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How does manufacturing output affect export behaviors in emerging market economies? Evidence from a dynamic panel ARDL for ten biggest emerging market economies

Arumugam Sankaran[1*], Arjun Krishna[1] and Arjunan Vadivel[2]

Abstract

Realizing the export-led economic growth potential, the study aims to check the dynamic influence of manufacturing output premised on learning effects model on the export behavior of emerging market economies. Among the mean group and pooled mean group models in the umbrella method of autoregressive-distributed lag econometric technique, the latter one was chosen as it has added advantages. Also, it is supported by the Hausman test. The findings articulate that manufacturing value-added is an important ingredient, which influences the export testifying the existence of dynamic learning effects in export growth. A dynamic model of acquiring sophistication among exporters pinpoints the learning effects technique of exports. The export competitiveness is actualized through a dynamic learning process. The policy suggestion in this regard is to pace up mechanization of the economies, foster measures to reduce supply rigidities and labor market inflexibilities, and assist small and medium-scale enterprises and other types of firms in finding fresh avenues of long-term investment from foreign and advocating domestic supplies.

Keywords: Internationalization, Emerging markets, Export behavior, Panel ARDL, Industrial-driven growth

Introduction

Achieving a higher level of economic growth coupled with a well-sophisticated standard of living occupies a predominant place in the developmental agenda of many nations. The development experience of the world portrays that though a good number of instruments have been used to achieve paramount and sustainable growth throughout development, export holds a significant place in facilitating a nation to obtain a targeted level of growth in a stipulated period. Owing to its significant contribution in exchange-rate earning, international relation and related support systems, many studies have been pursued on a different dimension of international trade in general and export in particular. The theoretical insights narrating the statistically significant relationship between export and economic growth dates back to Adam Smith, David Ricardo, Haberler, Cordon and others. The quintessence of the utilization of the ideal resource, vent for surplus, staple growth, technological spillover, static and dynamic gains has coined the world-famous hypothesis that '*trade as an engine of growth*.' In the growing body of literature, the nexus between export and economic development has been well articulated. Among the available empirical studies Thirlwall [45], Grossman and Helpman [22], Rivera-Batiz and Romer [39], Young [49], Chuang [14] and Blecker [10] have documented the substantial role played by the export in enhancing the

*Correspondence: sankaranecopu@gmail.com
[1] Department of Economics, School of Management, Pondicherry Central University, Pondicherry, India
Full list of author information is available at the end of the article

economic status and welfare of the nation. While many factors influence the pattern, direction and volume of export, industrial development significantly correlates with export.

Further, the industrialists have to undergo considerable augmentation in their sophistication level, technical know-how as they experience a learning process regarding the dynamics of export markets, the level of competitiveness and technological requirements. As a result, they become competitive in the export market over time and standardize their products with a lag. The favorable export regime will appear once the learning process has been realized.

Hence, the present study has been proposed to check the influence of learning effects model on export premised upon manufacturing output on export in the multi-country context premised on the dynamic effects of the learning effects hypothesis. The learning effects model is discussed in detail in the literature review.

The rest of this research article is structured as follows: "Emerging markets: a snapshot" section offers a snapshot about the nature of emerging market economies in general and their performance with respect to international trade in particular. "Literature review" section critically analyses the existing studies in terms of the relevance of export growth path-way, export performance and learning effects premised upon manufacturing sector and manufacturing-led export strategies. "Methods" section elucidates the data sources, variables used, the approach of the study and the econometric model incorporated. "Results" presents the estimated results and discusses the empirical findings. Finally, the conclusion and policy implications are drawn in "Conclusion" section.

Emerging markets: a snapshot

The term 'emerging markets' was coined in the International Finance Corporation in 1981 [46, 48]. Later, it became a popular icon in a short period and attracted the attention of policymakers, researchers, managers and economists as the world nations played different types of socio-economic roles in the global market in the form of production and value chains, etc. [18, 25, 26, 33]. In the recent period, emerging markets are used as an alternative to emerging economies [49]. The general perception of the social scientists and management scholars about the emerging markets is that it is encompassed by all economies that are not considered 'advanced' [21, 25, 36, 49]. In his forthright view, Carrasco and Williams [12] reveal that the nations experience a perceptible growth in gross domestic product, ceaseless increase in the volume of export and substantial improvement in the foreign reserve are considered as emerging market economies.

Industrialization is seen as a significant economic activity for increasing per capita income in the 1960s and 1970s in most of the industrialized nations [3, 9, 47]. Still, these nations moved upward and achieved service-oriented growth. At the same time, some emerging market nations, particularly in eastern and central Europe, have maintained an industrialization rate [30]. Since the financial crisis in 2008, some of the emerging nations such as Brazil, Turkey and South Africa have taken advantage of rising commodity prices, earmarked the extra money earned on the creation of jobs and subsidies. Further, they attracted a heavy dose of foreign direct investment for their development by changing the interest rate. The well-matured domestic market in some emerging nations facilitated producing and exporting low-cost goods and services by utilizing the existing labor force and fueled a higher degree of growth. For instance, India and China are the powerhouses among the emerging market nations. They together accommodated around 35% of the total world's labor forces, and their collective GDP was higher than that of the European Union in 2018. In the manufacturing products, the emerging market economies are contributing an ever-greater share in the world market. Particularly with the support of the low-skilled and labor-intensive sectors, emerging nations achieve robust growth in the production of cotton, iron ore, copper, wheat, coal, and cattle. Recently, emerging nations have obtained may opportunities to establish modern industries (such as the production of cars, computers, air conditioners, cell phones, etc.) in the context of global value chains in which different stages of processing are pursued in different parts of the world based on their comparative advantages.

The pulsating performance of the emerging market economies has epitomized the global business landscape and augmented the total volume of production and export in the past few decades. As a result of their higher growth performance, they developed business ties with developed nations and became leading world growth drivers. The growth pattern of the emerging market economies reported a robust growth of 7% per annum in terms of GDP when compared to around 3% growth of the developed market economies [11]. Many of these nations adopted the export-driven strategy. As a result, 48% of the total export of the globe has originated from emerging market nations. The wealth status, standard of living, and life expectancy of these nations have risen remarkably [33, 34, 36].

Consequently, many nations have a track record of economic growth higher than the average global growth. In this growth episode, both industrial development and export played significant roles. Under this circumstance, estimating the effect of the manufacturing sector on the

export in emerging market nations deserves scientific research. Hence, the present research has attempted to estimate the magnitude of manufacturing output's impacts on export behavior in big ten emerging market economies. Using the appropriate ARDL technique, the study found that the manufacturing output is the chief driver of export in emerging market nations, followed by import and GDP in the long run. Hence, the real contribution of this research is that it extracts the degree of impact of industrial output on export and offers an important source of knowledge about the relevance of industrial development in the context of the emerging market.

Literature review

Relevance of export growth strategy

Export-led growth strategies have been portrayed as one of the signs of development as it gives wide scope for economies of scale and increasing returns. Chow [13] unearthed the causal pattern between export growth and growth in manufacturing output and found reflexive relation escalating in Hong Kong, Brazil, Israel, Korea, Singapore, and Taiwan. Further, he detected a unilateral causal connection stemming from export growth to output growth in Mexico's case and no causality in the results for Argentina. This finding lies in sharp contrast to Jung and Marshall [31], who dissected Granger causality and testimony for export-led growth hypothesis in only 4 out of 37 countries.

The study of Bahmani–Oskooee conforms with the works of Jung and Marshall. So the relevance of the export-led growth hypothesis and the pursuance of export growth studies are motivated by their disruptive reflections of growth generating capability of export-oriented strategies. But such a relationship is found to be augmented by the study of Chow indicating the export and economic growth relationship, which is rather reflexive. That is, a two-way relationship has been dissected contributing to a symbiotic and cointegrating atmosphere of synergizing effect between the duo. This provides ample knowledge of empirical implications that as export activities strengthen long-term and short-term growth prospects, output expansion rewires the structural setting in favor of export generation activities and leads to an export multiplier process. This is thus akin to a *give and take* process, which is self-generating and self-sustaining. Such an outcome envisages the determining role of output expansion on export augmentation.

Export behavior has been constantly amplified by factors belonging to different dimensions such as better institutional environments, effective and timely decisions of the CEOs [35], management knowledge, internationalization of SMEs in the garment and textile industries in emerging African countries [17]. Hall et al. [24] did not differentiate emerging economies from the other developing countries argues the deleterious and substantial imprint of exchange-rate volatility on trade. Large firm size and a good internationalization strategy are the most significant strategic options for enhancing firm export performance in this market. Adu-Gyamfi and Korneliussen [1] portrayed the impression of resource commitment, experiential management, size of the firm, and internationalization on export performativity, keeping interior export obstructions as an intervening variable.

Export performance in emerging markets and manufacturing sector

Posner [40] and Vernon [49] elicit how imitating countries absorb a non-standardized innovative product from high technology nations through, standardize it and undersell the product in the world market and finally the high technology nations' market too. Their theories are, respectively, termed as technology gap model and product cycle models. The theories highlight the classic example of transistor industry-related technological disruption process that started in the USA, Japan, later internalized, standardized and started underselling the same in the third market and in the US market itself. Similarly, India is an apt example of a nation that has created ICT specialization by inheriting from the USA.

Castellani [15] conducted a study among Italian manufacturing products and dissected evidence for learning effects. Exporting involves a lot of learning process and the firms, which go through this process become competitive. In 2006, Edwards and Alves observed a large growth and diversification in the export performance of Africa primarily being led by the manufacturing sector and the major factors identified to this upsurge are real effective exchange rate, infrastructure costs, tariff rates and skilled labor. Agasha [2] by dissecting the determinants of export growth for the period 1986–2009 highlighted that foreign price level and terms of trade are significant contributors. Further, he found that FDI, real exchange rate and GDP have an insignificant influence on export prosperity. The study adds diversification of exports using manufacturing products to sustain the growth. Sankaran et al. [42] examined the effect of exports influence on manufacturing value-added where the key influencer was energy input in the context of late-industrialized nations. But the reverse instance of dependence is not estimated.

Jer [29] focuses on the export manufacturers' role in export augmentation in which innovative strategies and functional upgrading improve their innovativeness and export performance. Bianchi and Wickramasekera [10] observe that many SMEs in the emerging markets of Latin America are involved in export-related activities.

The result shows that the manager's export commitments and managerial and organizational endowments are key thrust factors in promoting growth. This emphasized the role of the manufacturing sector, particularly, that of SMEs in export augmentation process. Pacheco-Lopez [37] dissected a new dimension of the Kaldor model [32]; in a nutshell, the Kaldor's law states that: faster growth rate in the manufacturing sector brings in a much faster growth rate in GDP. Further, the high paced manufacturing growth induce a much higher paced increase in labor productivity. Pacheco-Lopez unearthed a close association between manufacturing output and export growth from 88 developing countries during 1990–2011. Relying on the reflections dissected from the study, he analyzed the Kaldor's first law in an open economy context.

Learning effects and manufacturing-led export strategies

Young [50] could be regarded as one among the illustrious researchers who were involved in innovatively applying *the learning by doing model* in international trade for the first time. Clerides et al. [16] in the context of Mexico, Columbia and Morocco postulated that firm-level productivity experiences an uptick during post-export market entry-regime because of the fall in *X*—inefficiency as a result of augmented export competitiveness, self-equipment of new technology, and economies of scales in operation due to widening market. To enhance learning effects, they adopted a dynamic choice model of Roberts and Tybout [40] in the context of Columbia, which implies that there exists a reflexive relationship between exports and productivity.

Eaton et al. [19], again in the context of Columbia, reported that the application of search and learning model was instrumental in successful exporters to persist in the foreign market. Fernandes et al. [20], in the example of China, explain how learning from neighbors is instrumental in exporters' entry into the market, opening sales, endurance, and advancement. Aitken et al. [4] examine in the context of Mexico and affirm that the firms that pierce the foreign markets diminish entrance charges for other budding exporters, either via learning effects or establishing commercial linkages. K et al. [7] argued that the relevance of manufacturing output where human capital has significant influence. Implicit in this is the relevance of learning effect embedded in manufacturing output, which could contribute to exports in the instance of late-industrialized nations.

It is globally accepted that trade is an engine of growth and manufacturing output is the best fuel to make trade more vibrant. Hence, research on trade, even in the manufacturing sector, is quite high. At the same time, a very few scholars (for instance Al Janabi [5], Javalgi et al. [28], Singh [44], İpek [27], Onyiriuba et al. [36], and Hajilee and Niroomand [23]) examined the performance of emerging market economies on different dimensions. But research in examining the robust contribution of the manufacturing sector toward international trade, particularly in the context of emerging market economies, is very scanty even though not consciously. Hence, the present study is an attempt to fill the gap existing in the literature.

Learning effects model is largely pursued in the context of a limited panel or single country instances, which were not largely generalizable. Despite there were attempts to revisit the theory in 2014 and all, the studies were limited to single countries, which may fail to generalize in a group of countries in the same genre and thus fail to bring in a cosmopolitan policy-frame. Distinguishing itself from the major studies restricted to China, Mexico and Columbia and certain developed ones like Italy, the current study is a very recent attempt and thus a revisit to the learning effects model. Further, the paper offers an empirical analysis of ten biggest emerging nations (BEM). This would help us to evolve a largely generalizable evidence of the learning effects model in the case of emerging nations.

Methods

Data

To estimate the long-run relationship between industrial development and export behavior, the study considered ten leading players among the emerging market economies such as *Argentina, Brazil, China, Indonesia, India, Korea, Mexico, Poland, Turkey and South Africa*. These nations are deliberately selected because of their appreciable economic performance, market expansion and export augmentation in the past few decades. The study used time-series data for a period of four decades from 1980 to 2019. Hence, the total number of observation considered in this study is 2000. To establish the dynamic nexus between export and industrial sector, we sourced the total monetary value of export from the direction of trade statistics published by the International Monetary Fund. While, time-series data on the total monetary value of import (which is one of the additional determinants) is also collected from the same data source. Manufacturing output is the chief determinant in our model. Hence, data on the manufacturing value-added, gross fixed capital formation and GDP have been collected from the famous database called World Development Indicators, published by the World Bank. Among the endogenous and exogenous variables considered in our model, both export and import are expressed in million USD; hence, GDP at constant 2010 USD is also converted into a million USD. Both manufacturing value-added and gross fixed capital formation are also expressed in million

USD. Before estimation, all the data were converted into the natural logarithmic form. We have employed manufacturing output as the independent variable to learn how manufacturing sector induced export takes place. Since learning takes place over time and with a lag, the manufacturing level data itself measure the learning effect. Other regressors are control variables used to insulate the interlink between manufacturing output and export performance (translated into learning effects and export performance) from other significant influencers. In this way, we could obtain partial regression coefficients. We have tried to be maximum honest with the kind of methodology we employed. Further, GFCF measures capital and export interlink, while GDP reflects structural change and the influence on the economy, and import proxies for technology penetration and resulting effect on export.

In our time-series data frame, for instance, gross fixed capital formation for Argentina and manufacturing value-added for China are considered as missing for a few years. Hence, to overcome this issue, we applied the data interpolation technique. All variables are converted into natural log form to achieve a normalized data set, and further, the econometric technique is used as directed by the preliminary estimation. The functional form of this model is as follows:

$$\text{LogExp} = f\left(\text{loggfcf},\ \text{loggdp},\ \text{logimp logmva}\right)$$

Estimation procedure

Before applying the time-series model, it is a prerequisite to assess the nature of the data set; hence, as an initial step, we checked the stationarity condition of the variables considered in this model. As the data set is panel in nature, we computed the panel unit root test of Levin, Lin and Chu, Im, Pesaran and Shin, ADF-Fisher Chi-square and PP-Fisher Chi-square at both constant and constant and trend form. The estimated result directed us to choose the Panel ARDL model as some of our variables are $I(0)$ and the remaining are $I(1)$. The ARDL technique developed by Pesaran et al. [38] has some added advantages over that of the conventional cointegration method advanced by Johansen and Juselius [30]. In the previous publications, researchers [6, 41, 44] highlighted that this model could be estimated,even if the exogenous and endogenous variables are in the mixed form of $I(0)$ and $I(1)$. The instantaneous and lagged response could be obtained by using both short- and long-run equations, simultaneously. Moreover, it tolerates the endogeneity problem by adding lags of targeting and targeted variables. Hence, the study has chosen the panel ARDL as an appropriate technique and the same is expressed in the mathematical form mentioned below:

The mean form of panel ARDL is (1, 0, 0, 0, 0), and the lag selection is instituted based on the Akaike information criterion (AIC).

$$Y_{1t} = \alpha_i Y_{i-1} + \sum_{j=0}^{1} \beta_{ij} X_{i,t-j} + \mu_i + \epsilon_{it} \tag{1}$$

$X_{i,t-j}$ is an $n \times k$ vector of all independent variables (……..), β_{ij} is $k \times 1$ coefficient vector, μ_i is country-specific effect and ϵ_{it} is white noise term (means variables have zero mean and constant variance). The short-run form of the model, including the error correction term, is specified below.

$$\Delta Y_{it} = \delta_{1,i}\left(Y_{i,t-1} - \pi'_{1,i} X_{i,t-1}\right) + \pi^{*'}_{1,i} \Delta X_{it} + \mu_i + \epsilon_{it} \tag{2}$$

where $\delta_{1,i} = -(1 - \alpha_i)$ and $\theta_{1,ji} = \frac{\sum_{j-0}^{1} \pi_{ij}}{1-\alpha_i}$.

Results

Manufacturing output can influence global export in multiple ways due to demand elasticity in the global arena and longevity of the manufacturing products. In this work, to estimate the dynamic effect of manufacturing output on export in ten emerging market economies, we employed an appropriate econometric tool on the time-series data collected for the period from 1980 to 2019. At first, we extracted the summary statistics for both explanatory and explained variables. The result presented in Table 3 provides the insights that all variables are normally distributed. Mean and median are closely associated. Further evidence from the Jarque–Bera value conformed the normal distribution of the variables, which are considered in our model. It is generally believed that the variables should be distributed generally for further estimation. The result of the correlation matrix is reported at the bottom portion of the same in Table 3. There exists a multi-collinearity problem if the correlation coefficient exceeds 0.8.

Our result revealed all variables are decently correlated with each other except manufacturing value-added and import in the nations considered in this study. Results demonstrated that a weak correlation exists between these two variables. Mention should be made here is that the prime focus of this research is to estimate the impact of manufacturing output on export. Before estimating the panel time-series model, it is necessary to determine the stationarity structure of the time-series variables. Hence, we used the Levin, Lin and Chu, Im, Pesaran and Shin, ADF-Fisher Chi-square and PP-Fisher Chi-square tests of panel unit root through the constant process and

Table 1 Result of panel unit root test. *Source*: Computed from secondary data

	LLC test		IP & SW test		ADF FC test		PP FC test	
	Constant	Constant and trend	Constant	Constant and trend	Constant	Constant and trend	Constant	Constant and trend
Tests in logarithmic levels								
EXP	−0.76	1.96	2.97	0.54	4.41	13.12	4.85	15.53
GFCF	−2.03***	−1.89	−2.03**	−1.76	32.16**	34.69	29.17**	35.23
GDP	−2.27**	−0.76	2.82	−0.71	24.95	22.71	45.76***	19.16
IMP	−3.13***	2.41	1.66	2.61	12.14	7.85	13.19	10.01
MVA	−0.48	0.01	−0.07	0.81	22.66	16.90	23.28	16.27
Test in logarithmic first difference								
EXP	−15.87***	−14.26***	−15.35***	−13.77***	214.94***	176.87***	214.89***	179.15***
GFCF	−13.17***	−10.16***	−12.57***	−10.40***	172.68***	130.33***	195.63***	164.33***
GDP	−12.14***	−11.95***	−11.88***	−11.60***	162.35***	147.35***	188.05***	364.56***
IMP	−14.67***	−13.53***	−14.42***	−13.24***	201.09***	165.92***	202.13***	167.32***
MVA	−14.74***	−16.37***	−14.29***	−15.91***	199.70***	225.51***	226.89***	300.27***

*** ,** and * denote 1%, 5% and 10% levels of significance

constant and intercept for both level and first difference. The computed result accommodated in Table 1 is elucidated from the above-mentioned panel unit root tests. The result implies that export, GDP import and manufacturing value-added are stationary at the first difference, but the gross fixed capital formation is stationary at the level in our time-series data set. This environment permits us to reject the null hypothesis, indicating that all variables are stationary in the first difference. Hence, it is proved that our data set is suitable for the estimation of panel ARDL.

In our exercise, we estimated both the PMG and MG model with the help of STATA-14. The appropriate model should be chosen based on the Hausman test. As the estimated *p* value of the Hausman test is more than 5%, we accepted the PMG model. According to Asteriou and Hall [8] and Roudet et al. [43] normally, the PMG model derives the coherent and asymptotic properties of the estimator for the stationary and non-stationary variables [I(0) and I(1)]. Further, the PMG model offers the long-run and short-run relationship among the co-integrated variables and provides error correction term, which facilitates us to confirm the existence of the long-run relationship and speed of adjustment [6]. The result reported in Table 2 articulates that quite expectedly, the error correction term is negative, and its corresponding probability value is significant, testifying that there is a long-run relationship among the time-series macroeconomic variables. It is worth noting that manufacturing output influences the export volume at 5% level of significance in the selected ten emerging market nations over the period under study.

The magnitude of the influence depicts that a 1% increase in manufacturing value-added facilitates to export 0.26% to the global market. The role of the learning effects model could be identified with abundant statistical significance. This is more deeply and effectively understood, if we look at the short-run relationship of manufacturing value-added with the outcome variable, which is negative, and the coefficient is −0.43. There is a definite and striking difference from short-run with a large negative dip to a moderate positive value of 0.26 in the long-run. This result confirms the significant role played by the industrial sector directly in the international trade and indirectly in economic development and welfare enhancement of the selected emerging markets nations. Mention should be made here that import is one of the additional determinants; its influence is also positive and statistically significant at 1% level on export.

The estimated statistical evidence illustrates that a 1% increase in import increases the export by 0.96%. This trend testifies that the emerging nations import preferably machines and equipment which are used in export-oriented industries. The import is supposedly composed of technologies that are required to practically apply learning effects model in the long-run. The export performance ought to be complemented mainly by the technology and learning effects model. The influence of import had invoked above-average performance of 0.68 per cent on exports in the instance of short-run evolving into the long-run value of near 100% response (0.96

Table 2 Result of pooled mean group regression. *Source*: Computed from secondary data

Panel variable (*i*): country1					Number of obs = 390	
Time variable (*t*): year					Number of groups = 10	
					Obs per group: min = 39	
					avg = 39	
					max = 39	
					Log likelihood = 759.0555	
D.exp	**Coef.**	**SE**	***z***	***P>z***	**[95% conf. interval]**	
ECT						
gfcf	0.1119	0.1220	0.92	0.359	−0.1272	0.3511
gdp	0.2585	0.1386	1.86	0.062	−0.0132	0.5302
imp	0.9627	0.0600	16.03	0.000	0.8449	1.0804
mva	0.2620	0.1067	2.45	0.014	0.0528	0.4713
SR						
ETC	−0.2303	0.0581	−3.96	0.000	−0.3442	−0.1164
Gfcf D1	0.4001	0.1309	3.06	0.002	0.1434	0.6567
gdp D1	1.7697	0.4031	4.39	0.000	0.9796	2.5598
imp D1	0.6405	0.1049	6.10	0.000	0.4348	0.8461
mva D1	−0.4369	0.1800	−2.43	0.015	−0.7898	−0.0840
_cons	−0.6368	0.1502	−4.24	0.000	−0.9313	−0.3422
	Hausman test				0.5405	

per cent). GDP influences the exportation of an emerging market nation at a 10% level of significance. This indicates that changes in the structural spectrum have desirable long-run consequences on exports. This result is a testimony to the lack of support from the governments of emerging market nations for export sectors and industries exclusively focusing on export-oriented products. Hence, supportive packages of governments in the form of subsidies, special grants and special loans will enhance the export sectors of the emerging market nations to tap the untapped potential markets of the world.

The short-run result provides some interesting insights that the manufacturing output has negatively affected the export volume in emerging nations. The statistical evidence revealed that a 1% increase in the manufacturing output decreased the total export by 0.43%. Hence, manufacturing units need sufficient maturity time to develop exportable commodities. Another important point that should be mentioned here is that the gross fixed capital formation influenced insignificantly in the long run turned to be significant in the short run, while other additional determinants such as GDP and import made substantial impacts on export in the short run.

Discussion

What could be the reasons behind all these dynamics? In the long run, manufacturing output surged to be one among the variables sharing a positive affirmation with the dependent variable, i.e., exports. It should be mentioned that we are considering a dynamic model of learning effects, which is relevant in BEM nations. In the current scenario, the industrial units do not have an instantaneous positive influence on export as they arrived at the required level of expertise, sophistication competitiveness only in the long run because they undergo a learning process post the export market entry. Furthermore, in the short run, there are supply rigidities in the market including raw material and labor supply rigidities. So we are left with a constrained production system that constrains the export horizon. But in the long run, supply becomes flexible and industrial output expands widening export spectrum. The effect is realized with a lag.

As Kaldor mentions, GDP expansion leads to structural shifts influencing manufacturing export. Manufacturing output can also expand export. But if we extend Kaldor's growth theory to the open-economic sector, the results in the paper can be justified, because primarily export horizon has been enlarged by the structural change. Further, the gross fixed capital information has realized its

effect, encouraging potential in the long run, indicating a 0.11% change in outcome variable for the increase in the regressor.

But among the whole set of variables, the most prominent variable turned out to be that of import. A 1% increase in the imports results in a 0.96% increase in exports. This indicates they are importing many manufacturing goods, in which technology is embodied. It is technology that drives export augmentation particularly led by the technology accumulation in manufacturing sector. The above results should be connected with the correlation matrix. We could see that correlation of manufacturing with import and GDP is moderate (around 5, which is safe and not suggesting multi-collinearity). These connections better explain how to import, and how structural changes strengthen manufacturing output, which further enlarges export.

Conclusion

The study embarked on ten emerging nations exploring the cointegration relation of export with manufacturing, GDP, imports and GFCF using panel estimation technique of PMG, generated distinct dynamics. The key variable taken was manufacturing, while others were added as the control variables to dissect the manufacturing output effect on export growth. The estimated model points out long-run positive association stemming from the key variable-manufacturing output and control variables,except for GFCF. The manufacturing output has a 0.22% favorable effect on the regressand for every 1% increase in the quantum. The learning effects model seemed to be valid in this regard. The short-run negative relation present among the variables indicated that supply rigidities in the output would constrain export, but a flexible supply of raw materials and capital can amplify export expansion. The key policy suggestion in this regard is to ensure an uninterrupted supply of resources, including time. It means unnecessary transaction costs in getting supplies and loss of time should be eliminated with effective policy intervention.

Among the control variables, the vital affirmative imprint is chalked out from import. Import contributes to a 0.96% increase for every per unit increase of the quantum. As we see in the case of emerging markets like India, the major import share is from manufacturing products. These goods are inbuilt with new technology. This can induce production augmentation, which further leads to export. The famous models such as the product gap model and life cycle models propounded, respectively, by Posner [40] and Vernon [49] argue that low-technology countries take the innovative country goods as raw material and, after doing value addition export it to the third market, and after the final stage of standardization to the high technology countries from which the product has been imported. Japan followed similar pathways in the cases of the radio industry, while India, in terms of IT industries. This shows India can bring similar outcomes, which are possible again by a well-flourished industrial sector.

The structural changes initiated by the GDP expansion intensify the export sector. We could integrate this observation into the theoretical realm if we expand the Kaldor model to an open economy context. To pursue export growth, we need to bring in a vertical and horizontal expansion of the economy and keep macroeconomic stability. The policy should be framed in this regard. Gross fixed capital formation has a sufficiently positive effect on export but not statistically significant. This implies that policymakers should frame policies to attract foreign and domestic long-term investments, remove labor market rigidity problems, etc. The investment is insignificant as it is likely that capital intensive technologies inbuilt in investment goods will serve the BEM nations having a comparative advantage in labor. The countries should look for labor-intensive technologies.

The major observation chalked out from the analysis is that the manufacturers undergo a learning process after the entry of the export market. This learning process involves a dynamic effect, which helps the exporter identify the technology that should be imported, required competitiveness, standardization and sophistication in the product to augment competitiveness. Thus, the dynamic effect of the learning process involves a lagged adjustment to the required competitiveness, warranting export growth.

In a nutshell, the study pinpoints the potential of augmenting mechanization relying upon comparative advantage to ensure large-scale export enlargement. The learning process involves identifying strategic areas of concern and speeding up the learning process; besides, expert opinions may help. Further, the emerging markets, including India, have a comparative advantage in labor. Hence, firms should look forward to importing labor intensive/capital saving techniques. This manufacturing output–export tranquillizing relation can be maximized by addressing key policy issues underlined in the relationship dynamics of the key variable and control variable with that of predictand. Further, assisting SMEs and other types of firms in finding fresh avenues of long-term investment from foreign and domestic supplies is advocated as they are involved in export-related activities.

Scope for future research

The present study assessed the nexus between the manufacturing output and export in the context of ten biggest

emerging market economics. The relevance of the world-renowned learning effects model is checked and ascertained at the aggregate level. Further sources of learning effects and potential sources of learning sophistication shall be the new spectrum of enquiry. The complementarity between R&D, technology imported and learning effects, as well as their interaction, has to be further observed. Moreover, further studies on the comparison between high performers and low performers in the emerging market nations will display the full spectrum of the emerging market economies. Also, the insights into such kind of studies will be very useful to the entire hub of the emerging market world.

Appendix

See Table 3.

Table 3 Descriptive statistics and correlation. *Source*: Computed from secondary data

	EXPO	GFCF	GDP	IMP	MVA
Mean	4.782	1.360	8.798	4.831	1.285
Median	4.730	1.350	8.748	4.790	1.260
Maximum	6.270	1.650	10.062	6.420	1.510
Minimum	3.580	1.010	8.128	3.450	0.970
SD	0.577	0.126	0.376	0.580	0.117
Skewness	0.304	0.045	0.760	0.415	0.034
Kurtosis	2.403	2.521	3.517	2.746	2.371
Jarque–Bera	12.132	3.950	42.998	12.582	6.654
Probability	0.002	0.138	0.000	0.001	0.035
Sum	1912.990	544.020	3519.569	1932.670	514.030
Sum Sq. Dev	133.2082	6.351	56.636	134.645	5.531
Observations	400	400	400	400	400
Correlation					
EXPO	1				
GFCF	0.535	1			
GDP	0.616	0.506	1		
IMP	0.768	0.523	0.737	1	
MVA	0.543	0.493	0.123	0.086	1

Abbreviations

ADF: augmented Dickey–Fuller test; ARDL: autoregressive-distributed lag; BEME: big emerging market economies; CEOs: chief executive officer; GDP: gross domestic product; FDI: foreign direct investment; ICT: information and communications technology; MG: mean group; PMG: pooled mean group models; SMEs: small and mid-size enterprises; USD: United States Dollar; GFCF: gross fixed capital formation; IT: information technology; EXPO: exports; GFCF: gross fixed capital formation; IMP: imports; MVA: manufacturing value-added.

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Authors' contributions

The authors contribute in ratio 50, 30 and 20%: the corresponding author (50%); second author (30%) and the third author (20%). The first author AS framed the research issue, collected data and prepared the theoretical part and interpretation. The second author KA estimated the result and provided suggestions for the preparation of interpretation, while the third author AV collected source materials, contributed to the review of literature and edited the document. All authors read and approved the final version of the manuscript.

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Availability of data and materials

The data set is available on request.

Declarations

Competing interests

The authors declare that they have no competing interests.

Author details

[1]Department of Economics, School of Management, Pondicherry Central University, Pondicherry, India. [2]Department of Economics, Arignar Anna Government Arts and Science College Affiliation To Pondicherry Central University, Pondicherry, India.

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