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Services Export and Economic Growth: A Panel Cointegration Approach

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Abstract

This paper attempts to quantify the contribution of services export to economic growth for 89 countries over the period 1970-2018. we estimate growth accounting equations to explore the causal relationship between services export and real GDP, using panel cointegration technique and panel error-correction models (VECM) in combination with fully modified OLS and dynamic OLS methods. Results show that long-run relationships exist and there is strong evidence of causality from services export to income and weak evidence of causality from income to services export. The results substantiate the existence of services export-led growth hypothesis. Further, the results show that in the long-run trade liberalization policies prove is beneficial in promoting productivity and growth.

Keywords: Services export, Economic growth, Panel cointegration, Causality.

1. Introduction

The causal relationship between exports and economic growth is known as Export-Led-Growth (ELG) hypothesis. The ELG hypothesis argues that export expansion orienting policy has a positive impact on economic growth. Instead of using import substitution industrialization policy, the adoption of the export-orientation policy by some Asian countries, such as Korea, Hong Kong, Singapore, and Taiwan, has a favorable impact on economic growth as well as overall economic development. As indicated by several previous studies, export-led growth strategy results in economies of scale, productive efficiency, imports of capital goods to increase the investment in the economy, and better resource allocation.

Over the past 40 years, economists have produced an extensive set of empirical evidence confirming the growth of export, mainly as the growth of merchandise export, and economic growth is positively and significantly related. Feder (1982) adopts a well-known source of growth approach, which is a supply-side description of changes of

aggregate output, to analyze export performance and economic growth over the period of 1964-1973 for a group of semi-industrialized less developed countries. The sources of growth framework relate aggregate output growth to changes in labor and capital through the underlying production. He assumed that the export sector had a positive externality effect on the non-export sector through the development of efficient and competitive environment, highly training of quality labor, and the introduction of advanced production techniques. The empirical evidence supports the view of optimal resource allocation from the non-export sector to the export sector in countries that adopt export-oriented policies. An interesting survey provided by Lewer and Van den Berg (2003) emphasizes not only the statistical significance but also the economic significance of trade growth relationships. According to the structure of economic data and the econometric methodology, they classified the vast growth-trade regressions into eight different categories. Surprisingly, each category generates, on average, consistent economic significance between export growth and economic growth for a large number of cross section and time series growth regressions. A one percentage point increase in the growth of export growth is associated with a 0.22 percentage point increase in economic growth.

Dawson and Sanjuán-López (2013) examines bivariate export-income relationships for 47 developing countries for the period of 1970-2004, using Westerlund's panel cointegration technique. Of those 47 countries, the World Bank designated 17 as "low income", 22 as "lower middle income", and 8 as "upper middle income". The empirical results show that there exists a meaningful long run relationship between exports of goods and services and GDP. Furthermore, the relationship between export and real output is bi-directional. The GDP-export elasticity for the full sample is 0.22 and the export-GDP elasticity is 1.13.Dawson (2005) explores quantitatively the nexus between agricultural exports and economic growth, focusing particularly on the role of 62 less developed countries for the period of 1974-1995. Fixed and random effect models are used to estimate panel data. Annual data on GDP at market price is obtained from the World Bank and data on agricultural and total export are taken from FAO. The empirical results support the ELG hypothesis and highlight the role of agricultural export as an engine of economic growth for less developed countries. Sanjuán-López and Dawson (2010) quantify the contribution of agricultural exports to economic growth for 42 developing countries for 1970-2004. The empirical findings indicate that there is a long run relationship between agricultural exports and GDP for the sample of 42 developing countries. The agricultural export elasticity of GDP is 0.07. Purna Chandra Parida and Pravakar Sahoo (2007) investigate the relationship between manufacturing exports and output growth for four Asian countries, using Pedroni's panel cointegration analysis over the period of 1980-2002. A production function with manufacturing exports and human capital as additional arguments is considered to examine the export-income relationship. The panel cointegration results support the view of manufacturing export-led growth hypothesis. Real manufacturing exports as

well as real total exports have a cointegrating relationship with real GDP for four South Asian countries.

The role of service exports as an engine of economic growth has drawn attention in recent years. According to WTO (2019), trade in services has been expanding rapidly, at a faster pace than trade in goods since 2011. Between 2005 and 2017, services grow at 5.4 percent per year. Developing economies, excluding LDCs, gained over 10 percentage points in their share in global trade, reaching US$ 3.4 trillion for the period of 2005 to 2017. As in the case with trade in goods, services trade could contribute to a more efficient allocation of resources, greater economies of scale beneficial spillovers, and improving firms' competitiveness in both the services and manufacturing sectors. Services also serve as crucial inputs into the production of goods. In value-added terms, services account for about 50% of world trade. On the other hand, UNTACD (2019) revealed that global services trade was valued at US $5.8 trillion, one-quarter of the value of total exports and 7 per cent of world GDP in 2018. The world's top services exporter in 2018 was the United States of America and the top five exporting developing economies were China, India, Singapore, Hong Kong SAR, and the Republic of Korea. In 2018, developing economies relied more on travel and transport and less on insurance, financial, intellectual property and other business services than developed economies for their exports. Telecommunications, computer, and information services were the category for which world services trade expanded fastest from 2017 to 2018.

Due to the fact that services are growing rapidly in developing countries and account for the majority part of international trade, the purpose of this paper is to examine the relationship between service exports and economic growth for 89 countries for the period of 1970-2018, using the panel cointegration techniques. Few studies examine the relationship between service exports and income, but two exceptions that use panel data are Sermcheep (2019) and Gabriele (2006). Using a new disaggregated annual dataset on the global trade in services for 192 countries from 1970 to 2014, Sermcheep quantifies the contribution of services export to economic growth in the ASEAN countries for the period 1980-2004.[2]This article classifies services export into modern and traditional services export.[3] The findings of the services ELG estimations from panel RE and FE model reveal that both the modern and traditional services export growths have a significant and positive effect on enhancing economic growth in ASEAN countries. The contribution from goods exports growth is significantly higher, comparing to those both of the services sector. Sermcheep concludes that the services export could serve as a new engine of economic growth and a complement of the existing growth engine. The OLS regression results by Gabriele (2006) reveal that services

[2] This new dataset is constructed by Loungani et al. (2017) and published by the IMF.

[3] Modern services are defined as ICT-enabled services including communication, computer, information, intellectual property (IP), financial, and business-related. Traditional services are defined as transport, travel, construction, maintenance and repair services, manufacturing services on physical inputs owned by others, personal, cultural, and recreational services, and government goods and services.

exports have a positive effect on GDP growth in developing countries and in developed countries from a panel of 114 countries throughout 1980-2000. However, the effect in developing economies is weaker than those in the case of developed economies. Priyankara (2018) employs the Granger non-causality test developed by Toda and Yamamoto (1995) to investigate the impact of services export on economic growth by using annual time series data from 1984 to 2013 in Sri Lanka. The findings reveal that services export-led growth hypothesis holds in Sri Lanka and there is a unidirectional causality running from services exports to economic growth. Policymakers in Sri Lanka should develop strategies to promote services exports in international trade. It is important to eliminate the inter-sectoral barriers to reallocate the resources from less productive and less efficient sectors to more productive and more efficient sectors.

This study contributes to the existing literature in three ways. First, this is one of the studies, which considers the effect of services export on economic growth, thereby identifying any long-run export–income relationship, using panel cointegration methods. It tests the ELG hypothesis by examining both at the aggregated and disaggregated services export. Second, this article complements to the extant literature by providing an empirical study to examine the export-income relationship to see whether it differs across different income groups; third, we test the services export-led growth hypothesis by testing causality between exports and income. The remainder of this paper is organized as follows: Section 2introduces the empirical model specification. Section 3 presents the data used in our model whereas empirical results are presented in Section 4. The final section contains the conclusions.

2. Empirical model

The ELG hypothesis stresses the importance of trade in stimulating economic growth in the form of technological spillovers. The countries pursuing export-orienting policies provide incentives for product innovation for both export and non-export sectors. Comparative advantage and specialization allow the domestic economy to exploit economies of scale. The increase in exports calls for the accumulation of human capital and the stock of technological knowledge thereby benefiting all firms. Furthermore, in the last decade, the endogenous growth theory emphasizes that those countries that are more open to the rest of the world have a greater ability to access the technological knowledge form developed economies. They support the proposition of trade in achieving a sustainable rate of economic growth. These models have utilized the different variables, such as openness indicator, real exchange rate, terms of trade, and export-GDP ratio, to verify the proposition that productivity growth is faster in more open economies.

In growth theory, the Solow residual is what remains in output growth after subtracting growth in the factors of production (capital and labor). This residual, which could not explain by using growth in capital and labor, was later called total factor

productivity or multifactor productivity.[4] TFP refers to the additional output generated through enhancements in the efficiency accounted for by such things as innovation and creation of knowledge, technology transfer, advancement in human capital, skills and training, trade, acquisition of efficient management techniques and knowhow, upgrading of present technology and enhancement in information and communication technology (ICT).

In this study, the general production function, econometric estimation, and the Solow's residual of growth accounting non-parametric analysis have been used as an additional argument:

$$Y = F(K, L, X) \qquad (1)$$

where Y is real GDP using two important inputs such as capital (K) and labor (L) and income received from abroad, which is through export (X) as proposed by growth theories and TFP. Given that trade is an important determinant of TFP, Van der Marel (2012) provides evidence that services trade is a key factor in explaining services TFP. Countries with more high-skilled labor and liberalizing services sectors would enjoy a relatively higher growth share in services trade. The econometric model of the relationship between the services export and economic growth is specified as follows:

$$y_{it} = \alpha_i + \beta_i x_{it} + \gamma_i k_{it} + \delta_i l_{it} + \mu_{it} \qquad (2)$$

where y_{it} is the log of real GDP, $x_{it}$is the log of real services export, k_{it} is the log of real capital stock, l_{it} is the log of labor, and y_{it} and x_{it} are cointegrated with slopes β, which may or may not be homogeneous across *i*. In this case, for ELG to hold, it requires under the null hypothesis that $H_0: \beta_i = 0$for all *i*.

3. Data

The data for calculation was taken from World Bank WDI (World Development Indicators). The panel data consists of annual observations on GDP, insurance and financial services, communications and computer services, transport services, travel services, service exports, exports of goods and services, gross fixed capital formation, and total population for 89 countries[5]. Measured using gross national incomes (GNI) per capita in U.S. dollars, economies are currently by the World Bank into four income groups. It consists of 89 countries, of which 14 are "low income," 17 are "lower-middle income," 22 are "upper-middle income and 36 are "high income". The panel covers the period 1970–2018 and total observations are 4,361. Definitions and sources of the variables are as follows. Annual data on GDP gross fixed capital formation are at

[4] Suppose that output, Y, is a function of capital, K, the labor, L, and the growth of technology at the rate A as given by the Cobb-Douglas production function$Y = e^{At}K^{\alpha}L^{1-\alpha}$ Converting to logarithms and differentiating with respect to time then yields the sources of growth equation: $g_Y = g_{TFP} + \alpha g_K + (1-\alpha)g_L$.

[5] Data on services export and goods export are taken from the International Monetary Fund, Balance of Payments Statistics Yearbook, and data files. License: CC BY-4.0.

current US$. Data on the total labor force are unavailable for many LDCs so the convention in the literature of using total population as a proxy is followed. Data on service exports are at current US$, BOP and insurance and financial services, communications and computer services, transport services, travel services are denoted as a percentage of service export, BOP.

4. The Results

The panel cointegration technique was used to study the long-run export-income relationship. Previous literature generally employs conventional methodology, such as panel fixed effect, or generalized method of moments (GMM) to estimate panel data. The endogeneity problem cannot easily be solved by these conventional models. However, the panel cointegration technique is able to deal with the problem of endogeneity and estimate the long term effect between variables.

When analyzing how the service exports affect real output, we proceed in four steps, namely, panel unit root test, panel cointegration test, and group-mean fully modified OLS and dynamic OLS (group-mean FMOLS and DOLS), and short-run and long-run causality tests.

Panel unit root tests

To evaluate a possible long-run relationship between services export and output, we need to first establish the order of integration of the variables. To test for the existence of non-stationary in a panel data, we have used tests due to Im et al. (2003) (henceforth IPS, 2003) and Fisher-ADF test proposed by Maddala and Wu (1999) (henceforth MW, 1999)[6]. The IPS equation for panel unit root tests is specified as below:

$$\Delta y_{it} = \alpha_i y_{i,t-1} + \sum_{j=1}^{p_i} \beta_{ij} \Delta y_{i,t-1} + X_{it}^{'} \delta + \varepsilon_{it} \qquad (3)$$

where $y_{i,t}$ and X_{it} denote of the variable of interest and exogenous variables, respectively. The null and alternative hypotheses for the tests may be written as:

$$H_0 : \alpha_i = 0 \; for \; all \; i$$

$$H_1 : \begin{cases} \alpha_i = 0 & for \; i = 1,2,\dots,N_1 \\ \alpha_i < 0 \; for \; i = N_1 + 1, N_1 + 2, \dots, N \end{cases}$$

The MW statistic is given by $\mathrm{P} = -2\sum_{i=1}^{N} \log(\pi_i)$ and π_i stands for the p-values from any individual unit root for cross-section *i*. The P test follows a χ^2 distribution with

[6] Both IPS and MW allow for heterogeneous coefficients in the panel.

degrees of freedom twice the number of cross-section units, i.e. 2N. The null and alternative hypotheses are the same as for the as IPS.

Both tests are conducted to check for the presence of a unit root for all variables, both in levels and in first differences. Table 1 summarized the results. Both tests support hypothesis of a unit root in all variables across countries, as well as the hypothesis of zero order integration in first differences. Therefore we can conclude that all variables involved in the estimation procedure are I(1).

Moreover, as mentioned by Shin (2019), if the IPS or MW tests can not reject the null hypothesis of non-stationarity and if one variable is confirmed as non-stationary, then the smaller data coverage of the variable is also non-stationary.

Panel cointegration analysis

Having verified that the presence of stationarity exists among the first difference of those variables in Table 1, the proper way to test for the long run export-income relationship is certainly to test for a cointegrating equation. We continue applying panel cointegration tests developed by Pedroni (1999; 2004) and the Fisher Johansen cointegration test. Pedroni extends the Engle-Granger based cointegration to tests involving panel data and offers two alternative tests: the homogenous alternative (referred to as within-dimension test or panel statistics test) and the heterogeneous alternative (terms the between-dimension or group statistics test). On the other hand, Fisher Johansen cointegration test is a system based cointegration test for the panel data set. Maddala and Wu (1999), with the help of Fisher's combined individual independent tests, adjusted the Johansen test to test for cointegration in whole panel data.

Table 2 reports the results of the Pedroni and Fisher Johansen cointegration tests. For the full sample and for each subsample, the failure of both, the Pedroni's between-dimension ADF statistics test and the Fisher Johansen maximum eigenvalue test, to reject the null hypothesis of no cointegration at a statistically significant level, means that there is a cointegration relationship between the variables.

Table 1. Panel unit root

Variables	Levels		First Differences	
	IPS	MW	IPS	MW
y	3.304	158.15	-17.98***	713.02***
goods & services	-0.928	153.11	-17.86***	769.58***
service	-0.125	174.26	-35.59***	526.76***
communication	6.876	98.97	-22.18***	841.17***
insurance	-0.523	164.73	-22.52***	1598.41***
transport	0.755	167.99	-32.95***	912.00***
travel	-0.523	171.02	-22.52***	919.51***
ICT	0.831	162.99	-12.22***	672.37***
k	1.72	160.31	-17.52***	867.13***
l	-0.261	42.11	-8.920***	245.48***

Notes: IPS and MW are the Im et al. (2003) t-test and Maddala and Wu (1999) t for panel unit root in the model. Null Hypothesis is H_o: unit root (individual unit root process). *** Signifies rejection of the unit root hypothesis at the 1% level.

There exist meaningful long-run relationships between GDP and service exports.[7]

Estimating the cointegrated relationship

Having established that a long-run relationship exists between services export and output, the next stage of the investigation is to estimate the parameters of services export in (2) by the method of fully modified OLS and dynamic OLS (DOLS). Pedroni (2001) describes how between-dimension group-mean panel FMOLS estimator and between-dimension group-mean panel DOLS estimator procedures can be employed to obtain the panel data estimates for β_i. These methodologies are superior to OLS when applied to a heterogeneous panel with I (1) variables. Non-parametric FMOLS is able to deal with serial correlation which uses a heteroscedasticity and autocorrelation consistent estimator of the long-run covariance matrix, whereas parametric DOLS considers lags explicitly when estimated. Both can handle the endogeneity problem given the existence of a cointegrating relationship.

Pedroni (2001) argues that the between-dimension group-mean panel estimator is superior to within-dimension estimators for three reasons: first, in the presence of heterogeneity in the cointegrating relationships, the grouped-mean estimator offers the desirable property of providing consistent estimates of the sample mean of the cointegrating vectors, in contrast to the pooled and weighted estimators; second, between-dimension estimators suffer from much lower small-sample size distortion than the within-dimension estimators; third, point estimates for the between-dimension estimator can be interpreted as the mean value for the cointegrating vectors. This is not true for the within-dimension estimators.

[7] For the low-income countries, the number of observations for ICT service exports is 99, which is not enough to run the Fisher Johansen cointegration test. Therefore, we do not include the ICT services export in low-income subsample.

Table 2. Panel cointegration tests

	Variables	Group ADF statistics	Fisher statistics
Full Sample			
	y services	-4.029***	371.3***
	y communication insurance transport travel ICT	'-2.430***	611.5***
High-income countries			
	y services	-4.209***	162***
	y communication insurance transport travel ICT	-2.816***	268.5***
Upper-middle income countries			
	y services	-1.616*	95.28***
	y communication insurance transportation travel ICT	-1.498*	206***
Lower-middle income countries			
	y services	-2.078**	78.25***
	y communication insurance transport travel ICT	-1.944**	100.2***
Low-income countries			
	y services	-2.581***	41.24**
	y communication insurance transport travel	-1.944**	114.8***

"Note: The Probabilities of Fisher statistics are computed using asymptotic Chi-square distribution. For the low-income subsample, the number of observations (ICT) is not enough to verify cointegrating relationship with real GDP. *, **, *** denote the significance level at 10%, 5%, and 1%, respectively. Null Hypothesis H0: No cointegration

Grouped mean FMOLS AND DOLS estimates are displayed in Table 3. The export-led growth hypothesis states that the export elasticities are expected to be positive. The estimated elasticities of services export with respect to real GDP are shown in Panel A of Table 3 for the full sample and each sub-income group. The statistically significant positive elasticities imply that there is strong evidence of the ELG hypothesis for 89 countries during the period of 1970-2018. The magnitudes of the positive elasticities are generally large, as expected. For the full sample, a 1% increase in services export increases GDP by 0.662% in terms of FMOLS estimates. Corresponding elasticities are 0.55 for low income countries, 0.64 for those with lower middle income countries, 0.84 for those with upper middle income countries, and 0.61 for those with high income countries. Similarly, for the full sample, a 1% increase in services export increases GDP by 0.66% in terms of DOLS estimates. Corresponding elasticities for low-income, lower middle incomes, upper middle incomes and high incomes are 0.62, 0.80, 0.66, and 0.55. The estimated coefficients seem to suggest that the impact of an increase in services export on GDP seems to increase as income increases, except for the countries of high income.

Panel B in Table 3 reports the estimated elasticities of disaggregated services export for the full sample and subsamples. According to Loungani et al. (2017), three sub-sectors, namely insurance and financial services, ICT services, and Communications, computer, etc., are in a group of modern services. Transport services and travel services are classified as traditional services.

The GDP-services export elasticities for the ICT services, insurance, communication, travel, and transport are 0.042, 0.072. 0.091, 0.159, and 0.229 and all statistically significant at 1 % level by using the grouped mean FMOLS estimation.

On the other hand, for the full sample of grouped mean DOLS estimates, ICT services and insurance are not statistically significant; The GDP-services export elasticities for the communication, travel, and transport are 0.171, 0.199, and 0.030 and are significant. For the sub-panel, the communication and travel coefficients are significantly positive in the case of FMOLS estimates. DOLS estimates show no obvious pattern for each sub-panel.

Wald statistics are used to test the hypotheses that for the full sample and each sub-income group the coefficient associated with modern services export is the same as that associated with traditional services export. That is, $\beta_1 + \beta_2 + \beta_3 = \beta_4 + \beta_5$.

Table 3 shows that this null hypothesis is rejected for the full sample at the 1 % significance level for FMOLS estimates and at the 5%significance level in the case of DOLS estimates. The negative t-statistics implies that the GDP-service elasticities are higher in the traditional service export sectors than those at the modern service export sectors. For the sub-income groups, the results are mixed.

The null hypothesis that $\beta_1 + \beta_2 + \beta_3 = \beta_4 + \beta_5$is rejected for high-income and low-income countries in terms of FMOLS estimates; for lower middle income countries, it is rejected at the 1% significance level in the case of DOLS estimates. The null hypothesis that $\beta_1 + \beta_2 + \beta_3 = \beta_4 + \beta_5$ cannot be rejected for lower middle income countries.

Thus, for lower middle income countries, changes in modern and traditional services export have a statistically identical effect on GDP, whereas, for the high and low income countries, a change in traditional services export has a greater impact on GDP than a similar change in modern services export.

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Table 3. Export led growth tests

		Full Sample		High-income countries		Upper-middle income countries		Lower-middle income countries		Low-income countries	
	Variables	*FMOLS*	*DOLS*	*FMOLS*	*DOLS*	*FMOLS*	*DOLS*	*FMOLS*	*DOLS*	*FMOLS*	*DOLS*
Panel A											
	services	0.662*** (0.017)	0.660*** (0.020)	0.612*** (0.018)	0.615*** (0.019)	0.835*** (0.032)	0.803*** (0.038)	0.640*** (0.050)	0.663*** (0.066)	0.548*** (0.056)	0.549*** (0.061)
Panel B											
	ICT services	0.042*** (0.013)	-0.006 (0.036)	0.010 (0.015)	-0.084 (0.055)	0.064** (0.031)	0.106 (0.065)	0.103*** (0.023)	-0.022 (0.058)		
	insurance	0.072*** (0.011)	0.030 (0.036)	0.116*** (0.0.12)	0.042 (0.068)	0.076*** (0.026)	0.084*** (0.032)	0.032** (0.015)	0.026 (0.038)	0.009 (0.019)	-0.010 (0.038)
	communication	0.091*** (0.015)	0.171** (0.080)	0.051** (0.025)	0.302** (0.148)	0.159*** (0.030)	0.110 (0.071)	0.047* (0.029)	-0.112 (0.161)	0.095*** (0.028)	0.166*** (0.157)
	travel	0.159*** (0.017)	0.199*** (0.061)	0.207*** (0.030)	0.118 (0.103)	0.063** (0.036)	0.137** (0.061)	0.214*** (0.026)	0.509*** (0.154)	0.182*** (0.042)	0.160 (0.148)
	transport	0.229*** (0.017)	0.030*** (0.046)	0.285*** (0.084)	0.278*** (0.064)	0.323*** (0.039)	0.336*** (0.025)	-0.010 (0.036)	0.353** (0.143)	0.149*** (0.029)	0.131* (0.074)
Wald Statistics		-0.183*** (0.029)	-0.305** (0.127)	-0.314*** (0.043)	-0.136 (0.203)	-0.087 (0.062)	-0.173 (0.116)	-0.022 (0.065)	-0.970*** (0.372)	-0.227*** (0.052)	-0.136 (0.167)

Note: *, **, *** denote the significance level at 10%, 5%, and 1%, respectively. For the low-income subsample, the number of observations (ICT) is not enough to verify cointegrating relationship with real GDP. The null hypothesis of testing the equality between modern services export and traditional services is $\beta_1+\beta_2+\beta_3 = \beta_4+\beta_5$

Panel Granger Causality

The existence of cointegration between the variables implies that there is a causal relationship between them in at least one direction. We test for Granger causality tests on GDP-exports (services and travel, transport, communication, ICT, insurance services export together) relationship for the full sample and sub-income groups from the panel-based VECM model. The panel-based VECM model can be specified as follows:

$$\Delta y_{it} = \alpha_i \varepsilon_{it-1} + \sum_{j=1}^{k} \Gamma_{1ij} \Delta y_{it-j} + \sum_{j=1}^{k} \Gamma_{2ij} \Delta x_{it-j} + \mu_i + v_i \qquad (4)$$

where Δ denotes first differences and k is the optimal lag length determined by the Schwarz Bayesian Criterion, ε_{it-1} is the estimated long-run disequilibrium which describes the deviation of short-run equilibrium from long-run equilibrium., α_i is the error-correction term that gives the reaction of y_{it} to return the system to long-run equilibrium, and μ_i is a constant for the full sample and sub-panels. In our case, y_{it} is real GDP and x_{it} is a vector containing services, travel, transport, communication, ICT, insurance services export.

Using the specification in Eq. (4) allows us to test for both short-run and long-run causality. The null hypothesis of no long-run causality fromx_{it} toy_{it} for the full sample and the income subpanels is:

$$H_0: \alpha_i = 0$$

And the joint null hypothesis of no short- or long-run causality from x_{it} toy_{it} is:

$$H_0: \Gamma_{2ij} = 0 \text{ and } \alpha_i = 0$$

Panel VECM allows us to test the bi-directional relationship between variables. In the reverse case, x_{it} is real GDP and y_{it} is the services export. Economic growth does not Granger-cause services export if and only if all the coefficients of Γ_{2ij} are equal to zero in Eq. (4). Similarly, Short-run causality tests between variables can also be undertaken in the same fashion.

Table 4 reports the results of the panel Granger causality test. Panel A shows the causality from export to GDP, whereas Panel B is the reverse direction. The optimal lag is chosen by using the Schwarz Bayesian Criterion and the labor and physical capital are used as exogenous variables in the estimation. The long-run causality term in Table 4 is also the error correction term in the Panel VECM model. The negative and significant error correction term represents that there is a long-run relationship between growth and export.

Furthermore, the negative error correction term coefficient implies that when there are deviations from its long-run equilibrium, short-run adjustments in export will return to the long-run path and its value measures the speed of adjustment convergence towards equilibrium level in the long run. The coefficient ofα_i, for the full sample in the first column of Table 4, is negative and significant at a 1% level meaning that the system corrects its previous periods' disequilibrium at a speed of 35.7% annually.

The negative and significant error correction terms in panel A of Table 4 for the full sample and subpanel by income groups indicate that there exist long run relationship between services export and income in the case of total services export. At the same time, significant coefficients also represent the long-run causality running from Table 4.

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Table 4. Panel Granger causality tests services export to real GDP

	Lags		Total services	ICT, insurance, communication, travel, transport
Panel A: from services export to GDP				
Full Sample				
	3	*Long run causality*	-0.357*** (0.008)	-0.364*** (0.013)
	3	*Short run and Long run causality*	1725.86***	810.57***
High-income countries				
	1	*Long run causality*	-0.266*** (0.012)	-0.280*** (0.015)
	1	*Short run and Long run causality*	465.71***	341.62***
Upper-middle income countries				
	2	*Long run causality*	-0.530*** (0.014)	-0.457*** (0.020)
	2	*Short run and Long run causality*	1518.15***	606.00***
Lower-middle income countries				
	1	*Long run causality*	-0.212*** (0.035)	-0.046 (0.052)
	1	*Short run and Long run causality*	37.11***	24.98***
Low-income countries				
	1	*Long run causality*	-0.117*** (0.018)	0.010 (0.032)
	1	*Short run and Long run causality*	45.31***	0.430
Panel B: from GDP to services export				
Full Sample	*Lags*		*Total Services*	
	1	*Long run causality*	-0.022*** (0.001)	
	1	*Short run and Long run causality*	990.96***	
High-income countries				
	1	*Long run causality*	0.005*** (0.0004)	
	1	*Short run and Long run causality*	262.16***	
Upper-middle income countries				
	1	*Long run causality*	-0.051*** (0.002)	
	1	*Short run and Long run causality*	585.99***	
Lower-middle income countries				
	3	*Long run causality*	-0.135** (0.060)	
	3	*Short run and Long run causality*	13.74***	
Low-income countries				
	2	*Long run causality*	-0.001 (0.003)	
	2	*Short run and Long run causality*	13.91***	

Note: The Wald statistics are computed using asymptotic Chi-square distribution. For the low-income subsample, the number of observations (ICT) is not enough to estimate panel VECM model. *,**,*** denote the significance level at 10%, 5%, and 1%, respectively. Null Hypothesis H0: No cointegration

Furthermore, the null hypothesis of non-causality in both the short and long run is rejected at the 1% significant level for the full sample and sub-income panels. Corresponding tests for the panels of sub-service sectors, which is the second column of Table 4, the error correction term is negative and significant for the full sample, high incomes, and upper middle income countries only. The null hypothesis in the short run and long run only is rejected for both lower middle income and low income countries.

Concerning the other direction of the causal relationship presented in Panel B of Table 4. Wald test statistics in panel B reveal that all the short- and long-run effects are significant at the 1% level for both the full sample and sub-income groups. The long-run effect of output on services export is negative and significant for the full sample, upper- and lower- middle income countries. The error correction term is significantly positive for high income countries and insignificantly negative for low income countries. These results combined with the outcome of the panel A imply that the long-run growth response to permanent shocks in services export tends to provide stronger evidence than the services export response to permanent changes in growth; hence, growth is more sensitive to services export than vice versa. The results show that in the long run free trade policies prove beneficial to productivity and growth, which is consistent with recent literature that suggests that openness promotes economic development through various channels, such as technological spillover, economies of scale, and rising competition.

Conclusion

Total exports served as an engine of growth has been recognized in the development and growth literature for many decades. The ELG hypothesis stresses that export activity leads to economic growth. The growth records of four Asian tigers: Hong Kong, Singapore, Korea, and Taiwan, second-generation four Asian tigers (Malaysia, Indonesia, Philippines, and Thailand) are cited as such examples.

A large number of empirical studies have been have used a wide variety of definitions of export and growth variables. In most cases, the variables are the real total, manufacturing, mineral, agricultural, technology export, and real GDP or the growth rates of these variables.

Services export contribution to total exports has gained much attention in recent years, and surprisingly, there have been very few empirical studies on the impact of services export on GDP. This paper aims to investigate the relationship between GDP and services (and sub-service sectors) exports for a sample of 89 countries. This paper extends existing studies of services export-income relationship in two ways: first, we examine real services export and real GDP in levels to provide information on long-run relationship; and second, we examine causality from services exports to GDP and from GDP to services export.

Panel cointegration test results show that there exist long-run relationships between GDP and services exports and sub-services for the full sample of 89 countries and each subsample by income group. Long-run relationships are estimated by group mean fully modified OLS and dynamic OLS. Total services export significantly determines GDP, in a Granger-causality sense. This result supports that of Sermcheep (2019) and Priyankara (2018). For the full sample, we find that the total services export elasticity of GDP is 0.66 in the case of FMOLS estimates, whereas those for low, lower middle, upper middle and high incomes are 0.55, 0.64, 0.84, and 0.61 respectively. Corresponding services export elasticities are 0.66 for the full sample and 0.55, 0.66, 0.80 and 0.62 for the sub-samples. When we classified the services export into modern and traditional groups, Wald statistics show that the contribution from traditional services exports growth is higher, for the full sample and high and low income countries, comparing to those from the modern sector. Finally, panel causality test results provide strong evidence that services export Granger-cause GDP, but weaker evidence of GDP-services export causality.

The conclusion that services export can play a role similar to that of merchandise exports as an engine of growth lends support to Sermcheep (2019). The significant long-run causality of GDP-services export results seem to suggest that the trade liberalization policies advocated and pursued by the countries all over the world to stimulate economic growth by lowering trade barriers and more technological progress seem justified.

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