Can Supply Chain Connectivity Effect on the Relationship between Port Performance and Economic Growth?

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***Abstract*— In the past decade, the ports served as a node in a network of transportation, trade and global supply chain. Their roles are becoming increasingly important. Their important role in improving the efficiency and effectiveness of transport has been recognized, as well as in realizing the connectivity and competitiveness of a country. In addition, their most important role is to develop and grow national economy. This study is aimed at analyzing the relationship between the performance of the ports and the country's economic growth by having the function of mediation by supply chain connectivity. Tanjung Priok Port as the main port in Indonesia is chosen as a case study. Port performance is measured by eight indicators, while the supply chain connectivity measured by seven indicators, and national economic growth measured by the Gross Domestic Product (GDP) constructs. Linear regression analysis is used to identify the relationships developed based on three hypotheses. The study concludes that the increase of port performance has no direct effect on the country's economic growth, but this increase affects the supply chain connectivity directly. The analysis also shows that the supply chain connectivity affects the relationship between port performance and country's economic growth. The importance of the port for the country's economic growth needs to be addressed with improved port performance and connectivity between ports, and it certainly demands hard efforts from the port authorities and other stakeholders.**

***Keywords*—** *port performance; supply chain connectivity; economic growth; ISCCI, LSCI*

1. Introduction

Changes in the industry structure and the world economy are currently accompanied by the formation of global trade chain and transportation gradually [1]. The global logistics industry has grown significantly, while logistics has become an important part of the business economic system and major global economic activity in recent years. Logistic activities are believed to accelerate economic and productivity growth, where the achievement of high levels of performance in the logistics field is essential to the profitability and efficiency of the national and global economy [2].

In the context of global logistics network, every country, region, even ports in the world almost becomes an integral part of this network [3]. More recently, port functions have become increasingly important as vertices and backbones of transport, trade and logistic networks [4], due to their critical role as a node in the global supply chain [5]. Thus, the role of port logistics has become a very important part in the modern logistics development [6]. Ports are an important point for global export and import activities that have been the focus of a wide spectrum of maritime activities that generate revenue, create employment opportunities and foster economic growth from maritime nations [7].

As part of a globally integrated logistics network, the presence of ports is important for maritime countries, including Indonesia. Indonesia has great potential in the marine sector, where most transportation in Indonesia is conducted by sea transportation (about 88%). Greater freightability (in volume) compared to other types of transportation (land and air) makes marine transportation more efficient. This condition indicates that efforts to improve marine transportation policy and management are

important to improve national logistics performance. Thus, it is expected that improvements in logistics performance will be able to lower national logistics costs [8].

Indonesian Government has formulated a national logistics policy by issuing Presidential Regulation No. 26/2012 on Blueprint of National Logistics System Development (SISLOGNAS) as one of the efforts to promote the national competitiveness improvement and to support the implementation of the Masperplan of Acceleration and Expansion of Indonesia's Economic Development (MP3EI) from period 2011 to 2025. This regulation is expected to become a guidance for relevant stakeholders [9]. One aspect that became the focus of the national logistics competitiveness strategy in Indonesian SISLOGNAS was the port development. The main problem of Indonesian ports currently concerns 3 (three) main points, including the unavailability of international hub ports, low productivity and capacity of ports, and and port management that has not been integrated [10].

Indonesia actually has a major port that can become an international hub port, Tanjung Priok Port. Nevertheless, the productivity and capacity of Tanjung Priok Port are currently considered to be incapable of offsetting the increase in the flow of goods, both domestic and international. Currently, Tanjung Priok Port is in desperate need of area development to anticipate the increasing flow of goods. Indeed, Tanjung Priok Port is one of the Indonesian major ports which is included in the Top 50 World Port League (besides Tanjung Perak Port) based on the containers capacity. At the ASEAN level, Tanjung Priok Port is also included in the Top 10 ASEAN Ports [11].

With regard to port competitiveness, it is understood that the port infrastructure quality is one of the factors contributing to port performance, affecting the productivity, effectiveness and reliability of port operations [12]. Several efficiency and effectiveness criteria can be used to measure port performance, such as efficiency, productivity, annual cargo throughput, and maximum cargo movement [13]. Some authors also measure port performance by using productivity, physical activity and relative efficiency [14]. Meanwhile, port performance model analysis is also performed by many other authors using cargo throughput [15].

In addition to relying on quality and other measurable factors, some intangible resources are also important for port competitiveness and performance. In particular, resources such as shipping connectivity and operating efficiency can enhance port competitive advantage and performance [16]. As a node in the supply chain system, port performance is judged to determine the competitive advantage and economic development of various countries [17]. Concerning the role of ports, [18] argues that ports play an important role in promoting the national economy with respect to their function in connecting marine and terrestrial transport for large quantities of commodities at a lower cost worldwide.

Taking into account that about 80% of international trade goes through ports, the participation of a country in the international supply chain depends not only on port performance such as the efficiency of the procedures involved in moving goods from and to port but also to how well the ports are connected to other countries [19]. In this context, port performance will be related to international supply chain connectivity.

Ports play an important role in improving the efficiency and effectiveness of transport as well as in realizing the connectivity and competitiveness of a country [20]. According to [21], the key role of ports in the efficiency and effectiveness of transport and the competitiveness and connectivity of a country is expanded to be important for the country’s economy development because the ports contribute significantly to the development of public infrastructure and industry. A country’s economic growth as measured by Gross Domestic Product (GDP) is strongly influenced by the development of logistics and supply chain networks, both directly and indirectly [22]. Integrating logistical activities organically will be able to serve regional economic development and improve the efficiency of regional logistics activities.

The relationship between port performance, connectivity and country’s economic growth as proposed by [16], [19], [20], [21], [22], and [23], became the rationale in this study. Therefore, this study was conducted to analyze the relationship between port performance and economic growth with supply chain connectivity acting as a mediating variable. Tanjung Priok Port was chosen

as a case study with the consideration that the port is considered to represent other ports in Indonesia. We suspect that there is a relationship between port performance and economic growth directly. It is also suspected that there is an indirect relationship between these two variables, where there is a supply chain connectivity acting as an mediator variable. This study intends to examine whether port performance has a relationship with economic growth with mediation by supply chain connectivity.

2. Literature Review

2.1 Port Performance

The port has been considered to play an important role as a critical node in international supply chain activities [24]. It is widely believed that the ports form an important relationship within the entire international trade chain [25]. The port is a component of the goods distribution system because it offers an interface between maritime and land within business traffic [26].

In recent years, port performance measures have been developed in various studies, particularly in relation to port functions in logistics. In a perspective that can be adapted to logistics performance theory, port performance has been noted about its integration into the global supply chain by using various measures [14]. Port performance can be measured from a productivity, financial, social and user satisfaction perspective. Productivity and finance perspectives are each oriented towards efficiency and finance. While social and user satisfaction perspective focus on effectiveness, viewed from the perspective of port stakeholders [4], [27].

Several factors can affect port performance in today's competitive environment, including local market traits, organizational and physical capacity, integrated capabilities in logistics systems, terrestrial and maritime accessibility, competition, dock equipment and parking field, delivery service and connection to the hinterland areas [25]. Correspondingly, [28] points out that in the current era of global supply chains, in addition to cargo throughput, there may also be other valid and useful measures for port performance such as slackness, agility and compression time and other parties performance in the supply chain.

Effectiveness and efficiency aspects should also be used in measuring port performance, which is usually associated with efficiency in operational activities, in terms of quantity, and in resource use [29]. Port and delivery services, infrastructure, port subscription, and market orientation also including factors affecting port performance [30]. On the other hand, [31] suggests that location, physical traits, ship frequency, port and dock infrastructure, operating time, productivity, and information systems become other factors in determining port performance.

Port activities are forced by ship services, location, accessibility, information systems, productivity, prestige, and port communities [32]. The importance of accessibility to the hinterland areas has had an impact on port performance [33]. Related to this, [31] also identifies that geographic location and physical characteristics are included in the key performance criteria of the ports. From a different point of view, the specialization is considered as a port performance factor reflecting the rate of port development, from industrial stage to commercial stage, and reflects the scale and agglomeration effects of the port and its impact on performance [34].

2.2 Supply Chain Connectivity

In a supply chain system, all parties are directly or indirectly involved in meeting customer demands, and their activities are efficiently facilitated by supply chain connectivity [35]. Connectivity is a prerequisite for increasing investment in global supply chain activities such as trading activities and improvement in logistics infrastructure and transportation services [23].

In relation to supply chain connectivity, the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) in 2013 established an International Supply Chain Connectivity Index (ISCCI) that informs the country's overall performance in the global supply chain. ISCCI was developed by the United Nations Conference on Trade and Development (UNCTAD) as a composite index of the World Bank Doing Business Report and the Linear Shipping Connectivity Index (LSCI). The components of the World Bank Doing Business Report used in ISCCI are Trading Accross Border (TAB) which consists of: a) import indicators: number of documents,

time, and costs involved in import, and b) export indicators: number of documents, time, and the costs involved in exports. With a certain formula, UNESCAP weighted all of LSCI indicators as a measure of connectivity for maritime shipping and trade facilitation so as to obtain ISCCI for the entire country [23].

UNCTAD has established LSCI as a measure of the trade competitiveness of the countries concerned with maritime transport and logistics. LSCI is a accumulation of the following statistical measures: number of vessel services, number of vessel companies, number of vessels, combined container capacity of vessels (in TEUs), and largest vessel capacity. In its analysis, LSCI seems to treat every country as one location and the whole world is its trading partner. LSCI aims to assess how well the maritime country connects to the global ship delivery network and provides annual information on a country's connection to the global network services. LSCI can assist merchants, investors, port operators and policymakers in assessing their country's position within the global network and its changes over time and comparing with neighbouring countries [36].

2.3 Economic Growth

Over the last few decades, the analysis of economic growth has become a popular topic in macroeconomic literature [37]. The economic growth of a country refers to the expansion of production possibilities, as a result of the accumulation of primary factors such as labor and capital (physical and human) or improvement of production technology [38]. Economic growth is an aggregate production function that describes the relationship between the aggregate output and inputs used in production [39]. The function assumes that there are only two inputs of production factors used, ie. labor input and capital input.

The macroeconomic analysis of the economic growth level a country wants to achieve is measured by the growth of real national income achieved in a given year, called the Gross Domestic Product (GDP). GDP is the market value of all goods and services (output) generated within a given period by production factors in a country [40]. GDP is a statistical summary of economic activity [41] which is the most important variable in economic growth analysis and often considered as the best measure of economic performance [42]. The purpose of GDP is to summarize economic activity in a particular money value over a certain period [43].

2.4 Conceptual Framework

The conceptual framework of this study is based on concepts developed by [44], [45], [46], [47], [48], [49], and [50] as shown in Figure 1.

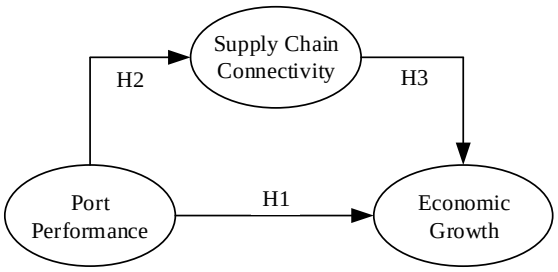

Figure 1. Conceptual Framework

2.5 Hypothesis Formulation

2.5.1 Effect of Port Performance on Economic Growth

Performance of Chittagong Port has been evaluated by [50] to know its impact on the Bangladesh's economy. The low performance of the port authority of Chittagong as measured in this study has an impact on the inefficiency of economic costs. On this measure, the study concludes that efficiency as a port performance measure is critical to achieving economic growth. The adoption of new economic strategies in the port contexts should be port-oriented as a facilitator of trade and not as a means of country revenue. The aim is to ensure that international trade facilitated by the ports is conducted at the most efficient cost.

Port performance is determined by the coherence between the optimal dimensions of the port and the economic potential of the area in which the port is located [48]. A study was conducted to understand the behavior of port parameters in the regional island economic zones by using the dynamic model of the Cobb-Douglas production equation. This study shows that the increased volume of loading / unloading cargo correlates with local economic growth, where it can promote GDP growth. Therefore, it can be concluded that there is a strong influence between the development of dimensions

to improve port performance and economic growth in the archipelagic country.

A Generalized Method of Moments (GMM) was introduced by [49] to analyze the relationship between port throughput and Gross Domestic Product (GDP) in hinterland areas. This study analyzes the level of synchronization between port throughput and GDP and examines the effects of trade intensity, world vessel developments, and transportation costs on this synchronization. This study concludes that there is a positive relationship between GDP and port throughput. Thus it can be concluded that the port serves as a trade gateway for the hinterland areas.

According to [51], ports are the main naval delivery of marine and consequently, the performance and efficiency of ports play an important role as part of a country's global competitiveness. With growing regional competition, many ports are then also competing and growing by identifying the appropriate strategies and competencies to become the engine of economic growth [52].

Hypothesis 1: Port performance has a positive and significant effect on economic growth.

2.5.2 Effect of Port Performance on Supply Chain Connectivity

A study conducted by [44] indicates that port productivity and performance are linked to overall supply chain effectiveness. Through integration into the global supply chain, ports and users can take advantage of complementary strategies and the ability to improve performance.

The literature review has revealed the importance of port integration into the global supply chain that will affect the performance improvement and competitive advantage in fulfilling roles in the modern logistics era. This reason supports the hypothesis that integration into the global supply chain will be positively associated with port performance and competitiveness that reflects the logistical objectives of the ports [45]. This study recommends that the relationship be empirically replicated using different case studies, contexts and performance measures.

Hypothesis 2: Port performance has a positive and significant effect on supply chain connectivity.

2.5.3 Effect of Port Performance on Economic Growth with Mediation by Supply Chain Connectivity

Connectivity plays an important role in shaping efficient regional and global network functions. Increased network connectivity will have a positive impact on increasing trade realization. There is a causal relationship between increased connectivity, integration and regional cooperation, as suggested by [53]. Economic connectivity has been identified by [54] as an important component to ensure inclusive economic growth and sustainable development in South Asia and Southwest Asia.

A study conducted by [55] concludes that there is a relationship between transport connectivity and regional economic development in China. This study develops appropriate measurements for transport connectivity based on a set of evaluation models, in which this model is used to analyze logistics connectivity from thirty-one provinces in China by focusing on eleven variables. Using panel data regression analysis, the empirical results of this study show a statistically significant impact of transport connectivity on economic development in China.

In another study, [7] conducted an econometric analysis of port development and its impact on Nigeria's economic growth. Using variables such as trade, GDP, logistics performance and LSCI analyzed by linear regression, the study concludes that LSCI has a moderate linear and positive correlation with economic growth. This means that if shipping connectivity increases, then economic growth increases. LSCI is one of the components used in measuring national supply chain connectivity.

As noted by [20] that ports play a key role in the efficiency and effectiveness of transport and competitiveness and connectivity of a country, and this role is expanded to be important for the country's economy development because of the significant contribution of ports to the public infrastructure development and industrial activities [21]. The economic growth of a country as measured by GDP is strongly influenced by the development of logistics and supply chain, both directly and indirectly [22]. Based on the study results of some researchers, it is suspected that there is an mediation function by the national

supply chain connectivity in the relationship between port performance and economic growth. This mediation function is also explained by Transnet (2012) in [56] that container ports provide substantial benefits to the region's economy and cargo owners by reducing total supply chain costs through increased connectivity, increased service levels and increased shipping lanes that ultimately lead to increased competition in the shipping industry.

Hypothesis 3: Port performance has a positive and significant impact on economic growth with mediation by supply chain connectivity.

3. Methodology

This study uses an explanatory design, in which the relationship between two or more variables or factors is analyzed and described as suggested by [57], [58] and the collected data are analyzed quantitatively [59]. In this case, the explanatory approach aims to test whether the specified hypothesis reinforces or even rejects the theory or hypothesis of previous research results. The study was conducted with three systematic steps, including preliminary study, data collection and analysis.

3.1 Preliminary Study

Preliminary study was conducted with the aim of collecting various information needed in the implementation of study. This needs to be done, since relevant information can support the success of the study, especially since the results of this preliminary study can be a reference, both in order to recognize and formulate hypotheses. Associated with the hypothesis formulation, through this preliminary study various theoretical and factual information can be collected, both general and scientific facts.

3.2 Data Collection

This study uses secondary data obtained from agencies that deliberately collect and publish data that can be used for the purposes of this study. The data used in this study are port performance, supply chain connectivity and economic growth

3.2.1 Port Performance

The category of port performance indicators consists of two perspectives, namely macro performance indicators that measure the impact of ports on economic activity and micro-performance indicators evaluating input/output ratio measurements of port operations [60]. In relation to port performance indicators, the Ministry of Transportation of the Republic of Indonesia through the Directorate General of Sea Transportation has issued the Decree of the Director General of Sea Transportation No. UM. 002/38/18/DJPL-11 year 2011 on Port Operational Service Performance Standards. Within the document has been established the performance indicators of port operational services and standards of value (in various units) for ports in Indonesia, as follows:

1) Waiting Time (WT)
2) Approach Time (AT)
3) Effective Time per Berth Time (ET:BT)
4) Work Productivity (loading/unloading) (Ton/Aisle/Hours)
5) Work Productivity (loading/unloading) (Box/Crane/Hours)
6) Berth Occupancy Ratio (BOR)
7) Shed Occupancy Ratio (SOR)
8) Yard Occupancy Ratio (YOR).

This study uses the eight indicators of port performance with the case of Tanjung Priok Port. Data collection is done through correspondence via letter, phone and email with PT. PELINDO II as the authority of Tanjung Priok Port. The performance of Tanjung Priok Port for the period of 2011-2015 is shown in Table 1, while the Tanjung Priok Port performance standard value set can be seen in Table 2.

Table 1. Performance of Tanjung Priok Port

Year	WT (Hours)	AT (Hours)	ET/BT (%)	T/A/H	B/C/H	BOR (%)	SOR (%)	YOR (%)
2011	1,00	1,00	79,42	44,07	15,83	54,62	40,51	42,59
2012	1,00	1,00	80,50	55,96	16,10	56,73	31,40	44,80
2013	1,00	1,00	82,00	72,23	15,58	50,25	34,33	45,37
2014	0,18	0,91	76,75	70,67	18,42	49,24	30,69	40,41
2015	1,00	1,00	64,98	75,19	22,36	36,12	15,23	36,21

Source: PELINDO II (2016)

Table 2. Tanjung Priok Port Performance Standard

WT (Hours)	AT (Hours)	ET/BT	T/A/H	B/C/H	BOR (%)	SOR (%)	YOR (%)
1,00	1,00	79,42	44,07	15,83	54,62	40,51	42,59

Source: PELINDO II (2016)

Based on the provisions in the Decree of the Director General of Sea Transportation No. UM. 002/38/18/DJPL-11 year 2011, the performance score scale for Tanjung Priok Port is determined. Performance score scale used is 1 (Poor), 2 (Fair) and 3 (Good). By converting the port performance value into the scale, the performance scale of Tanjung Priok Port for the period of 2011-2015 are shown in Table 3.

Table 3. Performance Scale of Tanjung Priok Port

Year	WT	AT	ET/BT	T/A/H	B/C/H	BOR	SOR	YOR
2011	2	3	2	3	1	3	3	3
2012	2	3	2	3	1	3	3	3
2013	2	3	3	3	1	3	3	3
2014	3	3	2	3	1	3	3	3
2015	2	3	1	3	2	3	3	3

3.2.2 Supply Chain Connectivity

In this study, ISCCI is used as a supply chain connectivity variable. The indicators used in building ISCCI are described as follows [61]:

1) Export document (types)
2) Export time (days)
3) Export cost (USD per container)
4) Import document (types)
5) Import time (days)
6) Import cost (USD per container)
7) LSCI.

The data collection of Indonesian supply chain connectivity for the period of 2011-2015 is done by downloading ISCCI database through UNESCAP website. Indonesia supply chain connectivity indicators for 2011-2015 period based on ISCCI database are shown in Table 4. To categorize the supply chain connectivity, the 5-point Likert Scale is used with index categories: 1 (Very Poor), 2 (Poor), 3 (Fair), 4 (Good) and 5 (Very Good). By converting the supply chain connectivity data to the scale, the scale of the 2011-2015 Indonesian supply chain connectivity indicators are shown in Table 5.

Table 5. Performance Scale of Tanjung Priok Port

Year	Indicators						
	Export document (type)	Export time (days)	Export cost (USD per container)	Import document (type)	Import time (days)	Import cost (USD per container)	LSCI
2011	5	20	704	6	27	660	25,91
2012	4	17	644	7	27	660	26,28
2013	4	17	644	7	23	660	27,41
2014	4	17	615	8	23	660	28,06
2015	4	17	572	8	26	647	26,98

Source: [19]

Table 5. Indonesian Supply Chain Connectivity Scale

Year	Indicators						
	Export document	Export time	Export cost	Import document	Import time	Import cost	LSCI
2011	4	5	5	4	4	5	1
2012	4	5	5	4	4	5	1
2013	5	5	5	4	5	5	1
2014	5	5	5	4	5	5	1
2015	4	5	5	4	5	5	1

3.2.3 Economic Growth

According to [62], the measure used in macro analysis of a country's economic growth is GDP. Indonesia's GDP data for the period of 2011-2015 was obtained from Bank Indonesia website, as shown in Table 6.

Table 6. Indonesia's GDP for the Period of 2011-2015

Year	GDP (Trillion Rupiahs)
2011	7.287,64
2012	7.727,08
2013	8.156,50
2014	8.566,27
2015	8.976,93

3.3 Analysis

Data analysis method used in this research is regression analysis technique. Regression analysis is a technique for constructing a straight-line equation and using the equation to make estimates [63]. The main purpose of regression is to make an estimate of the dependent variable value if another variable value associated with it has been determined.

Data analysis was done by using SPSS software to perform hypothesis testing. Prior to hypothesis testing, a classical assumption test was performed. According to [64] and [65], the classical assumption test of regression model includes normality test, multicollinearity test, and heteroscedasticity test. Hypothesis testing is performed if the classical assumption has been fulfilled. The steps in performing hypothesis testing are: 1) Determining the hypothesis formulation; 2) Determining the significance level (α); 3) Define test criteria; 4) Determine the statistical test value; and 5) Make a conclusion.

4. Results and Findings

4.1 Classical Assumption Test

The regression model used in testing the hypothesis must avoid the possibility of classical assumptions deviation. The purpose of testing this classical assumption is to provide assurance that the regression equation obtained has precision in estimation, unbiased and consistent. Classical assumption tests conducted in this study include normality test, multicollinearity test, and heteroscedasticity test.

4.1.1 Normality Test

Normality test aims to test whether the variables in the regression model have a normal distribution or not. A good regression model will have a normal or near normal distribution. Normality testing is required to test other variables by assuming that the residual values follow the normal distribution. The basis of decision making on the normality test can be done with reference to the value of significance. If the value of significance produced is greater than the specified significance level (0,05) then the data is normally distributed, so hypothesis testing is done with parametric tests. Conversely, if the resulting significance value is less than 0,05 then the data is not normally distributed, so hypothesis testing is done with non parametric tests [65].

In this study the type of normality test used is the Shapiro-Wilk test because the amount of tested data is less than 50. A study conducted by [66] initially tested the data normality by limiting the sample size to less than 50, then [67] recommends this test is only done for sample sizes less than 50. The normality test results for the three variables used can be seen in Table 7.

Table 7. Normality Test Results on Variables

Variable	Shapiro-Wilk		
	Statistic	df	Sig.
Port Performance	0,852	5	0,201
Supply Chain	0,821	5	0,119
Economic Growth	0,987	5	0,969

Table 7 shows that the significance value of the three variables shown in column (Sig.) is greater than the specified significance level (0,05). In this case it can be concluded that the data of port performance, supply chain connectivity and economic growth variables used in this study came from a normally distributed population. The assumption of data normality is fulfilled by the three variables used with the value of significance produced greater than the significance level (0,05) so that the data is normally distributed. Therefore, hypothesis testing in the next stage is done by using parametric statistic, that is test of influence of independent variable to dependent variable partially (t-test) and test of influence of independent variable to dependent variable simultaneously (F-test) [65].

4.1.2 Multicollinearity Test

According to [65], this test is conducted to test whether the correlation between independent variables is found in the regression model, which in fact is inevitable. To detect the presence or absence of multicollinearity in regression is done by analyzing the correlation between independent variables. If among independent variables there is a high correlation (greater than 0,90) then this indicates multicollinearity indicated by tolerance and variance inflation factors (VIF). The basis for decision-making on multicollinearity tests is based on the tolerance and VIF values. If the tolerance value is greater than 0,10 then it can be concluded that there is no multicollinearity. While if the tolerance value is smaller than 0,10 then it is concluded that there is multicollinearity. Multicollinearity test results of independent variables can be seen in Table 8.

Table 8. Multicollinearity Test Result on Independent Variables

Variable	Collinearity Statistics	
	Tolerance	VIF
Port Performance	0,444	2,250
Supply Chain	0,444	2,250

Table 8 shows that the port performance and supply chain connectivity variables have a tolerance value greater than 0,10 and the VIF value is less than 10. The port performance variables and the supply chain connectivity equally have tolerance value of 0,444 (greater than 0,10) and VIF value of 2,250 (smaller than 10). In this case it can be concluded that there is no multicollinearity between port performance and supply chain connectivity variables as independent variables in the regression model.

4.1.3 Heteroscedasticity Test

The heteroscedasticity test aims to test whether in the regression model there is a variant inequality of the residual of one observation of another observation. If the variant of the residual one observation to another observation is fixed then it is called homocedasticity and if it is different it is called heteroscedasticity. A good regression model is a model that does not occur heteroscedasticity. The basis of decision making in the

heteroscedasticity test is based on the value of significance. If the significance value of the independent variable is greater than the significance level (0,05) then there is no heteroscedasticity problem in the regression model. Whereas if the significance value of the independent variable is smaller than 0,05, then there is a heteroscedasticity problem in the regression model [65]. Heteroscedasticity test results can be seen in Table 9.

Table 9. Heteroscedasticity Test Results

Variable	Sig.	Collinearity Statistics	
		Tolerance	VIF
Port Performance	1,000	0,444	2,250
Supply Chain	1,000	0,444	2,250

Based on Table 9 it is known that heteroscedasticity testing results in significance value of port performance (Sig. 1,000) and supply chain connectivity (Sig. 1,000) which is greater than the significance level (0,05). Thus it can be concluded that there is no heteroscedasticity problem in regression model.

4.2 Hypothesis Test

Hypothesis testing is done by partial regression coefficient test (t-test), simultaneous regression coefficient test (F-test) (for multiple linear regression) and test of determination coefficient (R2). This study used a one-sided test with a significance level (α) of 5% or 95% confidence level whereas df = n - k, with n is the sample size and k is the number of regression variables. The decision-making basis of the t-test results is: if the significance value is smaller than the significance level (0,05) then the hypothesis is accepted, whereas if the significance value is greater than 0,05 then the hypothesis is rejected. Testing on the regression coefficient simultaneously (F-test) conducted to determine the effect of independent variables together on the dependent variable. Using the 95% confidence level (α = 5%), the degree of freedom of the numerator equal to (k-1), the degree of freedom denominator equal to (n-k), then the value of F-table = Fα (k-1) (n-k). The basis of decision making from the F-test results is: if the significance value is smaller than the significance level (0,05) then the hypothesis is accepted, whereas if the significance value is greater than 0,05 then the hypothesis is rejected [65]. The results of hypothesis testing are shown in Table 10.

Table 10. Hypotesis Test Result

Hipotesis	**R Square**	**Unstandardized Coefficients**		**Standardized Coefficients**	**Sig.**
		B	**Std. Error**	**Beta**	
H1: Port performance → Economic growth	0,089	0,364	0,671	0,299	0,625
H2: Port performance → Supply Chain Connectivity	0,833	1,667	0,430	0,913	0,030
H3: - Port performance → Economic growth	0,899	-2,085	0,672	-1,712	0,090
- Supply Chain Connectivity → Economic growth		1,470	0,368	2,203	0,057

Based on Table 10 it is known that the significance value (Sig.) of Hypothesis 1 is 0,625, which is greater than the level of significance (0,05). In this case Hypothesis 1 is rejected, so it can be concluded that port performance has no positive and significant effect on economic growth. The significance value (Sig.) of Hypothesis 2 (0,030) is smaller than the significance level (0,05). In this case Hypothesis 2 is accepted, so it can be concluded that port performance has positive and significant effect on supply chain connectivity. Path analysis to calculate the direct and indirect effect of port performance on economic growth in Hypothesis 3 can be seen in Figure 2.

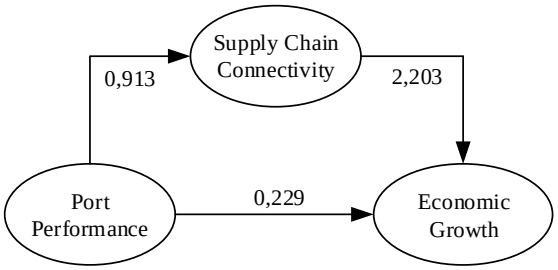

Figure 2. Path Analysis of Hypothesis 3

Z-value of the mediation model is calculated as follows as shown in Eq. (1):

$$z-value=\frac{(a)(b)}{\sqrt{(b)^2(Sa)^2+(a)^2(Sb)^2+(Sa)^2+(Sb)^2}} \quad (1)$$

$$z-value=\frac{(1,667)(1,470)}{\sqrt{(1,470)^2(0,430)^2+(1,667)^2(0,368)^2+(0,430)^2+(0,368)^2}}$$

$$=2,738$$

Based on the Sobel Test, the statistical significance level of z (p-value) is 0,006. Z-value in absolute value is greater than the critical value of z (2,738 > 1,96) and the statistical significance level of z (p-value) is smaller than the significance level (0,006 < 0,05). This indicates that the indirect effect of port performance on economic growth through the mediation function of supply chain connectivity is significant at the 0,05 significance level. In this case Hypothesis 3 is accepted, so it can be concluded that the port performance has a positive and significant effect on economic growth through the mediation function of supply chain connectivity.

Hypothesis 1 test results show that the direct influence of performance on economic growth is not proven positive and significant. Although the R-Square value (0,089) in the test results of Hypothesis 1 is quite large, it is not enough to support the effect because there are other variables that influence significant economic growth, which is an unknown variable and not included in the regression analysis other than port performance. In fact, this does not support the research results of [48], [49], [50], [51], [52] and [68], which they stated that in general, port performance will have a positive impact on the economic growth of a region or country. The absence of a direct influence of port performance on Indonesia's economic growth can be understood from the achievement of each port performance indicators as shown in Table 1 and Table 3. The performance of Tanjung Priok Port for the period of 2011-2015 is fair with an overall average of 2,55. However, the achievement of this performance is considered not optimal because of some inhibiting factors, such as the availability of adequate infrastructure, the duration of waiting and processing time at the port, and other factors.

One of the factors considered to be very important in supporting port performance in order to increase national economic growth is port infrastructure. The development of port infrastructure is costly, therefore the success or failure of the project will have long-term implications [69]. The minimal availability of infrastructure will have an impact on the deterioration of port performance and cumulatively impact the country's economic growth. The impact of port performance on the country's economic growth can not be seen partially but must be analyzed simultaneously and accumulatively.

Port performance has a positive and significant effect on supply chain connectivity, as shown in the test results of Hypothesis 2. The R-Square value onthe test results of Hypothesis 2 (0,833) shows that the port performance significantly influence the supply chain connectivity (83,3%). These results support the results of a study conducted by [48] which identify a positive relationship between port integration into supply chains and port performance reflecting port logistics objectives. The results of [44] studies also indicate that port productivity and performance will be related to overall supply chain effectiveness.

Hypothesis 3 is also proved, where supply chain connectivity is able to mediate the relationship between port performance and economic growth. In this case, it can be stated that the actual relationship between port performance and economic growth is an indirect relationship, since there is a mediation function by supply chain connectivity. From the aspect of this, it can be understood why Hypothesis 1 can not be proven. The test results of Hypothesis 3 support the results of a study conducted by [20] which states that ports play a significant role in the efficiency and effectiveness of transport and competitiveness as well as connectivity of a country, and this role is expanded to be important

for the development of the country's economy because the port able to contribute significantly to the public infrastructure development and industrial activities [21]. The results of [22] studies are also supported, that the economic growth of a country as measured by GDP is strongly influenced by the development of logistics and supply chain either directly or indirectly.

5. Conclusion

The role of the port as part of the global transport and logistics system cannot be denied has become a booster for a country's economic growth. However, this role will be amplified by the connectivity variables, because basically when the port function becomes optimal, the connectivity between ports will also increase. This will lead to increased economic growth. This study, conducted using the Tanjung Priok Port case as one of the main ports in Indonesia, has proven that improving port performance will not contribute positively and significantly directly to the country's economic growth. However, increased port performance will precisely impact on increased supply chain connectivity, as connectivity in global logistics and supply chains is currently dependent on the availability of excellent performance of ports in terms of infrastructure, resources, time and cost efficiencies, etc. Ultimately, port performance will have a positive impact on the country's economy growth because of good connectivity between ports.

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