Pakistan Journal of Commerce and Social Sciences
2022, Vol. 16 (4), 530-551
Pak J Commer Soc Sci

Moderating Role of Trade Openness between Export Upgrading and Economic Growth

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Article History

Received: 20 Sept 2022 Revised: 23 Dec 2022 Accepted: 27 Dec 2022 Published: 31 Dec 2022

Abstract

The present research analyzes the nexus between export upgrading and economic growth. In addition, it studies the moderating role of economies' level of openness to international trade between export upgrading and economic growth for a group of 131 countries covering the period of 2006-2019. The Generalized Method of Moment (GMM) is used for empirical analysis in STATA. Findings of this study express that export upgrading has a positive impact on economic growth. However, empirical results based on the developed and developing countries, show that although export upgrading has a positive impact on economic growth in developing economies, its effect is insignificant for developed economies. Unlikely, trade openness enhances the impact of export upgrading on economic growth in developed economies, however; it reduces this impact in developing economies.

Keywords: export sophistication, export upgrading, trade openness, economic growth.

1. Introduction

Both growth and trade theories emphasize the role of exports to determine the economic performance of economies. Lucas (1993) points out that all industries are not the same in terms of the creation of learning by doing effects and positive externalities in an economy. Based on an explanation regarding growth theories, Lucas (1993) conjectures that the role of the industry is characterized by high learning by doing effects amid specialization in exportable products. Export growth leads to specialization, which is the source of an increase in skill set and productivity level in a sector. As a result of this, investors shift their resources from the low-productive sector to the high-productive export sector (Hart, 1983; Ben-David and Loewy, 1998; Giles and Williams, 2000).

Nonetheless, Jaffee (1985) states that although exports lead to economic growth in developed countries, they can adversely affect developing nations because the situation of international markets is not certain and prices of primary products are suffering from volatility due to increasing competition among countries. Further, Cadot et al. (2011) and Fan et al. (2019) argue that the competition in the world market is getting further intensified in the era of globalization. Hence, countries that export traditional products may face an economic loss because of the weakening of their terms of trade. Furthermore, developing countries' initial investment in the production structure to produce primary products cannot be reversed easily which intensifies the loss of GDP growth in subsequent years (Bleaney and Greenway, 2001; Sachs and Warner, 1997; Sala-i-Martin, 1997; Buffie et al.1992). Likewise, Felipe et al. (2010) report that economies that cannot upgrade their production structure may be caught in a middle-income trap. Consequently, they cannot maintain their share of exports in the world market (Giordano, 2018).

Thus, instead of focusing on the volume of exports, countries should concentrate on the contents of the exports. In other words, today's buyer is more interested in the aspects of value for money and value addition of the manufacturing products (Fujii-Gambero and Garcia-Ramos, 2015; Markaki and Economakis, 2020). Therefore, researchers' focus has inclined to the role of sophisticated exports to determine economic growth. The role of export upgrading has emerged as a central theme in growth theories in previous decades (Atasoy, 2021). Jarreau and Poncet (2012) argue that those countries that remained involved in the production and export of manufactured products are enjoying better economic growth prospects as compared to the exporter of primary products. Hausmann et al. (2007), among others, conclude that fast-growing economies engage themselves in the production of sophisticated products therefore they grow relatively faster than countries with less sophisticated goods. As the former products are the bigger source of spillover and learning-by-doing effects than the latter.

However, the structural transformation in terms of shifting resources from the primary sector to the manufacturing sector is not an easy task. To upgrade a production structure and reap the benefits of export sophistication a particular level of advancement is necessary. Hence, developing countries could not shift their resources from the traditional sector to the advanced sector. Consequently, a major portion of the export basket of developing nations still consists of primary products (Hausmann et al. 2014; Ohno, 2009; Studwell, 2013; Jankowska et al. 2012). Furthermore, several studies have mentioned that to achieve sustainable economic growth by export upgrading a particular level of development is essential but development is multifaceted and depends on many factors such as the level of openness to international trade, investment, and human capital (Sheridan, 2014; Azariadis and Drazen, 1990). Bigsten et al. (2004) report that the target of export upgrading may be achieved more efficiently in the existence of trade openness because the role of trade openness is very crucial for the upgradation of production structure due to technological diffusion, positive spillovers, and knowledge creation associated with international trade linkages (Grossman and Helpman,1991).

According to endogenous growth theories, trade openness bolster economic growth because of positive externalities, technological diffusion, and knowledge creation (Grossman and Helpman, 1991; Edwards 1992; Coe and Helpman, 1995; Sachs and Warner, 1995, 1997; Ben-David and Leowy, 1998). In line with this, Findlay and Watson (1996) and Edwards (1997) state that Asian economies outperform Latin American economies in terms of macroeconomic stability and economic development as the former adopted outward-oriented trade policies and later adopted import substitution policies. Further, China's experience of sustainable and efficient growth performance provides ample evidence in support of outward-oriented trade policies and better utilization of domestic resources (Giles and Williams, 2000).

Therefore, to absorb the gains from export upgrading a country should be opened to trade otherwise inputs and incentives for export upgrading may become inaccessible and dissipate respectively. However, this process is not conditional on the capacity of a country to absorb these gains (Felipe et al. 2010; Poncet and De-Waldamer , 2013). According to our knowledge, previous studies did not investigate the effect of export upgrading on the economic growth of economies conditioned on their level of openness to international trade. Further, Hausman et al. (2007), among others, use export sophistication as a time-invariant variable in their growth models and analyze its effect on economic growth in the following years. Whereas, export sophistication is a dynamic phenomenon because it changes over time as a result of changes in the export basket of a country. Therefore, for a comprehensive analysis of the sophistication-led growth phenomenon, a time-variant nature of the export sophistication variable is necessary.

The present study has three objectives: First, to compute the export sophistication score of economies. For this, initially, we compute productivity scores of goods, and then by using these scores we compute the export sophistication of countries from 2006 to 2019. This methodology was proposed by Hausmann et al. (2007), and many studies have used it as a measure of export upgrading (Zhu and Fu, 2013; Li et al. 2021): Second, to study the nexus between export upgrading, trade openness, and economic growth: Third, to analyze the moderating role of trade openness between economic growth and export upgrading. The literature does not provide enough information on the conditional effect of export upgrading on economic growth.

Unlike many previous studies, for empirical analysis, the current research uses the system GMM estimator augmented by the nonlinear moment conditions (Ahn and Schmidt, 1995) proposed by Kripfganz, (2019). Thus, this study provides new evidence in the literature on the sophistication growth phenomenon. In addition, the current research examines how trade openness affects the sophistication growth nexus as a moderating factor.

The present study organizes in a way that section (2) provides the views of former studies followed by methodology (3) and data (4). Finally, this study presents results in section 5 and the conclusion along with recommendations and future directions in section 6.

2. Literature Review

After the influential work of Harrod (1939) and Domar (1946) on the issues of unstable economic growth, the heterogeneous economic performance of economies across the globe has garnered the attention of many researchers. Solow (1956) and Swan (1956) consider technological progress as the primary driver of steady-state economic growth, however; they assume it as an exogenous factor. To address the questions that arise on the unexplained Solow residual/technological progress, neoclassical growth theories resolve the issue of non-convergence (Barro and Sala-i-Martin, 1997).

A study by Mankiw et al. (1992) incorporates the role of human capital in the Solow model but with an assumption of diminishing returns to human capital. Endogenous growth theories highlight the role of human capital, knowledge, ideas production, and innovation through positive externalities and spillovers as a source of technological progress (Romer, 1986; Lucas, 1988; Grossman and Helpman 1991; Aghion and Howitt, 1992b). In contrast to neoclassical growth theories, endogenous growth theories assume non-diminishing returns to human capital. However, further research, to identify other factors, is required (Durlauf and Quah, 1998). Lucas (1993) mentions the diverse effect of learning by doing and externalities across industries and advocates the role of the export sector as a creative sector in an economy. In line with this, Melitz (2003) states that firms' productivity and creativity are primary factors that promote firms' exports and lead to higher earnings of firms.

However, Fosu (1990a) concludes that linkages between exports and economic growth are associated with the composition of the export basket of a country. According to this study, the manufacturing sector is a primary source of innovations that are the ultimate source of technology diffusion. As manufacturing firms focus on training workers to increase their skills and use technology more intensively than firms that belong to primary sectors. As a result of this, manufacturing firms produce innovative products that create positive externalities for both trade and non-trade sectors (Crespo and Worz, 2005).

Furthermore, Hausmann and Rodrik (2003) mention that firms face both ex-ante and ex-post discover costs while investing in R&D for innovations. The ex-post self-discovery cost is highly accompanied by the uncertainty of imitation and rejection or a lower rate of acceptance from customers. Furthermore, innovative products have heterogeneous effects on the revenue of firms due to variations in their spillover effects. Therefore, firms discourage investing in innovative products to avoid the cost of self-discovery because it is very difficult to identify such products that create more spillovers and positive externalities. Countries that export more advanced products produced by developed economies grow faster than those economies that export less sophisticated products exported by other developing countries (Hausmann et al. 2007). In addition, Sheridan (2014) reports that manufacturing exports are a source of knowledge spillovers and economies of scale therefore they contribute to economic growth more efficiently than primary exports. Unlike, Chrid et al. (2021) state that export upgrading has heterogenous

effects on economic growth and although it promotes growth in high-income economies, it affects adversely economic growth in low-income economies. Likewise, Chakroun et al. (2021) argue that export upgrading promotes economic growth in high-income economies however; it restricts economic growth in low-income economies. The prime reason for these contrasting results is the differences in productive capabilities and capacity to absorb knowledge spillovers, and knowledge accumulation in developed and developing economies.

However, Hausmann et al. (2014) document that upgrading production structure and exports is a tough phenomenon because it represents the productive capabilities of a country (Andreoni, 2011a). Similarly, Fortunato and Razo (2014) conclude that to upgrade exports a country has to transform its production structure. However, the effectiveness of the transformation of the production process itself depends on the productive capacity of a country (Nouira and Saafi, 2022). Jarreau and Poncet (2012) report that export sophistication determines the income level of China and regions of China that are more open to trade absorbed gains from export sophistication more efficiently. It indicates that trade openness complements the export upgrading in an economy. Export upgrading requires the use of advanced technology, knowledge spillovers, and international trade linkages that are associated with trade openness (Grossman and Helpman, 1991; Bigsten et al. 2004). Moreover, to reduce ex-post discovery cost, access to the world market is an essential factor therefore trade-oriented policies are required. Thus, trade openness affetcs the impact of export upgrading on economic growth. However, the gains from trade openness are conditional and depend on the quality of infrastructure development and factor endowments of a country (Kong et al. 2021) Likewise, Asamoah (2019) finds that trade openness has growth-enhancing effects in countries that are equipped with well-performed institutions but it decreases economic growth in countries that are suffering from low performed institutions.

3. Methodology

New growth theories explicitly capture the effect of export sophistication through learning-by-doing effects and knowledge spillovers (Atasoy, 2021). Because a product is a sophisticated product if it requires better quality inputs to be manufactured therefore such products created positive externalities for other firms in the industry (Chakroun et al. 2021). Hausmann et al. (2007) argue that economies that export more sophisticated products grow faster than countries with traditional products. Thus, economies should transfer their resources from an unproductive sector (nontraded) to a productive sector (traded sector). Consequently, they produce sophisticated products that gradually create learning by doing effects and knowledge spillover effects for the nontrade sector as well (Jankowska et al., 2012).

However, researchers agree that for effective economic reforms, the policies related to different sectors should complement each other. For an effective transformation from the nontraded sector to trade sector and to absorb the gains from the production of sophisticated

products international trade linkages are necessary. In other words, international trade complements the upgradation of production structure and more open economies to trade absorb gains from sophisticated products more efficiently (Alagidede et al., 2020, Jarreau and Poncet, 2012). Therefore, trade openness not only has a growth-enhancing effect but also affects the growth-induced effect of export upgrading.

To analyze the effect of trade openness and export upgrading, we start with the contribution of Solow (1956), Mankiw et al. (1992,) and Barro and Sala-i-Martin (2004) that can be articulated for country i as below:

$$Y_{i,t} = A_{i,t}K_{i,t}^{\alpha}H_{i,}^{\beta}L_{i,t}^{\gamma} \qquad (1)$$

Where $Y_{i,t}$is output, K is stock of capital, H is human capital, L is labor, A is technological progress, t denotes time, and i is for the country. Mankiw et al. (1992), among others, defined A as below:

$$A_{i,t} = A_o e^{g,t} \qquad (2)$$

Hausmann et al. (2007) state that export sophistication creates learning by doing effects and positive externality that can explain the part of technological progress. Similarly, Dollar (1992), Sachs and Warner (1995), and Edwards (1998) conclude that trade openness creates technological diffusion and knowledge spillovers that can influence the technological progress of a country. Therefore, export sophistication and trade openness affect economic growth by influencing technological progress. On the other hand, researchers identified some other factors that can also explain the technological progress and ultimately output level of an economy. Acemoglu et al. (2001) state that institutional quality explains the change in technological progress because it affects the capacity of an economy to absorb domestic and international knowledge. Similarly, another potential variable that can explain the variation in technological progress is foreign direct investment by helping an economy to perform its activities at the international level and convert itself into a modern economy (Mehic et al.2013). Therefore, the log transformation of equation (1) for regression analysis, after including all aforementioned variables that can explain equation (3), is as follows:

$$y_{it} = \beta_o + \beta X'_{i,t} + \mu_i + \varepsilon_{it} \qquad (3)$$

where, y_{it} is the natural log of GDP per capita, $X'_{i,t}$ is a vector of variables, μ_i is the unobserved country-specific effect, ε_{it} is the error term, i denotes cross sections and t represents the time.

For cross-country analysis of economic growth, we follow the methodology of Teixeira and Queiros (2016), and our catch-up cross-country regression equation is as follows:

$$y_{it} - y_{it-1} = \alpha y_{it-1} + \beta X'_{i,t} + \mu_i + v_{it} \quad (4)$$

We can rewrite equation (5) as:

$$y_{it} = \alpha_1 y_{it-1} + \beta X'_{i,t} + \mu_i + v_{it} \qquad (5)$$

where $\alpha_1 = 1 + \alpha$. However, the conditional convergence will be determined by the value of .

The final form of our standard estimable equation to investigate the effect of export upgrading, trade openness and their interactive term can be formulated as below:

$$y_{it} = \alpha_1 y_{it-1} + \beta_1 EXPY_{it} + \beta_2 CAP_{it} + \beta_3 HC_{it} + \beta_4 POP_{it} + \beta_5 TOP_{it} + \beta_6 FDI_{it} + \beta_7 IQ_{it} + \beta_8 EXPY\_TO_{it} + \beta_8 GFC_t + \epsilon_{it} \quad (6)$$

where EXPY is export upgrading, *HC* refers to human capital, CAP represents physical capital, TOP is trade openness, *FDI* is foreign direct investment, POP is population, IQ is institutional quality, and $EXPY\_TO$ is the interaction term of EXPY and TOP, GFC is the dummy of the financial crisis of 2007-08, ε is the disturbance term of equation (6), i is for country and t shows years.

As the estimate able equation (6) is a dynamic equation, therefore; the results of OLS and fixed effects models may become inconsistent and inefficient due to simultaneity bias and nonconstant variance of the error term respectively (Nickell, 1981). Baum et al. (2003) argue that the generalized method of moments (GMM) performs better than the OLS, and the instrumental variable methods in the existence of endogeneity, heterogeneity, and autocorrelation. Kripfganz (2019) proposed a two-step system GMM augmented by Ahn and Schmidt (1995) nonlinear moment conditions that increase the efficiency of estimates. Therefore, the current study applies the system GMM proposed by Kripfganz (2019) to get efficient results of estimates, and to check overidentification restrictions we apply the Sargan test proposed by Sargan(1958) and extended by Hansen (1982). Sebastian Kripfganz developed a command of STATA, XTDPDGMM, to estimate a panel model with lagged dependent variable with a two-step system GMM augmented by Ahn and Schmidt (1995) nonlinear moment conditions. Therefore, we use STATA to estimate equation (6).

4. Data Description and Source

4.1 Export Sophistication and its Measurement

Lall et al. (2006) introduced an index to measure the intensity of technology in exported products. However, Hausmann and Klinger (2007) state that industry-level data on exports is not available at the disaggregate level. Consequently, the measurement of the intensity of technology associated with products may be miscalculated. In addition, industry-level data did not capture the full productive capacity and capability of a country mentioned by the theory of productive capabilities (Andreoni, 2011a and 2010). An upgraded version of the Lall et al. (2006) index was constructed by Hausmann et al. (2007) to quantify the quality of the export basket level of a country.

This present research initially measures the productivity of products SITC 3-digit level available at UNCTADstat (https://unctadstat.unctad.org/EN/). The data on income level is attained from WDI covering the period of 2016-2108. For this purpose, we follow the

methodology of Rodrik (2006). To avoid the influence of economic structure on productivity scores we made the productivity index static by averaging the values for the aforementioned years. However, due to the unavailability of the data, the current research computes export sophistication scores for 131 countries from 2006 to 2019 by following the methodology of Hausman et al. (2007). The formula to measure product level sophistication in the first stage for a product k in year *t* is below;

$$PRODY_k = \sum_i \left\{ \frac{\left(x_i^k / X_i \right)}{\sum_i \left(x_i^k / X_i \right)} Y_i \right\} \qquad (7)$$

Where, Y_i is the GDP Per Capita, PPP (Constant 2017 international $) for country i, $\left(x_i^k / X_i \right)$ is the share of product k

in total exports of country i. Therefore, the PRODY is simply a weighted average of income of all those countries that are exporting product k and weight is equal to the revealed comparative advantage (RCA) of a country in product k to normalize the sum of RCA equal to one. Therefore, by construction, a product will be more productive if it is exported by high-income economies. In the second stage, this study uses the below formula to transform product-level sophistication into country-level export sophistication.

$$EXPY_{i,t} = \sum_l \left\{ x_{i,t}^k / X_{i,t} \right\} PRODY_k \qquad (8)$$

EXPY, export sophistication, is the weighted average of productivity associated with each product, k, exported by country i in a given year t.

5. Results and discussion

5.1 Descriptive Statistics and Co-Moments of Variables

Table 1 describes the basic features of variables used by the present study. EXPY is the export sophistication score. GDP is GDP per capita (constant 2015 US$). TOP is imports plus exports (% of GDP), FDI is net inflows of foreign direct investment (% of GDP), POP is total population and IQ rule of law index. The data on GDP, FDI, POP, and TOP is obtained from World Development Indicators, whereas, IQ is collected from World Governance Indicators. Similarly, CAP and HC are gross capital formation and human capital respectively. The data of both variables are collected from the Penn World Table, version 10.0.

The average value of the EXPY score is 21,491.6 (PPP, US$) with a maximum of 40,104.5, a minimum of 6,078.7, and a standard deviation of 6,054.6. Similarly, TOP has an average value of 88.3, a minimum of 1.2, and a maximum of 442.6 with a standard deviation of 58.6. The average value of GDP is 15,716.6, minimum and maximum values of GDP are 278.2 and 112,417.9 respectively. The value of the standard deviation of GDP is 20,520.3.

The values in table 1 indicate the strong heterogeneity of the data in terms of the standard deviation of variables. To reduce this heterogeneity, we transformed the data of GDP, EXPY, and PC into a natural log form and the data of POP into a growth rate form for further data analysis.

Table 2 presents the correlation among variables used by the current study. Column 1 of Table 2 reveals that both EXPY and TOP have a positive linear association with GDP. In addition, EXPY has the second highest correlation with GDP among all variables. The value of the correlation of EXPY with GDP is 0.79 which is in line with the findings of Hausmann et al. (2007).

Table 1: Descriptive Statistics

	GDP	EXPY	CAP	HC	POP	TOP	FDI	IQ
No. of Obs.	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834
Mean	15,716.6	21,491.6	3,389,592	2.6	50.5	88.3	6.2	0.1
Std.Dev.	20,520.3	6,054.6	8,912,314	0.7	165.4	58.6	20.5	1.0
Minimum	278.2	6,078.7	7,304.4	1.1	0.3	1.2	-57.5	-2.1
Maximum	112,417.9	40,104.5	102,000,000	4.4	1,407.7	442.6	449.1	2.4

Table 2: Pairwise Correlation Matrix

Variables	GDP	EXPY	CAP	HC	POP	TO	FDI	IQ
GDP	1.00							
EXPY	0.79	1.00						
CAP	0.53	0.58	1.00					
HC	0.79	0.68	0.49	1.00				
POP	-0.21	-0.03	0.68	-0.14	1.00			
TOP	0.39	0.32	-0.07	0.34	-0.46	1.00		
FDI	0.11	0.06	-0.10	0.07	-0.20	0.31	1.00	
IQ	0.88	0.69	0.46	0.72	-0.18	0.42	0.14	1.00

5.1.1 Estimation results of the two-step system GMM

To achieve the first and second goals of the current study, we estimated equation (6) with the two-step system GMM. The first column of table 3 consists of the results for a complete sample of 131 economies. The coefficient of EXPY (export upgrading) is the short-term elasticity. As per the values of estimates, export upgrading has a significant effect on economic growth because the coefficient of EXPY is significant (at the 1% level) and a 1% increase in export sophistication score leads to a 0.82% increase in economic growth.

These findings are in line with the findings of former studies (Sami and Ridha, 2018; Chakroun et al. (2021); Chrid et al. 2021; Guneri and Yalta, 2021). Traditional trade theories, comparative advantage, and factor endowment do not advocate the role of the upgradation of production structure in determining economic growth. However, endogenous growth theories highlight the role of the upgradation of production structure and exports and their transmission channels through learning by doing, positive externalities, and spillover effects. Countries with exports of sophisticated products grow quickly because export sophistication is a greater source of learning by doing and spillover effects. China's growth is highly associated with its export upgrading in the assembly sector. Guneri and Yalta (2021) conclude that economies involved in the production of sophisticated and complex goods can manage the volatility of output in a better way therefore they have relatively more stable economies than countries with the production of traditional products. Furthermore, such economies' have fast convergence and enjoy a better economic performance. Similarly, Chrid et al. (2021) state that the production of sophisticated goods is a tool to measure the differences among countries in their capabilities to upgrade their production structure and promote their extensive margin of exports.

The coefficient of TOP (trade openness) in column (1) is also significant (at the 1% level) which implies that TOP has a positive impact on economic growth. As per the value of estimates, a 1% increase in TOP leads to an increase in economic growth by 0.002%. These results are in line with former studies (Bari et al. 2020; Kishi and Okada, 2021). According to endogenous growth theories, trade openness increases the utilization of resources in the production process because of an increase in opportunities for access to international markets and advanced technology. Kishi and Okada (2021) find that trade openness generates spillover effects for new entrant firms in the industry. Bari et al. (2020) report that trade openness reduces the volatility of macroeconomic variables in a country therefore it has a growth-enhancing effect.

Moreover, physical capital, human capital, and institutional quality have a positive association with economic growth. These findings are consistent with Dogan et al. (2020) and others. However, FDI and POP do not significantly affect economic growth in the panel of all countries. On the other hand, the financial crisis of 2007-08 hurts economic growth.

For further investigation, we divide our sample by adopting the methodology of the World Bank. According to the classification of The World Bank, economies with a GDP per capita of US$12996 or above are called high-income economies. Therefore, we split our global panel into the panel of high-income (developed) and low-income (developing) economies. The coefficient of export sophistication in column 3 of developed economies is insignificant which implies that developed economies should produce innovative products and increase their specialization in innovative products rather than the production of goods produced by other developed economies (Chakroun et al. 2021). However, in the panel of developing nations, EXPY has a growth-enhancing effect which implies that developing

economies should produce goods produced by high-income countries because of their learning-by-doing effects. Abdmoulah (2023) documents that the production of sophisticated goods helps an economy to transform itself and to use its resources in more productive sectors, particularly the manufacturing sector. Consequently, countries involved in the production of sophisticated products succeeded to increase their supply capacity. Unlikely, TOP has a growth-enhancing impact in both developed and developing countries. In addition, the probability values of the test of overidentification restrictions and serial correlation confirm that the instruments used by the current study are valid.

Table 3: Panel Results (two-step system GMM)

	(1)	(2)	(3)
Variables	Global panel	Developing countries panel	Developed countries panel
$GDP_{(-1)}$	0.521***	0.660***	0.800***
	(0.0847)	(0.1071)	(0.0559)
EXPY	0.816***	0.411**	-0.007
	(0.205)	(0.173)	(0.1321)
CAP	0.096***	0.092**	0.080***
	(0.0334)	(0.0390)	(0.0305)
HC	0.458**	0.274*	0.194
	(0.1980)	(0.1660)	(0.2420)
POP	1.253	0.808	2.290*
	(1.2310)	(2.3100)	(1.1780)
TOP	0.002***	0.002**	0.001***
	(0.0005)	(0.0007)	(0.0004)
FDI	-0.0001	0.0002	-0.0002
	(0.000318)	(0.00209)	(0.000218)
IQ	0.305***	0.225**	0.123**
	(0.0948)	(0.112)	(0.0590)
GFC	-0.024***	-0.018***	-0.033***
	(0.0056)	(0.0062)	(0.0050)
Constant	-5.791***	-2.744**	0.470
	(1.821)	(1.234)	(1.238)

No. of obs.	1,703	1,066	637
No. of countries	131	82	49
No. of instruments	44	39	36
Arellano-Bond (H_0: no correlation of order 2)	0.66	0.74	0.54
Hansen test (H_0: overidentifying restrictions are valid)	0.08	0.32	0.21

Note: Standard errors are in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p<0.01$

5.2 The Moderating Role of Trade Openness

To analyze the complementary role of trade TOP for export upgrading as a determinant of economic growth and for a meaningful interpretation of the interactive term, we applied the mean centering strategy on both variables of interest in light of the previous (Rehman et al. 2012; Aiken and West, 1991; Jaccard et al. 1990). The results of column 1 of table 4 show that the interaction term between EXPY and TOP is insignificant. It implies that trade openness does not complement export upgrading in the global panel but both variables promote economic growth in the global panel.

However, we split our main panel into the panel of high-income (developed) and low-income (developing) economies for further empirical analysis. Column 3 of Table 4 shows estimates for developed economies. According to the results of this column, although export upgrading is responsible for a decrease in economic growth its effect is positive in developed countries that have more open economies to trade than countries with averagely open economies. Therefore, in developed economies, TOP reduces the adverse effect of EXPY on economic growth. As per the value and sign of interaction term, the impact of EXPY on economic growth is conditional on the value of TOP and TOP helps developed economies to gain from EXPY. It implies that countries that are more open to trade successfully develop their international trade linkages and earn more revenue from the sale of sophisticated products than countries that are less open to trade (Vo and Nguyen, 2021; Adegboye et al. 2020). Because the interaction term is not only positive but also significant (at the 5% level). These results are in line with the prediction of endogenous growth theories that trade openness creates knowledge spillovers, technological diffusion, and positive externality for the manufacturing sector of a country.

Unlike developed economies, the impact of export upgrading for developing economies with average trade openness is positive, however; the effect of export sophistication on economic growth is adverse for those developing economies that go beyond the average level of trade openness. It shows that trade openness moderates the relationship between growth and export sophistication and it weakens this relationship. Fu et al. (2011) state that developing economies' gains from technology spillovers and knowledge creation as the

result of globalization are conditional and depend on domestic factors such as domestic institutions and innovation procedures (Lall, 2003). In addition, the lack of social capability to adopt advanced technologies and the lack of knowledge accumulation in developing economies are other possible reasons for this result (Kim and Lin, 2009; Zahonogo, 2016). Furthermore, exhausting learning by doing effects due to the lack of compatibility of specialization with comparative advantage may adversely affect the benefits of trade openness in developing countries. In line with this, according to endogenous growth theories, developing countries' incompatibility of specialization patterns with dynamic comparative advantage and factor endowments may exhaust the learning by doing effects (Redding, 1999; Young, 1991).

Wang and Wei (2010) assert that human capital and government policies to promote industries enhance the absorption capacity of China to take benefit from trade openness. According to World Bank, openness is beneficial for a country with better productive capabilities and capacity including a sound macroeconomic outlook, business-friendly policies, better infrastructure, and good governance (The World Bank Group, 2017). The experience of countries namely Singapore, Switzerland, Ireland, New Zealand, and Luxembourg, provides a sufficient explanation regarding the absorption capacity of benefits from openness because of their productive capabilities. These economies are not only open to trade but also export sophisticated products. Consequently, they are considered in the club of fast-growing and stable economies. On the other hand, North Korea, Venezuela, Cuba, Sudan, and Zimbabwe are not only among the most restrictive economies but also have a lack of productive capabilities. Consequently, they are suffering from low growth rates (The World Heritage, 2022).

Table 4: Panel Results (moderating role of trade openness)

	(1)	(2)	(3)
Variables	Global panel	Developing countries panel	Developed countries panel
$GDP_{(-1)}$	0.483***	0.403***	0.661***
	(0.0933)	(0.102)	(0.119)
EXPY[a]	0.846***	0.789***	-0.529***
	(0.207)	(0.166)	(0.201)
CAP	0.098***	0.085	0.089*
	(0.0348)	(0.0672)	(0.0514)
HC	0.634***	1.378***	0.468**
	(0.2360)	(0.3840)	(0.2321)

POP	1.760*	5.327**	2.655
	(0.9420)	(2.4311)	(1.9834)
TOP[b]	0.002**	0.002**	0.002***
	(0.0007)	(0.0008)	(0.0005)
FDI	-0.0001	0.005**	-0.0001
	(0.0003)	(0.0021)	(0.0003)
IQ	0.292**	0.190*	0.295**
	(0.1470)	(0.0992)	(0.1251)
GFC	-0.025***	-0.020***	-0.023***
	(0.0073)	(0.0063)	(0.0066)
EXPY_TO	-0.002	-0.010***	0.006**
	(0.0027)	(0.0031)	(0.0031)
Constant	2.618***	2.513***	1.321**
	(0.754)	(0.589)	(0.666)
No. of obs.	1,703	1,066	637
No. of countries	131	82	49
No. of Instruments	44	39	36
Arellano-Bond (H_0: no correlation of order 2)	0.62	0.23	0.50
Hansen test (H_0: overidentifying restrictions are valid)	0.09	0.69	0.28

Note: Standard errors are in parenthesis. * p < 0.1, ** p < 0.05, *** p<0.01. [a] and [b] show mean-centering forms of variables.

6. Conclusion and Policy Implications

The present research has two main objectives: First, to empirically analyze the effect of export sophistication and trade openness on the growth of an economy, and: Second, to empirically study the complementary role of trade openness in sophistication-led- growth strategy. GMM estimation method was applied for empirical analysis of data from 131 nations from 2006-2019. As per the findings of this study, both variables of interest have a growth-enhancing impact on economic growth in the global panel. Although export upgrading has a growth-enhancing impact in developing economies, its effect is insignificant for developed economies. On the contrary, trade openness increases the

growth-induced effects of export upgrading in developed economies whereas it constrains these effects in developing economies.

Researchers agree that export upgrading plays a crucial role in the development of a country (Atasoy, 2021). Endogenous growth theories explained that export upgrading contributes to economic growth through the channel of learning by doing effects and knowledge spillovers (Hausmann et al. 2007; Sheridan, 2014). According to Jarreau and Poncet (2012) economies involved in the production of sophisticated products grow faster than countries that produce traditional products.

Trade openness is one of the factors which facilitates firms by providing them an opportunity to interact with foreigners which crates knowledge spillovers for them (Grossman and Helpman, 1991). Furthermore, it provides easy access to advanced technology, cost-effective inputs, and access to international markets for selling their final products (Sachs and Warner, 1995, 1997). Based on empirical results, the current study suggests promoting liberalized policies for the trading sector because international trade creates benefits for countries.

However, gains from trade openness are not unconditional and depend on the domestic capacity to absorb these gains. A country with more ability to accumulate knowledge and make better use of advanced technologies does not face exhausting learning-by-doing effects. Similarly, a country with the capacity to specialize in those products that are compatible with their endowments and comparative advantage absorbs the gains from export upgrading and trade openness more effectively. However, a country with low productive capacity may lose the opportunity for optimal absorption of gains from export upgrading and trade openness (Zahonogo, 2016).

The results of the current study suggest countries should specialize in more sophisticated products and upgrade their export basket by including products that have high learning-by-doing and positive spillover effects. Developing economies should be engaged in the production of products produced by developed economies. The role of government is indispensable for the upgradation of production structure in developing economies because to upgrade a production structure, an increase in the productive capabilities is required that build over time. Therefore, governments in developing economies should facilitate firms to upgrade their production structure by the imposition of a favorable industrial policy. However, the results of this study suggest that developed economies should involve in the production of innovative products rather than the production of goods already produced by developed economies.

Moreover, this study urges developing countries to build their domestic capacity by investing in human capital and institutions and further specialize in products that can enhance their competitiveness and international linkages with other countries. In addition, developing nations should export sophisticated products exported by developed nations and put their best efforts to increase their competitiveness in those products, otherwise, developing economies will fail to compete in international markets. Consequently, the

learning-by-doing and spillover effects may exhaust. The role of government in developing economies is also indispensable to increasing domestic absorption capacity which can create facilities for firms by promoting high-tech tax-favored industrial zones and strengthening the institutions of the country.

6.1 Limitations and Future Research Directions

For future research, the current study suggests researchers should investigate the sophistication growth phenomenon more comprehensively because we could not highlight all possible factors that can affect the sophistication growth nexus such as the role of education, institutional quality, and political stability. Furthermore, one could find the threshold value of trade openness by applying threshold techniques in future research to investigate this nonlinear relationship.

Research Funding

The authors received no research grant or funds for this research study.

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