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ARTICLE

The criticality of transport and export activities in the economic prosperity of high-middle income countries: the role of logistics performance

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ABSTRACT

This study considers the economic importance of export activities, logistics performance and transportation services as key agents of sustainable development. Considering this aspect of economic development, this study investigates the mediating role of logistics performance in determining the effects of export and transportation on the economic growth of the panel data of 35 emerging upper-middle-income countries over the period 2008–2018. By employing the economic growth model and considering essential indicators, this investigation addresses key aspects of development in the examined economies. The empirical results show that logistics performance, exports, human capital, and population have a statistically significant impact on economic growth with respective elasticities of 0.28, 0.36, 1.25, and negative 0.05. Importantly, the study reveals that logistics performance moderates the effect of export and transportation on economic growth, thus aiding the sustainable development of upper-middle-income countries by increasing export-economic growth elasticity from 0.36 to 1.26. Although transportation services do not influence economic growth independently, its economic importance became significant with elasticity of 1.113 when logistics performance is improved. Therefore, policy makers in upper-middle-income countries should maintain strict macroeconomic policies that could effectively engineer the sustainable export of goods and services and ensure high-quality logistics performance even in the transport sector.

Highlights

- The study examined the development aspects of 35 upper middle-income countries.
- Logistics performance, transport services, exports, and human capital positively triggers economic growth with respective elasticities of 0.28, 0.023, 0.34, and 1.25.
- Meanwhile, population inhibits the economic expansion of the region with an elasticity of 0.05.
- Logistics performance moderates the effect of export and transportation on economic growth.

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Sustainable development; economic growth; logistics performance; export; transportation; upper-middle income countries

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1. Introduction

Logistics is a strategic process that expedites global trade integration with high performance and sustainable activities (Magazzino et al., 2021). Unsurprisingly, a country's efficient logistics performance will provide convenience at every stage of international trade. Although the effect of logistics performance on economic growth has been discussed in terms of transportation in most studies, supply chain support activities such as stocking and customs also have an effect. The globalization of the world economy has accelerated due to logistical and technological developments. Logistics and transportation systems are increasingly becoming a core instrument for sustainable economic growth and development (United Nations Economic Commission for Europe, 2021). Logistics ensures the continuity of the flow of the supply chain, so that products can reach consumers. Therefore, the industry is often an essential part of promoting economic growth and development (Tang & Abosedra, 2011). Contrary to the belief that logistics processes only include transportation, logistics also includes the management of warehouses, inventory management, foreign trade operations, customs and so on.

Among the factors that are critical to economic growth, export of goods and services has continued to play important role and act as the engine of several economies across the globe. According to the literature, the export-induced economic growth or the export-led growth (ELG) hypothesis suggests that increase in exports is considered a vital determinant of growth. The growth processes of countries are not only a function of the amount of labor and capital in the economy but also of the increase in exports (Balassa, 1978). As mentioned above, the impact of logistics on a successful foreign trade transaction is undeniable. Therefore, the logistics industry remains one of the main facilitators of exports and economic growth (i.e. ELG) (Gani, 2017; Tang & Abosedra, 2011). Regarding logistics, most studies have been devoted to the noneconomic framework, such as the behavioral, environmental, and technical aspects of supply chains (Jajja et al., 2020; Liu et al., 2020; Xiong et al., 2021). However, previous studies on the ELG hypothesis and the effect of logistics activities on economic growth were mostly conducted as independent agent. Additionally, previous studies were mostly based on country levels and regions. For example, Ofluoğlu et al. (2018) and Abosedra and Tang (2019) are about MENA countries, while F. Ahmad et al. (2018); Taguchi and Thet (2021); and Oruangke (2021) are based on ASEAN countries. Given the information about previous studies, the income dimension of selected countries should be a loudable case (Sohag et al., 2017).

Given this background, the aim of this research is to examine the impact of exports on economic growth of the upper middle-income countries as affirmed by past literature. Furthermore, the objective is to advance the investigation by examining the impact of logistics on economic growth by focusing on the moderating effect of logistics performance in the relationship between exports economic growth, and between transportation services and economic growth. In essence, the current study investigates how LP could alter the effect of exports and transportation on the economic growth of the upper middle-income countries economies. The research is conducted empirically on a sample group by using a panel of 35 emerging upper-middle-income economies which is also rare in the literature. Beside considering the emerging economies which are expected to have high export activities amidst lower logistic performance in

comparison with the developed states, this investigation is also novel from the perspectives of putting the moderating effect of logistic performance under examination. The rest of the paper is structured as follows. Section 2 reviews the literature. Section 3 covers the empirical models, data, and methodology. Section 4 discusses the result and the conclusion of the investigation alongside policy implications is detailed in section 5.

2. Literature review

In addition to providing a comprehensive summary of the related studies in Tables 1 and 2, this section also offers a detailed discussion of selected relevant studies on ELG (highlighted in Table 1) and on logistics performance-led growth (highlighted in Table 2).

2.1 Literature review of export-growth studies

According to the results of several studies on the relationship between export and economic aspects, export contributes to the development of the economy in many ways. Export activities are effective in reducing unemployment rate by providing new job opportunities, competition between countries which leads to economies of scale, technological progress, and growth. These consequently also enhance the strength of domestic currency. These approaches supported the development of ELG hypothesis. Considering that export is of great importance for economic growth, the following studies closely examined the relationship between economic growth and exports. Mamun and Nath (2005) found that export has positive effect on economic growth of Bangladesh on different time interval. Awokuse (2003), Henriques and Sadorsky ((1996) examined the impact of export on Canada's economic growth and found a bidirectional effect between the indicators. Moreover, Awokuse (2003) also found that export has an effect on economic growth. In Balassa's (1985)study, the result shows that exports have a positive effect on economic growth in 43 developing countries by using cross-sectional data analysis.

2.2 Literature review of logistics performance-growth studies

In the study of Tang and Abosedra (2011), the findings from the four approaches specified that logistics performance has the potential to promote GDP. Firstly, the logistics sector especially when capitalized, yield increased total product demand. Secondly, the expansion of transportation networks through development and improvement in logistics may cause companies to reduce its stock levels, which translates to reduction in operating costs. Third, the study establishes that the development of logistics system increase the attractiveness of the country to foreign investors. Lastly, businesses with an advanced logistics system should be able to increase their productivity by focusing better on their core business. Thus, many methods have been developed to measure logistics performance, thus impacting a great and positive effect on the countries' economic development. Similarly, in the study of Çelebi and Civelek (2018); Henriques and Sadorsky (1996), the relationship between GDP and LPI was determined, and the result revealed that the components

Table 1. Studies on ELG.

No.	Studies	Methodology	Data Set	Main Causality Conclusions
1.	Darrat (1986)	Granger Causality (GC)	(1960–1982) GDP, Export	GDP →EX (Taiwan) GDP≠ EX (Hong Kong, South Korea, Singapore)
2.	Bahmani-Oskooee and Alse (1993)	GC method	GDP, Export	GDP↔EX (Indonesia and South Korea) GDP≠EX (Colombia, Greece, Malaysia, Pakistan, Philippines, Singapore, South Africa, Thailand)
3.	A. R. Khan and Qianli (2017)	ARDL estimation and Diagnostics tests	(1981–2016) Green LP, FDI, Renewable Energy, GDP	Green LP↔Renewable Energy (Short Term) FDI,GDP,Renewable Energy↔ Green LP (Long Term) (England)
4.	Kwan and Kwok (1995)	GC method	(1956–1985) GDP, FDI, EX, Labor Force	EX→GDP (China)
5.	J. Ahmad and Harnhirun (1996)	Cointegration (C) and GC	(1966–1989) GDP, EX	GDP →EX (ASEAN)
6.	Shan and Sun (1998)	Toda-Yamamoto Causality and VAR Analysis	(1978–1996) GDP, EX, IM, Labor Force, Investment, Energy Consumption	EX→GDP (Taiwan) GDP↔EX (Hong Kong and South Korea)
7.	Jordan and Fiona (1998)	Toda-Yamamoto Causality and VAR Analysis	(1978–1996) GDP, EX, IM, Labor Force, Investment, Energy Consumption	EX→GDP (China)
8.	Ibrahim (2002)	C and GC	(1960–1997) GDP, EX, IM, Investment, Public Spending	EX→GDP (Malaysia)
9.	Love and Chandra (2005)	Engle-Granger C and GC	GDP, EX	EX → GDP (Nepal, India, & Maldives) GDP → EX (Bangladesh) GDP ≠ EX (Sri Lanka, Bhutan & Pakistan)
10.	Afzal (2006)	C and GC	GDP, EX, IM	EX ↔ GDP (Pakistan)
11.	Furuoka (2007)	C and GC. Pooled OLS Regression	(1985–2005) GDP, EX	GDP≠EX (Malaysia, Philippines and Indonesia)
12.	Tan et al. (2007)	The vector error correction model and GC	(1958–1997) GDP, EX, Fixed Capital Formation	EX → GDP (Korea & Taiwan) GDP → EX (Singapore)
13.	Parida and Sahoo (2007)	Cointegration estimation	(1980–2002) GDP, EX, IM, Investment, Public Spending	EX → GDP (India, Pakistan, Bangladesh, Sri Lanka)
14.	Tang (2008)	VECM, GC, and DOLS	(1970–2006) GDP, EX, FDI	FDI and EX → GDP (Malaysia)
15.	Dash (2009)	C and GC	(1992–2007) GDP, EX, IM, Real Exchange Rate	EX→GDP (India)
16.	Tiwari (2011)	OLS Causality and Cobb-Douglas	(1995–2008) GDP, EX, FDI, Investment, Tourism	GDP≠ EX (India, China, Pakistan and Russia)
17.	Adnan Hye et al. (2013)	ARDL and GC	(1960– 2009) GDP, EX	EX → GDP (Bhutan & Sri Lanka) GDP ≠ EX (Bangladesh, India, Nepal & Pakistan)
18.	Tang (2013)	GC methods	(1975–2010) GDP, EX, IM	EX and IM ↔ GDP (Malaysia)
19.	Tang et al. (2015)	Cointegration, VAR, MWALD Causality	GDP, EX, Real Exchange Rate	GDP → EX (Korea & Taiwan) EX ↔ GDP (Hong Kong & Singapore)
20.	Abosedra and Tang (2019)	GC methods	(1980– 2012) Economic Growth, EX, FDI, Investment	EX ↔ GDP (Jordan) EX → GDP (Turkey)
21.	F. Ahmad et al. (2018)	Cointegration and Wald Causality	(1981–2013) GDP, EX, FDI	EX ↔ GDP (ASEAN Countries)
22.	Ali and Li (2018)	GC approach and ARDL co-integration	(1980–2015) GDP, EX, IM	EX → GDP (China and Pakistan)
23.	Das and Sarma (2021)	ARIMA Model	(1975–2018) EX, Growth	EX~GDP (India)

(*Continued*)

Table 1. (Continued).

No.	Studies	Methodology	Data Set	Main Causality Conclusions
24.	Tang (2013)	GC method	(1975–2010) GDP, EX, IM	EX ↔ GDP (Malaysia)
25.	Feder (1983)	Cross-Sectional Data (CSD) Analysis	(1964–1973) GDP, EX	EX → GDP (Less Developed Countries)
26.	Ram (1985)	CSD Analysis	(1960–1970) (1970–1977) EX, GDP	EX → GDP (73 Less Developed Countries)
27.	Balassa (1985)	CSD Analysis	(1973–1978) EX, GDP	EX → GDP (43 Developing Countries)
28.	Marin (1992)	C and GC methods	(1960–1987) EX, GDP	EX → GDP
29.	Afxentiou & Serletis (2000)	Engle-Granger C and GC	(1970–1993) EX, GDP	EX≠ GDP (Canada)
30.	Smith (2000)	Engle-Granger Cointegration	(1950–1997) EX, GDP	EX → GDP (Costa Rica)
31.	Awokuse (2003)	ECM, Toda-Yamamoto Causality	(1961–2000) EX, GDP	EX → GDP (Canada)
32.	Abual-Foul (2004)	VAR and ECM	(1976–1997) EX, GDP	EX → GDP (Jordan)
33.	Mamun & Nath (2005)	Engle-Granger C and GC	(1976–2003) EX, GDP	EX → GDP (Bangladesh)
34.	Ullah etc. (2009)	C and GC method	(1970–2008) EX, GDP	EX → GDP (Pakistan)
35.	Herrerias & Orts (2010)	Cointegration and ECM	(1964–2004) EX, GDP	EX → GDP (China)
36.	Henriques & 1998 Sadorsky (1996)	VAR model	(1870–1991) Economic growth, EX	GDP → EX (Canada)
37.	Shan & Tian (1998)	Toda-Yamamoto Causality	(1870–1991) GDP, EX	GDP → EX (Shanghai)
38.	Mah (2005)	ARDL method	(1979–2001) Economic Growth, EX	GDP → EX (China) EX → GDP (China)
39.	Lorde et al. (2011)	Cointegration and ECM	(1960-2003) GDP, EX	GDP → EX (Mexico) Long Term
40.	Halıcıoğlu (2008)	C and GC method	(1980–2005) Economic Growth, EX	EX → GDP (Turkey)
41.	Bahmani-Oskooe & Domac (1995)	Cointegration and ECM	(1923–1990) Growth, EX	EX → GDP (Turkey) GDP → EX (Turkey)
42.	Demirhan (2005)	C and GC methods	(1990–2004) Growth, EX	EX → GDP (Turkey)
43.	Bilgin & Şahbaz (2009)	Cointegration and Todo-Yamamoto Causality	(1987–2007) GDP, EX	EX → GDP (Turkey)
44.	Joshua et al, (2020)	GC method	(1989–2007) GDP, EX	Trase globalization → GDP (Nigeria)

Note: The →, ↔ and ≠ respectively imply uni-directional causality, bi-directional causality, and no causality while ~ indicates unsteady effect, EX= Exports, IM= Imports, FDI=foreign direct investment, LP= Logistics Performance, LPI= Logistics Performance Index.

Table 2. Studies on LPLG.

No	Studies	Methodology	Data Set	Main Causality Conclusions
1.	Sharipbekova and Raimbekov (2018)	Factor and Registration Analysis	(2007–2016) LPI, GDP	LPI ↔ GDP (CIS Countries)
2.	Takele and Buvik (2019)	Gravity model	export, GDP, LPI and dummy variables	LPI→EX (Africa)
3.	Gani (2017)	OLS Regression	GDP, LPI, Import and Export	LPI→EX (60 Countries)
4.	Yeo et al. (2020)	Generalized Structured Component Analysis (GSCA) Structural Equation Modeling (SEM)	(2010–2018) LP, IT, EP	LPI→EX (62 Low middle and high middle income countries)
5.	Siddiqui and Vita (2021)	OLS Regression Granger Causality	(2001–2016) GDP, FDI, LPI	GDP ≠ LPI (Cambodia, Bangladesh, India)
6.	L. Martí et al. ()	Gravity model	(2005–2008) IT, GDP, LPI, Population, Dummy Variables (Language, border)	LPI→IT (Developing countries)
7.	Saslavsky and Shepherd (2014)	Gravity model	IT, GDP, LPI, Population, Dummy Variables (Language, border and distance)	LPI→IT (Far East and Pasific Countries)
8.	Katrakylidis and Madas (2019)	Toda-Yamamoto Approach & Causality Analysis	(2007–2018) LPI, and GDP.	LPI → GDP (Short Term) LPI ↔ GDP (Long Term)
9.	Taguchi and Thet (2021)	Gravity model, OLS	(2007–2017) IT, GDP, LPI, Population, Dummy (Distance)	LPI→IT (ASEAN Countries)
10.	Wong and Tang (2018)	Panel OLS	(2007–2015) LPI, GDP, Corruption, Infrastructure, Technology, Education	Institutional reforms, upgrading resources → LPI (93 Countries)
11.	Goel et al. (2021)	Regression Analysis	(2007–2018) LPI, Economic growth, COVID-19 Effect	LPI→ Economic Growth (130 Nations)
12.	C. Wang et al. (2021)	Vector Autoregressive (VAR) and the Vector Error Correction Model (VECM)	(2000–2017) LPI, Economic Development	LPI→ Economic Development (China)
13.	Kabak et al. ()	Novel scenario analysis	(2007–2014) LPI, Export	LPI→EX (Turkey, Burundi, Zimbabwe, Brazil and Portugal)
14.	Töngür et al. (2020)	Gravity model	2007–2017 LPI, Export	LPI→EX (Turkey)
15.	Uca et al. (2015)	Structural equation modeling	(2012–2014) LPI, GDP	LPI (Customs and infrastructure) → GDP
16.	Sharipbekova and Raimbekov (2018)	Factor and Registration Analysis	(2007–2016) LPI, Economic growth	LPI→Economic Growth (CIS Countries)
17.	Çelikkol and Keskin (2021)	Regression Analysis	(2007–2018) LPI, GDP	LPI→GDP (Turkey)
18.	Maciulyte-Sniukiene & Butkus (2022)	The Fixed-Effect (FE) econometric model	(2007–2018) LPI, IT	LPI→IT (EU Countries)
19.	Zaninović et al. (2020)	Gravity Model	(2010–2018) LPI, IT	LPI→IT (EU Countries)
20.	Luttermann and Kotzab (2020)	Panel data analysis using secondary data	(2006–2017) LP, IT, Foreign Investment	LPI→IT + Foreign investment (20 Asian Countries)
21.	Korkut, Yavuz & Zeren (2022)	The panel cointegration and panel causality analysis	(1994–2017) LP, IT	LPI→IT (G20 Countries)
22.	Pınar and Diken (2020)	Descriptive analysis method	(2016–2018) LPI, Economy	LPI→ Economy (Turkey)

(*Continued*)

Table 2. (Continued).

No	Studies	Methodology	Data Set	Main Causality Conclusions
23.	Oruangke (2021)	Gravity Model	(2007–2018) LPI, Trade	LPI→Trade (ASEAN)
24.	M. L. Wang and Choi ()	Gravity Model	(2010–2014) LPI, Export and Import	LPI→E ≥ LPI→IM (Developing and Developed Countries)
25.	Ofluoğlu et al. (2018)	Gravity Model	(2007–2014) LPI, Trade	LPI→Trade (EU and MENA Countries)
26.	Maswana (2020)	Panel GMM Estimation, Panel fixed effect vs OLS dummy regression	(2004–2014) GDP, Foreign Investment, Çin FDI, LP	LPI→EX (China and 41 Africa Countries)
27.	Çelebiand Civelek (2018)	Mediator variable analysis method	(2007–2014) LPI, Global Competitiveness Index, GDP	GCI↔LPI↔GDP
28.	Çelebi et al. (2015)	Mediator variable analysis method	LPI, Foreign Direct Investments, Economic Growth	FDI↔LPI↔Economic Growth
29.	Tang and Abosedra (2011)	Cobb-Douglas Production Function and OLS	(2010–2016) LP, EX	(23 Asian Countries)

Note: The →, ↔ and ≠ respectively imply uni-directional causality, bi-directional causality, and no causality while ~ indicates unsteady effect, EX= Exports, IM= Imports, FDI=foreign direct investment, LP= Logistics Performance, LPI= Logistics Performance Index.

of LPI which include customs and infrastructure exert a statistically significant impact on GDP. Moreover, Çelebi et al (2015) examined the mediating effect of LPI on the relationship between Global Competitiveness Index (GCI) and Gross Domestic Product (GDP) by using hierarchical regression analysis. The result implied that the mediating effect of LPI on the economic growth is statistically meaningful.

The gravity model was employed in the studies of Takele and Buvik (2019), Saslavsky and Shepherd (2014), Taguchi and Thet (2021), Töngür et al. (2020), Zaninović et al. (2020), and Oruangke (2021). For instance, Takele and Buvik (2019) show that an improvement in one of the LPI components will lead to a significant growth in the exports of African countries while L. Martí et al. () found that LPI has the potential to increase the country's trade flows to the African, South American, and Eastern Europe countries. Moreover, the study of Saslavsky and Shepherd (2014) showed that developing countries' policy makers have the potential to promote international production networks by improving logistics performance. Additionally, Oruangke (2021), and Taguchi and Thet (2021) considered the case of the ASEAN countries and found that there is a positive and significant relationship between LPI and trade.

3. Data selection and method

In this part of the study, the information about the dataset, the theoretical underpinning of the study and the empirical results are carefully presented.

3.1 Theoretical underpinning

This study considers the role of exports and logistics performance in determining the GDP of the panel data from 35 upper middle-income countries. By extending the form of

the production function which is rooted in the economic growth model by Solow (1956), the production function has formed the background for literature of economic growth. However, the role of export in economic development has also been deepened in several related studies that include Hobday (2003), Parida & Sahoo, (2007), Tang & Abosedra, (2011), and Tiwari, (2011). The current approach applies a modification to the economic growth model

$$Y = AK^{\beta}L^{\propto} \tag{1}$$

where $\propto +\beta = 1$, from here $\propto = 1 - \beta$
this also is similarly written as:

$$Y = AK^{\beta}L^{1-\beta} \tag{2}$$

Adding the error term to the model and converting it to econometric form, the function is:

$$Y_{it} = A_{it}K_{it}^{\beta}L_{it}^{1-\beta}e^{\varepsilon_{it}} \tag{3}$$

where Y_{it}, K_{it}, L_{it} are economic growth, capital, labor force factors respectively for country i in the period t. A_{it} refers to technological development and economic efficiency and $e^{\varepsilon_{it}}$ is the error term of the model. We arrived at using per capita when both sides of the equation are divided by labor force (L_{it}) such that

$$y_{it} = A_{it}k_{it}^{\beta}e^{\varepsilon_{it}} \tag{4}$$

where $y_{it} = \frac{Y_{it}}{L_{it}}$ and $k_{it} = \frac{Y_{it}}{L_{it}}$. Additionally, in studies such as Tang & Abosedra, (2011) Wong & Tang, (2018), and Saidi et al., (1998) Siddiqui & Vita, (2021), exports (EXP), logistics performance (LP), and transportation services (TRANS) have been documented to have a significant impact on technological and economic efficiencies. Accordingly, A_{it} can be written as follow:

$$A_{it} = A_0 EXP_{it}^{\beta_1} LP_{it}^{\beta_2} TRANS_{it}^{\beta_3} \tag{5}$$

We substitute A_{it} into the previous equation and apply the natural logarithm (denoted as ln) such that

$$lny_{it} = lnA_0 + \beta_1 lnEXP_{it} + \beta_2 lnLP_{it} + \beta_3 lnTRANS_{it} + \beta lnk_{it} + \varepsilon_{it} \tag{6}$$

With control variables denoted as Z_{it} (such as physical and human capital, foreign direct investment, and population growth) such that the basic growth model to be implemented for this investigation is now presented as

$$lnGDP_{it} = \beta_0 + \beta_1 lnEXP_{it} + \beta_2 lnLP_{it} + \beta_3 lnTRANS_{it} + \beta Z_{it} + \delta_i + \varepsilon_{it} \tag{7}$$

where GDP_{it} is a country-specific real GDP per head, EXP_{it} is the country-specific per capita export of goods and service, LP_{it} is the country-specific logistics performance indicator, and $TRANS_{it}$ refers to the country-specific transportation services. Thus, our investigation is based on the following expression as illustrated in the study of Tang and Abosedra (2011).

$$lnGDP_{it} = \beta_0 + \beta_1 lnEXP_{it} + \beta_2 lnLP_{it} + \beta_3 lnTRANS_{it} + \alpha_1(lnEXP_{it} * lnLP_{it}) + \beta Z_{it} + \delta_i + \varepsilon_{it} \quad (8)$$

Previous studies such as Arvin et al., (2015), Canning & Fay, (1993) Sharif et al., (2019) have proven that the development of transport services in a country has a positive effect on economic growth. Furthermore, by incorporating the interaction of transportation services variable and logistics performance, we have another distinct expression as

$$lnGDP_{it} = \beta_0 + \beta_1 lnEXP_{it} + \beta_2 lnLP_{it} + \beta_3 lnTRANS_{it} + \alpha_2(lnTRANS_{it} * lnLP_{it}) + \beta Z_{it} + \delta_i + \varepsilon_{it} \quad (9)$$

Therefore, the econometric expressions (equations 7, 8 and 9) are now considered for investigation such that three distinct models are up for investigation.

3.2 Data and statistical properties

In this study, the analysis is based on annual data over the period 2008–2018.[1] The economic output model is employed to examine the panel data of 35 emerging upper middle-income economies.[2] The countries under investigation are Albania, Argentina, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Colombia, Costa Rica, Dominican Republic, Ecuador, Georgia, Guatemala, Jamaica, Jordan, Kazakhstan, Lebanon, Malaysia, Mauritius, Mexico, Moldova, Montenegro, Namibia, North Macedonia, Panama, Paraguay, Peru, Romania, Russian Federation, Serbia, South Africa, Thailand and Turkey. Data for these countries have been acquired from various dependable online sources such as the World Bank database that includes the World Development Indicators (WDI) and World Bank Logistics Performance Reports (WBLPR). In the study, per capita real GDP, per capita real exports of goods and services, per capita real foreign direct investment, population growth, transportation services and average life expectancy human capital were obtained from WDI. Logistic performance data were obtained from WBLPR. For the standardization of all data used in the model, conversion to natural logarithm is provided. Table 3 clearly provides description and sources of data used in the model while Table 4 shows the summary of the descriptive statistics of the variables, and Table 5 depicts the cross-correlation matrix.

Table 3. Variables and explanations.

Variables	Explanation	Source	Obs.
GDP	Per capita real GDP, (US$ at 2010 prices)	WDI	210
EXP	Per capita real exports of goods and services (US$ at 2010 prices)	WDI	210
LP	Logistics performance (score 0–5 in each of six areas)	WBLPR	210
FDI	Real foreign direct investment per capita (US$ at 2010 prices)	WDI	210
HC	Human capital (average years of life expectancy)	WDI	210
POPG	Population growth (annual %)	WDI	210
TRANS	Transport services	WDI	210

Note: WDI, World Development Indicators.

Table 4. Summary of statistical properties.

Variables	Mean	Maximum	Minimum	Standard Deviation	Jarque-Bera	Probability
GDP	4.173	4.492	3.862	0.144	6.025	0.049
EXP	3.357	3.931	2.673	0.272	4.160	0.125
LP	1.759	1.945	1.541	0.079	0.221	0.895
FDI	0.767	1.522	0.311	0.213	13.771	0.001
HC	1.876	1.914	1.737	0.029	6.240	0.000
POPG	0.411	0.917	−0.556	0.208	2.446	0.000
TRANS	1.306	1.832	0.770	0.241	3.1492	0.207

Table 5. Cross-correlation matrix.

Correlation	GDP	EXP	HC	FDI	LP	POPG	TRANS
GDP	1.000						
EXP	0.723	1.000					
HC	0.262	−0.025	1.000				
FDI	−0.037	0.018	0.122	1.000			
LP	0.418	0.347	0.144	−0.296	1.000		
POPG	0.006	0.142	−0.135	−0.069	0.165	1.000	
TRANS	0.145	0.174	−0.072	0.015	−0.018	−0.172	1.000

Note: The independent variables are correlated with the GDP with a 1% statistically significant level.

3.3 Estimation approach

The approach here is to determine the impact of LP on economic growth and moderating effects of LP on the relationships between EXP and economic growth, and between TRANS and economic growth in 35 upper middle-income countries economies. As such, we use the panel data analysis method because the panel data allows the collection of cross sectional observations of unit such as individuals, countries, companies, households in a certain time period (Baltagi, 2005; Gujarati, 2003). There are various panel data approaches in the literature. However, in this study, we used the static panel method because of the relatively smaller sample size (i.e. T = 6, N = 35).[3] Additionally, the stationary evidence in the model is also not put into consideration for the static panel approach because panel data set does not meet conditions the $T - p \geq 20$ given that the number of parameters is p as also established by Law (2018).

4. Discussion of empirical results

The pattern of discussion adopted in this section is the presentation of the priori alongside diagnostic estimations and the main coefficient estimation.

4.1 Diagnostics

The OLS estimator results of the model we have formulated in equations (7), (8) and (9) in the previous section are shown in Table 6. The Breusch Pagan LM test results confirmed that the fixed effects (FE) and random effects (RE) estimators outperformed the Pooled OLS estimators of the dataset. To determine the most efficient estimator for our growth model, we applied the Breusch Pagan LM test followed by the Hausman specification test to choose which of the fixed effects and random effects model is more suitable. The null hypothesis for the Hausman specification test reported in Table 6 is

Table 6. Outcome of panel FE model.

Variables	Model 1	Model 2	Model 3
Dependent variable	$lnGDP_{it}$	$lnGDP_{it}$	$lnGDP_{it}$
Constant, c	0.143	−3.073	1.686[c]
$lnEXP_{it}$	0.359[c]	1.260[c]	0.363[c]
$lnTRANS_{it}$	0.023	0.019	1.113[c]
$lnHC_{it}$	1.248 [c]	1.320[c]	1.208[c]
$lnPOPG_{it}$	−0.053[a]	−0.057[b]	−0.056[b]
$lnLP_{it}$	0.28[2c]	2.045[c]	0.561[b]
$lnFDI_{it}$	−0.024	−0.021	−0.026
$(lnEXP_{it} * lnLP_{it})$	-	0.515[a]	-
$(lnTRANS_{it} * lnLP_{it})$	-	-	0.648[c]
Other statistical results			
R^2	0.731	0.737	0.738
F-statistic	30.784[c]	28.781[c]	28.883[c]
Diagnostics			
Breusch-Pagan LM Test	1322.800[c]	1294.807[c]	1321.974 [c]
Pesaran scaled LM	21.098[c]	20.286[c]	21.074[c]
Heteroskedasticity Test	250.157	250.7756	254.249
Jarque-Bera	3.599[b]	3.827913[b]	6.555[a]
Hausman Test	2.618[c]	3.773117[c]	3.102[c]

Note: [c], [b] and [a] denote statistical significance at the 1%, 5% and 10% levels, respectively. In addition, the numbers in parentheses show the p-values.

rejected at a significant level of %1. This result proved that efficiency of the FE estimator as compared to the RE estimator.

The results of the Jarque-Bera test confirm the normality assumption of the model, while the results of the Heteroscedasticity test show that there is no problem of heteroskedasticity. The F statistical results provide evidence that the entire model is significant and coherent. These R^2 results show that at least 73% of the change in economic growth of upper middle-income countries can be explained by explanatory variables used in the model such as exports, foreign direct investments, human capital, logistic performance, transportation services and population growth. In the light of this priori information, the economic growth model as formulated in the three models (of questions 7, 8, and 9) are thoroughly investigated.

There are studies in the literature affirming the significant and positive effect of exports on economic growth. Some of these studies include Darrat (1986), Kwan and Kwok (1995), Shan & Sun (1998), Ibrahim (2002), Furuoka (2007), Tiwari (2011), Tang et al. (2015), Tang (2013), A. R. Khan and Qianli (2017), Ali and Li (2018), and Joshua et al. (2020). In addition to this evidence, the current investigation presents the direct and indirect contribution of the logistics network to the relationship between export and economic growth. While exports, transportation services, human capital, population growth, foreign direct investments and logistics performance are included as explanatory variables in Model 1, per capita real gross domestic product representing economic growth is the dependent variable. In Model 2, the variable $(lnEXP_{it} * lnLP_{it})$ is included to estimate the effect of logistics performance on economic growth through exports. In model 3, the variable $(lnTRANS_{it} * lnLP_{it})$ is added to determine whether the unit effect of transportation services on economic growth depends on the level of logistics performances.

4.2 Coefficient estimation results

Model 1

In the Model 1 shown in Table 6, this provides evidence for a statistically significant and positive effect of exports and logistics performance on economic growth. According to the results in Model 1, statistically significant effect of FDIs and transportation services on the per capita real GDP is not found possibly due to unobserved effects (Magazzino & Mele, 1992). The same results show that population has a statistically significant and negative effect on economic growth in the upper middle-income countries. In other words, the 1% increase in population growth in upper middle-income countries during the 2008–2018 period causes a decrease of approximately 0.05% in the per capita real gross domestic product. It is an expected situation in the economic literature that the rapid population growth especially in developing countries potentially exert a negative effect on economic growth which is caused by poor governance and weak institutions among other factors. For example, studies such as L. Martí et al. (), Saslavsky and Shepherd (2014), M. L. Wang and Choi (), Takele and Buvik (2019), Zaninović et al. (2020), and Taguchi and Thet (2021) have found that population growth has a negative effect on economic growth. Considering these studies, our findings support policy mechanism that improves governance and social measures that encourage planned parenthood as a way of easing pressure of social infrastructure and promote economic growth.

Additionally, these results show that exports have a significant impact on economic growth in upper middle-income countries. Specifically, this result in Model 1 implies that a 1% increase in exports positively affected economic growth by approximately 0.36%. These results support the finding of several previous studies such as Darrat (1986), Kwan and Kwok (1995), Shan & Sun (1998b), Ibrahim (2002), Awokuse (2003), Love and Chandra (2005), Afzal (2006), Furuoka (2007), Dash (2009), Tiwari (2011), Adnan Hye et al. (2013), Tang et al. (2015), Tang (2013), A. R. Khan and Qianli (2017), and Ali and Li (2018). By applying different approaches and different cases or country groups, it shows overwhelming evidence that exports have a significant share in increasing economic growth. Moreover, the model 1 result posits that human capital has a significant and positive effect on per capita real gross domestic product. It specifically translates that a 1% increase in human capital increases the real gross domestic product by approximately 1.25%. This is in addition to that statistical evidence that a 1% increase in logistic performance in upper middle-income countries increase the per capita real gross domestic product by approximately 0.23%.

Model 2

Since we found a significant relationship between exports and economic growth in Model 1, equation (8) is examined by exploring the moderating role of logistics performance i.e. $(lnEXP_{it} * lnLP_{it})$ in Model 2. According to the results of Model 2, it was found that the unit effect of exports on economic growth depends on the level of logistics performance. The fact that the coefficient of $lnEXP_{it} * lnLP_{it}$ in the model is statistically significant gives credence to the result. Additionally, the fact that the coefficient of the term $(lnEXP_{it} * lnLP_{it})$ is positive means that the effect of exports on growth is higher in these countries especially when there is high logistics performance. Specifically, this

evidence shows that the influence of exportation on the economy increased from~0.36% to~1.26% due to high logistic performance, thus suggesting that about LP increases the economic efficiency of export by 250%. Our findings are consistent with results from previous studies in the literature by Gani (2017), Katrakylidis and Madas (2019), Sharipbekova and Raimbekov (2018), Çelikkol and Keskin (2021), Maswana (2020) and C. Wang et al. (2021) which shows that countries with improved LP have the tendency to gain more revenue from exports.

Model 3

The last model under investigation is the model 3. In this model, the interaction term ($lnTRANS_{it} * lnLP_{it}$) was added to examine the moderating effect of logistics performance in respect to the relationship between transportation services and economic growth. According to the results shown in Table 6, the fact that coefficient of $lnTRANS_{it} * lnLP_{it}$ is statistically significant and it indicates that a unit effect of transportation services on economic growth depends on the level of logistics performance. The fact that the coefficient of $lnTRANS_{it} * lnLP_{it}$ is positive indicates that countries with higher LP does have a higher impact of transportation services on economic growth. Importantly, while transportation services show no economic effect independently, logistics performance moderates such that transportation services now exert a statistically significant impact on economic growth by an elasticity of 1.686. While the interaction term is considered in the interpretation of Model 2 and Model 3, this offers more information on the dimensions of economic expansion in respect to the effect of exports, transportation services, population growth, logistic performance, foreign direct investments and human capital as illustrated in Model 1.

5. Conclusion and policy recommendations

This study attempts to make important contributions to literature about the effect(s) of exports and logistics performance on economic growth alongside offering possible policy recommendations based on panel data from 35 upper middle-income countries during the period 2008–2018. For this reason, logistics performance, exports, human capital, population growth and foreign direct investments are included as explanatory variables in the economic growth model in which per capita real GDP is the dependent variable. Using the panel fixed effects OLS estimator, three different models were used to effectively explain the objective of the study.

The empirical results of this research reveal several interesting information. First, we found that human capital, logistics performance, and exports all exert positive and statistically significant effect on economic growth in the panel of upper middle-income countries. The elasticity of economic growth with respect to change in human capital, logistics performance, and exports are respectively, 1.25 (elastic), 0.28 (inelastic), and 0.36 (inelastic). However, population growth which serves as control variables is found to inhibit economic growth in the panel of examined countries while and foreign direct investments shows no statistically significant impact. Moreover, there is statistically significant evidence that logistic performance also desirably moderate the effect of export on economic growth. With the moderating role of logistic performance, the elasticity effect of export on economic growth increased from~0.36 to~1.26 while the impact

elasticity effect of human capital also increased from~1.25 to~1.32. Additionally, transportation services is found to play a statistically significant role on economic growth only when logistic performance moderates the relationship. Without the moderating influence of logistic performance, transportation services has no effect on economic growth, but a 1% increase in transportation services increase economic growth by~1.113% when there is high logistic performance. In all the three empirical analyses methods employed, only population growth exhibits a consistently negative and statistically significant impact on economic growth in the 35 upper middle-income countries while foreign direct investments show no indication of economic significance.

This study is limited in terms of the number of observations given that logistic performance index is only available from 2008 and for every two years which also hinders the possibility of applying a dynamic econometric approach, a non econometric method such as artificial neural networks algorithm adopted in Magazzino et al. () could be useful for future endeavour. In spite of the limitation of the study, the results offer relevant policy measures.

5.1 Policy

The empirical results have several important implications for policy making. Policy makers in the upper middle-income countries would need to maintain a stable policy of macroeconomic dimension to encourage exports of goods and services since growth in export is vital to the countries economic growth. The exchange rate and interest rate policies of the governments of these countries are very key in promoting export activities, thus the monetary policy regimes of should be assuring and void of uncertainty to a significant extend (Uddin et al., 2017). Moreover, due to the positive impact of transportation services on economic growth, policy makers should identify the specific circumstances by geographical and institutional priorities in the industry to improve the quality of transport services. Additionally, since the improvement in export and transportation services positively affects economic growth especially the moderating effect of logistics performance, policy makers should take more deliberate steps to improve the the channels of international trade. To improve logistics performance, policy makers should take steps to shorten the shipping times of the maritime companies, improve the operational logistics of in the airline sector, road, rail, and seaway networks. This anticipated improvement in logistics performance can be achieved through change in institutional and bureaucratic processes. Thus, by adopting advanced information system and technological innovations, the contribution of exports and transportation services to economic growth can be significantly increased in upper middle-income countries with improved logistics performance playing significant role.

Notes

1. Since the logistics performance report of the countries is published every two years, the data includes this period.
2. Among of 55 upper middle income countries, only 35 countries have complete information for per capita real GDP, per capita real exports of goods and services, logistic performance,

per capita real foreign direct investment, human capital, population growth and transport services. Thus, the study is restricted to these 35 countries because of data availability.

3. If $N > 50$, it would be more appropriate to use the dynamic GMM estimator in econometric analysis, such as.

Disclosure statement

No potential conflict of interest was reported by the authors.

Data availability statement

Data utilized is freely available in online sources. It can also be provided upon request.

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