log: denotes variables in natural logs

X_{ij}: Quantity exported by country i to country j

D_{ij}: Distance between country i and country j

Y_i: GDP of country i

Y_j: GDP of country j

P_i: Population of country i

P_j: Population of country j

LPI_i: Logistics Performance Index for country i

LPI_j: Logistics Performance Index for country j

$\sum_h \rho_h S_{ijh}$: Sum of dummy variables

S: Dummy variables (Border, official languages, colonizers, and countries)

The GDP coefficients of both the exporter and the importer (β_1) and (β_2) are expected to be positive because a high level of income in the exporting country indicates a high level of production and the high level of income in the importing country revels higher imports.

Furthermore, the population coefficient for the exporting country (β_3 and β_4) could be either positive or negative, depending on whether the most populated country exports and imports less (absorption effect) or exports or imports more (economies of scale).

The distance between countries (β_5) is expected to be negative since proximity promotes trade growth. Distance also determines the cost of transport; more the two capitals are close together, more transport costs are lower, thus increasing trade.

We augmented the gravity model by adding the exporter and importer LPI. The coefficient of both variables (β_6 and β_7) are expected to have a positive sign.

The model also includes a series of dummy variables representing the trading partners sharing a common language, common border. Also, the dummy variable evaluated whether the trading partners were in a colonial relationship and were the same country. The coefficients of all these trade variables (ρ_h) are expected to be positive.

The study also examines the importance of each component of the LPI in trade flows. Regressions similar to equation (6) were estimated by replacing the overall index with each index component separately. The coefficient of each component is expected to be significant and positive. Comparison of the results of the estimation allows us to identify the changes in the period (2010, 2012, 2014, 2016, and 2018) and to determine the component that has the greatest impact on trade flows since the components with higher values are likely to have a greater effect on the beginning, thus contributing to stimulate trade. Therefore, the following equations were formulated:

$$Log\ \left(X_{ij}\right)=b_0+b_1Log\left(Y_i\right)+b_2Log\left(Y_j\right)+b_3Log\ \left(P_i\right)+b_4Log\left(P_j\right)+b_5Log\left(D_i\right)$$
$$+b_6Log\left(Customs_i\right)+b_7Log\left(Customs_j\right)+\sum_h\rho_hS_{ijh}+\ u_{ij} \quad (7)$$

$$Log\ \left(X_{ij}\right)=b_0+b_1Log\left(Y_i\right)+b_2Log\left(Y_j\right)+b_3Log\ \left(P_i\right)+b_4Log\left(P_j\right)+b_5Log\left(D_i\right)$$
$$+b_6Log\left(Instrastructure_i\right)+b_7Log\left(Instrastructure_j\right)+\sum_h\rho_hS_{ijh}+\ u_{ij} \quad (8)$$

$$Log\ \left(X_{ij}\right)=b_0+b_1Log\left(Y_i\right)+b_2Log\left(Y_j\right)+b_3Log\ \left(P_i\right)+b_4Log\left(P_j\right)+b_5Log\left(D_i\right)$$
$$+b_6Log\left(International\ Shipments_i\right)+b_7Log\left(International\ Shipments_j\right)+\sum_h\rho_hS_{ijh}+\ u_{ij} \quad (9)$$

$$Log\ \left(X_{ij}\right)=b_0+b_1Log\left(Y_i\right)+b_2Log\left(Y_j\right)+b_3Log\ \left(P_i\right)+b_4Log\left(P_j\right)+b_5Log\left(D_i\right)$$
$$+b_6Log\left(Service\ quality_i\right)+b_7Log\left(Service\ quality_j\right)+\sum_h\rho_hS_{ijh}+\ u_{ij} \quad (10)$$

$$Log\ \left(X_{ij}\right)=b_0+b_1Log\left(Y_i\right)+b_2Log\left(Y_j\right)+b_3Log\ \left(P_i\right)+b_4Log\left(P_j\right)+b_5Log\left(D_i\right)$$
$$+b_6Log\left(Tracking_i\right)+b_7Log\left(Tracking_j\right)+\sum_h\rho_hS_{ijh}+\ u_{ij} \quad (11)$$

$$Log\ \left(X_{ij}\right)=b_0+b_1Log\left(Y_i\right)+b_2Log\left(Y_j\right)+b_3Log\ \left(P_i\right)+b_4Log\left(P_j\right)+b_5Log\left(D_i\right)$$
$$+b_6Log\left(Timeliness_i\right)+b_7Log\left(Timeliness_j\right)+\sum_h\rho_hS_{ijh}+\ u_{ij} \quad (12)$$

Poison's technique is used to reach the objective because it presents many properties suitable for linear models such as gravity. The method is in line with the existence of fixed effects that can be presented as dummy variables as in simple OLS. This attribute is an uncommon residential property of nonlinear maximum likelihood estimators, many of which have actually badly comprehended buildings in the visibility of fixed effects. This property is likewise essential for gravity modeling because the majority of in theory consistent models need the inclusion of exporter and importer fixed effects. After that, the Poisson estimator naturally includes observations where the observed trade value is zero. Because the logarithm of zero is

undefined, these observations are removed from the OLS model. Furthermore, the interpretation of the coefficients in the Poisson model is straightforward and follows the very same pattern as OLS. Furthermore, although the reliant variable in the Poisson regression is defined as exports in degrees instead of in logs, the coefficients of all independent variables entered in logs can still be interpreted as basic elasticities.

3.2 Data

The gravity model used in this study has been estimated for countries grouped in two different income level, namely:

Lower-middle income countries: Armenia, Bolivia, Cambodia, Cote d'Ivoire, Egypt, Arab Rep., El Salvador, Ghana, Guatemala, Honduras, India, Indonesia, Kenya, Kyrgyz Republic, Moldova, Myanmar, Nigeria, Pakistan, Philippines, Ukraine, Vietnam.

Upper-middle income countries: Algeria, Angola, Bosnia and Herzegovina, Brazil, Bulgaria, China, Colombia, Costa Rica, Dominican Republic, Ecuador, Jamaica, Jordan, Kazakhstan, Lebanon, Malaysia, Mexico, Paraguay, Peru, Romania, Russian Federation, South Africa, Thailand, Tunisia, Turkey.

Furthermore, the importers included in the model are the 120 countries whose LPI for 2010,2012,2014,2016 and 2018 were published by the World Bank

3.2.1 Economic data

UN Comtrade and the World Bank's World Development Indicators (WDI) contain economic data. The indicator taken from UN Comtrade is total exports in current U.S. dollars from each country to the rest of the world. The UN Comtrade dataset is an unbalanced panel as it only contains years for which countries have reported trade. Hence, time series differ from country to country. The first year for which some countries reported trade is 1962, the last year is 2019 (few observations are available for the start and end years of the time series).

The World Development Indicators (WDI) constitute the World Bank's main source of development indicators, collected from officially recognized international sources.It presents the most current and accurate global development data available, such as GDP, population, as in the present situation. WDI also provides aggregated information on country groups (such as "Europe & Central Asia" or "Low & Middle Income").

3.2.2 Gravity data

Distance and the series of dummy variables describing countries' social and cultural features that make up the areas were obtained from Centre d´Etudes Prospectives et d´Informations Internationals (CEPII). CEPII makes available a "square" gravity dataset for all world pairs of countries from 1948 to 2015. This dataset was originally generated by Head, Mayer, and Ries (2010) to be used in the following paper:

Distance: Weighted bilateral distance between origin and destination in kilometre (population-weighted). Source: CEPII Distance Dataset

Contig: dummy variables indicating whether the two countries are contiguous. Source: Head et al. (2010)

Official language: Dummy for common official or primary language. Source: Head et al. (2010)

colony: Dummy for origin and destination ever in a colonial relationship. Source: Head et al. (2010)

curcol: Dummy if origin and destination currently in a colonial relationship. Source: Head et al. (2010)

smctry: dummy variables indicating whether the two countries were/are the same country. Source: Head et al. (2010)

3.2.3 logistics performance index (LPI)

The LPI is a comparative, interactive indicator designed for countries to identify the challenges and opportunities faced in trade logistics and identify actions needed to improve their performance. The overall index is calculated by assessing six main components using the following indicators: customs, infrastructure, international shipments, logistics quality and competence, tracking and tracing, and timeliness. Each indicator doesn't independently guarantee a good level of logistics performance, and their inclusion is conditional on empirical studies and in-depth interviews with international freight transport experts. All indicators have been aggregated and appropriately weighted. The scores range from 1 to 5, with the highest score representing the best logistics performance. Each component is defined as follows:

• Customs: measures agility clearance processes in terms of speed, simplicity, and predictability of legal issues conducted by customs control bodies.

• Infrastructure: evaluates the quality of maritime, land, rail, and air transport infrastructure. The respondents' perception of this infrastructure is evaluated in terms of transport and storage modes and moving goods.

• International shipments: measures the ease of negotiating competitive prices for sending.

• Logistics quality and competence: indicates the quality of logistical services, such as transport operators or customs agents.

• Tracking and tracing: measures the follow-up and location of shipments. Identifying the exact location and route followed by each good is relevant to the moment of delivery to the final client. In this component, all goods supply chain agents are involved; therefore, traceability results from global action.

• Timeliness: refers to the exact time of shipment delivery. It is important to consider this factor because due to the high degree of existing competition, not meeting the established times is unacceptable.

The logistics performance indicators can be divided into two main areas: (1) regulatory policies (customs, infrastructure, and logistics quality and competency), and (2) service delivery performance outcomes (on-time performance, international shipments, and tracking and tracing). The first relates to the supply chain, while the second determines service efficiency. Each component is critical in determining the competitiveness of international trade within each country. (https://lpi.worldbank.org/)

3.3 Results

The results of applying the gravity model described in Section 3.3 are presented in Tables 3.1-3.8. Table 3.1-3.3 shows the impact of the overall LPI on export flows in 2010,2012, 2014,2016, and 2018. A gravity model was initially estimated for all countries and each lower and upper-middle-income country, respectively.

Table 1. Regression results for all countries

	2010	2012	2014	2016	2018
Constant	-5.137***	-4.735***	-4.904***	-4.728***	-4.849***
GDP Export	0.0999***	0.0932***	0.0975***	0.0989***	0.103***
GDP Import	0.137***	0.112***	0.109***	0.130***	0.146***
Pop Export	0.0168***	0.0168***	0.0144***	0.0110***	0.00900**
Pop Import	0.00278	0.0103***	0.0164***	-0.00318	-0.0132***
LPI Export	0.519***	0.549***	0.516***	0.461***	0.463***
LPI Import	0.703***	0.897***	0.931***	0.673***	0.552***
Distance	-0.0595***	-0.0546***	-0.0497***	-0.0496***	-0.0560***
contig	0.141***	0.143***	0.148***	0.159***	0.117***
Official language	0.115***	0.120***	0.119***	0.0926***	0.106***
colony	-0.022	-0.026	-0.032	-0.0133	-0.0247
o.curcol	-0.0636	-0.183	-0.0742	-0.127	-0.0692
smctry	0.149***	0.139***	0.150***	0.140***	0.152***
Observations	14,400	14,400	14,400	14,400	14,400
LR chi2(11)	27981.2	27545.37	26630.53	25665.27	25508.76
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.2601	0.2567	0.2509	0.2472	0.2439
Log likelihood	-39794.9	-39890.25	-39759.9	-39086.6	-39532.6

*Note: All variables except dummies are expressed in natural logarithms. ***,**, * denote significance at the 1%, 5% and 10% level, respectively.*

Table 2. Regression results for lower-middle-income countries

	2010	2012	2014	2016	2018
Constant	-5.673***	-5.459***	-5.065***	-5.216***	-5.422***
GDP Export	0.141***	0.123***	0.0615***	0.122***	0.127***
GDP Import	0.140***	0.123***	0.111***	0.133***	0.144***
Pop Export	0.00151	0.00569	0.0595***	0.00634	0.00534
Pop Import	0.00635	0.0123	0.0237**	0.0028	-0.00592
LPI Export	0.473***	0.654***	0.834***	0.462***	0.602***
LPI Import	0.858***	1.003***	1.072***	0.786***	0.660***
Distance	-0.110***	-0.0944***	-0.0913***	-0.0830***	-0.0891***
contig	0.0995**	0.117**	0.103**	0.137***	0.0896*
Official language	0.0642***	0.0698***	0.0527**	0.023	0.0585**
colony	-0.0818	-0.0697	-0.0552	-0.0437	-0.0453
o.curcol	-	-	-	-	-

smctry	0.116	0.118*	0.164**	0.154**	0.1
Observations	2,400	2,400	2,400	2,400	2,400
LR chi2(11)	4416.11	4490.29	4256.02	4132.78	4031.64
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.2504	0.2544	0.2438	0.2421	0.2368
Log likelihood	-6608.56	-6580.5114	-6601.61	-6469.89	-6496.87

*Note: All variables except dummies are expressed in natural logarithms. ***,**, * denote significance at the 1%, 5% and 10% level, respectively.*

Table 3. Regression results for upper-middle-income countries

	2010	2012	2014	2016	2018
Constant	-3.821***	-3.667***	-3.767***	-3.633***	-3.701***
GDP Export	0.0368***	0.0592***	0.0341**	0.0451***	0.0445**
GDP Import	0.139***	0.116***	0.126***	0.155***	0.155***
Pop Export	0.0688***	0.0516***	0.0667***	0.0480***	0.0576***
Pop Import	-0.0108	-0.00397	-0.00809	-0.0314***	-0.0299***
LPI Export	0.529***	0.332***	0.559***	0.514***	0.438***
LPI Import	0.547***	0.701***	0.667***	0.391***	0.363***
Distance	-0.0804***	-0.0717***	-0.0638***	-0.0718***	-0.0714***
contig	0.205***	0.186***	0.207***	0.199***	0.168***
Official language	0.111***	0.122***	0.131***	0.0881***	0.0985***
colony	0.0798*	0.0631	0.0709	0.0923**	0.0933**
o.curcol	-0.565	-0.745*	-0.576	-0.409	-0.36
smctry	-0.0447	-0.0555	-0.0229	-0.0159	0.0199
Observations	2,880	2,880	2,880	2,880	2,880
LR chi2(11)	4343.11	4235.03	4223.63	4079.6	3984.28
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.2195	0.2153	0.2149	0.2106	0.2061
Log likelihood	-7722.75	-7716.16	-7714.2196	-7644.78	-7675.08

*Note: All variables except dummies are expressed in natural logarithms. ***,**, * denote significance at the 1%, 5% and 10% level, respectively.*

The coefficients for the GDP of importing and exporting countries are positive and significant in all cases, indicating that the higher a country's production level, the more it is likely to trade. The coefficients of exporting countries' populations are positive and significant while importing countries vary considerably. In 2010 they were non-significant. In 2012, they were significant and positive in all countries. In 2016 and 2018, the population coefficients of upper-middle-income countries are negative and significant, while lower-middle-income countries are non-significant. In recent years, the population of underdeveloped countries has been growing at an uncontrolled rate. In contrast, there has been a decline in births in developing countries, thus

disrupting the trend in trade. The distance variable is negative and significant in all cases, which justifies the principle that a shorter distance between capitals intensifies trade relations between countries.

The LPI variables have significant and positive coefficients for both exporters and importers. We also find that the overall logistics index's impact on trade is greater for importers (from 0.363 to 0.931) than for exporters (from 0.438 to 0.549). For the lower-middle-income countries, the trend remains the same, while for the upper-middle-income countries, this trend will be reversed from 2016 onwards, making exports more impacted by LPI than imports. Emerging countries will quickly become exporters, while underdeveloped countries will remain importers. Indeed, as developing countries move to be "the world's factories," they will increase their efforts to improve infrastructure and customs procedures to more easily transport their products all over the world.

Similarly, in line with this research's objective, we estimated each of LPI components, as explained in the methodology section. The coefficients for these components are presented below (Table 3.4-3.8).

Table 4. LPI components. 2010

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
All countries	Export	0.519***	0.349***	0.358***	0.331***	0.439***	0.337***	0.189***
	Import	0.703***	0.438***	0.501***	0.546***	0.532***	0.373***	0.413***
Lower-middle	Export	0.473***	0.265***	0.614***	0.296***	0.478***	0.360***	-0.367***
	Import	0.858***	0.525***	0.642***	0.543***	0.613***	0.513***	0.618***
Upper-middle	Export	0.529***	0.354***	0.654***	0.334***	0.412***	0.348***	0.392***
	Import	0.547***	0.362***	1.003***	0.429***	0.328***	0.280***	0.363***

*Note: ***, **, * denote significance at the 1%, 5% and 10% level, respectively.*

(1)LPI;(2)Customs;(3)Infrastructure;(4)International Shipments;(5)Service Quality;(6)Tracking &tracing;(7)Timeliness.

The results for 2010 show that, in general, the impact of the overall index, as well as that of each of the components, is greater for importers than for exporters, as confirmed in the previous tables. Nevertheless, among upper-middle-income countries, service quality, tracking & tracking, and timeliness were more important for exporters than for importers. On the other hand, the slowness in the time taken to import and export in most of underdeveloped reported in many literature reviews is reflected here by a negative sign of the timeliness coefficient in lower-middle-income countries, thus negatively affecting the trade volumes of these countries (Raballand et al.,2012; Mogale et al.,2018).

Table 5. LPI components. 2012

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
All countries	Export	0.549***	0.340***	0.360***	0.591***	0.378***	0.430***	0.484***
	Import	0.897***	0.459***	0.535***	0.926***	0.751***	0.820***	0.845***

Lower middle	Export	0.654***	0.225***	0.212**	0.586***	0.374***	0.291***	0.777***
	Import	1.003***	0.493***	0.639***	1.077***	0.839***	0.928***	0.884***
Upper middle	Export	0.332***	0.255***	0.270***	0.438***	0.185***	0.294***	0.317***
	Import	0.701***	0.341***	0.427***	0.718***	0.578***	0.701***	0.630***

*Note: ***, **, * denote significance at the 1%, 5% and 10% level, respectively*

(1)LPI;(2)Customs;(3)Infrastructure;(4)International Shipments;(5)Service Quality;(6)Tracking &tracing;(7)Timeliness

The results presented in Table 3.5 show the estimation results for each LPI component for the year 2012. They are consistent with comments already made. Furthermore, it can be seen that both the coefficient of the overall index as well as those of the components of the logistics index affect imports twice as much as exports, mainly in lower-middle-income countries. Indeed, these countries import twice as much as they export.

Table 6. LPI components. 2014

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
All countries	Export	0.516***	0.279***	0.441***	0.414***	0.462***	0.383***	0.307***
	Import	0.931***	0.346***	0.621***	0.873***	0.783***	0.769***	0.781***
Lower middle	Export	0.834***	0.190***	0.795***	0.413***	0.454***	0.575***	0.435***
	Import	1.072***	0.454***	0.750***	0.939***	0.860***	0.831***	0.957***
Upper middle	Export	0.559***	0.383***	0.460***	0.485***	0.505***	0.552***	0.451***
	Import	0.667***	0.245***	0.406***	0.668***	0.552***	0.622***	0.504***

*Note: ***, **, * denote significance at the 1%, 5% and 10% level, respectively.*

(1)LPI;(2)Customs;(3)Infrastructure;(4)International Shipments;(5)Service Quality;(6)Tracking &tracing;(7)Timeliness.

Concerning the estimates made for 2014 (Table 3.6), and focusing on the regressions for each of the components in the different income levels, international shipments and timeliness are the most important components for lower-middle-income countries. For upper-middle-income countries, customs are the least important component.

Table 7. LPI components. 2016

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
All countries	Export	0.461***	0.277***	0.378***	0.321***	0.405***	0.396***	0.474***
	Import	0.673***	0.391***	0.416***	0.596***	0.560***	0.553***	0.779***
Lower middle	Export	0.462***	0.320***	0.370***	0.341***	0.373***	0.243***	0.514***
	Import	0.786***	0.496***	0.492***	0.717***	0.681***	0.592***	0.858***
Upper middle	Export	0.514***	0.248***	0.370***	0.474***	0.523***	0.520***	0.636***
	Import	0.391***	0.212***	0.143**	0.397***	0.306***	0.319***	0.528***

*Note: ***, **, * denote significance at the 1%, 5% and 10% level, respectively.*

(1)LPI;(2)Customs;(3)Infrastructure;(4)International Shipments;(5)Service Quality;(6)Tracking &tracing;(7)Timeliness.

In 2016 and 2018, as shown in tables 3.7-3.8, the trend remains the same in all countries and among lower-middle-income countries. However, for the upper-middle-income countries, we notice that these countries export more than they import. In other words, the improvement in the overall logistics index and these components tend to have more positive effects on exports than on imports. In 2018 the effect of improved infrastructure was more perceived on exports in all countries than on imports. Similarly, customs is found to be more important in lower-middle-income countries' exports than in imports.

Table 8. LPI components. 2018

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
All countries	Export	0.463***	0.262***	0.300***	0.420***	0.366***	0.340***	0.455***
	Import	0.552***	0.316***	0.256***	0.585***	0.441***	0.428***	0.550***
Lower middle	Export	0.602***	0.364***	0.329***	0.523***	0.523***	0.355***	0.498***
	Import	0.660***	0.360***	0.379***	0.660***	0.660***	0.530***	0.652***
Upper middle	Export	0.438***	0.217***	0.427***	0.408***	0.356***	0.351***	0.366***
	Import	0.363***	0.193***	0.104*	0.455***	0.312***	0.293***	0.330***

*Note: ***, **, * denote significance at the 1%, 5% and 10% level, respectively.*

(1)LPI;(2)Customs;(3)Infrastructure;(4)International Shipments;(5)Service Quality;(6)Tracking &tracing;(7)Timeliness.

In short, the fact that the overall index and its different components are significant in almost all countries as well as in countries with different income levels reinforces the global discussion about the importance of logistics performance. Also, by comparing the results obtained from 2010 to 2018, we realize that customs is the least important component, followed by tracking & tracing. With globalization and the opening of borders, international shipment is gaining more and more importance. Thanks to logistics companies' competitiveness, quality services, and tracking & tracing have entered the game and have enabled logistics services to become more efficient and sophisticated.

4. Discussion and conclusion

In this paper, the impact of logistics performance and its components on trade has been estimated using the augmented gravity model. A comparative analysis for the years 2010,2012, 2014,2016, and 2018 has been done using the Poisson estimation technique. The study sample comprises 120 countries on which a special attention has been made for the lower and upper-middle-income countries.

The estimated coefficients of variables such as GDP and population of the exporting and importing countries are statistically significant and positive, as expected from the gravity model. A 1% increase in the GDP of exporting countries will increase trade value by about 0.1% and about 0.12% and 0.05% respectively in lower and upper middle-income countries between

2010 and 2018. The same increase in importing countries' GDP will increase this value by 0.12% on average between 2010 and 2018. This also shows that the economy's size has a small influence on trade in lower and upper-middle-income countries. If exporting countries' population increases by 1%, the value of bilateral trade will increase by about 0.02%. Therefore, economic size and market size have an influence on trade activities, which means that large countries, which can create more products and services for export and have high revenues with a big consumer market, are most likely to raise the need for imports.

The geographical distance is statistically negative and significant, supporting the hypothesis that countries trade more with each other when they are geographically close. However, in the case of lower and upper-middle-income countries, this proximity has a weak effect on trade. For example, a 1% increase in distance will result in a decrease in the value of trade of only 0.089% on average in 2018 for lower middle-income countries. Also, speaking a common official language and sharing a common border with one's partner is positive and significant when participating in international trade. Indeed, according to studies published in the "CEPII letter" of January 2016, a common official language would increase trade by 43%. Sharing a language results in lower transaction and communication costs, allowing companies to enter new markets more easily and maintain existing trade flows over time, including during economic crises.

The results show a very strong influence of logistics performance and these indicators on international trade on balance. The positive effect of logistics performance is also demonstrated in our study for both importing and importing countries. A 1% increase in the logistics performance of exporting countries will increase the value of trade from 0.46% to 0.55% on average between 2010 and 2018 and a 1% increase in the logistics performance of importing countries will increase the value of trade from 0.55% to 0.93% on average between 2010 and 2018.

Overall, the results show that logistics performance has a significant effect on trade. Compared to the study conducted by Marti, Puertas, and Gracia (2014) on the 26 EU countries that states that logistics performance was more important for exporting nations than importing nations, our study on the lower and upper-middle-income countries reports that logistics performance was more important for importing nations than exporting nations. However, this trend has been reversed for upper-middle-income countries from 2016 onwards, where logistics performance becomes more important for exporters than for importers. The results also reveal that service quality is the most important factor, followed by international shipments, infrastructure, tracking, timeliness, and customs for the years 2010,2012 and 2014. For the years 2016-2018, timeliness, followed by international shipments, service quality is the most important factor. Customs and infrastructure are the least important factors, respectively.

Recent studies have shown that emerging countries have made great efforts to improve trade facilitation. Indeed, most of these countries, after becoming industrialized countries, are rapidly seeking to export their products around the world. Therefore, they increase investments in improving logistics services while underdeveloped countries increasingly import products from these emerging countries.

However, to succeed in international trade, the lower-middle-income countries should make a considerable effort to improve local logistics services. Similarly, these efforts must improve the customs procedures and infrastructure, which constitute a barrier to trade for these countries. In short, improving logistics performance positively affects trade for both importers and exporters, both for upper-middle-income countries and lower-middle-income countries.

However, the main problem lies in the high costs of logistics services for developing countries.

References

Anderson, J. E. (1979). A theoretical foundation for the gravity equation. The American economic review, 69(1), 106-116.

Anderson, J. E., & Van Wincoop, E. (2003). Gravity with gravitas: A solution to the border puzzle. American economic review, 93(1), 170-192.

Armington, P. S. (1969). A theory of demand for products distinguished by place of production. Staff Papers, 16(1), 159-178.

Arvis, J. F., Mustra, M. A., Ojala, L., Shepherd, B., & Saslavsky, D. (2014). Connecting to compete. *Trade Logistics in the Global Economy. The Logistics Performance Index and Its indicators Available at: http://siteresources. worldbank. org/INTTLF/Resources/lpireport. pdf, Accessed on August*.

Arvis, J. F., Ojala, L., Wiederer, C., Shepherd, B., Raj, A., Dairabayeva, K., & Kiiski, T. (2018). Connecting to Compete 2018.

Bakar, M. A. A., & Jaafar, H. S. (2016). Malaysian logistics performance: a manufacturer's perspective. *Procedia-social and behavioral sciences*, *224*, 571-578.

Batra, A. (2006). India's global trade potential: The gravity model approach. *Global Economic Review*, *35*(3), 327-361.

Bentyn, Z., Luetić, A., & Šerić, N. (2020). Development of business strategies based on logistics performance of the Republic of Croatia. *Ekonomski vjesnik/Econviews-Review of Contemporary Business, Entrepreneurship and Economic Issues*, *33*(1), 133-149.

Bergstrand, J. H. (1985). The gravity equation in international trade: some microeconomic foundations and empirical evidence. The review of economics and statistics, 474-481.

Bergstrand, J. H. (1989). The generalized gravity equation, monopolistic competition, and the factor-proportions theory in international trade. *The review of economics and statistics*, 143-153.

Chaney, T. (2008). Distorted gravity: heterogeneous firms, market structure, and the geography of international trade. American Economic Review, 98(4), 1707-1721.

Contractor, F. J., Dangol, R., Nuruzzaman, N., & Raghunath, S. (2020). How do country regulations and business environment impact foreign direct investment (FDI) inflows?. *International Business Review*, *29*(2), 101640.

Cooper, J., Browne, M., & Peters, M. (1990). Logistics performance in Europe: the challenge of 1992. *The International Journal of Logistics Management*.

Djankov, S., Freund, C., & Pham, C. S. (2010). Trading on time. *The Review of Economics and Statistics*, *92*(1), 166-173.

Eaton, J., & Kortum, S. (2002). Technology, geography, and trade. Econometrica, 70(5), 1741-1779.

Gani, A. (2017). The logistics performance effect in international trade. *The Asian Journal of Shipping and Logistics*, *33*(4), 279-288.

Haughwout, A. (2001). Infrastructure and social welfare in metropolitian America. *Economic Policy Review*, *7*(3).

Hausman, W. H., Lee, H. L., & Subramanian, U. (2013). The impact of logistics performance on trade. *Production and Operations Management*, *22*(2), 236-252.

Head, K., Mayer, T., & Ries, J. (2010). The erosion of colonial trade linkages after independence. *Journal of international Economics*, *81*(1), 1-14.

Helpman, E., Itskhoki, O., & Redding, S. (2008). Wages, unemployment and inequality with heterogeneous firms and workers (No. w14122). National Bureau of Economic Research.

Helpman, E., & Krugman, P. R. (1985). *Market structure and foreign trade: Increasing returns, imperfect competition, and the international economy*. MIT press.

Krugman, P. (1980). Scale economies, product differentiation, and the pattern of trade. The American Economic Review, 70(5), 950-959.

Korpela, J., & Tuominen, M. (1996). Benchmarking logistics performance with an application of the analytic hierarchy process. *IEEE Transactions on Engineering management*, *43*(3), 323-333.

Krugman, P. R., & Obstfeld, M. (2005). Theory and Policy, by 7th ed.

Lindert, P. H. (1991). Toward a comparative history of income and wealth inequality. Income Distribution in Historical Perspective, edited by YS Brenner, Hartmut Kaelble, and Mark Thomas, 212-231.

Martí, L., Puertas, R., & García, L. (2014). The importance of the Logistics Performance Index in international trade. *Applied economics*, *46*(24), 2982-2992.

Mendes dos Reis, J. G., Sanches Amorim, P., Sarsfield Pereira Cabral, J. A., & Toloi, R. C. (2020). The Impact of Logistics Performance on Argentina, Brazil, and the US Soybean Exports from 2012 to 2018: A Gravity Model Approach. *Agriculture*, *10*(8), 338.

Mogale, D. G., Kumar, M., Kumar, S. K., & Tiwari, M. K. (2018). Grain silo location-allocation problem with dwell time for optimization of food grain supply chain network. *Transportation Research Part E: Logistics and Transportation Review*, *111*, 40-69.

Puertas, R., Martí, L., & García, L. (2014). Logistics performance and export competitiveness: European experience. *Empirica*, *41*(3), 467-480.

Raballand, G., Refas, S., Beuran, M., & Isik, G. (2012). Why cargo dwell time matters in trade.

Skender, H. P., Host, A., & Nuhanović, M. (2016). The role of logistics service providers in international trade. *Business Logistics in Modern Management*.

Sohn, C. H. (2005). Does the gravity model explain South Korea's trade flows?. *The Japanese Economic Review*, *56*(4), 417-430.

Van Bergeijk, P. A., & Brakman, S. (Eds.). (2010). *The gravity model in international trade: Advances and applications*. Cambridge University Press.

Center for Management Practice
Brookes College
#250, 6424 36 St NE
Calgary, AB T3J 4C8
+1 (403) 800-6613
research@brookescollege.ca
www.cmp.brookescollege.ca