Asia Pacific productivity development determinants

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Abstract

Purpose – The purpose of this paper is to measure the factors determining the productivity development in the Asia Pacific countries such as Malaysia, Indonesia, Singapore, Philippines, Thailand, China, Japan, Korea, India, Australia and New Zealand.

Design/methodology/approach – The extensive growth theory that is expressed as the decomposition of the contribution of changes in employment, physical capital, foreign direct investment (FDI), human capital (HC), telecommunications investment and total factor productivity (TFP) growth on the selected Asia-Pacific countries' output growth is used in this study. In this respect, an annual time series data over the period 1970-2012 for the aforementioned variables are employed.

Findings – The study found that the FDI spillover effects through the TFP are considered as productivity-driven economic growth in which the FDI spillover effects have significant effect on the productivity growth of the majority of these countries. It should be noted that most of these countries showed technological progress through the FDI spillover effects that is translated into a form of technology transfer and HC skills development.

Originality/value – This study empirically compared the FDI spillover effects on sustainable productivity growth of the most growing countries in the Asia Pacific region by using modified extensive growth theory that closed the gaps in the past studies and addressed the issues of technology transfer, HC development and sustainable productivity growth brought by the technical progress in these countries through the FDI spillover effects on productivity growth.

Keywords Business, FDI spillover effects, Asia Pacific, Sustainable productivity growth

Paper type Research paper

Introduction

According to the Organization for Economic Cooperation and Development (OECD) "beyond the initial macroeconomic stimulus from the actual investment, FDI influences growth by raising total factor productivity (TFP) and, more generally, the efficiency of resource use in the recipient economy. This works through three channels: the linkages between FDI and foreign trade flows, the spillovers and other externalities *vis-à-vis* the host country business sector, and the direct impact on structural factors in the host economy" (OECD, 2002).

Moreover, the Asia Pacific region is considered to be one of the most growing regions in the world. Foreign direct investment (FDI) inflows help these countries to grow faster than the industrialised countries. It should be noted that the productivity of an economy specifies its ability in capturing a high level of income, which is one of the key factors explaining an economy's growth.

In this respect, there are many factors driving productivity in a competitive economy. Further, understanding the factors determining productivity had occupied the minds of researchers and economists. In this regard, the classical Economists' such as Adam Smith focus on the investment in physical capital and infrastructure, and, more recently, on the interest in education and training, technological progress, macroeconomic stability, among others. The former can be called input driven and the latter productivity driven. It should be noted that the productivity-driven countries showed positive technological progress through a significant contribution of the total factor productivity (TFP) to their economics

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such as Japan and Korea in East Asia, in the sense that the spillover effects of the interaction between foreign technologies, local human capital (HC) and local firms have taken place in Japan and South Korea. Input driven in which there is no significant technology progress by using input to produce output; these include the economic growth that took place in the rest of the East Asian countries and India.

Moreover, the productivity perspective in Asia Pacific remains very mixed. The area is host to some of the competitive countries, including three members of the top ten (Singapore, Hong Kong and Japan) and some of the most dynamic and rapidly improving economies in terms of competitiveness, such as Indonesia and the Philippines. It should be recalled that the decline in the global economic growth, will have an effect on a country's productivity performance due to a lower international investment flow which will result in a slower global growth. Global productivity growth declined in 2012 at 1.8 per cent (UNCTAD, 2014). However, Japan's labour productivity grew at a rate of 0.5 per cent to a value of USD76,340 in 2012. Meanwhile, South Korea registered at 0.8 per cent at a value of USD65,505, China reported that its labour productivity grew at a rate of 7.4 per cent to a value of USD18,325 in 2012, India's productivity growth was 3.7 per cent at a value of USD11,048 in 2012, while Thailand gained productivity growth by 4.9 per cent to a value of USD18,432.

Furthermore, Singapore and Malaysia have achieved a rate of 0.03 per cent to a value of USD100,278 and 2 per cent to a value of USD36,139, respectively. Besides, Indonesia's labour productivity grew at a rate of 4.2 per cent to USD11,904 in 2012.

Furthermore, the TFP growth analysis shows that despite an increase in TFP growth in recent years selected Asia Pacific economies need to focus their attention on enhancing productivity growth in order to sustain their competitive positions. In one study undertaken by Azomahou *et al.* (2013) for both developed and developing countries spanning over the years 1998-2008, the following factors have been found to exert positive and significant influence on the productivity growth:

(1) HC (higher education) can affect the productivity growth. HC serves to increase the productivity growth when it frontiers with both proximity to the world TFP growth and to the TFP growth of the USA. It decreases when it frontiers with proximity to the highest TFP growth.

(2) R&D intensity can promote greater productivity based on the government expenditure. Total staff in R&D decreased with respect to the highest TFP growth with different speed and increased with respect to the highest TFP and for the TFP growth of the USA.

(3) International trade has a positive effect on the productivity growth.

It should be recalled that Arazmuradov *et al.* (2014) investigated the impact of technology on productivity based on 15 former Soviet Union economies over the period 1995-2008. Their finding shows that FDI and HC promote technical efficiency which has a positive effect on TFP, and hence improves real GDP growth. Meanwhile, Krammer (2014) concentrated on the channels of technological spillover across 47 developed and transition countries between 1990 and 2009.

Generally, he found a strong relationship between trade productivity and technical progress, while the effects of FDI and patent as driven spillover effects are significantly small and the effect of patenting is observed more significantly in the developed economies. As well as the contribution of imports, inward FDI and foreign technology licensing are indicated as the important sources of know-how for the transition economies.

It should be noted that the examined TFP improvement for 12 Asian economies over the period1970-2007 by using the growth accounting framework. The findings of the study

stated that the main factors that have been found to contribute to the TFP growth calculation are as follows the catch-up effect and the HC-formation. As well as, for projections, the variables of the catch-up effect, life expectancy effect, HC and R&D showed strong effect on the TFP growth. In this respect, Madsen (2010) conducted a research on the OECD countries for the period 1870-2006 and found that TFP has been driven by R&D, knowledge spillover via the channel of imports, educational attainment and the interaction between educational attainment and the distance to the technology frontier.

Furthermore, Madsen (2010) searched the spillover benefits to developing countries and found that the imports and FDI are two channels of technology diffusion, in addition to the economic and social institutions, R&D and HC. Another literature by Helpman (2009) on the mystery of economic growth provided which technology diffusion takes place through trade and FDI. Moreover, in a theatrical approach, Aghion and Howitt (1990) analysed the spillover effects through the import channel that found improved quality of the existing intermediate inputs or capital goods which led to higher TFP growth. Meanwhile, the reflections on the Republic of South Korea's acquisition of the technological capacity pointed out that the crucial role of the human and institutional capital receiving countries are significant in improving the TFP growth in this regard, HC applied as a proxy by the level of education. As for the institutional framework, it can be proxy by some of its key components.

Methodology and estimation procedure

Extensive growth theory (output productivity model) is applied in this study as an effort to investigate the influence of labour force, physical capital, FDI, HC and absorptive capacity (AC) on the productivity growth of the selected Asia Pacific countries. In the growth accounting literature theory, the above mentioned model indicated the decomposition of GDP growth derived from definition accounting. Stigler (1947), Abramovitz (1956), Kendrick (1956) and Solow (1957) did a pioneering study on the growth accounting models. After providing more details on this model by Kendrick (1961), an attempt was made to refine itby Denison (1962), and Denison and Edward (1979), Griliches and Jorgenson (1966) and Jorgenson *et al.* (1987) that finally modified Elsadig's (2006/2013) model. By making use of the primal growth accounting model, it can be more extensive in support of the decomposition of contributions of the input-driven factors and TFP to achieve a higher economic growth. Therefore, this section covers the extensive growth theory (contribution of capital, labour, FDI, HC, AC and technology on GDP). In this regard, the production function of an economy can be written as follows:

$$\mathrm{GDP} = \mathrm{AK}^{\alpha 1} L^{\alpha 2} \mathrm{FDI}^{\alpha 3} \mathrm{HC}^{\alpha 4} \mathrm{AC}^{\alpha 5} \mathrm{Telint}^{\alpha 6} \tag{1}$$

Here, GDP as a function of physical capital, labour, FDI, HC, and AC shows the ability to develop the skills of local people through the FDI inflows investment and telecommunications investments (Telint). As a matter of fact, AC (spillover effect) is the interaction of HC with FDI activities to translate it into technological progress or what the so called TFP in order to develop productivity of an economy in the international level and (A) is proxies for TFP growth. This study followed Elsadig (2006/2013) that developed the growth accounting model into two steps. The following first step estimates the parameters of the variables to fill the gap of growth accounting as being not based on statistical analyses that cast doubt in the results generated. Equation (1) can be transferred as follows:

$$\begin{aligned} \boldsymbol{\Delta} \ln \mathrm{GDP}_{i,\,t} = {} & \ln A + \alpha_1 \boldsymbol{\Delta} \ln K_{i,t} + \alpha_2 \boldsymbol{\Delta} \ln L_{i,t} + \alpha_3 \boldsymbol{\Delta} \ln \mathrm{FDI}_{i,\,t} + \alpha_4 \boldsymbol{\Delta} \ln \mathrm{HC}_{i,\,t} + \alpha_5 \boldsymbol{\Delta} \ln \mathrm{AC}_{i,\,t} \\ & + \alpha_6 \boldsymbol{\Delta} \ln \mathrm{Telint}_{i,\,t} + \mu_{i,\,t} \quad i = 1, 2, \ldots, 11; \quad t = 1, 2, \ldots, 43 \end{aligned} \tag{2}$$

By assuming constant returns to scale, the parameters are the elasticity coefficients for the growth of GDP relative to the respective input factors. Therefore, the rate of output in this model simply depends on the accumulation of physical capital and employment, telecommunications investment, which in turn depends on FDI and other sources of input factors.

The next step is to calculate the TFP and its combined contribution from capital, labour, HC, FDI, AC and Telint in terms of their quantities and qualities. The estimation procedures of TFP growth are expressed as follows:

$$\Delta \ln \mathrm{TFP}_{i,\,t} = \Delta \ln \mathrm{GDP}_{i,\,t} - \{\alpha_1 \Delta \ln K_{i,t} + \alpha_2 \Delta \ln L_{i,\,t} + \alpha_3 \Delta \ln \mathrm{FDI}_{i,\,t} + \alpha_4 \Delta \ln \mathrm{HC}_{i,\,t} + \alpha_5 \Delta \ln \mathrm{AC}_{i,\,t} + \alpha_6 \Delta \ln \mathrm{Teling}_{i,\,t}\} \quad (3)$$

According to Elsadig (2012a, b), this approach decomposes the growth rate of aggregate output into the respective shares of input factor. In other words, the framework breaks down the growth rate of the aggregate output into the contribution growth rate of the aggregate physical capital, labour, HC, FDI, AC, Telint and the combined contributions of their quality that is expressed as TFP or technological progress.

Results and discussion

This study applies the modified extensive growth theory model which uses the output approach to examine the productivity growth indicators of the most important Asia Pacific economies as modified by Elsadig (2006/2013). In this regard, output productivity investigates the influence of labour force, physical capital, FDI, HC, AC and Telint on the productivity growth of the selected Asia Pacific countries for the period 1970-2012.

In this respect, this study applied the time series data for 11 Asia Pacific countries for the period 1970-2012, in order to assess the potential linkage between the FDI spillovers effect and the productivity growth. This period was followed by the structural change policies in these countries in improving the productivity growth that – mostly thanks to the manufacturing sector – had been supported by FDI. Nevertheless, the contribution of the TFP growth on the long-run productivity growth of these countries – excluding Japan and Korea – played a less important role due to the fact that the economic recession of 1973, 1985 and the financial crisis of 1997 took place in addition to the quality of HC and the technology applied in these countries (Elsadig, 2012a, b).

As a result, the contribution of TFP to the selected Asia Pacific economy by including FDI inflows, capital, labour, HC, AC (interaction variable between FDI and HC), and Telint in the model was slight (Table I). The countries like Korea and Japan had achieved their

Country	GDP	FDI	CAP	LAB	HC	AC	Telint	TFP
Malaysia	1.590	0.047	0.497	−0.058	0.167	−0.001	0.008	0.932
Indonesia	1.650	0.041	0.082	0.185	−0.026	−0.023	−0.015	1.405
Singapore	1.974	0.195	0.586	0.162	−0.135	−0.0009	−0.009	1.175
Philippines	0.597	−0.005	0.566	−0.110	−0.116	−0.001	−0.015	0.280
Thailand	1.748	0.0002	0.737	0.009	0.127	−0.006	0.009	0.872
China	3.142	0.122	0.531	−0.197	0.262	−0.060	0.050	2.437
Japan	0.890	0.0007	0.353	0.011	−0.007	−0.002	−0.051	0.587
Korea	2.150	0.019	0.730	0.034	0.030	0.037	−0.036	1.336
India	1.413	0.119	0.308	−0.006	−0.140	0.056	0.040	1.035
Australia	0.723	−0.004	0.532	−0.068	−0.492	0.0005	−0.003	0.758
New Zealand	0.508	−0.003	0.290	0.158	−0.106	−0.002	0.025	0.146

Notes: The values were calculated using Equation (3). The values are shown in percentage of variables

Table I.
Productivity indicators of selected Asia Pacific countries; 1970-2012

economic growth based on the productivity-driven economies along with technological progress. By looking at the TFP contribution of Japan and Korea with other countries, it can be found that there is no significant difference between these countries in terms of the average annual growth rates. This result can be interpreted as usage of low and insufficient quality inputs in the production function of these economies.

The highest contribution of GDP to the productivity growth of the selected Asia Pacific countries is observed for China's economy which includes a period investment-driven policy along with particular focus on the HC, and Telint variables. As a result, the productivity of the Chinese economic growth was rapid compared with the period before the structural change policy that had been supported by FDI. Moreover, the highest contribution of the FDI inflows to the selected economies' productivity growth through TFP growth was seen in the Singaporean economic growth. This implies that the quantity growth of FDI inflows can be explained by input-driven policies contributing to its economy's productivity growth.

In addition, the highest contribution of the aggregate physical capital to GDP in terms of the average annual productivity growth of these economies has been observed. In other words, the quantity of aggregate physical capital is reflected in the GDP growth and not the quality of physical capital applied in the productivity-driven economies. The highest contribution of the labour input to GDP in terms of the average annual productivity growth of these countries was made by the Indonesian economy. This shows that the comparative advantage in the intensive unskilled labour was beneficial in favour of attracting the FDI inflows.

Further, the highest contribution of HC to GDP in terms of average annual productivity growth of these group countries was recorded by China and Malaysia, respectively. By considering the contribution of HC to arrive at the productivity-driven economy, it can be found that there was a slight contribution of HC to TFPG of these economies (Table I). This indicates the input-driven productivity being based on the quantity of this factor and not through the new skills development achieved by productivity-driven economies.

Finally, the highest contribution of AC to GDP in terms of the average annual productivity growth of the mentioned countries was seen by India and South Korea among others, respectively. The highest contribution of telecommunications investment to GDP in terms of the average annual productivity growth of these economies was found by China. This reflects the increasing of telecommunications investment in order to achieve the sustainable economic growth to develop the knowledge-based economies.

Concisely, the productivity of the Malaysian economic growth was found to be input driven with particular focus on HC improvement and growth in telecommunications investment as a proxy for ICT. On the other hand, the economic growth for the period 1970-2012 was rapid compared with the period before the structural change policy that had been supported by FDI inflows. In comparison, the productivity of the Indonesian and Singaporean economic growth was found to be labour-driven and capital-oriented policy that had been supported by multi-national companies' investment in particular.

It should be noted that in the Philippines case, the productivity of the economic growth is perceived as an investment-driven policy for the entire period 1970-2012. Thailand, on the other hand, was labour-driven economic growth and investment driven with particular attention to the HC and Telint supported by FDI inflows. Moreover, the Chinese, Australian and Indian economies experienced their economic growth through investment-driven policies. Finally, the New Zealand productivity growth was found to be based on the combination of investment driven along with the labour-driven policies with particular investment in telecommunications.

Conclusion and implications

The test for econometric estimation implies that the coefficients of the effects of FDI inflows as a variable indicate a positive effect on all the selected Asia Pacific economic growth

approximately. It is used in future as a proxy for interaction variable AC (FDI × HC) that is considered to be spillover effects indicator, indicating a positive effect on the almost majority economic growth.

Additionally, the study finds that the impact of the FDI spillover effects is positive with insignificant contribution to the TFP growth. In other words, the ability of the FDI inflows to the growth enhancing of the recipient countries can be attributed to the potential local's HC, AC and labour force variables. In this point, the selected Asia Pacific economic growth is considered to be input driven with high dependence on the FDI inflows investment. Based on the TFP results of this model, the FDI spillover effects had a insignificant impact on the mentioned economies except for developed nations (Japan and South Korea). These findings are in line with the findings of the past studies mentioned in literature reviews.

Furthermore, the results showed that the productivity growth of the significant Asia Pacific economies in the aggregate output model that were input driven was generally more prevalent than the TFP growth driven when the results of TFP were compared with that of the output growth without considering single productivity indicators for the period 1970-2012. Although the results are mixed, an important conclusion that can be drawn is that the growth rates' output were positive but depend on a variety of input terms. Moreover, this paper showed that HC provides the potential effects of FDI to enhance the economic growth as an input-driven economy. Meanwhile, the contribution of HC offers the strongest evidence in influencing GDP. In addition the MNEs have played a major role in bringing economic development to selected countries. Furthermore, the new economic model calls for the FDI inflows to integrate the more technologically advanced foreign-owned into the economy to accelerate knowledge spillovers in the local economy. This involves conscious efforts to forge interaction of the knowledge spillover and domestic HC to upgrade their skills and firms to transfer the technology to the economy which drive high economic growth with spillover effects. These spillover effects might be helpful to enhance HC development and eventually to contribute significantly to economic growth.

Thanks to the FDI inflows, the participation in higher economic growth of selected Asia Pacific economies increased in the period 1970-2012. The policy recommendation is to offer policies that can help to overcome the main problem of input-driven productivity and strengthen the productivity-driven TFP. Besides, the recommendation also includes putting into consideration export-oriented economies, to sustained economic growth through technological intensity. Therefore, the enhancement and slowdown of the TFP contribution to economic growth in terms of the average annual growth rates rely on the quality of the input term used in the production function of the economy. Based on the estimation results of the study, TFP is influenced by the changes in various factors which affect the technological progress including the FDI spillover effect.

To measure the impact of TFP contribution, HC stock in modern production function is reflected in the long-run economic growth of the nations who "own" knowledge and skills. Most HC stock is built up through education or training to accumulate knowledge and skills acquired, which increases economic productivity. The data on the expenditure education corresponded with other series in the models for the period 1970-2012. Consequently, due to the unavailability of data on the skilled level of labour, this study considers expenditure education as proxy for the HC stock.

AC concept appears to be the key explanatory variable for developing countries. Spillover effects of FDI investment are determined by several factors. In this study, it addressed a new aspect of AC that highlighted the importance of skilled labour in mediating FDI spillover in the growth process. Data limitation on AC restricts this study to specify FDI and HC as interaction variables (FDI × HC) that are used as a proxy for AC to indicate the degree of spillover effects.

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