PEOPLE: International Journal of Social Sciences
ISSN 2454-5899

Ariowibowo et. al, 2024

Volume 10 Issue 2, pp. 163-196

Received: 26th December 2023

Revised: 4th January 2024, 8th January 2024

Accepted: 2nd January 2024

Date of Publication: 15th June 2024

DOI- https://doi.org/10.20319/pijss.2024.102.163196

This paper can be cited as: Ariowibowo, K. Z., Awokoyoa, O. F., Noveningtyas, A. (2024). The Correlation of a Country's Supply Chain Performance through Logistics Performance Have on Country's Economic Condition: A Comparative Analysis between Developing and Developed Countries. PEOPLE: International Journal of Social Sciences, 10(2), 163-196.

THE CORRELATION OF LOGISTICS PERFORMANCE AND ECONOMIC CONDITION: COMPARATIVE ANALYSIS BETWEEN DEVELOPING AND DEVELOPED COUNTRIES

Kemal Zaki Ariowibowo
Bandung Institute of Technology, Bandung, Indonesia,
kemal_zaki@sbm-itb.ac.id

Olajide Festus Awokoyoa
Ph.D, M.I.B, M.B.S.I, ACIPM, Rennes School of Business, Rennes, France, Olajde
awokoya@rennes-sb.com

Annisaa Noveningtyas
M.S.M, Bandung Institute of Technology, Bandung, Indonesia
a.novieningtyas@sbm-itb.ac.id

Abstract

Logistics sector is raising attention as previous studies have shown that it could directly affect a country's economic condition positively. Developing countries recognizing this opportunity should be trying to pursue and improve their logistics condition so that they can catch up and mature in their own economic condition just like the developed countries. Yet, how close the gaps between are developed and developing countries if we look at the perspective of supply chain through the

logistics sector. In this research, a total of 588 observations were divided and classified into 2, namely developed and developing and analyzed whether supply chain performances through logistics performance have direct correlation with that country's economic condition and the comparative analysis the difference between the uses of the logistics sector in each classification economic condition. This research finds that supply chain performance through logistics performance do have a direct impact on a country's economic condition. However, it was also found that the impact is statistically insignificant as there are limited data samples and other variables that were not considered. This research will covet the supply chain and economic condition field of studies and this research also provides recommendation for future research.

Keywords

Logistic, Supply Chain Management, Supply Chain Performance, Developed and Developing Countries

1. Introduction

1.1. Background

Improvement and development in country's supply chain management system through their logistics sector has been proven throughout history to be able to have a positive impact on country's economic conditions by dispersing production while promoting consumption globally which then would boost international trade in a form of export and import that always certain to corresponds to the increase of said country population's wealth (Gani, 2017; Smith, 1776). Studies have shown that operational costs that a country incur due to trading activities could be reduced by a significant margin if there is a profounding system accompanied by solid infrastructure such would have better services, equipment's, vehicles and technologies which would also attracts investment and advancement to develop those needs for international trade (Dee & Findlay, 2006; Katrakylidis & Madas, 2019; OECD/WTO, 2013). The access to a better system and infrastructure would also impact said country's performance in doing international trade comparatively and such would not only impact cost related metrics but also invite other side effects indirectly like triggering a multiplier effects through a promotion of expenditure that came from an increase in consumption (Arvis et al., 2012; Hausman et al., 2012; Hoekman & Nicitam, 2011; Katrakylidis & Madas, 2019; Portugal-Perez and Wilson, 2012).

Direct causalities between international trading activities, export and import, and supply chain performance through logistics sector of respective countries could be briefly summarized that as an increased in trading volume or activities will augment the need for better infrastructures and systems which then would trigger further investment opportunities to augment those infrastructures and systems (Hoekman & Nicita, 2010; Lee & Rodriguez, 2006; Nugyen & Tongzon, 2010; Vasiliauskas & Barysiene, 2008).

This direct causal relationship between trading activities and the logistics sector could imply a need for a strategic change in policy implementation, as it could trigger the multiplier effect and increase a country's economic condition (Katrakylidis & Madas, 2019). There are various examples of a country focusing on changing certain policies which led to the ascension of its own economic condition. Singapore, a small nation if measured by acres of land, were able to utilize their surroundings and create a solid foundation infrastructure to allow the process of international trading activities to the fullest. Due to this they were able to cement themselves as a global international route for trading activities in Southeast Asia. China, another example of a country that was able to ascend their economic conditions to an even bigger state than Singapore, so big that now China could even compete with the United States of America.

1.2. Problem Statement

This should and could be seen as an amazing opportunity for all developing countries to break through the global economic maturity threshold by improving their logistic sector respectively in hope to increase their international trade activities thus inciting a multiplier effect all around their economic condition. However, the variance and ambience of those countries, who are still developing, are too big. For instance, the defining condition that indicates developing countries in the European continent and the African countries are far different. Using the atlas method, those other than higher income countries would still be classified as developing countries. Not to mention after reaching a higher income economy, there would be no upper limit in that higher income categories.

Amidst all of that, there would still be a need to know how much difference between developed countries and developing countries in terms of their logistics sector performance correlation with their economic growth or condition. In this research, there would be no need to know how much impact a logistics sector could have on economic growth, as no matter the economical classification they are in, past research has found that an improvement in the logistics

sector would also inflict economic growth. Thus this research will enter a different point of view upon this matter and do a comparative analysis between those two countries classification to see the difference in correlation between their respective logistics sector and economic growth.

1.3. Research Question

- Does supply chain performance through the logistics sector have any correlating impacts towards economic growth for developing and developed countries?
- How significant is the impact for developing and developed countries?
- How different is the significance of supply chain performance towards respective economic conditions for developing countries and developed countries?

1.4. Research Objective

With those three research questions as a foundation for understanding whether or not the logistic sector of a country could affect each respective economic conditions, the objective of this dissertation is to understand,

- Whether there is a correlating impact between supply chain performance through the logistics sector and economic growth in both developing countries and developed countries.
- Understanding the significance of the impact the logistics sector has on a country's economic growth for both developed and developing countries.
- Compare the significance of the impact of logistics performances towards a country's economic condition for developing and developed countries.

This research will help further studies within the field of both supply chain management performance and economic growth causes while also contributing to this field of study.

2. Literature Review

2.1. Supply Chain Performance Measurement

The term supply chain was defined as a sequence of processes that include several parts and elements that would produce final products and deliver it to the designated customers from unprocessed raw materials (Chopra and Meindl, 2007). Thus, the supply chain management objective is to manage all of the parts and elements so that the sequences could be smoothly run and achieve the goals of delivering the end products to the final customers.

It was suggested the use of logistic metrics such as measuring facility used, inventory and transportation to measure performance within the supply chain. Logistics back then was defined as the managing process of procurement, inventory system, storage movement and information flow within the organization (Christopher, 1986). Now, logistics in itself does not focus solely on transportation and movement purposes but it includes activities such as customer services, localization of respective sites, and planning of trade and production (Stock and Lambert, 2001; Grant et al., 2006). In addition to that, managing a logistics system is an important part of supply chain management that objective is to reduce the costs needed while increasing the service level for customers by improving productivity, such could be achieve by flowing and coordinating the information and materials across the actors of the supply chain (Çelebi et al., 2010). Effectiveness in managing logistics system was measured with the how often the right products were delivered to the right place at the right time with the lowest costs possible and a logistics system that is well managed could provide a sustainable competitive advantage to promote customers satisfaction (Handfield and Nichols, 1999; Gourdin, 2006). With the world becomes more competitive over the years, the logistics sector is recognized as an essential factor to help maintain or even develop successes, as it provides a sustainable competitive advantage thus attention shift to focus on the logistics sector as a strategy in the last few years has occurred often (Serhat and Harun, 2011).

Logistics systems on a national scale are filled with activities that are related with the national economy such as the storage system, handling of goods, transportation of goods and information system processes. The logistics related activities mentioned above are in the production and non-production sectors (Dimitrov, 1991). In a national scale, an effective working logistics system will impact significantly affect that country's economic activities positively and if within that country, the logistics system are not effective in terms of their transportation structure, information flow, inventory warehousing, and infrastructures wise then it would not be surprised if companies related to that countries will face hindrances in the transportation and distribution of the goods (Goh and Ang, 2000; Grant et al., 2006). Logistics metric also correlates positively to international trade and some studies found that there is a linkage between country level logistic performance with the shifting of the volume of international trade (Gani, 2017; Beysenbaev, 2018; Beysenbaev and Dus, 2020). In fact, the activities of international trade has become an important parts of gross domestics products (GDP) as logistics proven to have an effect

on inflation rate, interest rates, availability of energy and its costs, productivity and other parts of a country's economic state, thus it is clear that logistics sector could affect a country's economic state and is considered a major costs driver and player in country's economic growth (Stock and Lambert, 2001). The logistic sectors of a country contribute about 5 percent of a country's gross domestic product (GDP), with a range from 2 percent to 12 percent (Shepherd, 2011). So in conclusion the use of logistics sector as a way to measure a country's supply chain performance is essential as the economic growth of a country is also proven to be dependent on whether or not that country instilled an efficient logistics system (Vilko et al., 2011; Sezer and Abasiz, 2017).

Every logistics system at both micro and macro level are deeply affected by their respective country's policies and actions of its government. Said actions and policies could both directly and indirectly affect the logistics network such as infrastructure investments and creation also the adoption of new technologies and services that could lead to the success or failure of its logistics system performance and impact countries economic growth. Though, it was stated by previous studies that application of policies and actions affect macro-level logistics more than micro as the competitiveness of said country through the level of their global trade will be deeply affected by the application of the implemented policies and actions of the government. Thus, consequently if the policies did succeed in altering their logistics system performance, that country economic growth will increase as an effect of that (Önsel Ekici et al., 2016) and if the government which play as an important actor do not invest to set up the appropriate needed infrastructure for the logistics sector to succeed, a huge challenge within their operations would be manifested and directly affected that country's economic growth (Erenberg, 1993).

2.2. Logistics and Economic Growth in Developed and Developing Countries

Previous study regarding the correlation between infrastructure of transportation and economic growth was conducted in one of the developing countries, namely Mauritius. The research was set with the time frame from 1950 to 2000 and it was found that infrastructure of transportation have an important correlation with the economic growth of Mauritius. By improving the state of the infrastructure there, it attracts more foreign direct investment while reducing cost of the logistics and supply chain (Khadaroo and Seetanah, 2008). The case of attracting investment does not only happen to Mauritius, as studies have proven that it happen in China and every other hosts country for logistics sector and impact the country's economic growth, thus by attracting foreign direct investments the economic growth of that respective countries increases as it is in the

case of many developing African countries, Asian countries such as India and Iran, and also a developed European country in Greece (Lu and Yang, 2006; Hong, 2007; Pantelidis and Nikolopoulos, 2008; Babatunde, 2011; Barzelaghi et al., 2012; Pradhan et al., 2013; Talley et al., 2014). Other studies relating to infrastructure of transport point out that sea-port or cargo port also have a positive correlation with economic growth. Two studies were done in two different countries with different classification, with one focusing on a developed country in Korea Republic from 2000 to 2013 and the other focusing on China, a developing country at that time from 2003 to 2010 (Shan et al., 2014; Park and Seo, 2016). Using the granger causality, Lean et al. (2014) found that in both the short run and long run economic growth and logistics output have a causal effects and mainly land infrastructure for transportation have a causal effect with a country's economic growth alongside it those two variables also have a feedback effect meaning the causality could happen the other way around. Additionally, studies have put a great importance on private firms to put their focus on the input of their logistics sector as it could both boost and increase the country's economic growth in both developing and developed countries (Evangelista and Sweeney, 2009; Chu, 2012).

2.3. Logistics Performance Index

It was stated that there are three current leading metrics that are used to measure supply performance logistically on a country level, the first one is the Logistics Performance Index (LPI) provided by the World Bank, the Agility Emerging Market Logistics Index (AEMLI) provided by the Agility Logistics Company in 2018 and lastly, the Global Competitiveness Index "Basic Requirement" subindex "Infrastructure" Pillar (GCII) provided by the World Economic Forum Schwab and Sala-i-Martin in 2020 (Beysenbaev and Dus, 2020). From these three options of country's supply chain performance tool measurement logistically, this research will use the LPI provided by the World Bank as LPI is the most precise tool in comparison to the other two in assessing logistics performances (Beysenbaev and Dus, 2020).

The World Bank had compiled logistics performances through LPI of countries across the globe and from this it was made possible to understand whether a country did achieve their goals in their logistics performances. The LPI is in the form of an online assessment tool that assesses an entire supply chain performance logistically in a country; the index was based on a survey of freight companies and logistics carriers globally (Arvis et al., 2018). The LPI is also used often in research within the logistics sector internationally for benchmarking purposes (Dang

and Yeo, 2018). Another use for the LPI is to assess intra-country logistics performances and to develop new tools and processes (Edirisinghe, 2013; Su and Ke, 2017).

The World Bank published logistic performances data biannually of countries that are members of the World Bank and made it possible to see those data for years 2007, 2010, 2012, 2014, 2016, 2018, and 2023. The Indexes of LPI are scaled from 1 to 5, with 5 as the highest for both overall measurements and each of the six dimensions of logistics performances and the higher the score, the more advanced their country's logistic level. The World Bank uses a weighted average of six dimensions logistically to measure a country's performances. The six dimensions mention are ability to track consignments (T), the quality of the services (Q), the ability to priced eased of shipments competitively (E), customs clearance process customs (C), the frequency of shipments reaching the consignee within the expected time (TM), and finally the trade quality and infrastructure (I) (Gani, 2017; Beysenbaev and Dus, 2020).

The six dimensions of logistic performances are calculated by using a statistical method to reduce the data set dimension; the method is called Principal Component Analysis (PCA). The input for PCA method are from scores of countries' market averages collected from the global survey of the international respondents with the scores are normalized by subtracting the data sample's mean and dividing it using standard deviation. From the PCA, the LPI comes out in the form of a weighted average of the six dimensions. These weighted averages are then multiplied by the same component weights for all six dimensions in which these data will be summarized (Beysenbaev and Dus, 2020).

2.4. Penn World Table

As this research aims to compare empirical differences of economic condition between two different classifications within a country, a source that has a full set of databases regarding any drivers that influence a country's economic condition is needed. The Penn World Table provides exactly the right data within a certain period of time frame that correlates to what our objectives are. It uses real GDP as the basis of their data and it covers all aspects of a country's economic condition such as a country's capital formation, population number year by year, and country's human labor growth over time. It was deemed as the most used economic data source for other studies in the economic growth field of studies (Johnson et al., 2013; Chen, DeJuan, and Tian, 2018). The Penn World Table in itself is a source of data that makes a country's measures of income into something that is comparable among other countries. Other sources that provide

that on a countries' income and GDP only provide them based on each country's domestic prices as that is what GDP actually means. With each country having different domestic prices and the discrepancy between different countries' classification are far, an adjustment must be made for these domestic prices to be comparable between one country and another regardless of their classification. The Penn World Table provides this, as they adjusted countries' domestic prices with PPP or purchasing power parity which basically means a metric that could compare currencies between countries regardless of their classification by eradicating the price difference levels. After it was adjusted, only then a comparative view on equal terms could be done (Johnson et al., 2013).

3. Methodology

3.1. Country Classification

The United Nations and the World Bank classified countries with different methods. Using the Atlas method, they classified countries by observing their gross national incomes per capita of the previous fiscal year that will get renewed on July 1st every year. The measures are calculated from a country's GDP combined with foreign income received by local workers and by property owners and investors, also net taxes subtracted by subsidies received from production and import activities. The World Bank divides the classification into four categories, low income, lower middle income, upper middle income, and high income based on the change in indication on July 1st 2022. The thresholds for each classification are in table 1. Only the higher income classified countries will be further identified as the developed countries with countries that are categorized other than that will be identified as developing countries.

Table 1: *Classification Thresholds*

Category	GNI classification	Identification
High income	>13.205	Developed Countries
Upper middle income	13.205 - 4.256	Developing Countries
Low middle income	4.255 – 1.086	
Lower income	<1.085	

(Source: World Bank's Atlas Method)

3.2. Data Sample

The data population for this research is countries that are within the members of the World Bank in a form of a data panel. The time frame of the countries in observation are from 2007 to 2018. The newest version of LPI already consist data from 2023 period yet data from the PWT only consist data until 2019 thus to even it out, it was decided to omit data from prior 2007 and after 2018 for the data panel to be processed. Sample sources will be from LPI 2023 and PWT 10.01.

3.3. Model

Based on the literature review, the basis of this research is that supply chain performances through logistics performance have a direct correlation with a country's economic condition. By improving the logistics sector, the economic condition of said country should increase as well as an improvement in the logistics sector would remove the unnecessary bottlenecks and influence a more timely delivery, and so if it is achieved these developing countries could be able to compete with the developed countries in competitiveness. Hence, a comparative analysis could be used to see the difference in the influence of supply chain performance through logistics performance of that country to the economic condition and be the interest of developing countries policy makers.

- $\square_0$: There are no correlation between economic growth and supply chain performance through logistics performances
- $\square_\square$: There are direct correlation between economic growth and supply chain performance through logistics performance

Series of analysis will be conducted in which will be further explained in sub chapter below with the underlying empirical form of:

$$EGR_{it} = f\left(LPI_{itm}, Z_{itg}, LL_i\right) \quad (1)$$

- i = no. of country (1, …, 98); t = year of observation (2007, …, 2018); m = logistics variable (LPIOve, LPIInput, LPIOutput); g = economic growth driver (GDPt-1, LGR, HC, INV)

As we want to know the influence supply chain performance through the logistics sector has on the economic condition of a country through growth and multiplication, the dependent variable of this research is the difference in real GDP per capita (EGR) for all the countries in observation.

The independent variables of the observation is the logistics variable, namely their overall score, their input and output. Economic growth drivers will also be included as it has influenced a country's economic condition.

The overall score of all six categories of the logistics performance index will be used as one of the logistics variables in LPIOve as the independent variable. Yet, this research will also include two specific categories out of the six in the logistics performance index, with infrastructure (I) will act as an input towards the logistics sector and timeliness (TM) will serve as an output of a logistics sector. According to Jones (2011), many aspects of the logistics performance index, which in this case are the categories, are dependent or complementary with one another. These two categories being considered as the output and input of the logistics performance is due to their direct correlation with other categories especially infrastructure (I). As the input, it affects not only the output of timeliness (TM), but also other categories such as tracking and quality of shipments.

As for the drivers of economic growth, Romer (1990) stated that the common drivers of economic growth factors are the capital formation investment (INV) made by the government of that country, the change in labor force yearly (LG), and the quality of the people in that labor force (HC). These two new inputs were considered due to their contribution to countries production and thus were expected to have an influence on countries economic condition positively (Jones, 2016). This research will also include GDP from the previous year that serves as the base of economic growth and regressor as Goel (2021) believes that developed countries in particular might find it hard to feel the impact of growth in their economic condition due to their prosperity level. Lastly, this research will also include border lengths (BL) of each country and their land condition (LL) as the instrument variables. Each variable definition will be provided in table 2.

Table 2: *Variables' Definition*

Variable	Definition
LPIOve	The overall score from all six sub-categories of the logistics performance index is measured by averaging all six sub-categories, namely, tracking (T), quality of logistics (Q), ease of shipments (E), customs clearance (C), and timeliness (TM). The index is scaled from 1 to 5, with 1 as the lowest and 5 as the highest.

LPIInput	The sub-categories of infrastructure (I) that measure the quality of infrastructure in a country. The index is scaled from 1 to 5, with 1 as the lowest and 5 as the highest.
LPIOutput	The sub-categories of timeliness (TM) that measure the amount of times the right product reaches the designated recipient within the agreed time. The index is scaled from 1 to 5, with 1 as the lowest and 5 as the highest.
EGR	The difference in real GDP per capita in two consecutive years of each country. The data is at constant 2017 prices and also in millions of USD.
GDPt-1	The real GDP per capita from the previous year of each country. The data is at constant 2017 prices and also in millions of USD.
INV	The gross capital formation of each country at current purchasing power parity (PPP).
LGR	The change in the number of people within a country's labor force. The people here are anyone that are or above the age of 15 years old and employed. The number of people is in millions.
HC	The ratings of the quality of the people within a country's labor force. The quality is measured through the educational background of the people, with higher ratings indicating better quality of the country's labor force.
LL	Countries that do not have any access to sea due to their location thus could have differences in infrastructures and logistics systems.
BL	Countries' border lengths. Data from CIA official website and are measured in kilometers.

(Source: Author's own interpretation)

3.4. Data Processing

As majority of the data used in this research is from the Penn World Table, all of its data are measured as a percentage of real GDP thus making every one an econometrics. Thus for linear regression, Gelman and Hill (2007) stated that it is better to use natural log to remove residual changes in values for the econometrics variable, especially the dependent variable in a form of heteroskedasticity.

First off, starting from the dependent variables, in the Penn World Table, the section 'rgdpna' or defined as the real GDP value at constant 2017 national prices in millions of USD will be divided by that country's population number in millions in the PWT 10.01 section 'pop' to achieve real GDP per capita. The real GDP per capita of that year are then would need to be subtracted by the previous year before a natural logarithmic (base e) will be applied to the difference of real GDP per capita in two consecutive years for each country, then the EGR variables or each year will be achieved, and such for this variables the equation will be as follow:

$$Real\ GDP\ per\ Capita = \frac{rgdpna_{it}}{pop_{it}} \quad (1)$$

$$Real\ GDP\ per\ capita_{it} - Real\ GDP\ per\ Capita_{it-1} = Difference\ in\ real\ GDP\ per\ capita_{it} \quad (2)$$

$$In(Difference\ in\ real\ GDP\ per\ capita_{it}) = EGR_{it} \quad (3)$$

Next up are the economic drivers of a country's economic growth that we use as a variable, namely investment (INV), labor growth (LG), human capital (HC), and the real GDP per capita value from the previous year (GDPt-1). The variable INV comes from the section 'csh_i' in the PWT 10.01 and as it is also an econometrics then natural logarithmic must be applied to it. The variable GDPt-1 comes from the section 'rgdpna' of the previous year and, again, we apply natural logarithmic as it is an econometric. The variables LG comes from the section 'emp' in the PWT 10.01 subtracted by the same section from the previous year which then will apply natural logarithmic as well. The variable HC on the other hand comes from the section 'hc' in the PWT 10.01 does not need to apply natural logarithmic as it is not considered an econometrics. All equations for all variables will be as follow:

$$In(csh\_i_{it}) = INV_{it} \quad (1)$$

$$In(rgdpna_{it-1}) = GDP_{it-1} \quad (2)$$

$$In(emp_{it}) - In(emp_{it-1}) = LG_{it} \quad (3)$$

For the last two variables, BL and LL, two different sources were used for these variables. For BL, the official site of CIA was used to get proper estimate of each countries border lengths measured in kilometers (Land boundaries - The World Factbook (cia.gov)) and for LL, this research will apply dummy variable in which countries that are landlocked will be given value 1 and countries that have accessed to the sea will be given the value 0.

3.5. Data Analysis Method

3.5.1. Chow Test

The commonly known chow test is an analytical test created by Gregory Chow (1960) with the purpose of understanding whether regression coefficients of two separate data are the same or not. The chow test will find out if the best fitted line of a single or multiple regression from two separate data sets. The two separate data sets mentioned above are defined as the split or collapsing of the regression best fitted line that separates the line into two different data sets. The chow test will provide one new best fitted line that we are calling the pooled regression line and will provide an answer whether two different regression coefficients are the same or not or the two separate regression lines. To run the chow test, each separated line needs to be regressed and from that regression the sum square of error will be collected. Then another regression needs to be conducted as well for both data from each separated line combined, this combined data is what we called the pooled data regression. Afterwards, the chow test formula will be used and the F-table will also utilized to determine the F-critical value and if the F-value is greater than the F-critical value, the H0 of no separating data sets will be rejected and if the F-value is smaller than F-critical value then we will fail to reject the null hypothesis. The common formula of the chow test is as follow:

$$F = \frac{(Pooled\ Reg. - (Reg.Line\ 1 + Reg.Line\ 2))x(n1+n2-2k)}{(Reg.Line\ 1 + Reg.Line\ 2)x\ k} \quad (1)$$

3.5.2. Hausmann Test

The Hausmann test or more commonly known as the Hausmann specification test or the Durbin-Wu-Hausmann is a test created by Johann Hausmann (1978) that we will use to identify endogenous variables in the regression. Endogenous variable means that it has a value included in the variable which needs another variable to determine it. Endogenous variables if not identified properly could cause ordinary least squares or OLS estimates to fail and fail to reject the common null hypothesis of no correlation between the dependent and independent variables. As the sample population of this research is in the form of a data panel, the Hausmann test could be utilized to determine whether this research should adopt a random or fixed effect model. The null hypothesis is still the same, no correlation between two different variables yet in here failing to reject the null hypothesis means that the random effects model will be adopted and if the null hypothesis were rejected then the fixed effects model will be adopted. In the Hausmann test, the results will be in

the p-value and if it's below 0.05 or with a confidence level of five percent then the null hypothesis will be rejected and a correlation between the two variables is deemed to exist.

3.5.3. Breusch and Pagan Lagrangin Multiplier Test

The lagrangian multiplier test is a test that assesses whether there is a heteroskedasticity or variance of errors in the independent variables of the research. If heteroskedasticity exists in the residuals of the regression then the results of the regression line are deemed unreliable statistically. This test uses the null hypothesis that residuals of the regression line are equally distributed and non-variance and if heteroskedasticity exists within those residuals then the null hypothesis is rejected thus proving the existence of the alternate hypothesis. To determine this, p-value or confidence level will be looked at, hence if it is below the determined significance level (i.e $p<0.1$; $p<0.05$; $p<0.01$) then the null hypothesis will be rejected and heteroskedasticity is proven to exist in residuals within the regression. To do this, the square value of the residual within the regression will be collected and from that collected square value of the residual another regression will be conducted. The Chi-square then will be calculated by multiplying the R squared value from the new regression line created from the collected square value residual with the number of observations. The null hypothesis that all residuals are equally distributed will be rejected if the confidence level or p-value is similar to the Chi-square and is smaller than the significance level, which concludes that heteroskedasticity exists.

3.5.4. Fixed Effect

As this research's data set is a data panel, this research will use the fixed effect method to omit variables that vary across the data sets which in this case the countries and the time frame, yet they remain constant over time. When utilizing the fixed effect method, this research will assume that there is a need to control or omit variables due to expecting certain variables to influence the others. With the rationale of having a correlation between variables, the fixed effect method will eradicate error in the data panel thus a proper analysis related to those variables could be done effectively. In this model, an intercept in the regression line that differs across the countries will be identified and the regression coefficient for the population needs to be the same. To achieve this, this method will utilize an estimator so that it allows the data panel to be assessed. If the fixed effects estimated is in small quantity then a regression of fixed effects model consisting of dummy variables would be conducted (Stokes and Watson, 2003).

4. Data Analysis

4.1. Country Classification Results

By using the threshold mentioned in table 1, a total number of 46 countries were identified as developed countries and 52 countries were identified as developing countries. Further derivation of the developing countries, 10 countries are in the low income classification, 26 countries are in the lower-middle income classification and 16 countries are in the upper-middle income classification. Countries that have been identified as developed countries are also classified as high income countries as their GNI per capita in millions USD have surpassed the amount needed to enter the high income threshold in 13.205. The full classification and identification for developing countries are on table 2.1 and for developed countries are on table 2.2.

Table 2.1: *Classified Developed Countries*

Classified Developed Countries					
Australia	Czechia	Hungary	Luxembourg	Qatar	Switzerland
Austria	Denmark	Ireland	Netherlands	Romania	Taiwan
Bahrain	Estonia	Italy	New Zealand	Saudi Arabia	UAE*
Belgium	Finland	Japan	Norway	Singapore	UK**
Canada	France	South Korea	Oman	Slovakia	United States
Chile	Germany	Kuwait	Panama	Slovenia	Uruguay
Croatia	Greece	Latvia	Poland	Spain	
Cyprus	Hong Kong	Lithuania	Portugal	Sweden	

*: United Arab Emirates; **: United Kingdom

(Source: Author's own calculation.)

Table 2.2: *Classified Developing Countries*

Classified Developing Countries						
Algeria	Burkina Faso	El Salvador	Indonesia	Mongolia	Serbia	Ukraine
Angola	Cambodia	Gabon	Jamaica	Nigeria	South Africa	Venezuela
Argentina	Cameroon	Ghana	Kazakhstan	Paraguay	Sudan	Viet Nam
Armenia	China	Guatemala	Kyrgyzstan	Peru	Syrian	
Benin	Colombia	Guyana	Laos	Philippines	Tajikistan	
Bolivia	Costa Rica	Haiti	Liberia	Moldova	Thailand	
Brazil	Dominican Republic	Honduras	Madagascar	Russia	Togo	
Bulgaria	Egypt	India	Malaysia	Rwanda	Turkey	

(Source: Author's own calculation.)

4.2. Data Processing Results

Details in comparison of economic drivers variables and dependent variables of the developed and developing countries is provided in table 2.3.

Table 2.3: *Economic Variables Comparison between Developed and Developing Countries*

	Developed Countries	Developing Countries
EGR	(0,028; 0,018; 276; -0,12; 0,118)	(0,042; 0,028; 312; -0,27; 0,28)
GDPt-1	(1,59; 10,379; 276; 1,59; 11,67)	(0,087; 8,821; 312; 6,23; 10,20)
INV	(0,285; -1,293; 276; -2,02; 0,53)	(0,478; -1,683; 312; -6,95; -0,76)
HC	(0,763; 3,060; 276; 2,11; 4,15)	(0,554; 2,423; 312; 1,14; 3,51)
LG	(0,030; 0,017; 276; -0,06; 0,20)	(0,024; 0,018; 312; 0,099; 0,11)

Inside parenthesis includes standard deviation, mean, and number of observations, min, and max.

(Source: Author's Own Calculation)

Details in comparison of logistics variables of the developed and developing countries is provided in table 2.4. Lastly, the landlocked countries that are classified in the developed countries are provided below in table 2.5.

Table 2.4: *Logistics Variables Comparison between Developed and Developing Countries*

	Developed Countries	Developing Countries
LPIOve	(0,41; 3,54; 277; 2,50; 4,22)	(0,38; 2,67; 313; 1,59; 3,77)
LPIInput	(0,52; 3,52; 277; 2,24; 4,43)	(0,44; 2,47; 313; 1,23; 3,78)
LPIOutput	(0,38; 3,92; 277; 2,80; 4,79)	(0,43; 3,11; 313; 2,02; 4,13)

Inside parenthesis includes standard deviation, mean, and number of observations, min, and max.

(Source: Author's Own Calculation)

Table 2.5: *Landlocked Countries List*

Landlocked countries	
Developed Countries	**Developing Countries**
Austria	**Armenia**

Switzerland	**Bolivia**
Hungary	**Burkina Faso**
Luxembourg	**Kazakhstan**
	Mongolia
	Paraguay
	Moldova
	Rwanda
	Serbia
	Tajikistan

(Source: Author's Own Interpretation)

4.3. Data Analysis Results

4.3.1. Chow Test Results

Table 2.6: *Developed Countries' Chow Test Results*

EGR	Coefficients (std. error)	t	P>[t]	95% confidence interval	
LPIOve	-0,020692 (0,0216425)	-0,96	0,340	-0,0633421	0,0219581
LPIInput	-0,0021494 (0,0142748)	-0,15	0,880	-0,0302801	0,0259814
LPIOutput	0,0104147 (0,0099445)	1,05	0,296	-0,0091826	0,0300119
GDPt-1	-0,0297908 (0,0231079)	-1,29	0,199	-0,0753286	0,0157471

LG	0,1636959 (0,0713165)	2,30	0,023	0,0231554	0,3042363
HC	-0,0098734 (0,0172899)	_-0,57	0,569	-0,0439459	0,0241992
INV	0,0406669 (0,0119708)	3,40	0,001	0,0170765	0,0642574

F test that all u_i=0 : F(45, 223) = 2,50 Prob > F = 0,0000

(Source: Author's Own Calculation)

Table 2.6 shows the chow test results for developed countries, the F-critical value is 0, 0000 which is lower than the confidence level of 0, 05, thus the fixed effect model will be adopted later and the null hypothesis is rejected.

Table 2.7: *Developing Countries' Chow Test Results*

EGR	Coefficients (std. error)	t	P>[t]	95% confidence interval	
LPIOve	0,0174253 (0,0245158)	0,71	0,478	-0,0308557	0,0657064
LPIInput	-0,0144723 (0,0157525)	-0,92	0,359	-0,0454951	0,0165505
LPIOutput	-0,0019177 (0,0109506)	-0,18	0,861	-0,0234837	0,0196483
GDPt-1	-0,0876751 (0,0194446)	-4,51	0,000	-0,1259689	-0,0493813
LG	0,2216281 (0,0947992)	2,34	0,020	0,0349321	0,4083242
HC	-0,0116734 (0,0235482)	_-0,50	0,621	-0,0580488	0,0347021

INV	0,0326602 (0,0059996)	5,44	0,000	0,0208448	0,0444757

F test that all u_i : F(51, 253) = 2,98 Prob > F = 0,0000

(Source: Author's Own Calculation)

Table 2.7 shows the chow test results for the developing countries, again, the F-critical value is 0,000 and below 0,05 thus the fixed effects model would be adopted later on.

4.3.2. Hausmann Specification Test Results

Table 2.8: *Developed Countries' Hausmann Test Results*

	FE (b)	RE (B)	Difference	Std. Error
LPIOve	-0,020692	-0,0037641	-0,0169279	0,0083102
LPIInput	-0,0021494	-0,0197976	0,0176482	0,0069443
LPIOutput	0,0104147	0,012053	-0,0016383	0,0025795
GDPt-1	-0,0297908	-0,0020298	-0,0277609	0,0230105
LG	0,1636959	0,1267412	0,0369547	0,0282485
HC	-0,0098734	0,020107	-0,0299804	0,016785
INV	0,0406669	0,0166346	0,0240323	0,0080668

b = Consistent under H0 and Ha; B = Inconsistent under Ha, efficient under H0; Prob > chi2 = 0,0003

(Source: Author's Own Calculation)

Table 2.8 shows that the Hausmann specification test results for the developed countries, the Chi-square value is 0,0003 which is below the significance level of 0,05, thus the fixed model will be adopted later on.

Table 2.9: *Developing Countries' Hausmann Test Results*

	FE (b)	RE (B)	Difference	Std. Error
LPIOve	0,0174253	0,0379964	-0,020571	0,0061043
LPIInput	-0,0144723	-0,0319205	0,0174482	0,0028762
LPIOutput	-0,0019177	-0,0047911	0,0028734	-
GDPt-1	-0,0876751	-0,0054489	-0,0822262	0,0188973
LG	0.2216281	0,2468574	-0,0252292	0,0226401
HC	-0,0116734	0,0042446	-0,0159179	0,0224572

INV	0,0326602	0,0367187	-0,0040584	0,0028598

b = Consistent under H0 and Ha; B = Inconsistent under Ha, efficient under H0; Prob > chi2 = 0,0000

(Source: Author's Own Calculation)

From table 2.9, Hausmann specification test on the developing countries shows that the Chi square value is 0,0000 which is below the significance level of 0,05, thus a fixed model will be adopted later on.

4.3.3. Lagrangin Multiplier Test Results

Table 2.10: *Developed Countries' Lagrangin Test Results*

	Variance	Sqrt(Variance)
EGR	0,0008133	0,0285186
e	0,0005591	0,0236463
u	0,0001113	0,0105479

Test: Var(u) = 0; chibar2(01) = 10,81; Prob > chibar2 = 0,0005

(Source: Author's Own Calculation)

Table 2.10 shows the results of the Lagrangian multiplier test for developed countries, the Prob > chibar 2 value is 0,0005 and it is below the significance level of 0,05 thus the model fixed effects will be preferred.

Table 2.11: *Developing Countries' Lagranging Test Results*

	Variance	Sqrt(Variance)
EGR	0,0018093	0,0425362
e	0,0011082	0,0332894
u	0,0001891	0,0137497

Test: Var(u) = 0; chibar2(01) = 7,49; Prob > chibar2 = 0,0031

(Source: Author's Own Calculation)

Table 2.11 shows the results of the Lagrangian multiplier test for developing countries, the Prb > chibar 2 value is 0,0031 which is below the significance level of 0,05 thus the model fixed effects will be preferred.

4.3.4. Fixed Effect Model Results

From Table 8, we could see that only LG and INV have significant correlation with the EGR from the t statistical probability value for the developed countries. The labor growth variables or LG have value of 0,023 and the variable investment or INV have value of 0,001 for their t

statistical value which is below the significance level of 0,05. All of the logistics variable (LPIOve, LPIInput, and LPIOutput) and human capital or HC variable are all deemed not significantly correlated due to their t statistical probability value all higher then the significance level of 5%, with the t statistical probability of 0,34, 0,88, 0,296, and 0,569 respectively. The lag GDP variable or GDPt-1 just barely exceeds the significance level of 10% in 0,199 t statistical probability value. Then, we look at the f statistic, for the developed countries the f statistical probability value is 0,0001 which is below 1% significance level thus using this all of the variables, both economic drivers and logistics variables, jointly significantly influencing EGR. Another thing to noticed is the adjusted R-squared with only amounted to 12,5%, which means that all of the logistics variable and the economic drivers only contributed to 12,5% of EGR and there are other variables not mention or considered in this research the amounted to the rest of 87.5%.

For the developing countries, in Table 9, LG and INV still are the only one that have significant correlation but one with the addition of GDPt-1, all have t statistical probability value below 5%, with t statistical value of LG is 0,020, INV and GDPt-1 even below significance level of 1% with both t statistical probability value is 0,000. Same as those in developed countries the logistics variables are all not significantly correlated in addition to HC as well not significantly correlated to EGR based on their t statistical probability value being above the significance level of 5%. The t statistical probability values are 0,478, 0,359, 0,861, and 0,621 for LPIOve, LPIInput, LPIOutput, and HC respectively. Again, we look at the f statistical probability value for developing countries with 0,0000 which is below 1% significance level then indicates all of the logistics variable and economic drivers combined still statistically influencing the EGR. Yet, just like the developed countries, the developing countries also have a low adjusted R-squared value with only 26,59%. This shows that there are other variables not mentioned that contributed 73,41% to the EGR variables.

Not satisfied with the results, a series of other methods were conducted and we compiled the adjusted R-squared values and f statistical probability values for each method used by each of the developing countries and the developed countries. Compiled information is provided in table 14.

Table 2.12: *Compiled Adjusted R-squared Values and f Statistical Probability Values*

	PLS	Panel EGLS	CSRE PLS	Panel TSLS	Panel TSEGLS	QR

Developed Countries						
Adjusted R-squared	0,134692	0,087888	0,312507	-0,583445	-0,196645	0,075603
F-statistic	0,000000	0,000099	0,000000	0,028133	0,268698	-
Developing Countries						
Adjusted R-squared	0,209347	0,177898	0,387516	-8,033150	-2,961786	0,089318
F-statistic	0,000000	0,000000	0,000000	0,003416	0,062272	-

Note: PLS: panel least squares; Panel EGLS: panel estimated generalized least squares; CSRE PLS: cross-section random effects panel least squares; Panel TSLS: panel two-stage least squares; Panel TSEGLS: panel two-stage estimated generalized least squares; QR: quantile regression.

(Source: Author's Own Calculation)

As shown in the compiled received information of R-squared and f statistical probability value in table 2.12, by using different methods to analyze these two different pooled data of developed countries and developing countries, the highest adjusted R-squared value received is only 38% and in panel two-staged estimation generalized least square method the f statistical probability value even reach insignificant level towards the EGR with 0,26898.

4.4. Discussion

By comparing the results from both the developed and developing countries, it could be interpreted that in both cases only the variable INV and LG statistically significantly correlate to the EGR. Which means that in both classifications of developed and developing countries through investment in infrastructure and an increase in labor growth, economic growth could be achieved effectively. In terms of logistics performances, it was worth noting that none were directly influencing the growth of the economy, contradicting all of the studies mentioned in the theoretical foundation.

Yet, despite all of that, a thorough comparison could still be conducted from the results received from the main methodologies used. First, from all of the variables we used in the testing, in the developed countries LG and INV are the only two statistically significant in the correlation to EGR with both coefficients are 0,163 and 0,040 respectively, both t-statistical probability value are 0,023 and 0,001 respectively in which for LG it is below the significance level of 5% and INV on significance level of 1%. The developing countries on the other hand also shows that only LG

and INV are statistically significant in correlating to EGR with both coefficients are 0,221 and 0,032 respectively, the t-statistical probability values for each are 0,02 and 0,000 respectively. Comparing these two results, the growth of labor impacted the economic growth more in developing countries compared to the developed countries and the opposite happens with investment made. In developed countries, investment directly correlates to economic growth more than those in developing countries.

From the F-statistics, it could be seen that in both case of developed and developing countries, all of the variables combined do have an impact to economic growth yet for developed countries all of them only contributed to 12.5% of impact in economic growth in comparison to variables in developing countries contributed to 26.59% to their economic growth. This shows that while logistics performances are proven to not have that significant effect statistically, in developing countries it still contributed more to their own growth in economic conditions. Thus, pursuing improvement in the logistics sector could be a strategy to keep up or even break through the classification into a developed country.

5. Conclusion

5.1. Conclusion

The three research questions posed in chapter 1 have the objectives to understand,

- Whether there is a correlating impact between supply chain performance through the logistics sector and economic growth in both developing countries and developed countries.
- Understanding the significance of the impact the logistics sector has on a country's economic growth for both developed and developing countries.
- Compare the significance of the impact of logistics performances towards a country's economic condition for developing and developed countries.

The sample data used is a data panel with 588 total observations derived from 98 total countries over 6 periods of time (2007, 2010, 2012, 2014, 2016, and 2018). The data samples were then separated into two classifications namely developed countries and developing countries based on their GNI per capita. The raw data then processed and analyzed using statistical methods.

Based on the results and findings, for the first research objective, it was found that supply chain performance through logistics performance indicators do have a direct impact on a country's economic growth regardless of their current classification, as through all four data

analysis method, there no trace of variance errors for heteroskedasticity, and both data sets were valid to be used also were statistically reliable.

For the second objective, the significance for all variables including logistics variables were 12.5% significance within developed countries and 26.59% significance within developing countries. These results also answer that developing countries depend more on their logistics performance to increase their economic growth, thus the third and last main research objective was also answered.

However, the direct correlations were not significant as variables not mentioned and considered in this research proven to contribute more to a country's economic condition. Thus, it can be concluded that developing countries depend more on their logistics sector in comparison to developed countries and logistics performance does have a direct correlation on a country's economic growth even though only for a small amount.

5.2. Limitations of Research

As stated in both the discussion and conclusion sub-chapter, the limitations of this research includes a probable limited data sample population with only a total of 588 number of observations consisting of 98 total countries over six time periods. Variables are proven to be small as well as it only contributes little to the dependent variables. Lastly, the methodologies used were limited as well as knowledge barriers and insufficient number of variables happens to limit the methodologies available for the data panel.

5.3. Recommendations

As this is mainly to compare analytically the significant difference in the correlation of supply chain performance through the logistic sector with the growth of a country's economic condition in developing countries and developed countries, the research methodologies were too small and non-variative. Future research could try and explore more methodology that would allow a comparative analysis in this sector between developed countries and developing countries. In terms of data population sample, as year goes by and both LPI and PWT's datasets got bigger as newer and larger sets of data arrive, these could be utilized to understand the comparison more for what the data have to offer now. Additionally, future research could also find then use new variables to add that consequently could make supply chain performance through logistics performance indicators correlate better with country's economic condition. Lastly, future research could also compare countries by region perhaps rather than the classification of economic maturity.

REFERENCES

Aiginger, K., 1998. A framework for evaluating the dynamic competitiveness of countries. Structural change and economic dynamics, 9(2), pp.159-188. https://doi.org/10.1016/S0954-349X(97)00026-X

Arvis, J.F., Ojala, L., Wiederer, C., Shepherd, B., Raj, A., Dairabayeva, K. and Kiiski, T., 2018. Connecting to compete 2018. https://doi.org/10.1596/29971

Babatunde, A., 2011. Trade openness, infrastructure, FDI and growth in sub-Saharan African countries. Journal of management policy and practice, 12(7), p.27.

Banomyong, R., 2010. Logistics Challenges in Cambodia, Lao PDR, Myanmar, and Vietnam. AStudy ON UPGRADING INDUSTRIAL STRUCTURE OF CLMV COUNTRIES, 392.

Barzelaghi, M.T., Dizaji, M. and Laleh, M.M., 2012. The effect of transportation infrastructure on foreign direct investment attraction in Iran. International journal of economics and finance studies, 4(2), pp.153-161.

Bascom, W.O., 2016. The economics of financial reform in developing countries. Springer.

Beamon, B.M., 1999. Measuring supply chain performance. International journal of operations & production management, 19(3), pp.275-292. https://doi.org/10.1108/01443579910249714

Behrouzi, F. and Wong, K.Y., 2013. An integrated stochastic-fuzzy modeling approach for supply chain leanness evaluation. The International Journal of Advanced Manufacturing Technology, 68, pp.1677-1696. https://doi.org/10.1007/s00170-013-4966-1

Beysenbaev, R. and Dus, Y., 2020. Proposals for improving the logistics performance index. The Asian Journal of Shipping and Logistics, 36(1), pp.34-42. https://doi.org/10.1016/j.ajsl.2019.10.001

Beysenbaev, R., 2018. The importance of country-level logistics efficiency assessment to the development of international trade. British Journal for Social and Economic Research, 3(6), pp.13-20. https://doi.org/10.22406/bjser-18-3.6-13-20

Breusch, T.S. and Pagan, A.R., 1980. The Lagrange multiplier test and its applications to model specification in econometrics. The review of economic studies, 47(1), pp.239-253. https://doi.org/10.2307/2297111

Burmaoglu, S. and Sesen, H., 2011. Analyzing the dependency between national logistics performance and competitiveness: Which logistics competence is core for national strategy?. Journal of competitiveness, 3(4).

Çelebi, D., Bayraktar, D. and Bingöl, L., 2010. Analytical Network Process for logistics management: A case study in a small electronic appliances manufacturer. Computers & Industrial Engineering, 58(3), pp.432-441. https://doi.org/10.1016/j.cie.2009.09.002

Chen, T., DeJuan, J. and Tian, R., 2018. Distributions of GDP across versions of the Penn World Tables: A functional data analysis approach. Economics Letters, 170, pp.179-184. https://doi.org/10.1016/j.econlet.2018.05.038

Chopra, S. and Meindl, P. (no date) Supply Chain Management : Strategy, Planning and Operation. 7th edn. Pearson.

Chow, G.C., 1960. Tests of equality between sets of coefficients in two linear regressions. Econometrica: Journal of the Econometric Society, pp.591-605. https://doi.org/10.2307/1910133

Christopher, M., 1986. Implementing logistics strategy. International journal of physical distribution & materials management, 16(1), pp.52-62. https://doi.org/10.1108/eb014627

Chu, Z., 2012. Logistics and economic growth: a panel data approach. The Annals of regional science, 49(1), pp.87-102. https://doi.org/10.1007/s00168-010-0434-0

Dee, P. and Findlay, C. 2006. Trade Facilitation: What, Why, How, Where and When? 3rd LAEBA Annual Meeting Seoul, South Korea, November 16

Dang, V.L. and Yeo, G.T., 2018. Weighing the key factors to improve Vietnam's logistics system. The Asian journal of shipping and logistics, 34(4), pp.308-316. https://doi.org/10.1016/j.ajsl.2018.12.004

Devlin, J. and Yee, P., 2005. Trade logistics in developing countries: The case of the Middle East and North Africa. World Economy, 28(3), pp.435-456. https://doi.org/10.1111/j.1467-9701.2005.00620.x

Dimitrov, P., 1991. National logistics systems.

Dossi, A. and Patelli, L., 2010. You learn from what you measure: financial and non-financial performance measures in multinational companies. Long Range Planning, 43(4), pp.498-526. https://doi.org/10.1016/j.lrp.2010.01.002

Ekici, Ş.Ö., Kabak, Ö. and Ülengin, F., 2016. Linking to compete: Logistics and global competitiveness interaction. Transport Policy, 48, pp.117-128. https://doi.org/10.1016/j.tranpol.2016.01.015

Evangelista, P. and Sweeney, E., 2009. The role of information and communication technology in small Italian logistics enterprises. International Journal of Business and Systems Research, 3(1), pp.1-18. https://doi.org/10.1504/IJBSR.2009.023504

Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer (2015), "The Next Generation of the Penn World Table" American Economic Review, 105(10), 3150-3182. https://doi.org/10.1257/aer.20130954

Gabler, S. (2014), "Gabler wirtschaftslexikon. schlagworte: kooperation, fokales unternehmen", Neue Institutionenökonomik, Institution, Transaktionskostenökonomik.

Galankashi, M.R., Fallahiarezoudar, E., Moazzami, A., Helmi, S.A., Rohani, J.M. and Yusof, N.M., 2018a. An efficient integrated simulation–Taguchi approach for sales rate evaluation of a petrol station. Neural Computing and Applications, 29, pp.1073-1085. https://doi.org/10.1007/s00521-016-2491-5

Galankashi, M.R., Fallahiarezoudar, E., Moazzami, A., Yusof, N.M. and Helmi, S.A., 2016. Performance evaluation of a petrol station queuing system: A simulation-based design of experiments study. Advances in Engineering Software, 92, pp.15-26. https://doi.org/10.1016/j.advengsoft.2015.10.004

Galankashi, M.R., Helmi, S.A., Hisjam, M. and Rahim, A.R.A., 2018b. Leanness assessment in automotive industry: case study approach. International Journal of Value Chain Management, 9(1), pp.70-88. https://doi.org/10.1504/IJVCM.2018.091110

Gani, A., 2017. The logistics performance effect in international trade. The Asian Journal of Shipping and Logistics, 33(4), pp.279-288. https://doi.org/10.1016/j.ajsl.2017.12.012

Goel, R.K., Saunoris, J.W. and Goel, S.S., 2021. Supply chain performance and economic growth: The impact of COVID-19 disruptions. Journal of Policy Modeling, 43(2), pp.298-316. https://doi.org/10.1016/j.jpolmod.2021.01.003

Goh, M. and Ang, A., 2000. Some logistics realities in Indochina. International Journal of Physical Distribution & Logistics Management, 30(10), pp.887-911. https://doi.org/10.1108/09600030010351273

Gourdin, K., 2006. Global logistics management: a competitive advantage for the 21st century. Wiley-Blackwell.

Gujarati, D.N., 2022. Basic econometrics. Prentice Hall.

Handfield, R.B. and Nichols Jr, E.L., 1999. Introduction to. Supply Chain Management, Prentice Hall, Englewood Cliffs, NJ, pp.1-29.

Hausman, J.A., 1978. Specification tests in econometrics. Econometrica: Journal of the econometric society, pp.1251-1271. https://doi.org/10.2307/1913827

Hausman, W.H., Lee, H.L, Subramaniam, U. 2013. The impact of logistics performance on trade. Production and Operations Management, 22(2), 236-252. https://doi.org/10.1111/j.1937-5956.2011.01312.x

Herliana, L. and Parsons, D., 2011. Logistics in Indonesia. APEC Policy Support Unit, The Impacts and Benefits of Structural Reforms in the Transport, Energy and Telecommunications Sectors in APEC Economies, Singapore: APEC Policy Support Unit, pp.446-61.

Hoekman, B. and Nicita, A. 2011. Trade policy, trade costs, and developing country trade. World Development, 39, 2069-2079. https://doi.org/10.1016/j.worlddev.2011.05.013

Hong, J., 2007. Transport and the location of foreign logistics firms: The Chinese experience. Transportation Research Part A: Policy and Practice, 41(6), pp.597-609. https://doi.org/10.1016/j.tra.2006.11.004

Indonesia. Kantor Statistik Propinsi Nusa Tenggara Barat. 1996, Produk domestik regional bruto (PDRB) Propinsi Nusa Tenggara Barat per kabupaten = Gross regional domestic product (GRDP) of West Nusa Tenggara Province by regencies

Intelligence, T., 2020. The Agility Emerging Markets Logistics index 2020. Agility Emerging Marketing Logistics. Available from Internet: https://logisticsinsights.agility.com/wpcontent/uploads/2020/02/Agility-emerging-Markets-Logistics-Index-2020.pdf

Johnson, S., Larson, W., Papageorgiou, C. and Subramanian, A., 2013. Is newer better? Penn World Table revisions and their impact on growth estimates. Journal of Monetary Economics, 60(2), pp.255-274. https://doi.org/10.1016/j.jmoneco.2012.10.022

Jones, C.I., 2011. Intermediate goods and weak links in the theory of economic development. American Economic Journal: Macroeconomics, 3(2), pp.1-28. https://doi.org/10.1257/mac.3.2.1

Jones, C.I., 2016. The facts of economic growth. In Handbook of macroeconomics (Vol. 2, pp. 3-69). Elsevier. https://doi.org/10.1016/bs.hesmac.2016.03.002

Khadaroo, A.J. and Seetanah, B., 2010. Transport infrastructure and foreign direct investment. Journal of International Development: The Journal of the Development Studies Association, 22(1), pp.103-123. https://doi.org/10.1002/jid.1506

King, R.G. and Levine, R., 1993. Finance and growth: Schumpeter might be right. The quarterly journal of economics, 108(3), pp.717-737. https://doi.org/10.2307/2118406

Lambert, D., Stock, J.R., Ellram, L.M. and Grant, D., 2006. Fundamentals of Logistics Management: First European Edition. McGraw-Hill.

Lean, H.H., Huang, W. and Hong, J., 2014. Logistics and economic development: Experience from China. Transport Policy, 32, pp.96-104. https://doi.org/10.1016/j.tranpol.2014.01.003

Lu, C.S. and Yang, C.C., 2006. Comparison of investment preferences for international logistics zones in Kaohsiung, Hong Kong, and Shanghai ports from a Taiwanese manufacturer's perspective. Transportation journal, 45(1), pp.30-51. https://doi.org/10.2307/20713624

Masoud Rahiminezhad Galankashi and Syed Ahmad Helmi (2016) 'Assessment of hybrid Lean-Agile (Leagile) supply chain strategies', Journal of Manufacturing Technology Management, 27(4), pp. 470–482. https://doi.org/10.1108/JMTM-08-2015-0069

Mayer, T. and Zignago, S., 2011. Notes on CEPII's distances measures: The GeoDist database. https://doi.org/10.2139/ssrn.1994531

Michael H. Hugos (2018) Essentials of Supply Chain Management. Hoboken: Wiley (Essentials Series). https://doi.org/10.1002/9781119464495

Neely, A., Gregory, M. and Platts, K., 1995. Performance measurement system design: a literature review and research agenda. International journal of operations & production management, 15(4), pp.80-116. https://doi.org/10.1108/01443579510083622

OECD/WTO. 2013. Aid for trade and value chains in transport and logistics. World Trade Organisation, Geneva.

Pantelidis, P. and Nikolopoulos, E., 2008. FDI attractiveness in Greece. International Advances in Economic Research, 14, pp.90-100. https://doi.org/10.1007/s11294-007-9106-y

Park, J.S. and Seo, Y.J., 2016. The impact of seaports on the regional economies in South Korea: Panel evidence from the augmented Solow model. Transportation Research Part E: Logistics and Transportation Review, 85, pp.107-119. https://doi.org/10.1016/j.tre.2015.11.009

Pradhan, R.P., Norman, N.R., Badir, Y. and Samadhan, B., 2013. Transport infrastructure, foreign direct investment and economic growth interactions in India: the ARDL bounds testing approach. Procedia-social and behavioral sciences, 104, pp.914-921. https://doi.org/10.1016/j.sbspro.2013.11.186

Portugal-Perez, A. and Wilson, J.S. 2012. Export performance and trade facilitation reform: hard and soft infrastructure. World Development, 40, 1295-1307. https://doi.org/10.1016/j.worlddev.2011.12.002

Rahiminezhad Galankashi, M. and Mokhatab Rafiei, F., 2022. Financial performance measurement of supply chains: a review. International journal of productivity and performance management, 71(5), pp.1674-1707. https://doi.org/10.1108/IJPPM-11-2019-0533

Rahiminezhad Galankashi, M., Helmi, S.A., Abdul Rahim, A.R. and Rafiei, F.M., 2019. Agility assessment in manufacturing companies. Benchmarking: An International Journal, 26(7), pp.2081-2104. https://doi.org/10.1108/BIJ-10-2018-0328

Roller, L., (2001). Telecommunications infrastructure and economic development: A simultaneous approach. American Economic Review, pp.909-923. https://doi.org/10.1257/aer.91.4.909

Romer, P.M., 1989. Human capital and growth: Theory and evidence. https://doi.org/10.3386/w3173

Smith, A., 1776. An inquiry into the nature and causes of the wealth of nations: Volume One. London: printed for W. Strahan; and T. Cadell, 1776. https://doi.org/10.1093/oseo/instance.00043218

Schwab, K., 2019, October. The global competitiveness report 2019. World Economic Forum.

Seferlis, P. and Giannelos, N.F., 2004. A two-layered optimisation-based control strategy for multi-echelon supply chain networks. Computers & Chemical Engineering, 28(5), pp.799-809. https://doi.org/10.1016/j.compchemeng.2004.02.022

Seiler, A., 2016. Measuring performance in supply chain networks. University of Salford (United Kingdom).

Sezer, S. and Abasiz, T., 2017. The impact of logistics industry on economic growth: An application in OECD countries. Eurasian Journal of Social Sciences, 5(1), pp.11-23. https://doi.org/10.15604/ejss.2017.05.01.002

Shan, J., Yu, M. and Lee, C.Y., 2014. An empirical investigation of the seaport's economic impact: Evidence from major ports in China. Transportation Research Part E: Logistics and Transportation Review, 69, pp.41-53. https://doi.org/10.1016/j.tre.2014.05.010

Shepherd, B., 2011. Logistics costs and competitiveness: measurement and trade policy applications. https://doi.org/10.1596/26724

Škrinjar, R., Bosilj-Vukšić, V. and Indihar-Štemberger, M., 2008. The impact of business process orientation on financial and non-financial performance. Business process management journal, 14(5), pp.738-754. https://doi.org/10.1108/14637150810903084

Stock, J.H. and Watson, M.W., 2003. Introduction to econometrics (Vol. 104). Boston: Addison Wesley.

Stock, J.R. and Lambert, D.M., 2001. Strategic logistics management (Vol. 4). Boston, MA: McGraw-Hill/Irwin.

Talley, W.K., Ng, M. and Marsillac, E., 2014. Port service chains and port performance evaluation. Transportation Research Part E: Logistics and Transportation Review, 69, pp.236-247. https://doi.org/10.1016/j.tre.2014.05.008

Tangen, S., 2004. Performance measurement: from philosophy to practice. International journal of productivity and performance management, 53(8), pp.726-737. https://doi.org/10.1108/17410400410569134

Thirumalai, S. and Sinha, K.K., 2005. Customer satisfaction with order fulfillment in retail supply chains: implications of product type in electronic B2C transactions. Journal of Operations Management, 23(3-4), pp.291-303. https://doi.org/10.1016/j.jom.2004.10.015

Vilko, J., Karandassov, B. and Myller, E., 2011. Logistic infrastructure and its effects on economic development. China-USA Business Review, 10(11).