EFFECTS OF LOGISTICS PERFORMANCE AS NON-DISCRIMINATORY TRADE POLICIES ON INDONESIA'S TEXTILE PRODUCTS EXPORTS

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ABSTRACT:

This study discusses the importance of trade facilitation in logistic performance to boost Indonesia's export. This work uses a structural gravity model to analyze the effect of logistics performance with respect to the export magnitude of textile products from Indonesia to its trading partner countries worldwide. This paper uses interval panel data for 2010, 2012 and 2014. In particular, it employs the Logistics Performance Index (LPI) as a proxy for trade facilitation and as a non-discriminatory trade policy of the origin country. Further, this study considers intranational trade in the structural gravity equation to ensure that the estimation effects for the non-discriminatory export policy in logistics can be identified in the presence of the fixed effect. The estimation results reveal that the LPI could play a role in expanding the export of textile products from Indonesia.

***Keywords**: Logistics Performance Index (LPI), trade facilitation, non-discriminatory trade policy, structural gravity equation, export, textile, Indonesia*

ABSTRAK:

Studi ini membahas pentingnya fasilitasi perdagangan dalam kinerja logistik untuk mendorong ekspor Indonesia. Penelitian ini menggunakan model gravitasi struktural untuk menganalisis pengaruh kinerja logistik terhadap besarnya ekspor produk tekstil dari Indonesia ke negara-negara mitra dagangnya di seluruh dunia. Tulisan ini menggunakan data panel dengan interval untuk 2010, 2012 dan 2014. Secara khusus, studi ini menggunakan Logistics Performance Index (LPI) sebagai proksi untuk fasilitasi perdagangan dan LPI sebagai cerminan kebijakan perdagangan non-diskriminatif dari negara asal. Selanjutnya, penelitian ini juga menggunakan data perdagangan intranasional dalam persamaan gravitasi struktural untuk memastikan bahwa efek estimasi untuk kebijakan ekspor non-diskriminatif dalam logistik dapat diidentifikasi walau dengan adanya fixed effect. Hasil estimasi menunjukkan bahwa LPI dapat berperan dalam memperluas ekspor produk tekstil dari Indonesia.

Kata Kunci: Logistics Performance Index (LPI), fasilitasi perdagangan, kebijakan perdagangan non-diskriminatif, persamaan gravitasi struktural, ekspor, tekstil, Indonesia

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1. INTRODUCTION

Reliable logistics performance is expected to boost exports by lowering transportation costs and increasing market access. Mustra (2011) argues that the quality of logistics performance is an element determining the national competitiveness level. Efficient logistics services and reliable infrastructure play a pivotal role in facilitating trade between countries. Conversely, inefficient logistics performance can significantly increase the cost of global commerce in terms of both time and money (Korinek & Sourdin 2011). Hence, it will influence the trade costs in the exporting as well as the importing countries. In this regard, the trade cost seems to be a more serious barrier to international trade than are the tariffs levied at the border (Anderson & van Wincoop 2004).

Tongzon (2012) estimates that Indonesia's logistics cost accounted for 14.08–25.0% of the total export cost, as against 10% and 11% for the United States and Japan, respectively. Thus, the logistics cost in Indonesia is significantly higher than the international standards. Arvis et al. (2007) argue that the inefficiency in its logistics sector affects Indonesia's competitiveness in the global market negatively. In Southeast Asia, Indonesia's export of logistics services does not perform as well as that of Thailand, Malaysia and Singapore (Tongzon 2012). Further, although Indonesia's Logistics Performance Index (LPI) for 2010–2018 has improved, it is still underperforming compared with other Association of Southeast Asian Nations (ASEAN) countries, such as Singapore, Malaysia and Thailand. In 2010, Indonesia's LPI was lower than that of Singapore, Malaysia, Philippines, Thailand and Vietnam; it was roughly 2.5 index points, and it was ranked 75th in the world. However, Indonesia strived to enhance its performance and managed to increase its LPI score from 2010 onwards. Although its performance fluctuated, its LPI continued to increase and Indonesia was ranked 46th worldwide in 2018 based on its LPI. Of note, Singapore leads the overall ranking of the ASEAN countries as well as of most other countries since it always features in the global list of the top 10 countries with the best logistics performance. Moreover, in 2012, the World Bank published that Singapore is the best country in terms of its logistics performance. Its performance confirms its status as a logistics hub in the ASEAN region. Therefore, Basri (2005) suggests that Indonesia should improve its logistics performance further.

In this regard, Korinek and Sourdin (2011) argue that logistics performance has a significant positive effect on bilateral trade. In addition, Marti and Puertas (2015) find that the development of logistics infrastructure is key to boosting international trade and increasing a country's export competitiveness. They employ the LPI as a proxy for trade facilitation in the gravity equation. Nevertheless, they operate a naive gravity equation that suffers from the issue of omitted variable bias, which leads to misinterpreted results (Anderson & van Wincoop 2003). By contrast, the structural gravity equation is a better method since it controls for multilateral resistance to solve the omitted variable bias in the naive gravity equation. Therefore, I intend to analyze the role of trade facilitation through the LPI within the structural gravity equation for the specific exporter country and the specific sector or industry. I expect that the LPI within the structural gravity equation will show a positive effect on the magnitude of exports.

To explain the correlation of logistics performance and exports, I would like to observe a specific industry in Indonesia, namely, the textile industry. This industry had the fourth largest export share in 2017, after the fuels, vegetables, and machinery

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and electricity industries, or about 7.43% of total Indonesia's total exports. Further, Indonesia's textile exports accounted for approximately 1.68% of the total global textile exports in 2016. As a comparison, in the same regional area in South East Asia, Vietnam is currently leading the textile and clothing trade with a 4.07% share of the total textiles traded on the global market. Nevertheless, Indonesia, and not Vietnam, had always dominated the textile trade before 2008.

Textile supply chains are interesting to observe since this industry is known to be a design-driven industry (Chan & Chan 2010). This characteristic increases the demand for logistics to meet the demand for textiles caused by the changes in fashion, season or event immediately. Moreover, logistics comprises the integration of transportation, information, warehousing, inventory, material handling, packaging and even security. In particular, in the textile industry, in which there are many stages involved in processing raw materials into the final products and then delivering these to the final customers within a short time frame, logistics performance plays a significant role in creating the best customer experience and enhancing customer satisfaction. Therefore, it is predicted that the development of logistics performance can lead to an increase in trade flow of Indonesia's textile exports.

The remainder of the paper is organized as follows. Section 2 provides a brief review of the literature on logistics performance and trade facilitation (in Section 2.1), presents the structural gravity theory (in Section 2.2) and introduces a non-discriminatory export policy within the structural gravity model (in Section 2.3). Next, Section 3 specifies the study methodology (in Section 3.1) and describes the data used (in Section 3.2). Then, Section 4 presents the econometric specification (in section 4.1) and explains the estimation results and analysis (in Section 4.2). Lastly, Section 5 presents the conclusions of this study.

2. LITERATURE REVIEW AND THEORETICAL FOUNDATION

2.1 Logistics Performance and Trade Facilitation

The quality of logistics performance drives the promotion of international trade and affects the trade costs incurred (Korinek & Sourdin 2011). Further, Devlin and Yee (2005) argue that the international competitiveness of some countries in the Middle East was adversely affected by their high logistics costs. Moreover, trade facilitation by enhancing efficiency at each stage of the logistics process can reduce trade costs (Moïsé & Sorescu 2013). As regards trade facilitation measures, these consist of behind-the-border policies, the logistics system, the infrastructure and shipping line access (Go 2018). The Independent Evaluation Group (IEG 2017) defines trade facilitation as streamlining and harmonizing the activities, practices and formalities related to international trade as well as the associated payments and border logistics while safeguarding legitimate regulatory and policy objectives (e.g. protecting public health and the environment).

Further, Go (2018) suggests using the International LPI published by the World Bank as a proxy for trade facilitation. The LPI shows the aggregate index of the logistics performance. These indexes allow us to rank and compare logistics performance across countries. Specifically, the logistic performance of a country reflects its application of a unilateral, non-discriminatory trade policy by which the policy advantages or disadvantages affect all trade partners equally.

The aggregate LPI consists of six main components: infrastructure, customs, ease of arranging shipments, quality of logistic services, tracking and tracing, and timeliness. Those components are

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sequential and interrelated stages contributing to create level of logistics performance collectively, each component was included in this index based on extensive interviews with experts in international freight transport and on empirical studies. The six components of the index are defined as follows:

1. Infrastructure
   This component relates to the quality of the transportation and trade infrastructure. Infrastructure is the backbone of logistics, and hence, its quality is described as its reliability in transporting goods to the final customer.

2. Customs
   This component involves the efficiency of procedures at the border. It consists of the various administrative procedures related customs and other government agencies and the implementation of trade legislation. The simplicity, speed and predictability of customs and other agencies in performing services are critical to provide reliable logistics performance.

3. Ease of arranging shipments
   It refers to the ease of organizing shipments at a competitive price. The availability of routes connected to international shipment hubs is critical to ensure the openness to the global supply chain network. In addition, the competitive price charged on consignment at each port also influences the transport flows in logistics.

4. Quality of logistic services
   This component includes the competence of the logistics services as well as their quality. It consists of the quality of services provided by logistics stakeholders, such as trucking, forwarding, or customs brokerage, which represents the behaviour of the organisational structure in optimising the relationship between the organisation's performance and consumer satisfaction.

5. Tracking and tracing
   This component relates to the capability to track and trace shipments. Spotting the exact location and route of each shipment is important to provide the best experience to the final customer. The collaboration activities of the entire sector in the supply chain is needed since all stakeholders are interrelated.

6. Timeliness
   It refers to the shipment delivery punctuality. Punctuality is an important factor that guarantees the level of competitiveness in logistics performance. Shipments must comply with the delivery schedule to create trust and customer satisfaction.

2.2 Gravity Equation

A gravity equation is used in not only physics but also economics. The terms in the gravity equation used in economics resemble those of Newton's gravity theory. This equation is used to estimate the magnitude of bilateral trade flows between two countries and was proposed by Jan Tinbergen (1962). Conceptually, the trade relationship between two countries is determined by the proportion of their respective size and proximity, similar to the attraction between planets that is determined by the proportion of their masses and distance. Further, the gravity equation for trade consists of two important factors, namely the size of the economy, which is commonly proxied by the gross domestic product, and trade cost, which is frequently represented by distance or other variables. Nevertheless, this early gravity trade equation is outdated and lacks theoretical support.

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In this regard, Anderson (1979) is acknowledged as having established the grounds for developing an economic model for the gravity equation on bilateral trade under the assumption of product differentiation by the country of origin. Next, Trefler (1995) suggests using the 'missing trade' term to describe this phenomenon in international trade that cannot be captured or explained by the Heckscher–Ohlin–Vanek (HOV) model. The HOV model forecasted more trade transactions than revealed by data on the actual bilateral trade. Trefler proposes that trade cannot run as smoothly as the HOV model suggests because of the restrictions imposed on trade. Therefore, it is necessary to understand the impediments to trade to predict a more rational volume for bilateral trade. McCallum (1995) observes the trade flow between the Canadian provinces and the US states by using a modified gravity equation and finds that trade between the Canadian provinces significantly exceeds that between the Canadian provinces and the US states. The study presents at least two important points. First, it manages to show that the gravity equation is reliable for predicting the magnitude of international trade. Second, it suggests the importance of incorporating the 'border effect' in analysing bilateral trade. Next, Anderson and van Wincoop (2003) establish 'gravity with gravitas', which is more consistent theoretically with the gravity equation accepted by many scholars and applied as the standard formulation. He includes additional variables in his model representing the trade cost in international trade, which are termed outward and inward multilateral resistance. These two variables are a notable feature and key to the model in capturing the changes in trade cost that affect the trade flow and relative price. Their model assumes that trade has impediments, unlike previous studies on the gravity equation (naive gravity) that assume frictionless trade. As a result, Anderson and van Wincoop manage to explain the McCallum border puzzle using the structural gravity model. In addition, Feenstra (2004) and Redding and Venables (2004) suggest theoretically that the multilateral resistance terms proposed by Anderson and van Wincoop to control trade cost components can be captured by utilising importer and exporter fixed effects.

Later, others, such as Arkolakis, Costinot and Rodrguez-Clare (2012), developed the gravity equation for trade with more robust theoretical foundations. Head and Mayer (2014) identify three types of gravity equation, namely, the general gravity, the naive gravity and the structural gravity equations. The present study will employ the last type. By using Armington's (1969) preferences assumption, the structural gravity equation is expressed as follows:

$$\mathrm{X}_{ij} = \frac{Y_i\, E_j}{Y}\left[\frac{\tau_{ij}}{\Pi_i\, \mathrm{P}_j}\right]^{1-\sigma} \tag{1}$$

where X_{ij} is the bilateral trade flow between origin country i and destination country j. Further, $Y_i = \sum_j X_{ij}$ is the total value of production in the exporter country, which includes the production for a domestic market, whereas $E_j = \sum_i X_{ij}$ is the total value of the importer's expenditure. Next, $\mathrm{Y} = \sum_i Y_i$ is the total value of production by all countries. The key condition for the structural gravity equation is market clearance, which means that the total sales of country i are bought by consumers in country j and in the domestic market. Further, σ is the elasticity

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of substitution between the products of different countries. Next, Yotov et al. (2016) categorise the trade cost term in the structural gravity equation into three components, namely, the bilateral trade cost (τ_{ij}), the inward multilateral resistance (P_j) and the outward multilateral resistance (Π_i). The inward and outward multilateral resistance represent the ease of market access for the destination country and the origin country, respectively. P_j and Π_i are defined as follows:

$$(P_j)^{1-\sigma} = \sum_i \left(\frac{\tau_{ij}}{\Pi_i}\right)^{1-\sigma} \frac{Y_i}{Y} \quad (2)$$

$$(\Pi_i)^{1-\sigma} = \sum_j \left(\frac{\tau_{ij}}{P_j}\right)^{1-\sigma} \frac{E_j}{Y} \quad (3)$$

The bilateral trade cost (τ_{ij}) is the trade cost between the origin country and the destination country due to the geographic and the trade policy of each country. Further, the bilateral trade cost (τ_{ij}) is not only related to the consignment cost incurred for international trade transactions and the import or export duty levied by border authorities but also to other relevant components that impede bilateral trade according to Anderson and van Wincoop (2003), such as distance, language, historical ties, tariffs, the agreement between trading partner countries, the administrative procedure for import and export and any other factor that can be reasonably assumed to determine τ_{ij}. Next, by taking the log of the structural gravity equation, adding the error term and assuming a panel model, the general empirical equation for the structural gravity model is derived as follows:

$$\ln X_{ijt} = ln\, Y_{it} + ln\, E_{jt} - ln\, Y_t + (1-\sigma) ln\, \tau_{ijt} - ln\, \Pi_{it}^{(1-\sigma)} - ln\, P_{jt}^{(1-\sigma)} + \varepsilon_{ijt} \quad (4)$$

2.3 Non-Discriminatory Export Policy in Structural Gravity Model

Davey (2012) describes the concept of a non-discriminatory trade policy as a set of provisions that ensures all stakeholders have the same opportunity to obtain an advantage. In particular, a non-discriminatory policy in international trade provides the same treatment to all trading partners as well as for intranational trade, and thus, it provides equal opportunity to trading partners to establish bilateral trade transactions. A non-discriminatory policy can be applied for imports or exports. As regards imports, the most pervasive non-discriminatory policy is most favoured nation (MFN) tariff, which is a common commitment by the World Trade Organization (WTO) member countries to impose an import duty with the same tariff for all countries. On the export side, an export subsidy that encourages exporters to sell their products abroad without differentiating between the destination countries is one such example. The present study will discuss in detail the effects of non-discriminatory policies on the export side from another perspective, namely, logistic performance.

Logistic performance for certain country presents its equal potential bilateral trade treatment that they can provide to all international and domestic trading partners in transporting and handling commerce products. Logistic performance is influenced by trade facilitation policies

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allowing all trading partner countries to enjoy the same impact of policies influencing logistics performance without any discrimination.

Thus far, studies on international trade have found it challenging to investigate the effects of a non-discriminatory trade policy under the structural gravity model. Head and Mayer (2014) identify that there are three types of variables whose effects potentially cannot be captured using the general structural gravity equation. Yotov et al. (2016) reveal that exporter- and/or importer-specific characteristic will be absorbed by the exporter- and importer-time fixed effects, respectively, required by the structural gravity model to control for multilateral resistance terms.

Nevertheless, Heid, Larch and Yotov (2017) offer a solution by proposing an alternative approach using international and intranational trade data in the structural gravity model. They show that employing intranational trade flows can make non-discriminatory policy variables in the structural gravity equation become linearly independent from the set of exporter and importer dummies. In their theoretical study, they interact the non-discriminatory export or import policy covariate with a dummy variable $INTL_{ij}$, which takes the value one for international trade and zero for intranational trade. The dummy variable $INTL_{ij}$, is used to ascertain the effects of the non-discriminatory policy, which will apply only on international trade separately. Then, this interaction variable is included in the structural trade gravity model to identify the effects of any non-discriminatory export policies, even in the presence of exporter-time fixed effects as required by structural gravity model theory. Therefore, the inclusion of the intranational trade flow in the structural gravity model allows it becomes a solution to identify the effects of a non-discriminatory policy even in the presence of fixed effects. In addition, this alternative approach also provides a direct, clear interpretation of the effects of country-specific variables, which can be applied on the export as well as import side.

3. METHODOLOGY AND DATA

3.1 Methodology

To know the effects of logistics performance which is a non-discriminatory export support policy on Indonesia’s export of textile products, I use the structural gravity model. I adopt Yotov et al.’s (2016) framework in operating the structural gravity model. This framework is a combination of the best practice solutions offered by certain studies to solve the biases and the inconsistencies that would occur on using the general structural gravity equation. They offer six recommendations for performing estimations using the structural gravity model. First, they recommend using panel data to improve the estimation efficiency, to apply the pair fixed effects method and to allow flexibility treatment and estimation with pair fixed effects. Second, they recommend using panel data with intervals to capture the effects of the adjustment of trade policy that possibly do not occur in a short period. Third, they suggest employing both international and intranational trade data

Within the structural gravity model, since doing so will yield some favourable results, among others, to allow identifying non-discriminatory trade policy effects (Heid, Larch & Yotov 2017). Fourth, directional time-varying (importer–exporter) fixed effects should be included in the model to control the multilateral resistance term and other observable and unobservable country-specific characteristics (Anderson & van Wincoop 2003). Fifth, gravity estimation must include a pair fixed effect. Their last recommendation is that the Poisson pseudo-maximum likelihood (PPML)

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estimator must be employed to estimate the model. Further, Yotov et al. (2016) propose a consistent estimation equation for the structural gravity model. However, I have to modify the equation to adjust it to my study, which focuses on one country as the exporter and includes non-discriminatory trade policy on the export side.

Further, to ensure that I include all the components of Yotov et al.'s (2016) framework, first I employ interval panel data with a two-year lag. Then, I utilise domestic trade data combined with international trade data in the structural gravity model since the main observed independent variable is related to non-discriminatory policy. Further, I attempted to include the time-varying variable by including a free trade agreement variable in the model, but unfortunately, this variable does not show variation in the period of my observations for Indonesia. Therefore, I do not include it in my main structural gravity equation but will also show the estimation results after including the free trade agreement variable. Next, I control for the fixed effects of the destination country and time. I consider only one exporter in my observation, namely Indonesia, and thus, I do not control in pairs since time variation has represented the characteristic from the exporter. Then, I run data to estimate this model using Stata software with ppmlhdfe package. The ppmlhdfe package is a Stata command to estimate a (pseudo) Poisson regression model with multiple high-dimensional fixed effects (HDFE) developed by Correia, Guimarães and Zylkin (2019). This module performs fast estimation with multi-way fixed effects for PPML regressions and is robust to statistical and convergences issues.

3.2 Data

In this study, I use an interval dataset on textile product transactions between Indonesia and its trading partners. The number of Indonesia's trading partners for textile products varies for each year of observation; there are 195, 189 and 185 countries for the years 2010, 2012 and 2014, respectively. Interval data is used in line with Yotov et al.'s (2016) suggestion and also because the main observed variable in this study, namely the LPI, is published regularly every 2 years from 2010. In addition, considering that the latest standard gravity dataset provided by Centre d'études prospectives et d'informations internationales (CEPII) is until 2015, I use interval data up to 2014. The presence of interval panel data can be an advantage in capturing the effects of trade policy changes that cannot be observed in a short period (Yotov et al. 2016). Moreover, using panel data in the gravity model reduces the bias generated by the heterogeneity across countries and allows using fixed effect methods and more flexible data treatment.

Next, data on four components are used in this study, namely, the LPI, intranational trade flows, international trade flows and standard gravity variables.

Logistics Performance Index. This study is focused on identifying the effect of trade facilitation related to logistics performance with respect to the magnitude of exports by using the LPI as the proxy. The LPI data are published by the World Bank in partnership with academic and international institutions as well as private companies and professionals engaged in international logistics. The LPI comprises six components of qualitative logistics evaluation by logistics stakeholders working outside a country. The LPI data are index data with values ranging from 1 to 5. This index was first published in 2007 and has been published every two years since 2010. In particular, I employ the overall score, the International LPI, and include the LPI 2010, 2012, and 2014 data. The LPI is not only a proxy for trade facilitation but also represents a non-discriminatory export policy.

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Intranational Trade Flows. Intranational trade data are needed in this paper to identify the effects of unilateral and non-discriminatory trade policies on logistics performance within the structural gravity model in the presence of exporter and imported fixed effects. To construct the intranational trade dataset, I rely on data from the World Input–Output Database (WIOD). The WIOD is commonly used to analyze global supply chains. The WIOD input–output tables show the values of the output produced and the input consumed within an economy by relating them to different industries and countries. Further, I utilise the WIOD version for 2016, which includes 56 sectors classified based on the International Standard Industrial Classification (ISIC) revision 4 and identified by 2-digit numerical codes. The textile products of each country are grouped in row six (r6) in the WIOD tables, which includes a combination of three groups with the 2-digit sector codes C13–C15 that cover the manufacture of textiles, wearing apparel and leather products including footwear. Therefore, the term textile product in this study comprises products of manufactured textiles, clothes and leather products. Next, by focusing only on a part of the WIOD table that presents data on specific domestic production and consumption allows me to obtain domestic trade data for Indonesia. In particular, I sum up the values across the columns within the cells presenting data on textile products in the input–output table for Indonesia to ascertain the intranational trade data for the country.

International Trade Flows. I exploit the United Nation's (UN) Comtrade database as a resource for international trade flows. The UN Comtrade Database is an open-source database on global trade data that has a detailed category for commodities, partner countries and periods. Thus, the international trade data employed in this study originates from Indonesia as a reporter of its products sold abroad. Hence, the trade data indicate Indonesia's exports to its partners. The Comtrade database provides international trade data according to three options of classification, namely Harmonized System (HS), Standard International Trade Classification (SITC), and Broad Economic Categories (BES). I choose to use the data classified according to the HS, specifically HS07 (H3). Further, I do not find a concordance table to establish one-to-one correspondence between HS07 international data and the ISIC revision 4 intranational data. Therefore, I decide to establish correspondence based on the HS07 nomenclature for the manufacture of textiles, clothes and leather products based on the two-digit classification HS07 codes. Consequently, I select section X, which includes chapters 47–49 that present data on leather products; section XI, which includes chapters 50–63 that have data on textiles and clothes; and section XII, which has chapter 64 with data on footwear products in HS07 to correlate with the intranational data based on the ISIC revision 4 grouped in sectors C13–C15.

Standard Gravity Data. They consist of ln_distw_{IDNj}, $contig_{IDNj}$, $comcol_{IDNj}$, $comlang\_ethno_{IDNj}$ and fta_wto_{IDNjt} from the CEPII Gravity Database, as proxies for market accessibility to control for bilateral trade costs. ln_distw_{IDNj} is the logarithm of the bilateral distance between the biggest cities of Indonesia and its trade partner countries; the distance both of the cities is weighted by the share of the city in the total population of the country. Next, $contig_{IDNj}$ is a dummy describing whether Indonesia and its trade partner are contiguous. Further, $comcol_{IDNj}$ depicts whether Indonesia and its partner country have colonial relationship post 1945. Last, $comlang\_ethno_{IDNj}$ is a dummy variable illustrating the relationship in terms of language between the origin country and the destination country, which takes the value 1 if at least 9% of the population in

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both countries speak a common language, and 0 otherwise. Then, ln_distw_{IDNj}, $contig_{IDNj}$, $comcol_{IDNj}$ and $comlang\_ethno_{IDNj}$ are time-invariant variables that will be absorbed in the bilateral fixed effects in the structural gravity equation. Hence, I exclude those variables from the main equation but estimate them for comparing the results with those of the main analysis. Next, fta_wto_{IDNjt} is the free trade agreement variable from the WTO database. This variable possibly represents a time-variant variable determining bilateral trade that has to be included in the structural gravity equation. However, I do not include it in the main structural gravity equation since the data for the free trade agreement between Indonesia and its partners in the period 2010–2014 do not show variation. However, I estimate it for comparison with the main equation and discuss the results in section 4.2.

4. EMPIRICAL ANALYSIS AND RESULTS

4.1 Econometric Specification

To estimate the effect of logistics performance on Indonesia's textile exports using the structural gravity equation and intranational trade data, I formulate the following equation:

$$X_{IDNjt} = \exp\left[\beta_1 (LPI_{IDNt} \times INTL_{IDNj}) + \eta_j + \mu_t\right] \times \varepsilon_{IDNjt},\ \forall\ IDN, j \quad \ldots\ldots(5)$$

where X_{IDNjt} is the magnitude of the exporting country Indonesia (IDN) for textile products to country *j* at time *t*. In this study, the exporter country is only one, Indonesia, whereas the importer country *j* represents Indonesia's trading partners. An interesting feature of this equation that distinguishes it from the commonly used gravity equations is that this equation comprises international and intranational trade transactions. The domestic trade flows are expressed by X_{IDNjt} for *j* equal to *IDN*, which is the primary modification to describe the effects of logistics performance on Indonesia's textile exports under the structural gravity equation, since I follow Heid, Larch and Yotov (2017).

Next, LPI_{IDNt} denotes the overall score on the LPI published by the World Bank. The overall score is the aggregate index for six components forming the LPI. The lowest logistics performance is assigned the value 1 on the index and the highest performance is assigned the value 5. LPI_{IDNt} indicates that only the LPI from the origin country, Indonesia, is employed in this equation. Further, the LPI variable interaction with dummy $INTL_{IDNj}$ is incorporated to distinguish international trade from domestic sales in which $INTL_{IDNj}$ is equal to 1 for international trade or 0 for domestic trade.

Further, η_j represent the sets of importer fixed effects. Importer fixed effects need to be included in this equation to control multilateral resistance terms, in line with Feenstra (2016). I control multilateral resistance terms to avoid potentially bias, as Anderson and van Wincoop (2003) observe regarding the gravity equation. In addition, controlling these terms can ensure that the model will avoid the 'gold medal mistakes' explained by Baldwin and Taglioni (2007). Moreover, some studies predict that importer fixed effects will also absorb other observable and unobservable country-specific characteristics from the structural gravity model (Feenstra 2016, Olivero & Yotov 2012). Next, μ_t depicts the sets of time fixed effects. However, I do not include exporter fixed effects in this model because the exporter country is only one and the presence of time variation represents the exporter characteristics. Lastly, ε_{ijt} is the error term.

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This estimation equation is arranged in the exponential form for the regressor in line with Santos Silva and Tenreyro (2006) who use the PPML to estimate the non-linear gravity model. They suggest the PPML as an alternative to replace the ordinary least squares (OLS) estimator since the PPML is a robust approach that can solve heteroscedasticity issues that are common in trade data. In addition, Sheperd (2013) summarises some benefits of employing PPML as an estimation method for the gravity model. First, PPML exhibits consistency in the presence of both importer and exporter fixed effects, and thus, the estimates of the effects of independent variables are not biased. Second, it performs very well, allowing the use of a non-linear structure to estimate the gravity model even in the presence of zero trade flows. Third, the coefficients from the PPML can be interpreted straightforwardly. The coefficients of the independent variable stated in the logarithm can be interpreted as elasticities, whereas the coefficients of the independent variable inputted in level can be interpreted as semi-elasticities. Further, gravity model estimation using the PPML estimator allows to establish the gravity fixed effects. Fally (2015) finds that the estimated importer and exporter fixed effects obtained using the PPML estimator are identical to their corresponding multilateral resistance terms. Overall, it is preferable to employ the PPML estimator rather than an OLS estimator in the gravity equation expressed in a multiplicative form. Next, I run data to estimate the structural gravity model by operating Stata software with the ppmlhdfe module that Correia, Guimarães and Zylkin (2019) developed to estimate a (pseudo) Poisson regression model with multiple high-dimensional fixed effects.

4.2 Estimation Results and Analysis

This section presents the estimation results and analysis of the proposed structural gravity equation. First, I reveal the effects of the LPI by using equation (5) as the main structural gravity equation. Then, I describe some additional estimations for comparison by including the free trade agreement variable and other variables related to the bilateral trade cost.

Column (1) of Table 1 shows the results of the estimation of equation (5). This estimation is performed using the PPML estimator. I regress the value of Indonesia's exports to each of its trading partners, which includes intranational sales, by employing interaction terms for independent variables to distinguish between the international trade and domestic sales and to capture the impact of the non-discriminatory policy in the structural gravity equation. *LPI_oXinter* is the variable that represents the interaction between Indonesia's LPI for a particular year and the dummy variable denoting the trade status, that is, whether international trade or intranational trade. In other words, *LPI_oXinter* represents (LPI_{IDNt} x $INTL_{IDNj}$) in equation (5).

The estimation results in column (1) of Table 1 show that I managed to identify the effect of Indonesia's LPI on its textile exports in the presence of fixed effects in the model treated to control for multilateral resistance. Moreover, the results show that the estimated coefficient highly statistically significant since $p < 0.001$. Therefore, from the econometric perspective, this structural gravity model with the PPML estimator can estimate the effects of Indonesia's LPI on the magnitude of the country's textile exports.

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Table 1: Comparison of Estimation Results

	(1) *exp_textile*	(2) *exp_textile*	(3) *exp_textile*
LPI_oXinter	0.929***	0.929***	0.929***
	(5.30)	(5.30)	(5.30)
fta_wto		0	0
		(.)	(.)
ln_distw			0
			(.)
contig			0
			(.)
comlang_ethno			0
			(.)
comcol			0
			(.)
N	557	557	557

t statistics in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Next, the estimation shows that the effect of the LPI is positive for exports, in which it is similar to the early expectation. The estimated coefficient for the interaction variable for LPI and the dummy is 0.929. This interaction variable is derived from two components, namely, the LPI, which is a continuous variable, and a dummy variable, which takes the value 0 or 1 only. Consequently, the interaction of both components generates a continuous variable, which allows a straightforward interpretation similar to interpretation pattern using the OLS estimator. Therefore, this result reveals that 1 additional unit on Indonesia's LPI can generate an increase in the country's exports of textile products by as much as 92.9%.

Further, as a comparison to the main estimation, I try to include the time-varying variable in the structural gravity equation by employing the free trade agreement (FTA) variable. Nevertheless, the data on trade agreements that I source from WTO database through the CEPII show no time variations for the FTA between Indonesia and its partners in 2010–2014. Consequently, the FTA variable in column (2) Table (1) is omitted since its effect is captured by the importer fixed effect. Moreover, I also include other common bilateral cost variables in the structural gravity equation, such as distance, contiguity, language relationship and historical ties. These standard gravity bilateral costs are time-invariant. The results of the regression that includes these variables are shown in column (3) of Table (1). The results indicate that all time-invariant variables are omitted. However, the results of the regressions presented in both column (2) and column (3) of Table (1) are identical for the coefficient for the LPI.The coefficient for the interaction variable for LPI and the dummy shows consistent results in the structural gravity equation estimated using the PPML estimator. Consequently, it can be concluded that time-invariant variables are not needed in the structural gravity equation since their impact will be absorbed by the fixed effect. Besides, this

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comparison estimation demonstates that equation (5) with the estimation result in column (1) of Table (1) is reliable to explain the effect of LPI to the magnitude of export.

From the economics perspective, the results in Table (1) indicate that the logistics sector is an influential element in determining the bilateral trade flows of textile products from Indonesia to its trading partners. The result shows that the increase of one unit in the LPI index for Indonesia can increase the value of exports of textile products from Indonesia by 92.9%. Moreover, the textile industry needs reliable logistics services to meet the extra demand caused by fast-changing, dynamic modes and trends. The effectiveness of the logistics performance by increasing the LPI empirically can boost trade flows where the LPI itself is the proxy for trade facilitation and is related to trade cost. The higher the LPI, the more effective the logistics performance. As regards the trade cost, efficient logistics performance could reduce the costs related to transportation and other logistics services. These costs are also included in product prices. Thus, a reduction in the cost of logistics services can lead to a reduction in the prices of textile products for exports. A price reduction for export products will increase the competitiveness of these products in the global market and could increase trade flows. In addition, reliable logistics performance can also increase the confidence level of the trading partners in engaging in business with Indonesia's exporters since customers indeed expect not only lower prices but also strong customer satisfaction, which is influenced by delivery punctuality, a track and trace application and quality services. This friendly, service-oriented logistics performance causes an increase in trade flows. A higher export trade flow will increase the real income of the textile sector that is currently the fourth highest industry in terms of exports in Indonesia. As a result, it can increase the country's economic growth and welfare as well. The LPI captures both the cost and the quality of services as the determinants of efficient logistics performance. Therefore, it is reasonable that increasing the LPI can increase the trade flow of textile products from Indonesia.

Further, from the policy perspective, this study's results suggest that developing the logistics sector in Indonesia is crucial to supporting the export of its textile products. Indonesia has to develop its logistics sector to encourage the textile industry to transport their product abroad smoothly. Therefore, to increase Indonesia's LPI, the government has to focus on supporting the development of six components of LPI. Trade facilitation is an effective way to help in reducing the cost of international trade. The IEG (2017) proposes a framework to support trade facilitation through simplifying rules, procedures, and documentation; modernizing border operations; strengthening border agencies; ensuring cross-agency coordination; and investing in border-related infrastructure and logistics. The IEG suggests that both the government and the private sector need to be involved in developing logistics performance. In addition, logistics performance as a proxy for trade facilitation represents a non-discriminatory policy that supports export. The trade facilitation associated with logistics performance allows all trading partners to obtain the same benefits since the related policies do not distinguish destination country. Therefore, the benefit of the development of Indonesia's logistics performance can influence the magnitude of bilateral trade in a fair manner for all its trading partners. Consequently, the increase of the LPI caused by a trade facilitation policy could enlarge the market access of exports of textile products to all destination countries.

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Lastly, I acknowledge that this study has some limitations. First, I use international trade data and intranational trade data from different sources. Therefore, it becomes a challenging task to combine the trade data from the two sources. Moreover, both sources have different classification nomenclatures and hence combining the two nomenclatures would not yield a perfect match. Thus, it would be preferable that future studies use trade data for both intranational trade and international trade from one source. Second, concerning the LPI data, I employ the overall LPI score in my analysis rather than details of the six component indexes forming the aggregate index. Hence, future research could extend the present study by observing and comparing in detail the effect of each component of the LPI on trade flows using the structural gravity equation.

5. CONCLUSION

Logistics performance is important for promoting exports. Reliable logistics performance can reduce bilateral trade costs. In turn, the lower the trade cost, the more competitive the product price. Further, reliable logistics performance will escalate the consumer satisfaction level owing to the high level of delivery punctuality and services. Consequently, the combination of competitive prices and higher customer satisfaction will boost export trade flows even further. Next, it will increase the real income from Indonesia's exports of textile products and can have a positive effect on the country's economic growth and welfare. Further, I investigate the impact of logistics performance on the export magnitude through a structural gravity equation. In particular, I observe this relationship by employing the World Bank LPI, which I use as a proxy for trade facilitation, namely, a set of policies associated with a non-discriminatory policy. The impact of LPI development could possibly yield the same benefits to all trading partners without any discrimination. Measuring the impact of a non-discriminatory export policy on trade flows by using the structural gravity equation needs both intranational and international trade data. My observation shows that logistics performance has a significantly positive relationship with Indonesia's exports of textile products. Lastly, I suggest that the Indonesian government implement trade facilitation measures to increase its LPI rank by which it can boost the export trade flow for textile products, as revealed in this empirical study.

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