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Mapping the Moderating Role of Logistics Performance of Logistics Infrastructure on Economic Growth in Developing Countries

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Abstract: Logistics performance is an important determinant of economic growth. The present study investigates the moderating role of logistics performance of the logistic infrastructure on economic growth in developing countries. We employ the World Bank computed LPI index in the year 2010, 2012, 2014, 2016 and 2018 to measure the logistic performance. The current research includes the 50 developing economies, and a panel data set comprising of total 300 observations is collected. The study used the conventional Cobb–Douglas production function with labor, capital stock as main drivers of economic growth. The study found that the labor and capital endowments have significantly different impacts in terms of elasticity coefficients for developing countries with different logistics performance levels. It implies that logistics performance, i.e., the efficient performance of logistic infrastructure, plays a moderator role in economic growth in developing economies.

Keywords: logistic performance; logistics performance index; economic growth; higher LPI performer developing economies; low LPI performer developing economies

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1. Introduction

The logistics industry has fastened the momentum of economic globalization. The logistics industry has improved the inter-industrial linkages and intensified the process of spreading the growth impulses to its economic sphere and on a global scale (Candemir and Çelebi 2017). Besides, Logistics development strengthens the regional exchange of information and economic factors and expands the market space, which has spillover effect on the economic growth of the surrounding areas (Xu and Wang 2017). It has multiple advantages in terms of transportation revenues of local logistics enterprises, the logical flow of factors to these areas, which reduce the production cost and promote regional economic growth. Nowadays, it has become a source of global production networks, and the production networks become more distributive with, the more transportation sector development (Hesse and Rodrigue 2006). Besides, it is an essential input for the day-to-day operation of the economy and is highly relevant for employment and social development (Mahpula et al. 2013).

Logistics is described as "the process of planning, implementing, and controlling the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption to conform to customer requirements" (Council of Logistics Management). Logistics management is a broad concept related to transportation, inventory management, warehouse management, material handling and packaging and supply chain management. The logistics sector improves with the

transport infrastructure development and enhances economic performance by reducing cost, increasing labor productivity, stimulating trade and increasing job opportunities (Deng 2013; Lan et al. 2017; Saidi et al. 2018). While the poor and inadequate transport infrastructure generates constraints for material handling, labor movement, market expansion, and economic growth. However, the term logistics is known in the literature and has been measured through various indicators. A few studies have used the physical infrastructure investment as a proxy for logistics and found its positive impact on economic growth (Banister and Berechman 2001; Wang 2002). Later on, studies have measured the impact of real physical stock of variables in terms of road, rail, air and telecommunication as logistics indicators on countries' economic growth (Arimah 2017; Hong et al. 2011; Perkins et al. 2005). However, nowadays, logistics is considered a comprehensive measure and multidimensional phenomena for accomplishing activities associated with the degree of efficiency, effectiveness and differentiation (Fugate et al. 2010).

The empirical studies on economic growth start with the two basic factor inputs, i.e., human capital and physical capital, in the form of the Cobb–Douglas production function in 1928. Second, the social overhead capital, especially the public supplied the infrastructure for growth. The work that regenerated public infrastructure development for economic growth was presented by (Aschauer 1989), who incorporated the public infrastructure as factor of production. Initially, studies have incorporated infrastructure investment as a driver of economic growth in growth models and traced out its positive and significant impact on economic growth (Banister and Berechman 2001; Wang 2002). Afterwards, researchers considered the physical stock of infrastructure as a factor of economic growth. They estimated the varying levels of rate of return for physical capital for both developing and developed countries. Studies revealed that infrastructure development is not only a necessary factor for sustainable economic growth, but its estimated impact on economic growth is higher in developing economies (Hong et al. 2011; Hussain et al. 2021; Pradhan et al. 2013). Additionally, investment in infrastructure becomes more important as countries shift from primary and secondary industries to tertiary industries. It enhances economic growth drastically in less developed countries (Kodongo and Ojah 2016). Similarly, several studies have used the physical capital stock such as road, rail, air and telecommunication indicators as logistic development and found a strong positive impact on economic growth (Batool and Goldmann 2020; Chu 2012; Lean et al. 2014).

Additionally, (Batool and Goldmann 2020) examined the efficiency of private and public transport infrastructure on economic growth. Along with the physical transport infrastructure, recently, the policy focus is shifted towards the quality content of the existing physical capital stock, i.e., this is known as "logistic performance" in the literature. Logistics performance is a more comprehensive measure i.e., the efficiency and competitiveness of transport physical infrastructure computed by the World Bank. World Bank has computed the logistics performance index (LPI) to measure countries' logistics performance and trade facilitation (See Table 1 for a brief description of LPI index calculation). The World Bank has computed this index using trade and transportation relating data based upon the six components of the country's import and export logistics companies participating in the eight markets of trade for that country (Arvis et al. 2016).

The data are analyzed on the six-dimension scale rating 1 to 5 to evaluate the country's trade facilitation. The single score is obtained through the aggregation and an average of the score for the six areas. The LPI index is computed for the years 2007, 2010, 2012, 2014, 2016 and 2018. The LPI is based on the responses collected from logistics companies working in different countries about the countries' logistics performance. The respondents answered on the Likert scale from 1 to 5 for worst to best performance. The data of LPI is now part of the World Bank Development Indicators and can be extracted from the World Bank database. A few studies have incorporated the World Bank computed LPI index to explain the role of the efficiency of the logistic industry on economic growth and trade flows. For example, (Arvis et al. 2010) found that improved logistics reduce trade costs for manufactured and agricultural goods in developed countries and increases GDP per capita.

logistics performance is an important factor of trade. Martí et al. (2014) have analyzed the role of logistics performance in international trade. Using logistics performance index (LPI) for a country's bilateral trade, it is found that, 10% improvement in LPI for an exporter is associated with more than 69% increase in bilateral exports on average and for 10% improvement in LPI for an importing country is associated to 54% increase in imports on average. The results revealed that logistics performance is significantly correlated with exports and imports volume.

Table 1. LPI Components and Descriptions.

Components	Description
CUSit (Customs)	Speed, simplicity and predictability of CUSTOM formalities of panel data
INFit (Trade and Transport Infrastructure)	Ports, railroads, roads, information technology of panel data
SHIPit (Priced Shipment)	The ease of arranging competitively priced shipments
QOLit (Logistics Services)	The competence and quality of logistics services (e.g., transport operators, customs brokers) of panel data
TTit (Track and Trace)	The ability to track and trace consignments of panel data
EDTit (Expected Delivery Time)	The frequency with which shipments reach consignees within scheduled or expected delivery time of panel data

Source: 'Connecting to Compete' LPI Report World Bank, 2012.

Furthermore, the study has also detected possible advances in logistics performance by comparing the LPI data of 2007 to 2012 for five regions of developing countries (Africa, South America, Far East, Middle East and Eastern Europe) and found that trade flows for these countries increases with the improvement in components of LPI for all regions and specifically for South America, Africa and Eastern Europe (Martí et al. 2014). In the same way, Gani (2017) analyzed the large set of data of developing and developed countries to explore the effect of logistics performance on international trade. Logistics performance level plays an essential role in economic growth under the export-led growth hypothesis in Asia (Tang and Abosedra 2019). Further, economic growth is also considered to be a positive contributor to foreign direct investment (Akbar and Ahsan 2015).

Although, all these studies have taken up the logistics performance index and relate it to economic growth and trade flows in a different set of economies, evidence is still scant, and there is a call for further research. The present study revealed that logistics performance, i.e., the quality content of available physical capital infrastructure, is an important and undeniable factor that may put underdeveloped economies on the path of progress. The present study addressed this matter and undertaken the logistics performance and the other conventional explanatory variables such as labor, capital and financial development in the augmented Cobb–Douglas production function. We empirically verified the outlined phenomenon in details. At first, we have estimated the economic growth model with factor inputs labor, capital and financial development for 50 developing economies. World Bank statistics revealed that a small group of countries have logistically developed sector. Therefore, we split our sample into two groups based on their LPI scores and estimated the growth model for each group separately. We also observed that elasticity coefficient values for both labor and capital are switched in case high LPI performer developing economies. It implies that logistics performance is a game-changer and played a significant impact on economic growth. The study further confirmed these findings by incorporating the LPI index as a separate indictor in the regression equations, however, the LPI index is turned out to be insignificant. Further, literature evidenced that logistics performance has an indirect effect, i.e., increase the productivity of real sectors' i.e., agriculture, industry and services, i.e., tourism or enhancing the performance of other indicators as competitiveness index and ultimately improving economic growth (D'Aleo and Sergi 2017; Kalim et al. 2019; Mahpula et al. 2013; Nazir et al. 2019; Saidi et al. 2018). Therefore, the study also attempts to measure the indirect effect of logistics on economic growth. For this, the study uses the moderator approach (Kalim et al. 2019; Nazir et al. 2019) and evaluates the indirect

contribution of logistics performance on economic growth via interaction terms of LPI index and real capital stock. Estimated results prove that logistics performance has a positive moderating impact in case of high logistic performer countries, while a negative moderating impact in case of low logistic performer countries.

The remainder of the article is organized into four sections. Section 2 characterizes the model—data variables and methodology were undertaken here. Section 3 presents the estimated results and discussion and Section 4 concludes and provides the policy implications.

2. Model, Data and Methodology

We followed the traditional production function and specified the economic growth with two-factor inputs employed labor force and real capital stock such as;

$$Y = A\, K^{\beta 1} L^{\beta 2}, \text{ where } \beta 1 + \beta 2 \geq 1 \quad (1)$$

We proposed that factor inputs i.e., employed labor force and real capital stock impact on economic growth, may vary depending upon the varying levels of countries logistic performance. We have estimated the production function in two groups: one in case of lower logistic performer developing economies and the other in case of high logistic performer countries.

Further, considering the logistics as a logistics performance production factor, the country's logistic performance, i.e., the quality aspect represented by the World Bank LPI index, is incorporated in the production function such as specified in (Li et al. 2018).

$$Y = A\, K^{\beta 1}\, L^{\beta 2}\, LPI^{\beta 3} \quad (2)$$

The log-linearized reduced version of the equation where the estimated parameters are elasticities to each regressor and setting for panel data in the following form:

$$\ln Y_{it} = \ln A + \beta_1 \ln K_{it} + \beta_2 \ln L_{it} + \beta_3 \ln LPI_{it} + u_{it} \quad (3)$$

By putting $\ln A = \beta_0$ in the Equation (4) we get:

$$\ln Y_{it} = \beta_0 + \beta_1 \ln K_{it} + \beta_2 \ln L_{it} + \beta_3\, \ln LPI_{it} + u_{it} \quad (4)$$

Developing countries have weak logistics performance mostly because of poor physical infrastructure capital, and it may have some negative impacts on economic growth. Therefore, the model is also developed to estimate the moderator role of logistics and incorporate the interactive term of logistics and capital stock in the Equation (5), as suggested by (Ilhéu and Simões 2017; Vutha and Strange 2013).

$$\ln Y_{it} = \beta_0 + \beta_1 \ln (K^{*}LPI)_{it} + \beta_2 \ln L_{it} + u_{it} \quad (5)$$

where the variables $\ln Y_{it}$, $\ln K_{it}$, $\ln L_{it}$, $\ln LPI_{it}$ represents the log transformation of real GDP (a proxy for economic growth), real capital stock (real domestic capital stock), employed labor force, and logistics performance index (see Table 2) respectively, and the error term u_{it} has a normal distribution with zero mean and finite (constant) variance.

Table 2. Description of Variables.

Variable	Description
Y_{it}	Real GDP of country 'i' at time 't'
K_{it}	Real capital stock of country 'i' at time 't'
L_{it}	Number of employed persons of country 'i' at time 't'
LPI_{it}	LPI index of country 'i' at time 't'

According to World Bank definitions, "developing countries are those countries which have per capita income from USD 996 to USD 22,000 at purchasing power parity 2016". Accordingly, there are 129 developing countries. The countries with missing values are dropped from the sample, and 50 countries with complete data are included in the analysis. Thus research estimates an aggregate growth model for 50 selected developing countries.

We have classified the developing countries into two distinct groups based on their respective logistics performance level, i.e., high performer LPI developing countries (LPI > 3.00) and low performer LPI developing countries (LPI < 3.00). Figure 1 presents selected 09 high performer developing countries in the red color and 41 low performer developing countries with the green color on the world map (see Figure 1).

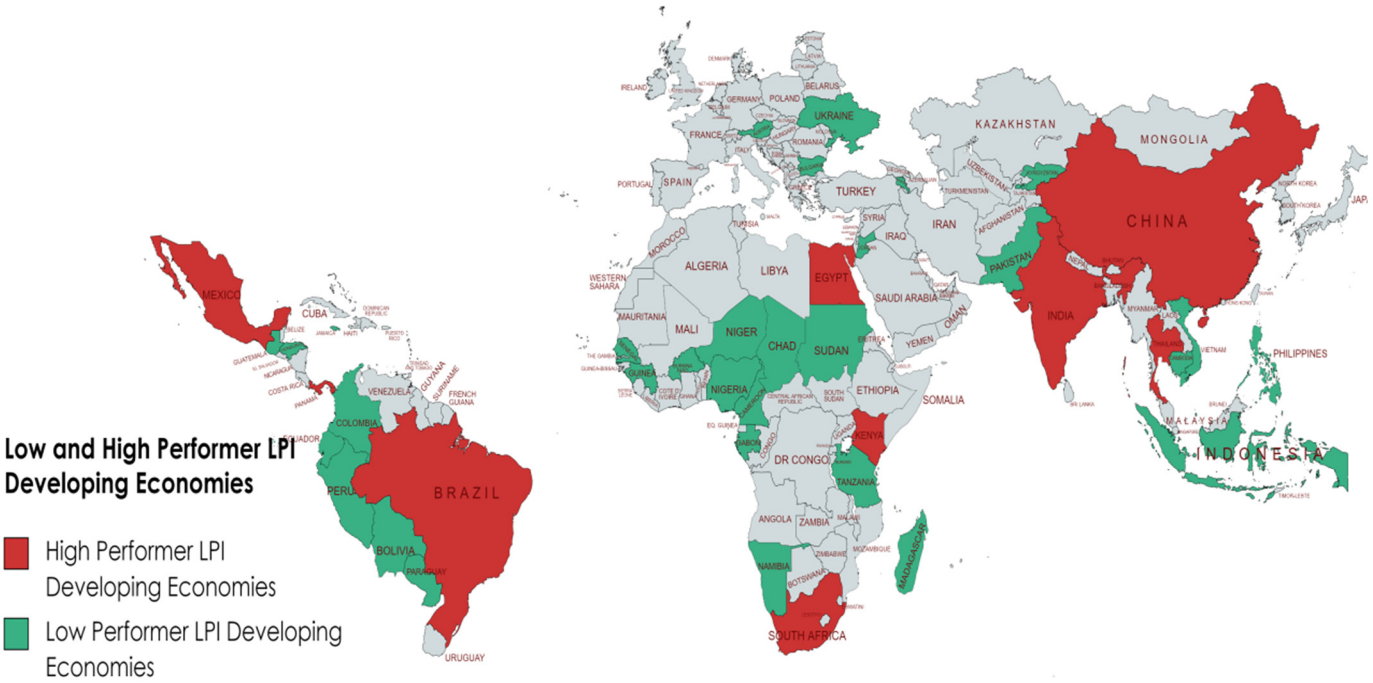

Figure 1. The Selected High and Low Performer LPI Developing Countries on World Map.

Besides we also estimate the growth model for these two groups separately and include the logistics performance index as an additional factor of production. This is an added feature over the previous studies, that we have emphasized both physical infrastructure quantities and quality portfolio of logistics infrastructure into the analysis.

Variable Description and Data Sources

1 Real Gross Domestic Product (Y_{it})

Real gross domestic product (RGDP) at constant prices 2017 is used as a proxy for the economic growth of developing countries. Data on RGDP in a million dollars at constant prices (2017) for developing countries is taken from Penn World Tables, Version 10.0 (Feenstra et al. 2015).

2 Real Capital Stock (K_{it})

The data on real capital stock at constant prices 2017 is used to proxy for the real capital stock (investment) in developing countries. The data is taken from Penn World Tables, Version 10.0 (Kalim et al. 2019).

3 Employed Labor Force (L_{it})

The number of the employed labor force (millions) is used as a proxy for labor in developing countries' economic growth model. The data has been collected from Penn World Tables, Version 10.0 (Kalim et al. 2019).

4 Logistics Performance (LPI_{it})

Logistics performance index (LPI) developed to measure the logistics performance of the developing countries by World Bank for selected years 2007, 2010, 2012, 2014, 2016 and 2018 is used (See Table 2 for variables description).

3. Results and Discussion

3.1. Descriptive Statistics

Table 3 represents the descriptive statistics of high performer and low performer LPI developing countries. The data showed that high performer LPI countries have average real GDP (Y) of about USD 3.40 trillion. On average, the real capital stock for high-performing LPI developing countries is about USD 12.39 trillion. China is making the highest real capital stock, i.e., about USD 76.68 trillion in the group. In comparison, the minimum real capital stock is about USD 0.15 trillion, which is observed in case of Kenya. The average real capital stock in low performer LPI developing countries is about USD 0.94 trillion. Indonesia is making the highest real capital stock i.e., about 16.78 trillion dollars, while the minimum real capital stock is about USD 0.005 trillion, which is recorded in the case of Guinea-Bissau.

Table 3. Descriptive Statistics of High and Low Performer LPI Developing Countries.

Variables	Yit		Kit		Lit		LPIit	
	High Performer LPI	Low Performer LPI	High Performer LPI	Low Performer LPI	High Performer LPI	Low Performer LPI	High Performer LPI	Low Performer LPI
Average	3.40	0.21	12.39	0.94	167	13.01	3.14	2.55
Maximum	19.84	2.96	76.68	16.78	799	127.06	3.78	3.34
Minimum	0.06	0.001	0.15	0.005	1.26	0.14	2.37	1.72
Std. Dev.	5.05	0.41	17.8	2.28	263	21.65	0.31	0.28
Skewness	2.08	3.86	2.10	4.38	1.58	3.09	−0.35	−0.04
Kurtosis	6.34	21.14	6.91	24.16	3.89	13.43	2.85	2.81

Note: The variable description of 'Y' and 'K' are in USD trillions and 'L' is in millions.

The employed labor force on average in high performer LPI developing countries is 167 million. The highest employed labor force is about 799 million (in numbers) in China and Panama has the lowest employed labor force, which is about 1.26 million (in numbers). The employed labor force on average in low performer LPI developing countries is about 13.01 million.

Another important characterization of the sample countries is their LPI score. The average logistics performance is about 3.14 for high performer LPI developing countries, and it shows that these countries are consistent performers in logistics. A total of nine developing countries have LPI of more than 3.00. It suggests that these countries are logistics friendly and consistent performers and have comparatively better infrastructure and all related logistics factors during all survey years. While the average logistics performance score is about 2.55, that is below '3' on the Likert point scale, which shows the below-average levels of logistics performance for the low performer LPI developing countries. Among the 41 low performers LPI developing countries, the highest score of LPI is 3.34, recorded for Lebanon, and the lowest score is 1.72 measured for Haiti in the selected sample. Most of the low performer LPI developing countries (41) have LPI less than 3.00. Eight countries have LPI less than 2.3 which explains that these countries are logistics unfriendly and have the relatively weaker infrastructure and all related factors of logistics.

3.2. Panel Data Analysis

Study used the panel data set consisting of 50 developing countries over the years i.e., 2007, 2010, 2012, 2014, 2016 and 2018. The selected panel data have the advantage of taking care of the countries individual differences and the intra-individual countries dynamics by considering both cross-section and time dimensions. Since our selected sample consists

of a large number of countries and a small number of years (e.g., N > T), therefore, the resulting panel is a cross-sectional static panel or short panel. Therefore, the time series properties are not dominating in this context. However, even study examined the statistical and time-series properties of the selected data series.

The study used the Levin et al. (2002) unit root test and PP Fisher Chi-square panel unit root (Levin et al. 2002). The results of unit root are shown in Table 4. All variables are first transformed into natural logarithmic form and then utilized for further analysis for high and low performer LPI developing countries. All variables are found to be stationary at levels, based on the data characteristics. The study estimates coefficients using the panel data estimation techniques of fixed/random effect.

Table 4. Unit Root Analysis (Stationary Test Results).

Variable Description	LPI Performance Level	Model Specification	Levin, Lin and Chut * Test Value at Level	PP Fisher Chi Square	Decision
Ln Y_{it}	High Performer LPI	Constant	−2.11804 ***	52.1407 **	I(0)
	Low Performer LPI	Constant	−3.26145 ***	201.898 ***	I(0)
Ln K_{it}	High Performer LPI	Constant	−10.0344 ***	110.961 ***	I(0)
	Low Performer LPI	Constant	−5.84648 ***	242.704 ***	I(0)
Ln L_{it}	High Performer LPI	Constant	−8.25271 ***	65.1819 ***	I(0)
	Low Performer LPI	Constant	−10.6591 ***	149.638 ***	I(0)
Ln LPI_{it}	High Performer LPI	Constant	−8.00306 ***	52.8056 ***	I(0)
	Low Performer LPI	Constant	−13.0586 ***	170.597 ***	I(0)

***, **, * denotes 1%, 5%, and 10% significance level, respectively.

3.3. Empirical Results

Table 5 shows that the employed labor force, capital have a significant positive impact on real GDP. The elasticity coefficient of the employed labor force is turned out to be 0.49; it implies that a one percent increase in the employed labor force enhances the real income by about 0.49 for all developing economies. Similarly, the capital input contribution is found to be 0.62. The study also estimates the regression equation for two groups: low LPI performer and high LPI performer countries. The estimated results for low performer developing countries are approximately the same as in 50 developing economies; however, the elasticity coefficients of labor and capital factor inputs have drastically changed in high LPI performer developing countries. The elasticity coefficient of capital is increased to 0.67 in the case of high LPI performer countries, from 0.62 in developing economies. Similarly, the labor contribution is reduced to 0.23 percent, from 0.49 in case of developing economies. Our results confirmed that capital stock is the most important and contributory factor of production in high performer LPI developing countries. The results are consistent and justified to the underlying fact that these countries are well capital equipped, and therefore, the capital contribution is dominant for economic growth.

On the other hand, the employed labor force is the most important and contributing factor of production of economic growth in low performer LPI developing countries, consistent with the underlying fact that these countries are largely labor abundant countries. Hence, production processes are labor-intensive processes. Therefore, the labor contribution is found to be dominant. In short, study confirmed that logistics performance is an important determinant, and there is a significant impact of logistics performance in the economies. Keeping in view the estimated results for low performers and high performers, the present research also incorporated the logistics performance variable as an added factor of production in the analysis.

Table 5. Determinants of Economic Growth for High and Low Performer LPI Developing Countries.

Dependent Variable: LnY_{it}			
Variables	**Developing Countries**	**High Performer LPI Countries**	**Low Performer LPI Countries**
C	2.68 *** 8.38	2.86 *** 5.89	2.33 *** 7.51
LnK_{it}	0.62 *** 19.31	0.67 *** 16.07	0.66 *** 22.9
LnL_{it}	0.49 *** 7.46	0.23 *** 3.18	0.37 *** 8.58
R^2	0.9989	0.9370	0.8901
Adj-R^2	0.9987	0.9346	0.8892
F-Statistic	4719.065	379.802	984.924
Prob (F-statistic)	0.00	0.00	0.00
Cross Sections Included:	50	09	41
Total Panel (Balanced) Observations:	300	54	246

Note: ***, ** and * denotes rejection of null hypothesis at 1%, 5% and 10% percent level of significance.

The inclusion of the logistics performance index negatively affects the contribution of other determinants of economic growth in these countries (see Table 6). The estimated coefficient of LPI is found insignificant and negative for the selected developing countries. It implies that LPI creates hurdles on economic growth and hurts economic growth. The LPI coefficient is also found insignificant in high and low performer LPI developing countries economic growth. However, it shows an insignificant positive impact on economic growth for high performer LPI developing countries, but this impact is small in magnitude.

Table 6. Determinants of Economic Growth for High and Low Performer LPI Developing Countries.

Dependent Variable: LnY_{it}			
Variables	**Coefficients**		
	Developing Economies	**High Performer LPI**	**Low Performer LPI**
Constant	2.67 *** 8.19	2.93 *** 5.79	2.71 *** 6.86
LnK_{it}	0.62 *** 18.55	0.66 *** 14.36	0.61 *** 15.17
LnL_{it}	0.49 *** 7.41	0.23 *** 3.04	0.52 *** 6.90
$LnLPI_{it}$	−0.01 −0.23	0.07 0.57	−0.01 −0.16
R-Square	0.99	0.94	0.99
Adjusted R-squared	0.99	0.94	0.99
F-Statistic	4611.09	245.43	2724.57
Prob (F-statistic)	0.00	0.00	0.00
Cross Sections Included:	50	09	41
Total Panel (Balanced) Observations:	300	54	246

Note: ***, ** and * denotes rejection of null hypothesis at 1%, 5% and 10% percent level of significance.

The estimated coefficient value shows that a one percent unit increase in the logistics performance index of high performer LPI developing countries will enhance their economic growth by about 0.07 percent. It is further noted that with the logistics performance index, the estimated coefficients values of capital on economic growth fall by 0.01%. On the other hand, the capital and contribution to economic growth decreased by 0.05 percent after the inclusion of the logistics performance index. However, the contribution of labor as input is observed increased by 0.15% after the inclusion of logistics as a determinant in growth model. The contribution of logistics to economic growth is found negative for developing countries and our results are consistent with other studies (Saidi et al. 2018) and have very small coefficients like (Kalim et al. 2019).

Literature revealed that logistics performance haves an indirect effect i.e., increase the productivity of real sectors, (i.e., agriculture), industry and services (i.e., tourism) or enhancing the performance of other indicators as competitiveness index and ultimately improving economic growth (D'Aleo and Sergi 2017; Kalim et al. 2019; Mahpula et al. 2013; Nazir et al. 2019; Saidi et al. 2018). Therefore, the study also attempts to measure the indirect effect of logistics on economic growth. For this, the study uses the moderator approach (Kalim et al. 2019; Nazir et al. 2019) and evaluates the indirect contribution of logistics performance on economic growth via interaction terms of LPI index and real capital stock.

Estimated results show that the logistics performance with developed capital stock has a positive and significant impact on economic growth for both countries. The estimated coefficient shows that logistics has moderating impact on the growth process of developing countries.

Estimated results show that the interactive variable of logistics performance and real capital impact has still a positive and significant impact on economic growth. However, its coefficient value has been reduced from 0.62 to 0.42 for the selected developing countries. Besides, interestingly, the estimated coefficient estimates of labor input is increased to 0.73 from the value 0.49 in this case.

Similarly, when we regress the same model in case of lower performer developing economies. We found that real capital stock contribution to economic growth is further reduced to 0.39 percent, while the labor force has much-pronounced impact (i.e., 0.79) on the economic growth. The empirical results are justified based on the given fact that developing countries have poor infrastructure that cause hurdles in economic growth, and resultantly the contribution of real capital stock is reduced and labor force contribution is more pronounced here (see Table 7). In contrast, we regress the same model for high performer developing countries. We found that the real capital stock contribution to economic growth is reduced a bit (i.e., 0.55 percent), and the labor force factor contribution is found to be 0.29 percent. In general, our results are consistent to other studies in the existing literature (Arvis et al. 2016; Candemir and Çelebi 2017; Chu 2012; Lan et al. 2017; Khadim et al. 2021; Lean et al. 2014; Mahpula et al. 2013). The study revealed that most developing countries with poor infrastructure and least developed physical capital, create hurdles on the way of economic growth directly and by weakening capital stock indirectly. Our results are also consistent with the literature which shows that logistics performance in developing countries constraints competitiveness (Ilhéu and Simões 2017) and improvement in logistics have the potential for economic growth (Vutha and Strange 2013). Further, study results imply that logistics performance is an important determinant of economic growth, and therefore, it needs to be emphasized more to increase the efficiency of existing capital and contribution to economic growth.

Table 7. Determinants of Economic Growth for High and Low Performer LPI Developing Countries (the Moderating Role of LPI).

Dependent Variable: LnYit			
Variables	**Coefficients**		
	Developing Economies	**High Performer LPI**	**Low Performer LPI**
Constant	4.32 *** 14.25	3.76 *** 8.50	4.55 *** 12.90
Ln(K*LPI)it	0.42 *** 15.01	0.55 *** 14.11	0.39 *** 12.25
LnLit	0.73 *** 10.64	0.29 *** 3.84	0.79 *** 10.60
R-Square	0.9986	0.9217	0.9977
Adjusted R-squared	0.9983	0.9186	0.9973
F-Statistic	3596.05	300.45	2180.27
Prob (F-statistic)	0.00	0.00	0.00
Cross Sections Included:	50	09	41
Total Panel (Balanced) Observations:	300	54	246

Note: ***, ** and * denotes rejection of null hypothesis at 1%, 5% and 10% percent level of significance.

4. Conclusions and Policy Recommendations

The present study attempts to estimate the moderating role of logistics performance on economic growth in case of developing economies. To measure the logistic performance, we have used the World Bank's logistics performance (LPI) index computed for 2007, 2010, 2012, 2014, 2016 and 2018. The LPI data set demonstrates that developing economies are significantly different in terms of logistics performance score and logistic supporting infrastructure and facilities. Acknowledging this fact, World Bank classified them into two groups i.e., low LPI performers and high LPI performers. The study hypothesized that the growth mechanism may also be different in these two groups. In order to confirm this hypothesis, the study first estimates the Cobb–Douglas production function with labor and real capital stock as factor inputs for economic growth for 50 developing economies. Besides, the study also estimates the growth model for two economic groups, i.e., lower LPI performer and high LPI performer countries.

Estimated results show that estimated elasticities are significantly different in terms of elasticities magnitude of factor inputs for overall developing countries and for high and low LPI performer developing economies. Further, we note that the employed labor force contribution is dominant for economic growth in case of low LPI performer countries; consistent with the underlying fact that these countries are largely labor abundant countries and therefore, labor is more important. Besides, these countries have poor infrastructure that creates hurdles and cost to economic growth in terms of efficiency losses, delays and wastages. Therefore, the factual contribution of real capital stock is further compressed compared to when it has good logistic performance. Further, the real capital stock contribution is positive, significant and more pronounced on economic growth in the case of high LPI performer countries. Estimated results suggest that country's logistics performance, i.e., the outcome of different logistic infrastructure and facilities prevailing in that country adds value to real capital stock, contributes more efficiently, and explains the process of economic growth. (Table 8 consist of all the countries selected for the current study).

Table 8. List of High and Low Performer LPI Developing Countries.

Sr. No.	Name of the Country	Region	Sr. No.	Name of the Country	Region
	High Performer LPI Developing Countries		16	Honduras	North America
1	South Africa	Africa	17	Indonesia	Asia
2	China	Asia	18	Jamaica	North America
3	India	Asia	19	Jordan	Asia
4	Panama	North America	20	Kyrgyz republic	Asia
5	Kenya	Africa	21	Madagascar	Africa
6	Thailand	Asia	22	Namibia	Africa
7	Egypt Arab rep.	Africa	23	Nepal	Asia
8	Mexico	North America	24	Niger	Africa
9	Brazil	South America	25	Nigeria	Africa
	Low Performer LPI Developing Countries		26	Pakistan	Asia
1	Armenia	Asia	27	Paraguay	South America
2	Benin	Africa	28	Philippines	Asia
3	Bhutan	Asia	29	Rwanda	Africa
4	Bolivia	South America	30	Senegal	Africa
5	Burkina Faso	Africa	31	Sudan	Africa
6	Cambodia	Asia	32	Tanzania	Africa
7	Cameroon	Africa	33	Togo	Africa
8	Chad	Africa	34	Ukraine	Europe
9	Comoros	Africa	35	Vietnam	Asia
10	Ecuador	South America	36	Algeria	Africa
11	El Salvador	North America	37	Bulgaria	Europe
12	Guatemala	North America	38	Colombia	South America
13	Guinea	Africa	39	Lebanon	Asia
14	Guinea-Bissau	Africa	40	Peru	South America
15	Haiti	North America	41	Gabon	Africa

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