Journal of Applied Economics and Business Studies, Volume. 5, Issue 4 (2021) 59-96 https://doi.org/10.34260/jaebs.544

Journal of Applied Economics and Business Studies (JAEBS)

Journal homepage: https://pepri.edu.pk/jaebs

ISSN (Print): 2523-2614

ISSN (Online) 2663-693X

Productivity and Export Performance of Emerging Asian Economies

Asma Saeed[1] & Mehrin Zaid Ullah[2]

[1] Lecturer, Department of Economics, Women University Mardan (WUM), Pakistan.

[2] Lecturer, Department of Economics, Mirpur University of Science & Technology (MUST), Mirpur, AJ&K, Pakistan.

ABSTRACT

This study estimates the effect of productivity on export performance of selected sectors and countries. Specifically, this study analyzes both theoretically and empirically, the nexus between productivity and export performance of selected emerging Asian economies including China, India, Indonesia, South Korea, and Japan. Total Factor Productivity (TFP) is used as a proxy for productivity and measured using two different techniques, growth accounting framework and data envelopment analysis. The study uses Auto Regressive Distributed Lag technique to estimate the effect of productivity on export performance of agricultural and manufacturing sectors of emerging Asian economies over the period of 1990 to 2016. Results show that TFP significantly and positively affect the agricultural and manufacturing sectors' export performance of selected emerging Asian economies both in long and short run. Hence, policies and economic strategies promoting adoption of advanced production technologies will increase exports of the emerging Asian economies in the long run.

Keywords

Productivity, Total Factor Productivity, Export, Growth Accounting Framework, Data Envelopment Analysis

JEL Classification

O47, F1

1. Introduction

The factors responsible for the export performance are classified into two main categories by the literature. The first set of factors is concerned with the supply side factors such as total production capacity and productivity. Productivity is the ratio of output(s) to input(s). It reflects technological progress and the efficiency of all factors of production (Liao & Liu, 2009). Productivity can significantly contribute not only to the economic growth and investment but can also boost the export performance of a country (Ahmad, Ilyas, Mahmood, & Afzal, 2010; Comin & Gertler, 2006; David Fadiran & Akanbi, 2017; Jienwatcharamongkhol, 2013). The literature has explained the nexus between productivity and export performance in at least two ways.

First, productivity raises export performance via raising the efficiency of the production factors which lowers the cost of production in domestic market and this in turn increases the competitiveness of domestic product in the international market (Morley & Morgan, 2008). This relationship between productivity and export performance is commonly referred to as the productivity-led export growth hypothesis. Melitz (2003) provides the theoretical framework for exploring this relationship using heterogenous firms, monopolistic competition, differentiated products and only one factor of production (i.e.labor). Melitz (2003) argued that firms can self-select themseleves to exports markets only if they have high level of productivity. Because firms with high level of productivity are able to afford trade costs. So, more producive firms can expand output and this in turn will lead to generate exportable surplus, higher revenues, lowering prices and higher profits. Helpman, Melitz, and Yeaple (2004) and Head and Ries (2003) extended the the Melitz (2003) framework. . Helpman et al. (2004) consider firms' foreign direct investment (FDI) in the analysis to extended Melitz model. Helpman et al. (2004) argue that more productive firms attract FDI which further extend their exports. While Head and Ries (2003) extend the Melitz (2003) model by incorpoating heterogenity with respect to foreign countries. They states that less productive frims can take advatge of the low cost countries in terms of labor wages. Therfore, Head and Ries (2003) pointed out that less productivie firms should invest in low cost countries, as it will reult in positive profits for less productive firms. Alongside the less productive firms, high productive firms can also consider countries with low labor cost. The productivity-led export growth hypothesis has been supported by most of the empirical work. Bernard and Jensen (1999) showed that it is the productivity which leads to an increase in the export growth. Thus, their findings accept the productivity-led export growth hypothesis. Sharma and Mishra (2009) also confirmed that productivity causes the export growth.

Second, the productivity-export performance relationship was further elaborated by the new endogenous growth model. This model provides a framework for linking trade and productivity growth to find out the way trade can increase the productivity growth of the host country through technology spillover effects. Romer (1993) pointed out that trade causes productivity by increasing access to new ideas. According to him if a firm invests in research and development, the resulting benefit may not be restricted only to this firm but also will spillover to other firms and trade partners and hence can increase their production. Therefore, export-oriented knowledge leads to productivity. This relationship between exports and productivity is referred as learning by exporting hypothesis. Grossman and Helpman (1991) argued that firms' exposure to foreign markets results in the knowledge spillover effect. The knowledge gained in this way can then be used by the exporting firms to further increase their level of productivity. This knowledge spillover effect will also help the firms in improving their design of the products and the process of production. So, the exporters can gain technological progress and knowledge through learning by exporting effect which ultimately increases the productivity of the firms. The learning by exporting hypothesis is also supported by Clerides, Lach, and Tybout (1998). Clerides et al. (1998) claimed that exposure to trade increases the firm's productivity through transfer of knowledge from foreign buyers. They also claimed the firm's productivity depends on his previous experience of the export participation. The findings of Greenaway and Kneller (2004) and Baldwin and Gu (2003) also revealed that productivity increases with the increasing participation in the foreign markets. Baldwin and Gu (2003) showed that productivity is positively associated to the economies of scale and product specialization. They also states that one percent increase of the firm's participation in the export market increases the labor productivity by 6% and TFP by 2%. Baldwin and Gu (2003) also found that exporters are productive as compared to non-exporters.

The second category of the factors responsible for the export performance is concerned with the demand side factors of export performance. It focuses on the world income, exchange rate and export prices as the main reasons for export demand. World income is expected to have a positive association with world's export expansion. However, exchange rate and export prices have negative association with export demand. The association between world's income, exchange rate, export prices and export demand has been confirmed by Nadeem, Azam, and Islam (2012) and Gururaj, Satishkumar, and Kumar (2016).

In summary, there is a wealth of the literature that discusses the factors affecting the export performance. Most of the studies on the nexus between productivity and export performance used ad hoc models without providing a theoretical framework to estimate the impact of productivity on export. The present study filled the gap by developing the theoretical framework by reconciling consumer and producer side which are obtained from the process of optimization, and then applied it to study the relationship between productivity and export performance of agricultural and manufacturing sectors in China, India, Indonesia, South Korea, and Japan. Findings on both the productivity-led export growth hypothesis and learning by exporting hypothesis are mixed so far. Similarly, the effect of demand and supply side factors on the export performance have been extensively studied. However, the evidence to support productivity as a major determinant of the export performance is limited in the sample countries. Therefore, the present study is motivated by the lack of the theoretical model and the mixed results from empirical models investigating the nexus between productivity and export performance in the sample countries.

The rest of the paper is arranged into four sections. Section 2 provides summary of earlier studies. Section 3 discusses theoretical model, data, and empirical model. Section 4 compiles empirical results of the econometric model. While section 5 summaries the conclusion of the study.

2. Literature Review

In this section, a review is provided on the nexus between export and total factor productivity. This review provides the theoretical as well as the empirical framework for the present study. It is discussed as follows

2.1 Theoretical Models of the Nexus between Productivity and Trade

The Ricardo idea of comparative advantage can be traced back to the link between productivity and export performance. According to this theory, even though countries do not have an absolute advantage in the manufacture of goods, they may benefit from trade by specializing in the production of goods in which they have a productivity advantage. Ricardo presented his theory based on the assumption of only one factor of production (labor) and constant return to scale in production. Ricardo's theory mainly focused on the trade in the homogenous products and the inter-industry trade of two goods between two countries.

Contrasting to Ricardo's theory of comparative advantage, the Heckscher-Ohlin (H-O) proposed the theory of the endowments of the production factors. H-O highlights that a country will produce and export the good that is produced from its relatively abundant factor. So according to this theory, the difference in the factor's endowment is the major driver of trade between countries. Like Ricardo's theory, this theory is also based on some assumptions such as the assumptions of two factors of production (labor and capital), constant returns to scale, and perfect competition. The H-O theory also viewed an inter-industry trade of two homogenous goods between two countries.

Though the H-O theory focused on the differences in the factor's endowment as the main cause of trade, however, this theory failed to elucidate some recent realities. The first is the non-existence of perfect competition in the real world as most of the production of goods takes place under imperfect competition. Secondly, the goods are differentiated and not homogenous. Thirdly, unlike the new trade theories, old trade theories assumed that goods were commonly produced under constant returns to scale. Similarly, the old trade theories focused only on inter-industry trade and failed to explain the intra-industry trade.

The work of Krugman (1980) generally referred to as the new trade theories in the literature incorporated the monopolistic competition and increasing returns to scale into the old trade theories. In the monopolistic competition, goods are differentiated so firms can produce and export its unique variety of the goods. Further, under increasing returns to scale, the average cost of production decreases as the production of goods increases.

In the new trade theories, firms are assumed to be homogenous. Melitz (2003), however, incorporated firms heterogeneity into the new trade theories. Melitz (2003) assumed that firms are different from each other based on the differences in the level of productivity.

Krugman (1987) developed a model of productivity where it is assumed that there are two countries (i) domestic (D); and (ii) foreign (F) country. Krugman (1987) postulates that the productivity of a domestic country increases with the exposure to trade with a foreign country over time. This implies that a firm's productivity increases through learning by exporting. Firm's exposure to foreign trade results in the knowledge spillover effect. The knowledge gained in this way can then be used by the exporting firms to increase their level of productivity.

Melitz (2003) showed that the fixed cost of entry and productivity are the two major determinants of a firm's exports. Melitz (2003) criticised Krugman for assuming homogenous firms within sectors. Melitz (2003) showed that firms can export only if they have a high level of productivity.

2.2 Empirical Review of the Factors Influencing Export

There are numerous studies, which have empirically examined the impact of productivity and other macroeconomic variables on the export performance.

2.2.1 Productivity and export Performance

A lot of research has discovered a link between productivity and export success that is both positive and significant. South Africa, Kenya, Egypt, Madagascar, Morocco, Tanzania, Mauritius, and Zambia were among the African economies studied by Balchin (2008), who looked at the influence of productivity on export performance. Balchin (2008) used a panel data set from 2002 to 2005 to quantify the influence of productivity on export performance using a probit regression model. Balchin (2008) discovered that the productivity coefficient is positive and significant at the 5% level of significance. This demonstrates that the better the productivity of African enterprises, the more likely they are to export on the global market. Ricci and Trionfetti (2011) examined the relationship between productivity, comparative advantage and export peformance. Ricci and Trionfetti (2011) found that productivity and comparative adavatage positively affects the firms' export performance.

Faustino, Lima, and Matos (2012) conducted a study on exports of Portugal to Spain. Specifically, Faustino, Lima, and Matos (2012) studied the impact of productivity and innovation on export performance of Portugal. They used panel data over the period 2004 to 2008, the Pooled OLS and GMM methods to empirically evaluate the impact of productivity and innivation on export performance. Faustino, Lima, and Matos (2012) found that the expected positive sign of the coefficient of TFP is consistent and showing that an increase in productivity leads to an improvement in Portugal's exports to Spain. So, a positive association is found between productivity and export performance of Portugal. Similarly, the coefficient of R&D expenditures is also positive and significant implying that innovation increases the export performance of Portugal.

Amornkitvikai, Harvie, and Charoenrat (2012) investigated the nexus between productivity and the export decisions of firms in Thailand. Amornkitvikai et al. (2012) argued that a firm can become exporters only if they have a high level of productivity. The impact of productivity on export decisions of firms is tested by using cross-sectional data for the period 2007 and estimating probit and logit regression models. They also found that productivity proxied by the level of output per unit of labor has a positive impact on firms' decision to export.

Reis and Forte (2016) examined the impact of productivity on the export performance of firms with reference to Portugal. Using panel data for the period 2008 to 2010, they found that the coefficient of labor productivity is positive and significant implying that firms having a high level of productivity could increase its exports performance.

2.2.2 GDP and Export Performance

There have been quite a few studies that estimated the relationship between the gross domestic product (GDP) and the export performance in various countries. Chan and Au (2007) estimated the determinants of textiles' export of China. Specifically, they studied the impact of GDP on China's textile export. Chan and Au (2007) argued that raising gross domestic product (GDP) of the exporting country results in the expansion of production capacity and export supply. They used time series data for the period 1985-2004 and the gravity model for the estimation of results. They found that all the variables except distance are significant at 1 percent level of significance. The coefficient of China's GDP is positive and significant 1 percent, showing that an increase in GDP increases the textile export of China. While the coefficient of exchange rate is negative and significant implying that an increase in the exchange value of China's currency reduces exports. Das (2007) studied the relationship between GDP and exports of China, India, and Malaysia. He used secondary data covering the period 1995 to 2000. He showed that the coefficient of GDP is positive and significant implying that an increase in production results in improving the export performance of sample countries. While FDI had no impact on the export performance.

Srinivasan (2012) estimated the relationship between GDP and exports of India by using the ARDL model. Srinivasan (2012) concluded that GDP and world income is positively related to the exports of India. While the real exchange rate has a negative relationship with the export performance showing that appreciation of the exchange rate lowers exports of India.

Similarly, Bhatt (2013) investigated the impact of GDP and FDI on exports of China. He used the Vector Autoregressive model and time series data for the period 1978 to 2009. He found that GDP and FDI have a positive impact on China's exports showing that an increase in the GDP and FDI inflows raises the export performance of China in the long run as well as in the short run.

Jawaid, Raza, Mustafa, and Karim (2016) analyzed the relationship between GDP and exports of Pakistan. The study used time series data over the period 1974 to 2012. Autoregressive Distributed Lag (ARDL) model is employed for the estimation of results. Jawaid et al. (2016) showed the the coefficient of GDP is positive and significant at 5 percent level of significance, implying that higher the GDP higher is the exports growth of Pakistan both in the long run and short run as well. Similarly, FDI also has a positive impact on the export performance of Pakistan in the long run as well as in the short run.

Potelwa, Lubinga, and Ntshangase (2016) analyzed the growth of South Africa's agricultural exports. This study used the gravity model for the period 2001-2014 to estimate the determinants of export growth. They concluded that GDP and population of South Africa's trading partners cause an increase in the agricultural export growth of south Africa. The gross domestic product of South Africa and export capacity also caused an increase in its export growth. Epaphra (2016) used the OLS method and concluded that gross domestic product, exchange rate, and trade liberalization positively affect the export in Tanzania.

2.2.3 Real Exchange Rate and Export Performance

Veeramani (2008) analyzed the impact of real exchange rate on exports of India using time series data for the period 1960 to 2007 and multiple regression model. Veeramani (2008) found that exchange rate is negatively and statistically significantly associated to the export performance of India. Veeramani (2008) also found real gross domestic product positively affect the exports suggesting that an increase in the real GDP increases the production and supply capacity of exports in India.

Chit (2008) studied the nexus between bilateral exchanger rate volatility and bilateral exports with reference to emerging East Asian economies including China, Malaysia, Indonesia, Thiland, and Philpines. Chit (2008) used panel data set for the period 1982 to 2005 and a gravity-type bilateral trade model. Fixed effect model was employed for the estimation of results. Chit (2008) found the coefficient of bilateral exchange rate is positive and significant at 5 percent level of significance showing depreciation of the exchange rate has the effect of increasing bilateral export performance. While the coefficient of bilateral exchange rate instability is negative and significant at 1 percent level of significance, inferring that instability in the bilateral exchange rate declined the export performance in the sample countries. Similarly, the coefficient of GDP of importing country and the common border is positive and significant at 5 percent level of significance. This means that there is a positive relationship between the importing country's income and sharing a common border.

Kafayat (2013) evaluated the association between the exchange rate volatility and export performance of Pakistan. He argued that volatility of exchange rate can effect exports performance positively and negatively as well. If volatility of exchange rate is triggered by an appreciation of domestic currency then it will reduce domestic exports by making it expensive in the international market. However, an appreciation of domestic currency will increase imports by lowering the value of imported goods. On the other side, if the volatility of the exchange rate is triggered by depreciation of domestic currency then it will positively affect export performance and will negatively affect imports by raising prices of imported goods. Kafayat (2013) employed time series data for the period 1981 to 2011 and regression model to empirically test the impact of depreciation on export and imports performance of Pakistan. Kafayat (2013) found that the coefficient of the exchange rate is positive and significant at 1 percent level of significance. However, depreciation of the exchange rate positively affects imports of Pakistan, which is not consistent with the prior expectations. This study concluded that the exchange rate volatility triggered by depreciation has improved the export performance and have no or very little impact on imports of Pakistan. He suggested that boosting exports via a depreciation of the exchange rate is not a good tool. For sustained export growth, the dire need is to enlarge the production capacity. And only through massive production Pakistan can increase its export supply in the international markets.

Hassan, Hassan, and Mahmood (2013) investigated the nexus between exchange and exports performance of Pakistan. They postulated that the appreciation of domestic currency can increase the supply of export by reducing the price of imported inputs used in the production of goods and services. Hence, the supply side effects of the exchange rate appreciation result in expanding the capacity to exports. However, the demand side effects of the exchange rate appreciation lower the demand for exports in the international markets. They further argued that depreciation of exchange rate will increase the demand for exports and decrease the supply of exports by raising the cost of imported inputs and hence lowering domestic production capacity. They employed secondary time series data and using the ARDL model for the empirical investigation of the impact of the exchange rate and other macroeconomic variables on the exports performance of Pakistan. They concluded that the coefficient of the exchange rate is positive and significant showing that depreciation of the exchange rate has a positive impact on the export performance of Pakistan. This result confirmed the existence of a long run relationship between exchange rate and export performance of Pakistan. The coefficient of GDP and trade liberalization were also positive and significant showing that an increase in GDP and trade liberalization leads to an increase in the export performance of Pakistan both in the long run and short run as well.

Genc and Artar (2014) examined the long run relationship between exchange rate and export performance for 22 emerging economies. They employed panel dataset and ARDL model for estimating the long run relationship. They deduced that the pooled mean group estimator (PMG) results confirmed the existence of a long run relationship between the exchange rate and export performance of the sample economies. This implies that the appreciation of the exchange rate is not beneficial for the export growth in the sample countries.

Falianty (2015) studied the relationship between exchange rate and exports in Indonesia. The main objective of his study was to estimate the impact of exchange rate depreciation on the export performance of Indonesia. Falianty (2015) used time series data (1995-2014) and regression model for the estimation of results. This study found that the coefficient of the exchange rate is positive and significant implying that one percent depreciation of Indonesia's Rupiah increases its export performance by 0.103 percent. This means that depreciation of the Rupiah can improve the export performance of Indonesia.

2.2.4 World Income and Export Performance

Santos-Paulino (2002) examined the factors responsible for the export performance of developing economies. They found results consistent with the prior expectations. The coefficient of world income is positive and significant at 10 percent level of significance, showing that the larger the world income larger is the export growth. Trade liberalization is also found with a positive impact on the export growth of developing countries. While relative prices had a negative association with the export performance.

Gupta, Raychaudhuri, and Haldar (2015) studied the determinants of India's exports. Gupta et al. (2015) estimated the relationship between exports and its major determinants using industry level data. They found a positive link between world income and export showing that the increase in world demand for exports increases the exports performance of India. Similarly, public expenditures on research and development activities are also positively linked. Whlie foreign capital inflows and appreciation of the real exchange rate results in lowering the export performance of India.

In summary, there are many studies that discuss the factors affecting the export performance. However, evidence to support productivity as a major determinant of the export performance in emerging Asian economies is limited. The previous studies have also ignored using multiple measurements of productivity and hence do not provide robust results. As a result, the findings of these studies are mixed. The present study fills the gap mentioned above by developing the theoretical model and then uses such model to study the relationship between productivity and export performance of agricultural and manufacturing sectors of selected emerging Asian economies namely China, India, Indonesia, South Korea, and Japan. Further, this study measures productivity with more than one technique and hence provides robust estimates of the effect of productivity on export performance of the sample economies.

3. Data and Research Methods

3.1.Theoretical Model

The present study develops a theoretical framework based on the framework of Melitz (2003). The theoretical framework is described in detail as follows:

3.1.1 Consumers

Consider an open economy with monopolistic competition. The key agents in this economy are consumers and producers. Producers produces varieties of product, q_(ja(m)), in sectors a and sector m demanded by identical consumers. Assume, a representative consumer having the following Constant Elasticity of Substitution (CES) preferences.

$$U = \left(\sum_{i=1}^{n} q_{ja(m)}^{\rho}\right)^{\frac{1}{\rho}} \qquad (1)$$

where U represent a utility function, n is the number of varieties of product q_(ja(m)) , ρ is a measure of substitutability while sectors a and m represents agriculture and manufacturing sectors, respectively. Assuming non-satiation, the representative consumer maximizes utility subject to income constraint, p_(ja(m)) q_(ja(m))=I where p_(ja(m)) is the price of commodity q_(ja(m)) and I is the income of consumers. Maximization yield the following Marshallian demand function:

$$q_{ja(m)} = \frac{p_{ja(m)}^{-\sigma} I}{P^{1-\sigma}} \qquad (2)$$

Where σ is the elasticity of substitution among varieties, q_(ja(m)) is the quantity demanded of commodity j, p_(ja(m)) is the price of commodity q_(ja(m)), I is total income of the consumer and P is the price index of the economy other than q_(ja(m)).

3.1.2 Producers

Producers are heterogenous in terms of their level of productivity. They produce varieties of product q_(ja(m)) using labor l_(ja(m)) and capital k_(ja(m)) in sector a and sector m . Where sectors a and m represents agriculture and manufacturing sectors, respectively. Each variety competes with all other varieties, and hence the firm is better off by selecting a variety that is not being produced by others, to avoid sharing demand for its variety. The production function of the producers is assumed to have increasing returns to scale (IRS).

$$q_{ja(m)} = \varphi_{a(m)} f\left(l_{ja(m)}, k_{ja(m)}\right) \tag{3}$$

where φ is producers' productivity in sector a and sector m. The objective of the producer is to maximize profit given a technology approximated by a cost function ($C_{ja(m)}$) as follows.

$$C_{ja(m)} = wl_{ja(m)} + ik_{ja(m)} + \frac{q_{ja(m)}}{\varphi_{a(m)}} \tag{4}$$

where w represent wage of labor, l is labor, i represent interest rate and k is capital. Maximizing the producer's profit ($\pi = p_j q_j - \frac{q_j}{\varphi} - wl_j - ik_j$) yields the equilibrium price, $p_j = \frac{1}{\rho\varphi}$ which is a function of productivity of producers. Producer's supply function in sector a and sector m is generated as under.

$$q_{ja(m)} = \varphi_{a(m)}(\sigma - 1)\left(wl_{ja(m)} + ik_{ja(m)}\right) \tag{5}$$

At national level, income of a country is determined by the entire use of labor and capital and their respective rewards that is $GDP = wl_{ja(m)} + ik_{ja(m)}$ in our case and hence, $q_{ja(m)} = \varphi_{a(m)}(\sigma - 1)GDP$. This illustrates that producer's supply function of varieties of product $q_{ja(m)}$ is increasing with level of productivity $\varphi_{a(m)}$ and income of the country.

3.1.3 The Productivity-Trade Nexus

The productivity and trade nexus is developed by subtracting the consumer's demand function from the producer's supply function.

$$E_{ja(m)} = \varphi_{a(m)}(\sigma - 1)GDP - \frac{p_{ja(m)}^{-\sigma} I}{P^{1-\sigma}} \tag{6}$$

where $E_{ja(m)}$ represents exports of varieties of product $q_{ja(m)}$ in sector a and sector m and other variables are already defined.

3.2. Data and Econometric Methodology

3.2.1 Data

This study is carried out for a panel of five countries which include China, India, Indonesia, South Korea, and Japan by employing panel data over the period 1990 to 2016. The selection of sample is purely based on the data availability. The data used in this study are agriculture and manufacturing sectors' export performance, total factor productivity, real gross domestic product (GDP) per capita, consumer's demand in the exporting country, real exchange rate, cost to export per container and world income. The data for agriculture and manufacturing sectors exports are collected from the World Trade Organization (WTO). While the data for GDP, consumer's demand, exchange rate, cost to export and world income are mainly taken from WDI. The data for total factor productivity is computed by employing the growth accounting method and Data Envelopment Analysis. The detail computation of productivity data is reported in Appendix-A

3.2.2 Econometric Methodology

This section has two subsections. In first subsection 3.2.1 the unit root analysis is discussed. While second subsection 3.2.2 discusses estimation techniques that are used for the estimation of results.

3.2.3 Unit Root Analysis

The first step in econometric analysis is to conduct the unit root analysis. The unit root analysis is a standard approach that determines the stationarity of time series data. The present study carried out both panel unit root analysis as well as country specific unit root analysis. The most widely employed tests for panel unit root analysis are Lavin, Lin and Chu-t test, Im, Pesaran and Shin W-stat test and ADF-Fisher Chi-square test. While Augmented Dickey-Fuller Test is mostly employed for a country specific unit root analysis. In these tests the null hypothesis of unit root (non-stationarity) is tested against the alternative hypothesis of stationarity. So, if the null hypothesis is accepted this means that the variables are non-stationary. The problem of non-stationarity in a given series can be solved by taking the first difference of the series. After taking the first difference, if the test-statistics leads to the rejection of null hypothesis this means that the variable is now stationary and can be used for the estimation purpose. The results of panel unit root tests are reported in Table 1. The results of these tests reveal that the study variables include unit root meaning that they are not stationary at level. In case of full sample, test statistics demonstrates that both agricultural and manufacturing sectors' total factor productivity (TFP), consumer 'demand and world income are stationary at level while real GDP per capita, real exchange rate, cost to export and agricultural and manufacturing sectors exports variables are non-stationary at level and become stationary at first difference. The results of country specific unit root test statistics demonstrated in Table 2 also indicates that variables are not level stationary but made stationary at first difference.

3.2.4 Estimation Methodology

The panel unit root test unit results reveal that the study variables include unit root meaning that they are not stationary at level. Similarly, the country specific unit root test results also demonstrate that the variables have a mixture of order of integration meaning that some variables are integrated of order one and some are integrated of order zero. Based on the unit root test results, therefore this study uses the Auto regressive distributed lag (ARDL) model for the estimation of results. So, the export performance model specified in section 3.1 is re-specified to get a panel data ARDL model. The panel ARDL model is specified as follows.

$$\Delta \ln EXP_{it} = \alpha_{\circ} + \sum_{k=1}^{r} \beta_i \Delta \ln EXP_{it-k} + \sum_{k=1}^{r} \delta_i \Delta \ln STFP_{it-k} + \sum_{k=1}^{r} \delta_i \Delta \ln GDP_{it-k} + \sum_{k=1}^{r} \delta_i \Delta \ln FCE_{it-k} + \sum_{k=1}^{r} \delta_i \Delta \ln REX_{it-k} + \sum_{k=1}^{r} \delta_i \Delta \ln CE_{it-k} + \sum_{k=1}^{r} \delta_i \Delta \ln WY_{it-k} + \emptyset_1 \ln EXP_{it-1} + \emptyset_2 \ln STFP_{it-1} + \emptyset_3 \ln GDP_{it-1} + \emptyset_4 \ln FCE_{it-1} + \emptyset_5 \ln REX_{it-1} + \emptyset_6 \ln CE_{it-1} + \emptyset_7 \ln WY_{it-1} + \varepsilon_{it} \quad (7)$$

Where β_i and δ_i are short term coefficients, $\emptyset_1 \ldots \emptyset_7$ are the long term coefficients, i is the ith country, t is time period for the study variables, EXP is sectoral export measured as the value of exports in million dollars, STFP is sectoral productivity, GDP is real gross domestic product per capita of exporting country, FCE is the final consumption expenditure which is a proxy for the consumer's demand in the model, REX is the real Exchange rate, CE is the Cost to export per container and WY is the world income measured by the US GDP, Δ is the first difference operator and ε is the error term. The decision between pooled mean group (PMG) and mean group (MG) model is made based on the Hausman specification test. The model is estimated as pooled mean group (PMG) panel data model after conducting the Hausman specification test.

Table 1: Panel Unit Root Tests

Variables	Lavin Lin Chu Test				Im Pesaran Test				Fisher-ADF-Chi Square Test			
	Level		First Difference		Level		First difference		Level		First difference	
	T-stat	p-value	T-stat	p-value	T-stat	p-value	T-stat	p-value	T-stat	p-value	T-stat	p-value
Agricultural Export	0.218	0.413	-5.681	0.000	1.667	0.952	-5.377	0.000	2.983	0.982	43.867	0.000
Manufacturing Export	1.728	0.958	-8.663	0.000	1.311	0.905	-8.387	0.000	4.079	0.943	69.538	0.000
Agricultural TFP	-4.396	0.000	---	---	-3.522	0.000	---	---	28.198	0.002	---	---
Agricultural Malmquist Total Factor Productivity Index (ATFPI)	-10.518	0.000	---	---	-9.745	0.000	---	---	82.647	0.000	---	---
Manufacturing TFP	-6.259	0.000			-7.306	0.000	----	---	61.284	0.000	---	---
Manufacturing Malmquist Total Factor Productivity Index (MTFPI)	-4.434	0.000	---	----	-4.675	0.000	---	---	40.905	0.000	---	---
Real GDP per capita	0.553	0.710	-6.161	0.000	2.210	0.986	-5.341	0.000	12.255	0.268	44.894	0.000
Consumer’s Demand	1.301	0.903	-7.793	0.000	-2.293	0.989	-8.778	0.000	12.718	0.239	73.353	0.000
Real Exchange rate	-0.982	0.163	-8.441	0.000	-0.498	0.309	-7.736	0.000	9.089	0.523	68.761	0.000
Cost to Export	1.212	0.887	-7.363	0.000	2.341	0.991	-6.870	0.000	1.812	0.997	66.103	0.000
World Income	-2.365	0.009	---	---	-2.863	0.002	---	---	23.247	0.009	---	---

Source: Authors ‘own calculation

Table 2: County Specific Unit Root Test (ADF Test)

	China		India		Indonesia		South Korea		Japan	
	Level	1st Difference	Level	1st Difference	Level	1st Difference	Level	1st Difference	Level	1st Difference
Agricultural Export	-1.298	-3.847**	-1.415	-3.905**	-1.533	-5.281***	-1.808	-3.686**	-1.574	-5.000***
Manufacturing Export	-1.711	-4.309**	-1.731	-4.706***	-2.742	-4.809***	-2.168	-4.376**	-2.154	-5.808***
Agricultural TFP	-3.426**	---	-3.487*	---	-3.848**	---	-3.549**	---	-3.962**	---
ATFPI	-4.961***	---	-7.532***	---	-7.532***	---	-3.557*	---	-5.147**	---
Manufacturing TFP	-3.319**	---	-3.109	-5.222***	-4.337**	---	-7.734***	---	-5.695**	---
MTFPI	-2.071	-6.519***	-4.196**	---	-6.494***	---	-4.322***	---	-3.790**	
Real GDP per capita	-3.102	-3.686**	-5.667***	---	-6.809***	---	-1.912	-5.208***	-2.823	-3.648**
Consumer’s Demand	1.547	-5.516***	-1.557	-4.900***	-3.612**	---	-2.402	-5.142***	-2.946	-4.381***
Real Exchange Rate	-2.563	-4.289**	-2.162	-3.833**	-1.725	-5.292***	-1.997	-4.424***	-3.716**	---
Cost to Export	-3.898**	---	-4.524**	---	-2.722	-4.438***	-5.135***	---	-1.219	-5.447***
World Income	-3.296*	---	-3.296*		-3.296*		-3.296*	---	-3.296*	---

Note: ***, **, * denote 1%, 5% and 10% level of significance respectively.

4. Results and Discussion

The ARDL estimated results are compiled in this section. This section has two subsections. In subsection 4.1 the ARDL long run results are discussed. While second subsection 4.2 discusses the ARDL short run results

4.1. ARDL Long Run Results for The Nexus Between Productivity and Export Performance of Emerging Asian economies

The Pedroni's Cointegration test is employed to check the existence of long run relationship between productivity and export performance within the panel ARDL framework. The results of ARDL Pedroni's test of cointegration and bound test of cointegration are shown in Table 3. The results of Pedroni's test of cointegration reveal that out of seven test statistics.

Table 3: Pedroni's Co integration Test

Test Statistics	Agriculture Sector Export Performance and TFP		Manufacturing Sector Export Performance and TFP	
	(i)	**(ii)**	**(i)**	**(ii)**
Panel V	-1.303	-1.286	-1.318	-1.103
Panel rho	-0.694	-0.742	-0.855	-0.441
Panel t	-6.859	-6.851	-6.592	-5.096
Panel ADF	-5.291	-5.366	-6.065	-4.214
Group rho	-0.126	-0.075	-0.059	-0.469
Group t	-7.474	-7.249	-7.409	-5.179
Group ADF	-4.024	-5.700	-6.161	-3.623

Note: Authors' own calculations

the calculated values of four test statistics are more than two in absolute terms, so this indicates the presence of long run relationship between productivity, export performance and other variables of the study. While the bound test or joint F test is used to check the existence of long run relationship between productivity and export performance of the individual country within the ARDL framework. The results of ARDL bound test of cointegration are shown in Table 4. Similarly, for each country the calculated values of F- statistics are compared with the Pesaran statistical table. As these F-statistics values are greater than the upper bound of the Pesaran table, so this also indicates the presence of long run relationship between productivity, export performance and other variables of the study.

Table 4: ARDL Bound Test of Co integration between Productivity and Export Performance of Emerging Asian Economies

Note: Authors' own calculations

The presence of long run relationship can also be checked via the negative and

Countries	Agriculture Sector		Manufacturing Sector		Result
	F-Bound Test		F-Bound Test		
	(i)	(ii)	(i)	(ii)	
China	12.635***	7.736***	23.808***	28.739***	Co integration
India	10.757***	8.249***	23.478***	15.708***	Co integration
Indonesia	7.579***	9.450***	6.749***	5.486***	Co integration
South Korea	3.943**	3.679**	3.828**	16.517***	Co integration
Japan	5.856***	6.431***	9.464***	23.599***	Co integration

significant value of the error correction term (ECT) which is the sign of long run relationship between the variables of the study. The cointegration equations for both agriculture and manufacturing sectors shows that the value of ECT is negative and statistically significant which is the evidence of long run association between productivity and export performance of emerging Asian economies. The value of ECT is the speed of adjustment of short run disequilibrium towards the long run equilibrium.

To inspect the impact of productivity on export performance of the emerging Asian economies, Pooled mean group (PMG) method is used after conducting the Hausman specification test. The estimated results of long run coefficient for agriculture and manufacturing sectors are presented in Table 5. The impact of productivity on export performance is estimated for full sample of five countries and then separately for China, India, Indonesia, South Korea, and Japan. The impact of productivity on export performance is measured using two different specifications. In the first specification TFP is calculated using growth accounting technique and in the second specification TFP is estimated via the Malmquist total factor productivity index (MTFPI) using data envelopment analysis (DEA). The results show that both the agricultural and manufacturing sectors TFP have a positive and statistic- ally significant impact on agricultural and manufacturing sector's export performance of sample countries in all specifications which is consistent to the theory of productivity. It could be due to the reason that productivity improves the efficiency of factors of production and reduces the cost of production of domestic products, improving their competitive advantage in the worlds market (Morley & Morgan, 2008).

Table 5: ARDL Long Run Results for the Nexus between Productivity and Export Performance of Emerging Asian Economies

Variables	Agriculture Sector				Manufacturing Sector			
	PMG		*MG*		PMG		*MG*	
	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)
TFP	0.373*** (0.113)	--	0.893** (0.417)	--	0.717*** (0.093)	--	0.396* (0.229)	--
MTFPI	--	0.178*** (0.056)	--	0.438** (0.198)	--	0.065** (0.033)	--	0.084** (0.038)
Real GDP per capita	1.497*** (0.433)	1.761*** (0.591)	5.212*** (1.616)	5.207*** (1.624)	2.110*** (0.531)	0.405** (0.203)	2.681** (1.364)	2.606** (1.139)
Consumer's Demand	-0.080** (0.035)	-0.029 (0.051)	-6.209*** (2.327)	-5.367*** (1.516)	-0.136*** (0.049)	-0.174*** (0.050)	-0.805 (0.602)	-0.269 (0.721)
Real Exchange rate	-0.027 (0.035)	-0.089** (0.041)	-0.002 (0.062)	-0.028 (0.095)	-0.054*** (0.021)	-0.058* (0.031)	-0.181** (0.072)	-0.016 (0.086)
Cost to Export	-0.003 (0.049)	-0.023 (0.044)	-0.272** (0.129)	-0.045 (0.232)	-0.021 (0.051)	0.036 (0.039)	-0.111 (0.077)	0.011 (0.187)
World Income	0.667*** (0.127)	0.433** (0.168)	0.373 (0.237)	0.560*** (0.209)	0.586*** (0.160)	0.453** (0.168)	1.043** (0.459)	0.561*** (0.197)
Constant	-4.100*** (0.647)	-3.498*** (0.249)	-3.194 (2.253)	-5.942*** (2.152)	-2.367*** (0.163)	-0.064 (0.061)	-11.175 (13.368)	-2.977*** (0.952)
Hausman Test	0.827	0.554	---	---	0.463	0.856	---	---

Note: * p<0.10, **p<0.05, ***<0.01 (Standard errors are in parentheses)

With respect to other factors, the GDP per capita has a positive and statistically significant relationship with the export performance implying that economic growth is beneficial for the export performance of agricultural and manufacturing sectors in the sample countries. The positive association between export performance and GDP per capita results in surplus output and this surplus output can then be exported in international markets. Various empirical studies also provide evidence that GDP increases the export performance (Epaphra, 2016; Nadeem et al., 2012; Potelwa et al., 2016).

Consumer's demand in the exporting country has a negative and statistically significant impact on export performance, implying that consumer's demand has a towing effect on the export performance of sample countries through decreasing the exportable surplus. These findings are in line with studies that have find a negative relationship between consumer's demand and export performance (Boansi, OdilonKounagbéLokonon, & Appah, 2014; Rahmaddi & Ichihashi, 2012). Exchange rate has a negative and statistically significant impact on the export performance, implying that appreciation of exchange rate is not beneficial for the export performance in the sample countries. This confirms the traditional view that countries with a high exchange rate are not better in terms of their export performance. Because high exchange rate makes domestic products expensive in the international markets via increasing the price of that products. These results are in accordance to previous studies that have concluded a negative association between exchange rate and export performance (Kohler & Ferjani, 2018; Saqib & Sana, 2012).

Cost to export has a negative and statistically significant impact on the export performance. While world income has a positive and statistically significant impact on the export performance, implying that an increase in income of trading partner economies increases the demand for domestic products in the sample countries. So, to improve its export performance policy makers of the sample countries should observe cyclical booms in economies of its trade partners. These results are line with study conducted by (Nadeem et al., 2012).

4.2. ARDL Short Run Results for the Nexus between Productivity and Export Performance of Emerging Asian Economies

The ARDL short run results are shown in Table 6. Like long run results, short run results indicate that agricultural and manufacturing TFP have a positive and significant association with the agricultural and manufacturing sectors export of emerging Asian economies. The coefficient of ECT shows the speed of adjustment. The coefficient of ECT is negative and highly significant which is also evidence of the existence of cointegration. The value of the ECT shows that if there is any disequilibrium in the agricultural and manufacturing sectors export it will converge to the long run equilibrium at the speed of 82%, 93%, 91% and 86% respectively.

The results of the individual country-wise for both long run and short run are presented in Table 7, Table 8, Table 9 and Table 10. The results of the individual country-wise also shows that improving productivity through increasing accesses to advance production technology is positively and significantly associated to the export performance of China, India, Indonesia, South Korea and Japan.

Table 6: ARDL Short Run Results for the Nexus between Productivity and Export Performance of Emerging Asian Economies

Variables	**Agriculture Sector**				**Manufacturing Sector**			
	PMG		***MG***		**PMG**		***MG***	
	(i)	**(ii)**	**(i)**	**(ii)**	**(i)**	**(ii)**	**(i)**	**(ii)**
TFP	0.299** (0.158)	--	0.588* (0.326)	--	0.411*** (0.057)	--	0.235* (0.136)	--
MTFPI	--	0.137*** (0.047)	--	0.234** (0.092)	--	0.087* (0.052)	--	0.105** (0.051)
Real GDP per capita	1.329* (0.825)	0.362 (0.489)	2.859*** (1.083)	2.515** (1.267)	1.932*** (0.396)	0.932* (0.563)	2.442* (1.356)	3.279** (1.340)
Consumer's Demand	-0.326 (451)	-0.808 (1.294)	-2.666*** (0.929)	-2.704*** (0.844)	-0.573 (0.628)	-0.475 (0.386)	-2.841** (1.243)	-1.389 (0.957)
Real Exchange rate	-0.133* (0.074)	-0.379*** (0.141)	-0.039 (0.086)	-0.064 (0.113)	-0.392*** (0.106)	-0.477*** (0.103)	-0.504*** (0.133)	-0.281 (0.189)
Cost to Export	-0.029 (0.055)	-0.112* (0.061)	-0.004 (0.039)	-0.097** (0.051)	-0.009 (0.047)	-0.023 (0.029)	-0.003 (0.029)	0.033 (0.029)
World Income	2.776*** (0.897)	2.442*** (0.542)	3.673* (2.168)	1.787 (1.447)	2.962*** (0.590)	2.268*** (0.557)	3.251*** (0.684)	1.682* (1.017)
ECM	-0.819*** (0.126)	-0.928*** (0.044)	-0.979*** (0.078)	-0.971*** (0.022)	-0.915*** (0.056)	-0.858*** (0.042)	-0.971*** (0.076)	-0.739*** (0.150)

Note: * p<0.10, **p<0.05, ***<0.01 (Standard errors are in parentheses)

Journal of Applied Economics and Business Studies, Volume. 5, Issue 4 (2021) 59-96 https://doi.org/10.34260/jaebs.544

Table 7: Country-Wise ARDL Long Run Results for the Effect of Productivity on Agricultural Exports Performance

Variables	**China**		**India**		**Indonesia**		**South Korea**		**Japan**	
	(i)	**(ii)**	**(i)**	**(ii)**	**(i)**	**(ii)**	**(i)**	**(ii)**	**(i)**	**(ii)**
TFP	0.451*** (0.101)	--	1.911*** (0.583)	--	0.895** (0.390)	--	0.944*** (0.207)	--	0.168** (0.067)	--
MTFPI	--	0.325** (0.127)	--	1.059** (0.482)	--	0.297* (0.166)	--	0.407*** (0.068)	--	0.334** (0.137)
Real GDP per capita	-0.347 (-0.637)	-1.135 (1.098)	0.403 (0.375)	0.674** (0.303)	2.009* (1.072)	3.352*** (1.008)	7.460* (3.739)	10.758** (3.506)	1.321** (0.535)	3.669*** (1.074)
Consumer's Demand	-0.109** (0.048)	-0.948** (0.332)	11.953*** (2.595)	0.212 (2.111)	-1.944* (1.037)	-3.281*** (0.950)	-2.857* (1.549)	-6.747** (2.384)	-0.398 (2.234)	-6.265*** (1.764)
Real Exchange rate	-0.109* (0.059)	-0.514** (0.232)	-1.916*** (0.582)	-0.323 (0.817)	-1.029** (0.359)	-1.370*** (0.408)	-0.000 (0.286)	0.609 (0.306)	-0.858*** (0.153)	-0.774*** (0.189)
Cost to Export	-0.074*** (0.016)	-0.001 (0.032)	-0.078 (0.128)	0.402** (0.139)	0.116 (0.311)	0.605 (0.466)	-0.639* (0.350)	-0.041 (0.186)	-0.018 (0.063)	0.037 (0.158)
World Income	0.621*** (0.076)	0.795*** (0.168)	-0.325 (0.876)	0.305 (0.911)	2.074* (1.103)	3. 267*** (1.053)	0.093 (0.274)	0.413 (0.269)	0.026* (0.141)	0.236 (0.852)
Constant	-0.617*** (0.726)	-8.633*** (1.729)	1.672** (7.615)	0.068 (8.496)	13.867 (8.684)	26.095*** (7.819)	3.019 (3.497)	-4.669 (3.297)	-2.672 (1.594)	-0.507 (1.100)
Serial Correlation	1.202 (0.349)	1.077 (0.398)	0.554 (0.591)	0.265 (0.774)	1.564 (0.249)	1.361 (0.291)	1.250 (0.337)	1.865 (0.265)	0.496 (0.624)	0.251 (0.784)
Heteroskedasticity	1.296 (0.345)	0.779 (0.681)	1.836 (0.179)	0.686 (0.751)	1.351 (0.294)	1.391 (0.273)	1.425 (0.290)	0.188 (0.995)	1.841 (0.158)	0.610 (0.808)
Jerque Bera Normality Test	1.637 (0.441)	2.190 (0.334)	0.025 (0.987)	4.468 (0.110)	0.185 (0.912	0.066 (0.967)	1.020 (0.600)	0.524 (0.769)	0.181 (0.913)	0.052 (0.974)
Functional Form Ramsey Reset Test	0.987 (0.346)	0.277 (0.614)	1.972 (0.184)	0.876 (0.376)	0.133 (0.721)	1.126 (0.306)	2.847 (0.145)	1.156 (0.342)	0.096 (0.763)	0.316 (0.260

Note: * p<0.10, **p<0.05, ***<0.01 (Standard errors are in parentheses)

Table 8: Country-Wise ARDL Short Run Results for the Effect of Productivity on Agricultural Exports Performance

Variables	**China**		**India**		**Indonesia**		**South Korea**		**Japan**	
	(i)	**(ii)**	**(i)**	**(ii)**	**(i)**	**(ii)**	**(i)**	**(ii)**	**(i)**	**(ii)**
TFP	0.361** (0.123)	--	0.051* (0.027)	--	1.418*** (0.339)	--	0.525*** (0.114)	--	0.205** (0.087)	--
MTFPI	--	0.144*** (0.034)	--	0.340*** (0.100)	--	0.531*** (0.105)	--	0.212** (0.071)	--	0.130** (0.059)
Real GDP per capita	2.828*** (0.624)	1.308* (0.712)	0.976* (0.497)	2.100*** (0.499)	-2.613 (1.583)	4.151*** (1.303)	6.107*** (1.273)	4.903*** (1.295)	2.893*** (0.636)	3.596*** (0.704)
Consumer's Demand	-0.119 (0.073)	-0.422*** (0.081)	-3.321*** (0.997)	-2.601** (0.904)	-4.060*** (1.121)	-2.451** (0.958)	-4.393*** (0.864)	-3.445*** (0.914)	-0.434 (1.573)	-4.592*** (1.273)
Real Exchange rate	-0.057 (0.106)	-0.622** (0.108)	-0.847*** (0.234)	-0.904** (0.210)	-1.145*** (0.197)	-1.128*** (0.134)	-0.263 (0.191)	-0.102 (0.209)	-0.323** (0.129)	-0.148 (0.138)
Cost to Export	-0.067 (0.055)	-0.063 (0.051)	-0.059 (0.089)	-0.047 (0.086)	0.249 (0.286)	0.302 (0.248)	-0.035 (0.440)	-0.147 (0.482)	-0.145 (0.195)	-0.015 (0.175)
World Income	1.490** (0.507)	3.169*** (0.515)	4.186*** (1.169)	3.581*** (1.124)	8.653*** (1.467)	6.497*** (1.161)	1.441* (0.761)	-0.735 (0.758)	1.048 (0.631)	1.055 (1.553)
ECM (-1)	-0.896*** (0.179)	-0.863*** (0.155)	-0.824*** (0.117)	-0.988*** (0.122)	-0.745*** (0.136)	-0.639*** (0.099)	-0.963*** (0.191)	-0.913*** (0.195)	-0.701*** (0.073)	-0.903*** (0.105)
R-square	0.74	0.85	0.83	0.84	0.85	0.86	0.76	0.71	0.77	0.79
F-statistics (P-Value)	7.183 (0.002)	14.962 (0.023)	5.791 (0.006)	5.678 (0.006)	2.583 (0.048)	3.137 (0.023)	2.505 (0.074)	2.313 (0.069)	2.865 (0.044)	2.438 (0.089)
Durbin. Watson Stat.	2.116	2.022	2.204	2.294	2.099	2.101	2.349	2.055	2.47	2.019

Note: * p<0.10, **p<0.05, ***<0.01 (Standard errors are in parentheses)

Table 9: Country-Wise ARDL Long Run Results for the Effect of Productivity on Manufacturing Exports Performance

Variables	**China**		**India**		**Indonesia**		**South Korea**		**Japan**	
	(i)	**(ii)**	**(i)**	**(ii)**	**(i)**	**(ii)**	**(i)**	**(ii)**	**(i)**	**(ii)**
TFP	0.426*** (0.127)	--	0.657** (0.239)	--	0.516*** (0.139)	--	1.509*** (0.273)	--	0.790** (0.220)	--
MTFPI	--	0.423** (0.161)	--	0.074** (0.033)	--	0.141* (0.077)	--	0.909*** (0.231)	--	0.302* (0.167)
Real GDP per capita	-1.621 (0.902)	-3.669 (2.197)	0.152** (0.058)	0.151 (0.086)	1.211* (0.676)	2.555** (1.005)	4.061 (2.139)	3.416** (1.579)	3.026*** (0.542)	3.538** (1.331)
Consumer's Demand	-0.711** (0.275)	-0.883** (0.391)	-0.419 (1.153)	-4.158*** (0.878)	-1.205* (0.658)	-2.402** (0.922)	-3.497** (1.492)	-3.545*** (1.136)	-1.455*** (0.270)	-0.059 (0.247)
Real Exchange rate	-0.518** (0.235)	0.474 (0.288)	-0.347* (0.171)	-0.608*** (0.182)	-0.286** (0.108)	-0.591 (0.426)	-0.450*** (0.085)	-0.406** (0.194)	-1.013*** (0.084)	-1.021*** (0.225)
Cost to Export	-0.126*** (0.028)	-0.315** (0.098)	-0.099*** (0.022)	-0.065** (0.028)	-0.285 (0.276)	-0.140 (0.292)	-0.649** (0.182)	-0.391** (0.176)	0.042 (0.149)	0.055 (0.175)
World Income	0.524*** (0.129)	1.368** (0.460)	-0.151 (0.161)	-0.052 (0.251)	1.014 (0.779)	2.022* (1.024)	-0.109 (0.087)	0.304* (0.164)	1.521*** (0.236)	2.293 (1.374)
Constant	-4.659*** (1.222)	-12.429** (4.231)	1.345 (1.423)	0.206 (2.225)	11.819** (5.698)	22.333** (7.795)	5.437*** (1.144)	-6.729** (2.559)	25.848*** (5.862)	1.399 (7.298)
Serial Correlation	2.794 (0.128)	0.483 (0.258)	2.251 (0.113)	1.153 (0.362)	0.461 (0.639)	0.157 (0.856)	3.683 (0.156)	1.188 (0.338)	0.485 (0.647)	0.793 (0.474)
Heteroskedasticity	0.677 (0.757)	0.707 (0.737)	1.027 (0.502)	0.577 (0.831)	0.899 (0.546)	0.474 (0.897)	1.035 (0.524)	0.471 (0.883)	0.484 (0.891)	0.370 (0.940)
Jerque Bera Normality Test	0.999 (0.606)	1.760 (0.414)	0.437 (0.803)	1.196 (0.571)	0.355 (0.837)	2.485 (0.288)	0.311 (0.855)	0.209 (0.901	0.631 (0.729)	0.384 (0.639)
Functional Form Ramsey Reset Test	2.028 (0.901)	0.110 (0.751)	0.487 (0.504)	0.110 (0.751)	0.487 (0.504)	0.133 (0.721)	0.271 (0.625)	1.972 (0.184)	3.064 (0.156)	0.072 (0.792)

Note: * p<0.10, **p<0.05, ***<0.01 (Standard errors are in parentheses)

Table 10: Country-Wise ARDL Short Run Results for the Effect of Productivity on Manufacturing Exports Performance

Variables	China		India		Indonesia		South Korea		Japan	
	(i)	**(ii)**	**(i)**	**(ii)**	**(i)**	**(ii)**	**(i)**	**(ii)**	**(i)**	**(ii)**
TFP	0.645*** (0.124)	--	0.615** (0.207)	--	0.514*** (0.085)	--	0.226** (0.097)	--	0.741*** (0.223)	--
MTFPI	--	0.363*** (0.111)	--	0.112* (0.059)	--	0.042** (0.019)	--	0.431*** (0.109)	--	0.308** (0.125)
Real GDP per capita	2.234*** (0.633)	3.020*** (0.821)	3.351*** (0.572)	0.786** (0.375)	0.425 (0.575)	3.416*** (0.923)	4.376*** (0.886)	4.112*** (0.732)	6.687*** (0.564)	5.726*** (0.667)
Consumer's Demand	0.121 (0.074)	-0.045 (0.085)	0.322 (0.699)	-0.680 (0.732)	-2.726*** (0.580)	-0.792 (0.718)	-3.921*** (0.631)	-4.022*** (0.493)	-6.337*** (1.306)	-5.623*** (1.481)
Real Exchange rate	-0.472*** (0.124)	-0.875*** (0.158)	-0.819** (0.152)	-1.157*** (0.176)	-0.384*** (0.052)	-0.715*** (0.094)	-0.421** (0.151)	-0.559*** (0.129)	-0.661*** (0.105)	-0.661*** (0.101
Cost to Export	-0.029 (0.053)	-0.013 (0.065)	-0.006 (0.069)	-0.028 (0.073)	-0.114 (0.153)	0.291 (0.191)	-0.486 (0.357)	-0.179 (0.280)	0.193 (0.128)	0.139 (0.125)
World Income	4.264*** (0.519)	4.182*** (0.659)	0.333 (0.861)	0.710 (0.868)	1.825** (0.669)	5.144*** (0.952)	-0.854 (0.626)	1.004* (0.474)	0.478 (0.799)	1.643* (0.867)
ECM (-1)	-0.951*** (0.079)	-0.931*** (0.229)	-0.556*** (0.069)	-0.502*** (0.071)	-0.779*** (0.140)	-0.533*** (0.082)	-0.729*** (0.105)	-0.885*** (0.084)	-0.954*** (0.161)	-0.713*** (0.173)
R-square	0.90	0.86	0.81	0.81	0.86	0.82	0.87	0.92	0.98	0.86
F-statistics (P-Value)	28.210 (0.000)	19.744 (0.000)	9.018 (0.001)	5.589 (0.005)	6.111 (0.000)	3.642 (0.014)	7.598 (0.009)	9.053 (0.000)	17.339 (0.000)	9.069 (0.000)
Durbin. Watson Stat.	2.075	2.294	2.11	2.308	2.255	2.239	2.014	2.061	2.401	2.187

Note: * p<0.10, **p<0.05, ***<0.01 (Standard errors are in parentheses)

GDP per capita positively affect the export performance of all the six countries. The long run coefficient of GDP has not the expected positive sign for both agriculture and manufacturing sector export in China, however, this result is statistically insignificant. Consumers' demand has a negative impact on the export performance of both agriculture and manufacturing sectors export performance in all the countries. Similarly, the coefficient of real exchange rate is negatively and statistically significant associated to the export performance for all the countries in both agriculture and manufacturing sectors. While cost to export has a negative impact and world income has a positive impact on the export of both sectors in the sample countries.

The lower part of Table 7 and Table 9 presents results of diagnostic tests. The results of these tests reveal that the model has the desirable econometric properties and the model's residuals are normally distributed and free from the problem of serial correlation and heteroskedasticity. It is also confirmed that the model has correct functional form. The model's stability for agricultural and manufacturing sectors is tested through the Ramsey's reset stability test. The results of the test show that the functional form of the model is correct and overall, the model is stable as the value of F-statistics and their respective probabilities for the whole sample are greater than 5%. The CUSUM and CUSUM square test results of agriculture and manufacturing sectors for all specifications are given in the Appendix-B. The results revealed that parameters for the two sectors are stable over the period of the study.

5. Conclusions

In this study, we estimate the relationship between productivity and export performance of China, India, Indonesia, South Korea, and Japan. The empirical findings revealed that both agricultural and manufacturing productivity have a positive and statistically significant impact on the export performance of China, India, Indonesia, South Korea, and Japan. Similarly, world income is positively associated to the export performance while consumer's demand, real exchange rate and cost to export have a negative impact on the export performance of emerging Asian economies.

These findings offer some policy implications to improve further export performance. Policies and economic strategies should aim at investing in and adoption of advance production technology at firm level in the emerging Asian economies. GDP growth is directly related to the export performance as it expands the production capacity and hence exportable surplus. Therefore, keeping in mind this result the present study offer important policy implication that the objectives of government policies must be to ensure economic growth.

References

Ahmad, H. K., Ilyas, M., Mahmood, T., & Afzal, M. (2010). Exploring the effect of total factor productivity growth on future output growth: Evidence from a panel of East Asian countries. *Pakistan Economic and Social Review*, 105-122.

Amornkitvikai, Y., Harvie, C., & Charoenrat, T. (2012). Factors affecting the export participation and performance of Thai manufacturing small and medium sized enterprises (SMEs).

Balchin, L. (2008). Trade-related business climate and manufacturing export performance in Africa: a firm-level analysis. *Journal of Development Perspectives, 4*(1), 32-66.

Baldwin, J. R., & Gu, W. (2003). Export-market participation and productivity performance in Canadian manufacturing. *Canadian Journal of Economics/Revue canadienne d'économique, 36*(3), 634-657.

Bernard, A. B., & Jensen, J. B. (1999). Exceptional exporter performance: cause, effect, or both? *Journal of International Economics, 47*(1), 1-25.

Bhatt, P. (2013). China’s exports and foreign direct investment. *Applied Econometrics and International Development, 13*(2), 183-196.

Boansi, D., OdilonKounagbéLokonon, B., & Appah, J. (2014). Determinants of agricultural export trade: case of fresh pineapple exports from Ghana. *Journal of Economics, Management and Trade*, 1736-1754.

Chan, E. M., & Au, K. F. (2007). Determinants of China's textile exports: An analysis by gravity model. *Journal of the Textile Institute, 98*(5), 463-469.

Chit, M. M. (2008). Exchange rate volatility and exports: evidence from the ASEAN-China Free Trade Area. *Journal of Chinese Economic and Business Studies, 6*(3), 261-277.

Clerides, S. K., Lach, S., & Tybout, J. R. (1998). Is learning by exporting important? Micro-dynamic evidence from Colombia, Mexico, and Morocco. *The quarterly journal of economics, 113*(3), 903-947.

Coelli, T. J. (1996). Measurement of total factor productivity growth and biases in technological change in Western Australian agriculture. *Journal of applied econometrics, 11*(1), 77-91.

Comin, D., & Gertler, M. (2006). Medium-term business cycles. *American Economic Review, 96*(3), 523-551.

Das, B. B. (2007). Impact of Foreign Direct Investment on the Export Performance of India, China and Malaysia. *Asia Pacific Business Review, 3*(1), 107-114.

David Fadiran, & Akanbi, O. A. (2017). *Institutions and Other Determinants of Total Factor Productivity in Sub-Saharan Africa*. University of South Africa,Hazelwood, Pretoria, South Africa.

Douglas, C., Laurits, C., & Erwin, D. W. (1982). The economic theory of index numbers and the measurement of input, output, and productivity. *Econometrica: Journal of the Econometric Society*, 1393-1414.

Epaphra, M. (2016). Determinants of Export Performance in Tanzania. *Journal of Economics Library, 3*(3), 470.

Falianty, T. (2015). ’Exchange Rate Effect on Indonesian Export: Comparisons of Two Crises Episodes’. *International Journal of Economic Research, 6*(6), 60-75.

Fare, R., Grosskopf, S., Lindgren, B., & Roos, P. (1992). Productivity changes in Swedish pharamacies 1980–1989: A non-parametric Malmquist approach. *Journal of productivity analysis, 3*(1-2), 85-101.

Faustino, H. C., Lima, J. C., & Matos, P. V. (2012). Exports, productivity and innovation: evidence from Portugal using microdata.

Genc, E. G., & Artar, O. K. (2014). The effect of exchange rates on exports and imports of emerging countries. *European Scientific Journal, ESJ, 10*(13).

Greenaway, D., & Kneller, R. (2004). Exporting and productivity in the United Kingdom. *Oxford Review of Economic Policy, 20*(3), 358-371.

Grossman, G., & Helpman, E. (1991). *Innovation and Growth in the Global Economy*. Cambridge: The MIT Press. Hansen.

Gupta, S. D., Raychaudhuri, A., & Haldar, S. K. (2015). Determinants of exports of information technology in India: An empirical analysis. *South Asia Economic Journal, 16*(1), 64-81.

Gururaj, B., Satishkumar, M., & Kumar, M. A. (2016). Analysis of factors affecting the performance of exports in India. *International Journal of Agriculture, Environment and Biotechnology, 9*(4), 613.

Hassan, M. U., Hassan, M. S., & Mahmood, H. (2013). An empirical inquisition of the impact of exchange rate and economic growth on export performance of Pakistan. *Middle-East journal of scientific research, 14*(2), 288-299.

Head, K., & Ries, J. (2003). Heterogeneity and the FDI versus export decision of Japanese manufacturers. *Journal of the Japanese and international economies, 17*(4), 448-467.

Helpman, E., Melitz, M. J., & Yeaple, S. R. (2004). Export versus FDI with heterogeneous firms. *American Economic Review, 94*(1), 300-316.

Jawaid, S. T., Raza, S. A., Mustafa, K., & Karim, M. Z. A. (2016). Does inward foreign direct investment lead export performance in Pakistan? *Global Business Review, 17*(6), 1296-1313.

Jienwatcharamongkhol, V. (2013). Effects of Productivity and Import on Firm-Level Export. *Ratio Working Papers, Paper*(225).

Kafayat, A. (2013). Effects of Exchange Rate Instability on Imports and Exports of Pakistan. *Acta Universitatis Danubius. Œconomica, 10*(2).

Khan, S. U. (2006). *Macroeconomic determinants of total factor productivity in Pakistan*. Working Paper No. 10. State Bank of Pakistan.

Kohler, A., & Ferjani, A. (2018). Exchange rate effects: A case study of the export performance of the Swiss Agriculture and Food Sector. *The World Economy, 41*(2), 494-518.

Liao, H., & Liu, X. (2009). Export-total factor productivity growth nexus in East Asian economies. *Applied Economics, 41*(13), 1663-1675.

Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica, 71*(6), 1695-1725.

Morley, B., & Morgan, W. (2008). Causality between exports, productivity and financial support in European Union agriculture. *Regional studies, 42*(2), 189-198.

Nadeem, M. M., Azam, M., & Islam, R. (2012). An Investigation of the Various Factors Influence on Exports. *Global Journal of Management and Business Research, 12*(19).

Potelwa, X. Y., Lubinga, M. H., & Ntshangase, T. (2016). Factors Influencing the Growth of South Africa's Agricultural Exports toWorld Markets. *European Scientific Journal, ESJ, 12*(34).

Rahmaddi, R., & Ichihashi, M. (2012). How do foreign and domestic demand affect exports performance? An econometric investigation of Indonesia's exports.

Reis, J., & Forte, R. (2016). The impact of industry characteristics on firms' export intensity. *International Area Studies Review*, *19*(3), 266-281.

Ricci, M. L. A., & Trionfetti, M. F. (2011). *Evidenceon Productivity, Comparative Advantage, and Networks in the Export Performance of Firms*: International Monetary Fund.

Rolf, F. (1988). *Fundamentals of Production Theory: Lecture Notes in Economics and Mathmetical System,* . Heidelberg: Springer.

Rolf, F., Shawna, G., Mary, N., & Zhongyang, Z. (1994). Productivity growth, technical progress, and efficiency change in industrialized countries. *The American Economic Review*, 66-83.

Romer, P. (1993). Idea gaps and object gaps in economic development. *Journal of monetary economics, 32*(3), 543-573.

Santos-Paulino, A. U. (2002). Trade liberalisation and export performance in selected developing countries. *Journal of Development Studies, 39*(1), 140-164.

Saqib, N., & Sana, I. (2012). Exchange Rate Volatility and its Effect on Pakistan's Export Volume. *Advances in Management and Applied Economics, 2*(4), 109.

Sharma, C., & Mishra, R. K. (2009). Does export and productivity growth linkage exist. *Evidence from the Indian Manufacturing Industry*.

Shephard, R. W. (1970). Theory of Cost and Production Functions Princeton University Press. *Princeton, New Jersey*.

Solow, R. M. (1956). A contribution to the theory of economic growth. *The quarterly journal of economics, 70*(1), 65-94.

Solow, R. M. (1957). Technical change and the aggregate production function. *the Review of Economics and Statistics*, 312-320.

Srinivasan, P. (2012). Exchange rate volatility and export growth in India: An empirical investigation. *MPRA Paper*.

Veeramani, C. (2008). Impact of exchange rate appreciation on India's exports. *Economic and Political Weekly*, 10-14.

Vikram, N., & Ashok, D. (1993). A new database on physical capital stock: sources, methodology and results. *Revista de análisis económico, 8*(1), 37-59.

Appendix -A

Measures of Total Factor Productivity

Researchers and policy makers measured TFP performance via different techniques. The present study uses two methods (1) growth accounting framework and (2) Data Envelopment Analysis (DEA) to estimate productivity performance measures.

Growth Accounting Framework (GAF)

The growth accounting method follows the seminal work of Solow (1956). This method involves the production function which is based on the assumption of constant returns to scale and the perfect competition in factor markets. Symbolically this function is specified as follows:

$$Y_{a(m)it} = A_{a(m)it} F\left(K_{a(m)it}, L_{a(m)it}\right) \qquad (A.1)$$

where $Y_{a(m)it}$ is output, $A_{a(m)it}$ is total factor productivity, $K_{a(m)it} and\ L_{a(m)it}$ are units of capital and labor inputs respectively.
when taking logarithms on both sides of equation (A.1) , it takes the following form:

$$\mathrm{lnY_{a(m)it}} = \mathrm{lnA_{a(m)it}} + \mathrm{lnF}\left(\mathrm{K_{a(m)it}}, \mathrm{L_{a(m)it}}\right) \qquad (\mathrm{A.2})$$

In the next step differentiating equation (A.2) with respect to time, equation (A.3) is obtained as:

$$\frac{\dot{Y}_{a(m)it}}{Y_{a(m)it}} = \frac{\dot{A}_{a(m)it}}{A_{a(m)it}} + A_t.Fk.\frac{K_{a(m)it}}{Y_{a(m)it}}.\frac{\dot{K}_{a(m)it}}{K_{a(m)it}} + A_t.Fl\frac{L_{a(m)it}}{Y_{a(m)it}}.\frac{\dot{L}_{a(m)it}}{L_{a(m)it}} \qquad (A.3)$$

Assuming that capital and labor markets are competitive, so the share of the marginal product of the factors are equal to their prices. Where $\frac{\Delta \mathrm{Y}}{\Delta \mathrm{K}} = \mathrm{A}\frac{\partial \mathrm{Y}}{\partial \mathrm{K}} = \mathrm{AF_k} = \mathrm{r}$ is the marginal product of capital and $\frac{\Delta \mathrm{Y}}{\Delta \mathrm{L}} = \mathrm{A}\frac{\partial \mathrm{Y}}{\partial \mathrm{L}} = \mathrm{AF_l} = \mathrm{w}$ is the marginal product of labor and r and w are the prices of capital and labor respectively. Therefore, equation $(\mathrm{A.3})$ takes the following form:

$$\frac{\dot{Y}_{a(m)it}}{Y_{a(m)it}} = \frac{\dot{A}_{a(m)it}}{A_{a(m)it}} + r\frac{K_{a(m)it}}{Y_{a(m)it}}.\frac{\dot{K}_{a(m)it}}{K_{a(m)it}} + w\frac{L_{a(m)it}}{Y_{a(m)it}}.\frac{\dot{L}_{a(m)it}}{L_{a(m)it}} \qquad (A.4)$$

Now rearranging equation (A.4) Solow residual can be obtained as follows:

$$\frac{\dot{A}_{a(m)it}}{A_{a(m)it}} = \frac{\dot{Y}_{a(m)it}}{Y_{a(m)it}} - r\frac{K_{a(m)it}}{Y_{a(m)it}} \cdot \frac{\dot{K}_{a(m)it}}{K_{a(m)it}} + w\frac{L_{a(m)it}}{Y_{a(m)it}} \cdot \frac{\dot{L}_{a(m)it}}{L_{a(m)it}} \qquad (A.5)$$

where $\frac{\dot{A}_{a(m)it}}{A_{a(m)it}}$ shows the growth rate of the total factor productivity, $\frac{\dot{Y}_{a(m)it}}{Y_{a(m)it}}$ is the growth rate of output, $\frac{K_{a(m)it}}{Y_{a(m)it}}$ is the ratio of stock of capital to output, $\frac{\dot{K}_{a(m)it}}{K_{a(m)it}}$ is the growth rate of the stock of capital, $\frac{L_{a(m)it}}{Y_{a(m)it}}$ is the ratio of labor to output, $\frac{\dot{L}_{a(m)it}}{L_{a(m)it}}$ is the growth rate of labor while r and w are the prices of capital and labor.

As the capital's stock data is not available, so the present study uses the following perpetual inventory method to gauge it

.

$$K_{a(m)it} = (1 - \sigma)K_{a(m)it-1} + I_{a(m)it} \qquad (A.6)$$

The data on initial stock of capital is gauged based on the following formula:

$$K_{a(m)it-1} = \frac{I_{a(m)it-1}}{\sigma + g_{a(m)}} \qquad (A.7)$$

where K_(a(m)t) shows the stock of capital in the current period, I_(a(m)t) is the level of investment in the current period, σ is the rate at which the stock of capital depreciates and g_(a(m)) represents the growth rate of output. The present study used 4 percent depreciation rate of the stock of capital. Vikram and Ashok (1993) and Khan (2006) also used 4 percent depreciation rate for the stock of capital.

Malmquist Total Factor Productivity Index (MTFPI)

Malmquist productivity index was first introduced by Douglas, Laurits, and Erwin (1982) and then further developed by Rolf (1988) and Rolf, Shawna, Mary, and Zhongyang (1994). Coelli (1996) defined Malmquist productivity index as the ratio of output distances from the production frontier. The Malmquist productivity indices have several desirable advantages. They can breakdown productivity growth into total factor productivity change, technical change and efficiency change. The decomposition of productivity change provide insight into the sources of productivity performance. The Data Envelopment analysis (DEA) presented by Coelli (1996) is employed in the present study to compute output-based Malmquist productivity indices. Rolf et al. (1994) pointed out that the Malmquist productivity indices are based on distance functions that reflects patterns of production technology and requires only input and output data. Rolf et al. (1994) also argued that distance functions can be utilized to identify the sources of productivity growth and to find whether change in productivity growth is due to the efficiency change or whether it is attributed to the technological change. Shephard (1970) and Rolf (1988) defined distance function on production technology S_t such that input x_t can produce output y_t. The distance function can be expressed as follows;

$$d_o^t\,(y_t, x_t) = \min\{(\theta\colon y_t, x_t/\theta)\epsilon S_t\} \qquad (A.8)$$

This function measures the maximum proportional change in output that can be attained from a certain combination of inputs. When distance function d_(o)^t (y_t,x_t) is equal to 1, it shows that (y_t,x_t) is on the boundary of the production frontier. This implies that output is technically efficient. However, if the distance function d_(o)^t (y_t,x_t) is less than 1 this implies that there is technical inefficiency. To show trends in productivity growth, the Malmquist productivity index uses distance function with respect to time that are defined as;

$$d_o^t\,(y_{t+1}, x_{t+1}) = \min\{(\theta\colon y_{t+1}, x_{t+1}/\theta)\epsilon S_t\} \qquad (A.9)$$

$d_o^t\,(y_{t+1}, x_{t+1})$ measure maximum proportional change in output to confirm whether (y_{t+1}, x_{t+1}) is attainable, or not attainable in time period t. The maximum proportional change in output entailed to ensure the attainability of (y_t, x_t) in time period $t+1$ that is represented by $d_o^{t+1}(y_t, x_t)$. According to Rolf et al. (1994) the Malmquist productivity index MPI in time period t is defined as:

$$MPI^t = \frac{d_o^t(y_{t+1}, x_{t+1})}{d_o^t\,(y_t, x_t)} \qquad (A.10)$$

Likewise, the productivity index at time period $t+1$ is defined as follows;

$$MPI^{t+1} = \frac{d_o^t(y_{t+1}, x_{t+1})}{d_o^t\,(y_t, x_t)} \qquad (A.11)$$

So, according to Douglas et al. (1982) the Malmquist total factor productivity index can be defined in terms of the geometric mean of two Malmquist indexes as defined above.

$$MPI_o(y_s, x_s, y_t, x_t) = \left[\frac{d_o^t(y_{t+1}, x_{t+1})}{d_o^t\,(y_t, x_t)} X \frac{d_o^{t+1}(y_{t+1}, x_{t+1})}{d_o^{t+1}(y_t, x_t)}\right]^{\frac{1}{2}} \qquad (A.12)$$

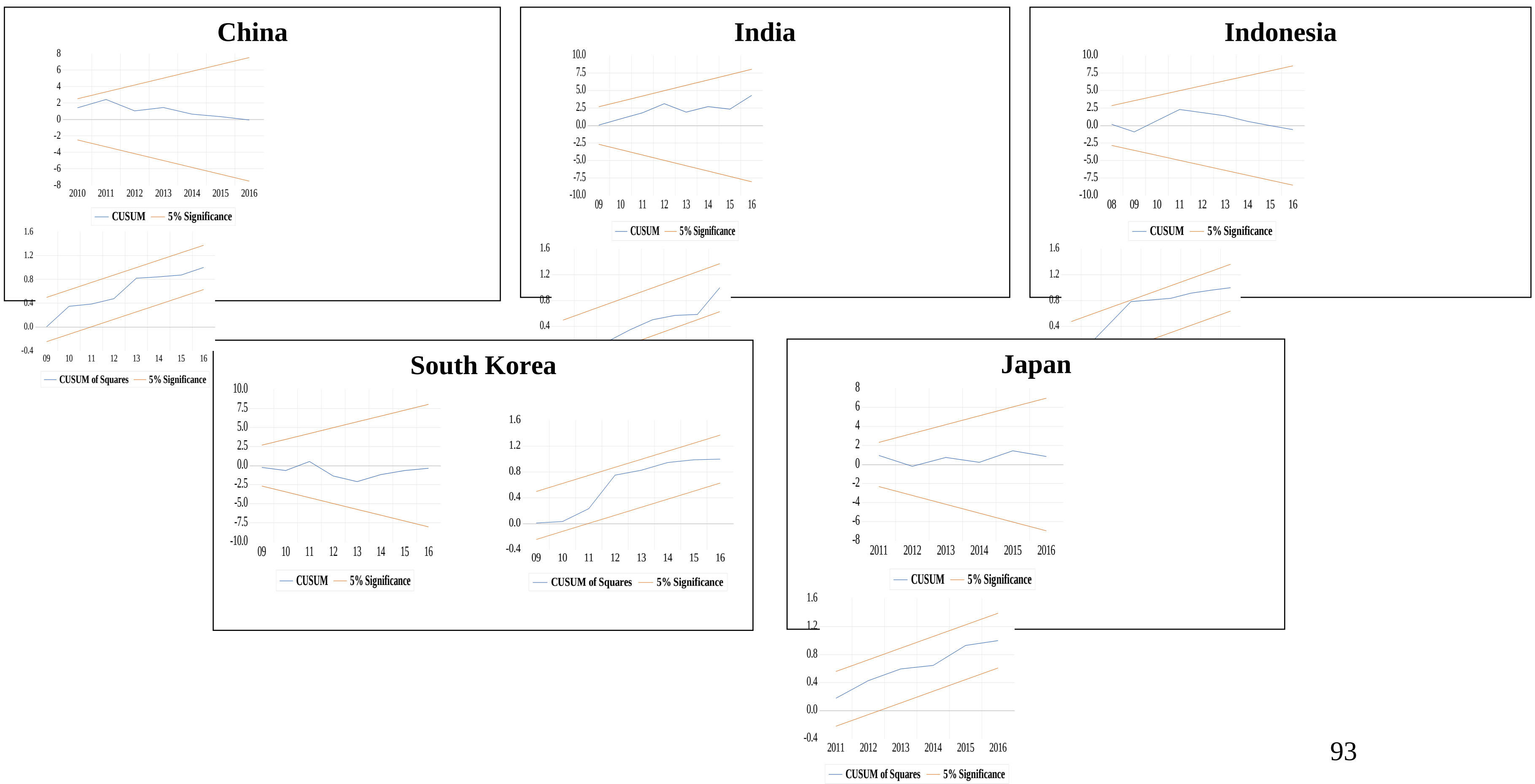
This index is based on the ratios of output distance functions to show changes in productivity growth over the time. A value of $MPI_o > 1$ shows growth in the overall total factor productivity performance from period t to period $\mathrm{t}+1$. And a value of $\mathrm{MPI_o} < 1$ shows that the overall productivity performance is declining over the period. By rewriting equation (A.12), MPI can be decomposed into its two main sources; technical efficiency that represent a shift towards the production frontier and technological change that represent a shift of the production frontier (Fare, Grosskopf, Lindgren, & Roos, 1992);

$$MPI_o(\, y_{t+1}, x_{t+1},\, y_t, x_t) = \frac{d_o^{t+1}(y_{t+1,} x_{t+1})}{d_o^t\,(y_t, x_t)}\left[\frac{d_o^t(y_{t+1,} x_{t+1})}{d_o^{t+!}(y_{t+1}, x_{t+1})} X \frac{d_o^t(y_{t,} x_t)}{d_o^{t+1}(y_t, x_t)}\right]^{\frac{1}{2}} \qquad (A.13)$$

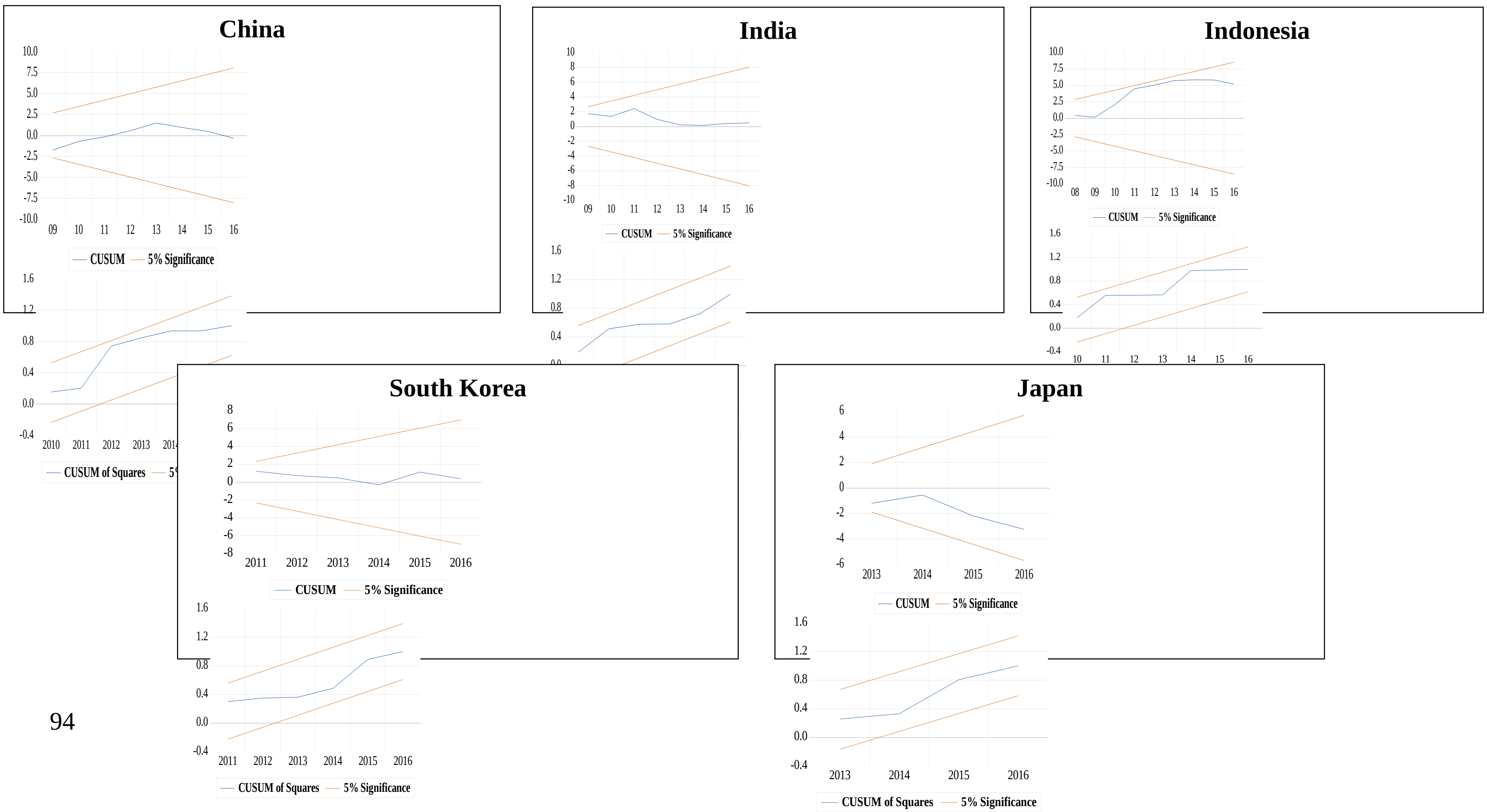
where $\frac{d_o^{t+1}(y_{t+1,} x_{t+1})}{d_o^t\,(y_t, x_t)}$ is the change in technical efficiency between the current period t and next period $t+1$ and the remaining part of this equation, $\left[\frac{d_o^t(y_{t+1,} x_{t+1})}{d_o^{t+!}(y_{t+1}, x_{t+1})} X \frac{d_o^t(y_{t,} x_t)}{d_o^{t+1}(y_t, x_t)}\right]^{\frac{1}{2}}$, is the technical change between the current period t and next period $t+1$.

Appendix-B

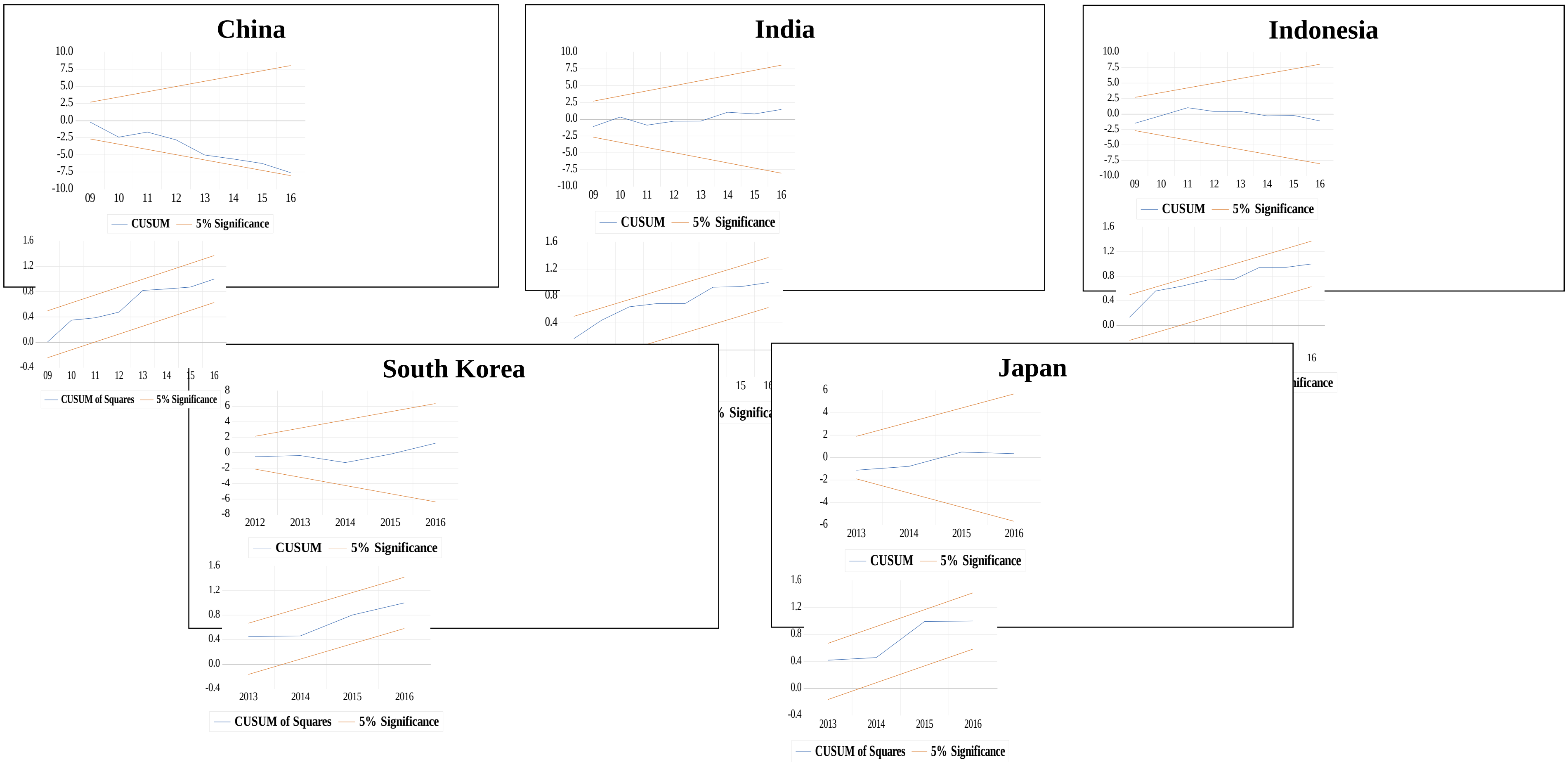
Stability Test Results for First Specification of the Nexus between Productivity and Export Performance of Agriculture Sector of Emerging Asian Economies



Stability Test Results for First Specification of the Nexus between Productivity and Export Performance of Manufacturing Sector of Emerging Asian Economies



Stability Test Results for Second Specification of the Nexus between Productivity and Export Performance of Agriculture Sector of Emerging Asian Economies



Stability Test Results for Second Specification of the Nexus between Productivity and Export Performance of Manufacturing Sector of Emerging Asian Economies