The multi-dimension of international logistics performance and export flows: An empirical study from developing countries

Huynh, Cong Minh and Hong, Thien Huong

Becamex Business School, Eastern International University, Binh Duong Province, Vietnam.

21 January 2022

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Cong Minh Huynh *

Becamex Business School, Eastern International University, Binh Duong Province, Vietnam.

Email: minh.huynh@eiu.edu.vn

ORCID ID: 0000-0001-8169-5665

Thien Huong Hong

Becamex Business School, Eastern International University, Binh Duong Province, Vietnam.

Email: huong.hong.0101@gmail.com

Abstract

This research empirically examines how the overall logistics performance index (LPI) and its different dimensions affect export flows in 38 developing countries during the period 2007-2018. Results significantly shows positive impacts of the overall index of international logistics performance and its five dimensions on export flows, including Customs (C), Infrastructure (I), International shipments (IS), Logistics quality and competence (LQC), and Timeliness (T). Notably, three dimensions of LPI that have the strongest impacts on export flows are LQC, T, and C. The findings provide policymakers strong evidence on making the right decisions to facilitate and enhance the export flows by promoting international logistics performance in developing countries.

Key words: *Developing countries; International logistics performance; Export flows.*
JEL Classification: F14; H54; O24

1. Introduction

Nowadays, globalization is a trend that many countries in the world are trying to catch due to a lot of benefits from increasing the integration and the interdependence in terms

* Postal address: Becamex Business School, Eastern International University, Nam Ky Khoi Nghia St, Hoa Phu Ward, Thu Dau Mot City, Binh Duong Province, Vietnam.

of goods, services and commodities (UNCTAD, 2008). According to Adam Smith (1904), if we can find another supplier which offers lower price than our cost of making, we should buy some of the produce and use it in our way to make benefits. In fact, after the world crisis, the total amount of trade goods and services has significantly increased, and most of them are related to physical goods (Nicita & McLaren, 2015). Moreover, according to Khandelwal (2010), a country that provides high quality product may lead to comparative advantages, which pushes both productivity and export revenue. Thus, export-oriented growth policies are focused by policy-makers of most countries (Henn et al., 2013).

Meanwhile, the development of logistic system is a matter of concern in developing countries, where there is a lack of facilities. Huxiang Zhao, President of International Federation of Freight Forwarders Associations, said that "there is no trade without logistics, and poor logistics often means poor trade" (Arvis et al., 2016). World Bank (2007) created a benchmark called Logistic Performance Index (LPI), which is conducted every two years, to measure various dimensions of international logistic performance in many worldwide countries. The purpose of LPI is that each nation can know the difficulties and opportunities that it had, then it can focus to improve the logistic performance (Arvis et al., 2007).

In fact, most nations have used logistic performance as competitiveness in global trade; unluckily, many developing countries have not approached the modernization and internationalization logistic by advanced economies (Hoekman et al., 2010). Thus, there is a gap in Logistic Performance Index between developing countries and developed countries, meaning that firms in developing countries have less competitiveness than that in developed countries in global battle of international trade, especially in export flows. Then the question arises that whether logistic performance

boosts export flows. In this research, we investigate the impacts of the overall index of international logistics performance and its multi-dimensions on export flows in 38 developing countries during the period 2007-2016. The multi-dimension of international logistics performance will be distinctly examined through its six components including efficiency of the customs clearance process, quality of trade and transport-related infrastructure, ease of arranging competitively priced shipments, competence and quality of logistics services, ability to track and trace consignments, and frequency which shipments reach the consignee within the scheduled or expected time.

2. Literature review

2.1. Fundamental concepts

2.2.1. Definition of Logistics Performance Index (LPI)

Logistics Performance Index is an interactive benchmarking tool which created by Work Bank (2007) with the purpose of helping nations define their difficulties and opportunities in the field of trade logistics; based on the benchmark, the countries can enhance their performance. Work Bank (2007) creates LPI every two years by a survey which measures on a scale of 1 (lowest performance) to 5 (highest performance). LPI can measure the performance of both logistics supply chain and different perspectives between international and domestic (Hoekman et al., 2010).

2.2.2. Dimensions of international LPI

Logistics Performance Index, which is published by the World Bank, is defined by six components including efficiency of the customs clearance process, quality of trade and transport related infrastructure, ease of arranging competitively priced shipments, competence and quality of logistics services, ability to track and trace consignments, and frequency with which shipments reach the consignee within the scheduled or

expected time. The overall LPI is the average of these six dimensions (Hoekman et al., 2010). Customs are understood as gatekeepers of a country, thus all trade flows are needed to approve by them (Martincus, Carballo, & Graziano, 2015). Transport infrastructure is the framework that supports transportation system, including transit, highways, airports, railways, waterways and intermodal link (OECD, 2013). In terms of international shipments, ease of arranging competitively priced shipments means the competitive pricing of port fees, airport fees, railroad fees, storage/loading fees and agent's fees which lead to decrease trade costs (Arvis et al., 2016). Competence and quality of logistics refer the different service levels at a similar level of perceiving; high service quality boosts the logistics performance in emerging and high-income markets (Arvis et al., 2016). The ability to track and trace consignments reflects the location, route defining process, and the origin of an item or property (Arvis et al., 2016). Tracking and tracing are going to be focused because all the firms in the supply chain will take advantages from the ability to define the location of their products, which also means firms can have clear plans, time prediction, and reduce the likelihood of lost goods (Korinek & Sourdin, 2011). The frequency with which shipments reach the consignee within the scheduled or expected time is concerned from the beginning to complete the transaction (Arvis et al., 2016).

2.2. Theoretical review

The concept framework of this paper on the impact of LPI on export flows is based on well-established international trade theory and gravity model.

David Riccardo Theory: Riccardo (1817) explained why trade happened by using the theory of comparative advantage which refers to a country's ability to produce a good and specialize in production with lower opportunity cost than another.

Heckscher-Ohlin Theory (H-O Theory): Riccardo theory did not mention about

how and why a country can produce a specific product cheaper than another. Eli Heckscher and Bertil Ohlin argued the new theory named factor endowment theory which based on Ricardian model (Blaug, 1992). The goods which produces with resources that are relatively abundant are exported by nation and import goods which produces with resources that are relatively scarce (Blaug, 1992). H-O theory assumed the countries have the same technology, same demand and only different on labor and capital (Blaug, 1992).

New Trade Theory and Empirical theory: Krugman (1979) built up the New Trade Theory to answer the question why a country can both import and export a specific type of product. The theory focused on the role of economic of scale and monopolistic competition. In some industries, two countries can have no differences in opportunity cost but when one country specializes in a specific product, it can gain from trade (Krugman, 1979). Moreover, when that country was pioneer and specialize in a specific industry, the new one could not compete; leading to a form of monopolistic competition (Krugman, 1979). The advantage of the theory was that it suggested that firms were often competing on branding, quality and not just simple price, then being the first one in the industry would bring a strong competitive advantage (Krugman, 1979). Ricardian Trade Theory was also a fundamental theory for Shiozawa (2007). The case that a many-country, many-commodity with intermediate goods and choice of production techniques, the author argued that the traded volume increased for intermediated goods when the transportation cost decreased (Shiozawa, 2007).

Gravity Model: Gravity Model, first introduced by Walter Isard (1954), is an important and popular empirical model in the arena of international trade which predicts bilateral trade flows based on the economic size and distance between two units. The model is described by the equation:

$$Mij = G\frac{Y_i Y_j}{Dist_{ij}}$$

Where Mij is bilateral imports from country j to country i, G is a constant, Yi and Yj are the GDP of these 2 countries and Distij is the distance between these 2 countries (Isard, 1954).

2.3. Empirical studies

Korinek and Sourdin (2011) conducted a quantitative analysis with gravity model about the impact of logistics quality on trade by using Enabling Trade Index and Logistic Performance Index in 2010 by seven regions (Europe, East Europe & Central Asia, Latin America & Caribbean, East Asia & Pacific, Middle East & North Africa, South Asia, and Sub-Saharan Africa), income group (high income, upper middle income, lower middle income, low income, and medium) and selected importers (United States, Australia, Brazil and Chile). The results indicated that a significant relationship between trade flows and trade logistics; and a potential gains from trade when increasing logistics quality.

In other paper, Saslavsky and Shepherd (2012) used the dataset of 155 countries over the period 2007-2010, and concluded that the Logistics Performance Index positively affected the international trade and that the LPI was more sensitive for trade among developing countries in the Asia-Pacific region.

Portugal-Perrez and Wilson (2012) also used gravity model with the dataset of 100 countries in the period 2004-2007 to find out that enhancing in infrastructure quality had a positive relationship with export growth.

Gani (2017) tested whether or not the Logistics Performance affected international trade by using the sample of 60 countries across four-time-period (2007, 2010, 2012 and 2014). The results showed that there was a significantly positive relationship between Logistics Performance Index and international trade.

Focusing on Africa, South America, Far East, Middle East and Eastern Europe area, Martí et al. (2014) clearly showed the relationship between LPI and international trade was also clearly shown. Enhancing the LPI would boost the global trade volumes in a nation, especially those in Africa, South America, and Eastern Europe.

In the paper by Kabak et al (2018), with the dataset of 154 countries in 2007, 2010, 2012 and 2014, the research concluded that the efficiency in some of the Logistics Performance Index components would increase the export level in one nation.

The review of previous studies illustrates that the impacts of international logistics performance on export flows are still a research gap for: i) developing countries – those have low quality of logistics, and ii) multi-dimensional analysis of international logistics performance.

3. Model, hypotheses, and data

3.1. Model

By combining the international trade theory, gravity model and prior empirical studies, the impacts of international logistics performance on export flows is proposed in the model as follows:

$$X_{it} = \beta_0 + \beta_1 LPI_{it} + \beta_2 P_{it} + \beta_3 M_{it} + \beta_4 GDP_{it} + \beta_5 FDI_{it} + u_{it} \qquad (1)$$

In which:

- X_{it}: Export flows by country i in the year t
- LPI_{it}: Logistics Performance Index for country i in the year t
- P_{it}: Population growth of country i in the year t
- M_{it}: Import flows by country i in the year t
- GDP_{it}: GDP of country i in the year t
- FDI_{it}: Foreign Direct Investment by country i in the year t
- u_{it}: Error term

- β_1, β_2, β_3, β_4, and β_5: respective coefficients of regressors

The dependent variable is Export flows (X), calculated as % of Gross domestic products (GDP). Exports of goods and services represent the value of all goods and other market services provided to the rest of the world. They include the value of ―merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments.

The dependent variable is the overall Logistics performance index (LPI). Logistics Performance Index is an interactive benchmarking tool which created by Work Bank (2007) with the purpose of helping nations define their difficulties and opportunities on trade logistics field; based on that countries can enhance their performance. All the data was conducted by surveys in the markets which are most important export and import markets of the respondent's country, random selection, and, for landlocked countries, neighbouring countries that connect them with international markets. The respondents audit six core dimensions on a scale from 1 (worst) to 5 (best), the average of six results will be counted as overall LPI. Six dimensions of LPI include Customs (C), Infrastructure (I), International shipments (IS), Logistics quality and competence (LQC), Tracking and tracing (TT), and Timeliness (T). First, we use the overall LPI, then it is proxied by each component of LPI in the model (1).

Control variables are Population growth rate (P), Import flows as % of GDP (M), Real GDP growth rate (GDP), and Foreign direct investment as % of net inflows in GDP (FDI). The selection of these control variables refers to prior scholars such as Mukherjee et al. (2014), Harding & Javorcik (2012), Feng et al. (2016), Nag & Mukherjee (2012), Edwards (1993), Kelley & Schmidt (1994), and Martí et al. (2014).

3.2.Hypotheses

In this study, there are seven hypotheses, developed from six dimensions of LPI and the overall LPI.

Customs are understood as gatekeepers of a country, thus all trade flows are needed to approve by them (Martincus, Carballo, & Graziano, 2015). In their study, Martincus, Carballo, & Graziano (2015) found out the delay that caused by customs have a significant negative effect on foreign companies' sales. De Jong and Bogmans (2011) also investigated the corruption as well as quality of customs and concluded that inefficiency customs will lead to higher waiting times, which significantly reduce international trade. Therefore, we build the first hypothesis:

H1: Efficiency of the customs clearance process (C) has a positive on export flows in developing countries.

Transport infrastructure is the framework that supports transportation system, including transit, highways, airports, railways, waterways and intermodal link (OECD, 2013). The relationship of transport infrastructure and international trade is considered by many researchers. An evidence from Brazil over the period 2009-2012 showed that the increase in port infrastructure is related with large volume of export (Bottasso, Conti, de Sa Porto, Ferrari, & Tei, 2018). Another evidence in Turkey proofed that improving quality of road will lead to transport cost reduction which increases international trade (Coşar & Demir, 2016). Moreover, investing on airport is also concerned by many researchers and conducted that an efficiency airport network will improve economy and international supply chains (Van De Vijver, Derudder, & Witlox, 2014). By all the evidences above, the second hypothesis is created:

H2: Quality of trade and transport-related infrastructure (I) has positive relationship with export flows in developing countries.

In terms of ***international shipments***, ease of arranging competitively priced shipments means the competitive pricing of port fees, airport fees, railroad fees, storage/loading fees and agent's fees which lead to decrease trade costs (Arvis et al., 2016). According to Olken & Barron (2009), due to corruption, some operations unobtrusively pay for "speed money" which directly leads to increase cost. Moreover, export price affects directly to sourcing input of developed markets and output price; thus, the export flows of a nation are affected (Bas & Strauss-Kahn, 2015). Therefore, this builds the third hypothesis:

H3: Ease of arranging competitively priced shipments (IS) has a positive impact on export flows in developing countries.

Logistics quality and competence refer the different service levels at similar level of perceive; high service quality boosts the logistic performance in emerging and high-income markets (Arvis et al., 2016). Nordas, Pinali, and Geloso Grosso (2006) mentioned in their paper about the effect of logistics services on firms' decision that whether or not they will enter international market, which represents for export activities.

A real case study of Yemen that it sold fresh tuna to Germany with the price of $4 per kilogram, and frozen tuna to Asia with the price of $1 per kilo. A half of the tuna capacity was frozen and sold in Asia; because of poor logistics services, Yemen cannot increase the exported fresh tuna quantity to Germany with higher price in compared to Asia (Devlin & Yee, 2005).

Another case study of textile industry in Dominican Republic shows that thanks to advance logistics services, Dominican firms had more competitive advantage in terms of lead time with 4 weeks compared to 10 weeks from China, so they won the competition with China in order to export textile products to US (TheWorldBank, 2005).

By all the evidences above, the fourth hypothesis is created:

H4: Logistics quality and competence (LQC) positively affects export flows in developing countries.

The ability to track and trace consignments reflects the location and route defining process of an item or property (Arvis et al., 2016). Tracking and tracing will be focus in the next period because all the firms in supply chain will take advantages from the ability to define the location of their products, which also means firms can have clear plans, time prediction, and reduce the likelihood of lost goods (Korinek & Sourdin, 2011). Nowadays, many firms apply high technology on their logistics management system such as RFID, bar-coding, EDI and so on. Moreover, Internet of Things (IOT) is a new trend of the world which is also brings a lot of benefits to supply chain management field (Yong et al., 2018). Therefore, it is clear that hi-tech is used and applied commonly in supply chain management field in general, in logistics field in particular. Additionally, Jacks and Pendakur (2010) found out that the more technological development is, the more international trade growth in terms of communication and transport sectors. Hence, the fifth hypothesis is built:

H5: Tracking and tracing (TT) has a positive effect on export flows in developing countries.

The timeliness in logistics is concerned from the beginning to complete the transaction (Arvis et al., 2016). In their paper, Nordas, Pinali, and Geloso Grosso (2006) pointed out that time delays have negative relationship with trade volume, especially with time-sensitive products. Another paper argued that long transit delay, which leads to long timeliness, will reduce the export likelihood of success of an item in a country (Hummels & Schaur, 2013). By all the evidences above, the sixth hypothesis is created:

H6: The timeliness (T) has a positive effect on export flows in developing countries.

The overall score of Logistics Performance Index (LPI) is the average of six

dimensions' score. According to the research of Gani (2017), the overall LPI's score has positive relationship with international trade. Additionally, Martí et al. (2014) concluded in their paper that the LPI had significantly positive relationship with international trade in Africa, South America and Eastern Europe areas over the period of 2005-2010. Therefore, the seventh hypothesis is:

H7: The overall LPI has a positive impact on export flows in developing countries.

3.3. Data

Because LPI is reported every two years, we use six spans (2007, 2010, 2012, 2014, 2016, and 2018 for the period 2007-2018. All data in the model (1) are collected for the above six spans of years, and for 38 developing countries including Afghanistan, Armenia, Benin, Bhutan, Bolivia, Cambodia, Cameroon, Chad, Comoros, Côte d'Ivoire, Egypt, El Salvador, Ghana, Guatemala, Guinea-Bissau, Haiti, India, Indonesia, Kenya, Kyrgyz Republic, Laos, Liberia, Madagascar, Moldova, Mongolia, Myanmar, Nepal, Niger, Pakistan, Philippines, Rwanda, Senegal, Sudan, Tanzania, Togo, Ukraine, Uzbekistan, and Vietnam. We collect data of overall LPI and its components from The Logistics Performance Index and Its Indicators – LPII (World Bank, 2007, 2010, 2012, 2014, 2016, 2018). Data for P, M, GDP and FDI are extracted from The World Development Indicators – WDI (World Bank, 2019). We have a total of 228 observations. Descriptive statistics is presented in Table 1.

Table 1. Descriptive statistics.

Variables	Obs	Mean	St.deviation	Min	Max
X	228	28.053	16.351	0.611	105.832
LPI	228	2.519	0.319	1.211	3.420
C	228	2.314	0.309	1.300	3.174
I	228	2.272	0.344	1.100	3.337

IS	228	2.559	0.381	1.222	3.404
LQC	228	2.446	0.355	1.250	3.399
TT	228	2.529	0.409	1.000	3.519
T	228	2.958	0.392	1.375	3.826
P	228	1.874	1.023	-1.718	3.909
M	228	38.781	18.025	0.683	102.473
GDP	228	5.110	3.660	-17.005	18.361
FDI	228	4.105	9.720	-37.173	103.337

4. Methodology

Before conducting the multiple linear regression, some tests would be arranged in order to make sure that the data was normally distributed and did not have multicollinearity.

In term of panel data, there are three basic types of estimation method that include fixed effects model (FEM), random effects model (REM), and pooled ordinary least squares (OLS). First, we perform OLS and FEM. Then, we use the Lagrange multiplier test to decide whether choosing OLS or FEM. Finally, we run FEM and we employ the Hausman test to compare with the REM (Hausman, 1978). Additionally, tests for heteroscedasticity and serial correlation are also performed.

5. Empirical results and discussions

We estimate the model (1) in two specifications. In the first specification, we estimate the impact of the overall LPI on export flows. In the second one, we decompose the overall LPI into six components, and we estimate their effects on export flows. Control variables appear in both specifications.

After checking the stationarity and the cross sectional dependence for panel data, we conduct the OLS estimation and the REM estimation. The Lagrangian multiplier

tests reject the null hypothesis of zero variances across entities, indicating that the REM estimation is appropriate, compared to the OLS estimation. Therefore, we perform the FEM estimation. Results from the Hausman tests reject the null hypothesis of non-systematic differences in coefficients, implying that the FEM estimation is chosen because of systematic differences in coefficients. Year dummies are also included in all estimations. Estimations results and relevant tests are reported in Table 2 and Table 3.

Table 2. Regression results for the overall LPI.

Dependent variable: X	REM	FEM
Independent variable		
LPI	10.844***	9.347***
	(7.60)	(4.66)
P	-1.31**	-1.077**
	(2.34)	(2.25)
M	0.962***	0.759***
	(12.68)	(8.55)
GDP	0.583*	0.426***
	(3.91)	(3.34)
FDI	-0.227**	-0.193**
	(2.38)	(2.21)
Constant	29.378***	25.615***
Year dummies	Yes	Yes
Obs.	228	228
LM test for RE	337.84***	
F-stat	298.17***	314.26***
Hausman test for FE		255.61***

LM: Lagrangian multiplier; Absolute T-statistics are in the parenthesis.
****: P < 0.01, ** : P <0.05, * : P < 0.1.*

Results in Table 2 show that the overall LPI has a positive impact on export flows in 38 developing countries at statistical significance of 1%, supporting our seventh hypothesis on the increasing effect of the overall LPI on export flows. It can be seen

that one unit increase in the overall LPI could promote export flows by 9.35%, other things being equal.

Table 3. Regression results for six components of the LPI.

Dependent variable: X	REM	FEM
Independent variable		
C	3.148***	2.996***
	(5.53)	(4.05)
I	0.978**	0.843**
	(2.36)	(2.28)
IS	0.522**	0.406**
	(2.39)	(2.31)
LQC	8.653***	7.881***
	(7.83)	(5.04)
TT	-1.225	-1.457
	(1.35)	(1.58)
T	5.933***	5.081***
	(5.27)	(4.12)
P	-1.595**	-1.382**
	(2.41)	(2.09)
M	0.923***	0.775***
	(12.58)	(9.82)
GDP	0.572***	0.438**
	(2.27)	(2.42)
FDI	-0.271**	-0.126*
	(2.24)	(1.98)
Constant	29.175***	31.859***
Year dummies	Yes	Yes
Obs.	228	228
LM test for RE	529.71***	
F-stat	382.57***	288.35***
Hausman test for FE		198.12***

LM: Lagrangian multiplier; Absolute T-statistics are in the parenthesis.

****: P < 0.01, ** : P <0.05, * : P < 0.1.*

Results in Table 3 reveal that export flows are positively affected by five dimensions of the LPI, including Customs (C), Infrastructure (I), International shipments (IS), Logistics quality and competence (LQC), and Timeliness (T) at significant levels of 1-5%. Particularly, one unit increase in C, I, IS, LQC, and T leads to 2.996%, 0.843%, 0.406%, 7.881%, and 5.081% increase in export flows, respectively. Remarkably, in term of impact magnitude, three dimensions of LPI that have the strongest impacts on export flows are LQC, T, and C. Hence, these finding confirm the first, second, third, fourth, and sixth hypotheses on the beneficial impacts of C, I, IS, LQC, and T on export flows. However, the impact of Tracking and tracing (TT) on exports is statistically insignificant.

The above findings are consistent with similar arguments which were tested in different regions in other studies including Martí (2014), Gani (2017), Jong and Bogmans (2011), Bottasso et al. (2018), and Nordas et al. (2006). The reason may be related to global supply chain. Global supply chain is defined when firms source their input from multiple foreign suppliers, have distributors in others countries, or produce abroad (Caniato et al., 2013). A study of Kim and Chai (2017) pointed out that global sourcing is becoming common in manufacturing field, and should be considered to improve supply chain agility. Additionally, due to globalization, focal companies tried to have competitive advantage by finding low-cost sources around the world (Gereffi & Lee, 2014). Moreover, a nation which has high logistics performance may connect to domestic and international market easier with low cost because of good transportation and reliable supply chains (Arvis et al., 2016). Thus, not only developed countries, developing countries also use the efficiency at logistics as a competitive advantage to integrate (Arvis et al., 2016). Therefore, the results in this study which tested in developing countries were similar with previous papers which tested in different regions

including both developed and developing countries (Bottasso et al., 2018; Gani, 2017; Jong & Bogmans, 2011; Martí et al., 2014; Nordås et al., 2006).

However, according to Arvis et al (2016), top 10 countries which had the highest LPI in 2016 were developed countries; the gap of LPI between high-income economies and low-income economies still existed. There were some reasons for this gap. As the definition of Customs, all the import-export activities are needed to approve by Customs before entering or exiting a nation (Martincus et al., 2015). According to Cunningham (1996), firms feel uncertain about how to deal with customs when trading with low-income countries. Additionally, inefficiency customs would lead to longer time, which significantly reduced international trade (Jong & Bogmans, 2011). Corruption also affects the cost of export-import activities, which leads to reduce the competitiveness of international shipments (Olken & Barron, 2009). Moreover, in reality, developing countries have not approached the modernization and internationalization logistics by advanced economies which related to the tracing-tracking ability and logistics service (Hoekman et al., 2010). Lack of knowledge and experience about international payment terms, language, and capital are also inhibiting the development of logistics service, and tracingtracking ability in developing countries. Logistics services in developing countries are also affected by small size market and fragmentation of services (Arvis et al., 2012).

In terms of control variables as illustrated in Tables 2 and 3, population growth rate, import flows, GDP growth rate, and FDI are statistically found to be correlated with export flows at significant levels of 1-10%. Specifically, import flows and GDP growth have significantly positive impacts on export flows. These findings are consistent to Edwards (1993), Kelly & Schmidt (1994), Nag and Mukherjee (2012), and Feng et al. (2016). By contrast, population growth and FDI have significantly negative impacts on

export flows. These findings are in line with Harding & Javorcik (2012), and Mukherjee et al. (2014).

6. Conclusion and policy implication

This research empirically examines how the overall logistics performance index (LPI) and its different dimensions affect export flows in 38 developing countries during the period 2007-2018. Results from the estimator of fixed effects significantly shows positive impacts of the overall index of international logistics performance and its five dimensions on export flows, including Customs (C), Infrastructure (I), International shipments (IS), Logistics quality and competence (LQC), and Timeliness (T). Notably, three dimensions of LPI that have the strongest impacts on export flows are LQC, T, and C. In addition, it is found that import flows and GDP growth increase export flows while population growth and FDI reduce export flows.

The findings provide policymakers strong evidence on making the right decisions to facilitate and enhance the export flows by promoting international logistics performance in developing countries. Especially, policy-makers should concentrate on improving three dimensions of the LPI – including Logistics quality and competence, Timeliness, and Customs – because these components have the strongest impacts on export flows in developing countries. Other policies to promote exports should take population growth rate, import flows, GDP growth rate, and FDI into consideration as well.

Compliance with ethical standards: Disclosure of potential conflicts of interest

Conflict of interest: The authors declare that they have no conflict of interest.

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