Central Asia Journal No. 85, Winter 2019

DETERMINANT OF PRODUCTIVITY GROWTH: EVIDENCE FROM EMERGING ASIAN COUNTRIES

Muhammad Asim Afridi[*] & Sohail Farooq[**]

Abstract

Total factor productivity growth has played a significant role in uplifting the economic development process of nations in recent years. This paper uses the recently published data of Penn World Table (PWT, 9) for six emerging economies (China, India, South Korea, Malaysia, Thailand and Taiwan) to establish a relationship between the growth of total factor productivity and its various determinants. Panel data econometric techniques are employed and the data utilized were spanning from 1955 to 2012. We found that growth of real GDP and human capital are positively and significantly related with the growth of total factor productivity. Similarly physical capital stock is although positively impacted the growth of total factor productivity but however this relationship is not significant statistically. Lastly, an inverse and significant relationship is observed between employment level and total factor productivity growth for the selected emerging economies. The study concludes that relatively richer and highly educated economies have improved their productivity while employment level has adversely affected the growth of TFP. The results of the study imply that economies should focus on income and human capital increasing policies and further to translate the benefits the focus should be on efficiency of labor rather increasing the employment level.

Keywords: Productivity, Emerging Asian Economies, Panel Model

[*] Assistant Professor, COMSATS University Islamabad, Abbottabad, Pakistan.
Email: asimafridi@cuiatd.edu.pk,

[**]Department of Economics, Hazara University, Mansehra, Pakistan.
Email: thesohailfarooq@hotmail.com

1. Introduction

Total factor Productivity (TFP, hereafter) is considered as the main driver of economic growth in the economic growth literature[12]. TFP could be defined as an increase in the level of production using the same level of inputs. Economic growth which improves standard of living depends upon the growth of TFP. Improved standard life for the masses through high economic growth is the ultimate goal of all economic activities and hence policy makers both in the developing and developed world are constantly trying their best to improve it using various policies. The economic growth literature explored the determinants (macroeconomic, institutional factors, trade openness, technology and human capital etc.) explaining cross country differences in productivity growth[345]. The investigations on sources of economic growth have increased rapidly since the works of Young[6] and Krugman[7]. Krugman was of the view that capital accumulation and skilled labor are main determinants of growth in East Asian economies but the growth unsustainability was mainly associated with the absence of gains from productivity.

The growth of TFP is an essential factor for the long run sustained economic growth and development is also evident from the Solow growth model[8] where he discussed that cross-country differences in TFP might cause cross country differences in per capita income. Nonetheless, the factors that improve productivity growth need to be discussed and will add to the literature discussed in the study of Isaksson[9]. Later on Romer[10]

---

[1] Robert E. Hall and Charles Jones, "Why Do Some Countries Produce So Much More Output Per Worker than Others?," *The Quarterly Journal of Economics* 114, no. 1 (1999): 83–116.

[2] David N. Weil, "Accounting for the Effect Of Health on Economic Growth," *The Quarterly Journal of Economics* 122, no. 3 (2007): 1265–1306.

[3] Sebastian Edwards, "Openness, Productivity and Growth: What Do We Really Know?," *The Economic Journal* 108, no. 447 (March 1, 1998): 383–398.

[4] Robert J. Barro, "Human Capital and Growth," *The American Economic Review* 91, no. 2 (2001): 12–17.

[5] Daron Acemoglu, Simon Johnson, and James Robinson, "Institutions as a Fundamental Cause of Long-Run Growth," in *Handbook of Economic Growth*, ed. Philippe Aghion and Steven Durlauf, vol. 1, Part A (Elsevier, 2005), 385–472, https://EconPapers.repec.org/RePEc:eee:grochp:1-06.

[6] Alwyn Young, "A Tale of Two Cities: Factor Accumulation and Technical Change in Hong Kong and Singapore," in *NBER Macroeconomics Annual 1992, Volume 7* (National Bureau of Economic Research, Inc, 1992), 13–64, https://EconPapers.repec.org/RePEc:nbr:nberch:10990.

[7] Paul Krugman, "The Myth of Asia's Miracle," *Foreign affairs* (1994): 62–78.

[8] Robert M. Solow, "A Contribution to the Theory of Economic Growth," *The quarterly journal of economics* 70, no. 1 (1956): 65–94.

[9] Anders Isaksson, "Determinants of Total Factor Productivity: A Literature Review," *Research and Statistics Branch, UNIDO* (2007).

theoretically explained the role of TFP in an endogenous growth model while various empirical studies[11],[12],[13],[14] justified the significance of TFP in explaining economic growth. Hence it is very important to comprehend the sources of TFP in order to give insights to the policy makers. Besides, another perspective identified by Miller and Upadhyay[15] that certain growth determinant studied in literature e.g. Barro[16] influence economic growth via productivity channel.

The changes in technological improvements boost productivity growth is significant, indicating the significance of focusing on technology as a growth catalyst. The intuition of technological progresses captured in productivity enhancements are clearly explained in the innovation based endogenous growth models by Romer[17], Rivera-Batiz and Romer[18], Grossman and Helpman[19], and Aghion and Howitt[20] [21]. These models capture the contribution of R&D based innovations which directs economy on development path.

The productivity improvements may also be characterized to human capital. The role of human capital in explaining economic growth in endogenous growth framework was presented by Romer[22] and Lucas[23]. The influence of human capital might be either direct when it enters directly the production function or it has an indirect effect on economic growth through

---

[10] Paul M. Romer, "Endogenous Technological Change," *Journal of political Economy* 98, no. 5, Part 2 (1990): S71–S102.
[11] Krugman, "The Myth of Asia's Miracle."
[12] Peter J. Klenow and Andres Rodriguez-Clare, "The Neoclassical Revival in Growth Economics: Has It Gone Too Far?," *NBER macroeconomics annual* 12 (1997): 73–103.
[13] Hall and Jones, "Why Do Some Countries Produce So Much More Output Per Worker than Others?"
[14] Jona-Lasinio, C., Schiavo, S., & Weyerstrass, K. (2019). How to revive productivity growth?. EconPol Policy Report, 3(13).
[15] Stephen M. Miller and Mukti P. Upadhyay, "The Effects of Openness, Trade Orientation, and Human Capital on Total Factor Productivity," *Journal of development economics* 63, no. 2 (2000): 399–423.
[16] Robert J. Barro, "Economic Growth in a Cross Section of Countries," *The quarterly journal of economics* 106, no. 2 (1991): 407–443.
[17] Romer, "Endogenous Technological Change."
[18] Luis A. Rivera-Batiz and Paul M. Romer, "International Trade with Endogenous Technological Change," *European economic review* 35, no. 4 (1991): 971–1001.
[19] Gene M. Grossman and Elhanan Helpman, "Quality Ladders in the Theory of Growth," *The Review of Economic Studies* 58, no. 1 (1991): 43–61.
[20] Philippe Aghion and Peter W. Howitt, "A Model of Growth Through Creative Destruction," *Econometrica* 60, no. 2 (1992): 323–351.
[21] Philippe Aghion and Peter W. Howitt, *Endogenous Growth Theory*, n.d., https://mitpress.mit.edu/books/endogenous-growth-theory.
[22] Paul M. Romer, "Increasing Returns and Long-Run Growth," *Journal of political economy* 94, no. 5 (1986): 1002–1037.
[23] Robert E. Lucas, "The Industrial Revolution: Past and Future," *Lectures on economic growth* (2002): 109–188.

TFP by enhancing technical or creative skills as human capital could encourage innovative outcome and therefore adds to economic growth. Hence the growth literature also recognized the supportive nature of R&D activities and human capital in encouraging productivity growth. It is evident in the study by Jajri[24] that economic growth may be enhanced by adopting both input driven growth policies and technologies driven such as TFP growth. High level of human capital empowers the innovation capability of a nation to develop new technologies and adopt, implement, and effectively utilize existing technologies[25] [26]. It also influences the speed of technological catch up and diffusion[27] [28]. High level of human capital also induces labor productivity due to the increased capacity of workers.

The present study is mainly an attempt to see how the TFP has behaved in six emerging economies in the Asian region (China, India, South Korea, Malaysia, Thailand and Taiwan). We examine the effects of human capital which is proxied by an index which is recently developed by the Penn World Tables (Version 9.5)[29] and is based on years of schooling and returns to education), physical capital, and employment and GDP growth on TFP.

This attempt is significant in the sense that TFP differences account for most of the cross-country differences in per capita income and TFP is considered as the major sources of long run increase in well-being[30] [31] [32]. Secondly, there is abundant literature which advocates the effects of human capital on TFP. We suppose that any of the possible determinants of GDP growth considered in the literature might have a direct effect on total factor productivity. Technology driven growth has contributed a lot to the growth process of many developed and developing countries and therefore has got prime importance over the input driven growth strategies. Debacles and

---

[24] Idris Jajri, "Determinants of Total Factor Productivity Growth in Malaysia," *Journal of economic Cooperation* 28, no. 3 (2007): 41–58.

[25] Daron Acemoglu, Philippe Aghion, and Fabrizio Zilibotti, "DISTANCE TO FRONTIER, SELECTION, AND ECONOMIC GROWTH," *Journal of the European Economic Association* 4, no. 1 (March 1, 2006): 37–74.

[26] Philippe Aghion and Peter W. Howitt, *The Economics of Growth*, n.d., https://mitpress.mit.edu/books/economics-growth.

[27] Richard R. Nelson and Edmund S. Phelps, "Investment in Humans, Technological Diffusion, and Economic Growth," *The American economic review* 56, no. 1/2 (1966): 69–75.

[28] Jess Benhabib and Mark M. Spiegel, "The Role of Human Capital in Economic Development Evidence from Aggregate Cross-Country Data," *Journal of Monetary economics* 34, no. 2 (1994): 143–173.

[29] Robert Feenstra, Robert Inklaar, and Marcel Timmer, "The Next Generation of the Penn World Table," *American Economic Review* 105, no. 10 (2015): 3150–82.

[30] Hall and Jones, "Why Do Some Countries Produce So Much More Output Per Worker than Others?"

[31] Klenow and Rodriguez-Clare, "The Neoclassical Revival in Growth Economics."

[32] Weil, "Accounting for the Effect Of Health on Economic Growth."

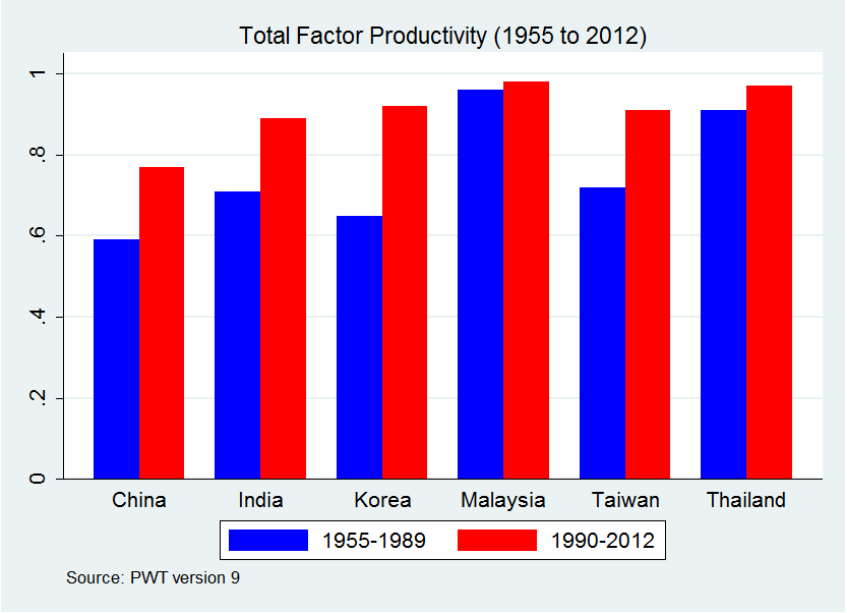
miracles on the path of economic growth could be explained largely by looking into the TFP behavior. The reason behind selecting these economies is that recently, the Penn World Tables version 9.5 has provided a comprehensive data set on TFP for the chosen economies for an extended time period. This extended database has provided an opportunity for the researchers to observe the behavior of TFP with respect to various determinants in the selected economies.

This paper is organized as following. A comprehensive overview on TFP trends in recent times has been reported in section two. Modeling for the purpose of the empirical testing is shown in third section. In the fourth section, estimating methodology is documented. Major findings are discussed in the penultimate section. In the final section, based on the findings, conclusions are drawn and policy recommendations are suggested.

2. An Overview on total factor productivity (TFP) in Emerging Asia

The developed countries have achieved remarkable improvements both in economic growth owing to higher level of TFP over the years. On the other hand, the developing countries haven't had any significant improvement in economic growth due to the low level of TFP. The major difference between the developed and developing economies is the state of TFP. Developed countries have boost up their economies remarkably owing to higher TFP, whereas due to lack of technology and hence low level of TFP, the developing world have not achieved the desired growth objectives. It is also an established fact, that TFP differences leads to differences in economic growth.

The behavior of TFP over the years has been shown in the following Figure 1 for some of the sampled emerging economies. The time period used is indeed very long spanning from 1955 to 2012 and hence a division is being made in order to do meaningful comparison over the years. The entire time period is divided into two sup-periods from 1955-1989 and from 1990 to 2012. The blue bars indicates average productivity level during the period 1955-1989 and the red bars shows an average productivity level from the period 1990-2012. The following Figure 1 depicts the behavior of TFP for the sampled countries.



In Figure1, the TFP behavior in the sampled Asian emerging countries is reported. It can be seen that all of the emerging countries located in the Asian region, have achieved a significant and sustainable improvement during the period 1990 to 2012 as compared to 1955-1989. And this could be the possible reason why these countries have secured and sustained remarkable growth rates over the years in the Asian region. Other countries in the Asian region have not had the opportunity to accelerate their growth rates due to the low level of TFP.

The Korean economy has achieved higher improvement in TFP as compared to other economies during the period 1990-2012 as compared to 1955-1989. China, Taiwan and India have also recorded impressive improvements in their TFP during the recent time period[33]. The Chinese economy did well economically during the last few decades and has attracted the attention of many policy makers and researchers. Among the list, the Malaysian and Thailand economies have marginal increases in TFP. One interesting observation from the figure is that economies having higher TFP during the period 1955-1989 have shown very marginal improvements in TFP while those having low level of TFP during the period 1955-1989 have shown remarkable improvements in TFP in recent times from 1990-2012. It could be concluded that the productivity level has improved a lot recently especially in the emerging economies. Further, it is also a fact that

[33] Chan et. al., Green total factor productivity growth and its determinants in China's industrial economy. Sustainability, 10(4), 1052. (2018)

growth in TFP has been considered as a vital factor for achieving higher economic growth. Therefore, it seems very important to investigate the behavior of TFP and its determinants for the sampled emerging economies.

3. Modeling Strategy and Data

The prime objective of the current paper is to explore the determinants of the growth of TFP in the selected emerging economies. TFP growth is indeed a complex process and hence depends upon various factors. In the literature various researchers have identified different factors in the context of different countries. However, new growth theory which is emerged from the pioneering work of Romer[34] has provided a base to potential researchers to study the growth of TFP and its multiple determinants. Human capital which is the main driver of growth in the new growth literature is directly linked with the growth of TFP. Similarly, a growth of TFP may also depend upon the level of available physical capital stock. In fact capital stock is the key factor that could explain both TFP growth and economic growth differences across countries. Similarly, domestic employment level could also be the reason behind the growth of TFP. More employment level means more labor force is there to operate physical capital stock. The following model is specified to be estimated in order to obtain results regarding the impact of various determinants and the growth of TFP.

$$GTFP_{i,t} = \beta_0 + \beta_1\, emp_{i,t} + \beta_2\, hc_{i,t} + \beta_3\, gdp_{i,t} + \beta_4\, K_{i,t} + \epsilon_{i,t} \quad (1)$$

Where the dependent variable is the growth of TFP and is calculated as the log differences. TFP is measured in constant national prices. Employment level is captured through the number of people engaged in millions. This proxy seems to be better than the commonly used proxies for labor force such as population aging between 15-64 years. The reason is that economically active population (population aging between 15 to 64 years) is indeed very broad term and it is quite possible that majority of them may be involved in some odd jobs or even no jobs. The growth of real GDP is also measured in constant US Dollars. Human capital is proxied by an index which is recently developed by the Penn World Tables (Version 9.5) and is based on years of schooling and returns to education. The general form of equation can be re-written as below.

$$GTFP_{it} = b_0 + b_k(X)_{it} + U_{it} \quad (2)$$

Equation 2 is the simplified version of equation 1. The term $(X)_{it}$ consists of all explanatory variables mentioned in equation 1 already. The disturbance term (U_{it}) represents a composite disturbance term and it is the combination of cross section specific error (α_i) and idiosyncratic error term (ϵ_i). The cross section specific error term (α_i) is also known as unobserved

[34] Romer, "Increasing Returns and Long-Run Growth."

heterogeneity and it remains constant, while the idiosyncratic error term (ϵ_i) is the usual disturbance term and it has the usual OLS properties.

Unlike previous literature, we have used long panel data covering time period from 1955 to 2012 for the selected emerging economies. The Penn World Tables (PWT, Version 9)[35] online available at (http://febpwt.webhosting.rug.nl/Dmn/AggregateXs/PivotShow) has provided an extended data for almost all countries in general and for some countries in particular. The selected countries for which data is provided for long time period is selected for the current academic exercise. Detailed information about the data sources and variables description is provided in the appendix Table 2.

4. Estimating Methodology

Panel or longitudinal data can be analyzed using the either random effects or fixed effects model as reported in the literature by Dewan and Hussein[36]. Both of these models have advantages as well as disadvantage. The fixed effects model which is also known as within estimator controls for the serial correlation between the disturbance term and explanatory variables. However, the fixed effects estimator is unable to estimate the impact of variables which are time invariant. On the other hand, the random effects model is appropriate if there is no correlation between the explanatory variables and the disturbance term. A study by Hill et al.,[37] and Tahir and Azid[38] stated that it is always safe to use the fixed effects estimate model instead of random effects owing to the presences of correlation between the disturbance term and independent variables. However, the exact decision can be made using the well-known test which is specifically designed for choosing between the fixed effects and the random effects model.

Next the presence of cross-sectional dimension may lead both the problem heteroscedasticity problem which affects standard errors and hence the associated test-statistic (t-test) may be misleading. Therefore models are estimated using the white robust standard errors in order to correct standard errors. Results are reported in the following Table 1.

---

[35] Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer (2015), "The Next Generation of the Penn World Table" American Economic Review, 105(10), 3150-3182, available for download at www.ggdc.net/pwt

[36] Edwin Dewan and Shajehan Hussein, *Determinants of Economic Growth (Panel Data Approach)* (Citeseer, 2001).

[37] R. Carter Hill, William E. Griffiths, and Guay C. Lim, *Principles of Econometrics*, 5th Edition. (The Wiley Network, 2018), https://www.wiley.com/en-pk/Principles+of+Econometrics%2C+5th+Edition-p-9781119320944.

[38] Muhammad Tahir and Toseef Azid, "The Relationship between International Trade Openness and Economic Growth in the Developing Economies: Some New Dimensions," *Journal of Chinese Economic and Foreign Trade Studies* 8, no. 2 (2015): 123–139.

Table 1: Main Regression Results

Variables	Pooled OLS	Fixed Effects
Constant	-0.095*** (0.019)	0.318 (0.044)
Employment	-.005*** (0.001)	-0.155*** (0.011)
Human Capital	-0.027*** (0.007)	0.272*** (0.026)
Physical Capital Stock	0.007 (0.002)***	0.001 (0.003)
Growth of real GDP	0.767 (0.025)***	0.817 (0.034)***
Econometric Criteria	Adj-R-Squared: 0.735 S.E: 0.020 F:234.00239***	Adj-R-Squared: 0.821 S.E: 0.017 F:175.772***

Dependent variable: The growth of total factor productivity. Where (***), (**) and (*) represents significance level at 1 percent, 5 percent and 10 percent level respectively.

5. Results and Analysis

Table 1, reports empirical results based on pooled least squares as well as panel fixed effects techniques. The second column of Table 1 includes results based on pooled least squares show that the growth of TFP is associated with the variables included in the model. According to the results, physical capital stock and growth of real per capita GDP have positively and significantly influenced the growth of TFP. On the other hand, human capital and domestic employment have played and adversely impacted the growth of TFP for the selected countries. However, the data is not poolable as confirmed by the Hausman test reported at the bottom of Table 1. Hausman test decides the econometric technique (between panel fixed effect and random effect technique) to be used for the dataset under study. Therefore, the pooled least square results are not discussed in greater detail consequently. However, it does not mean that the pooled least square results are unimportant. Infect the least squares estimation provides an initial understanding about the relationship between the dependent and independent variables as discussed by Chen and Gupta[39] and Tahir and Azid[40].

[39] Pei-Pei Chen and Rangan Gupta, "An Investigation of Openness and Economic Growth Using Panel Estimation," *Indian Journal of Economics* 89, no. 355 (2009): 483.

[40] Tahir and Azid, "The Relationship between International Trade Openness and Economic Growth in the Developing Economies."

Regression results obtained through panel fixed effects estimator are shown in the third column of Table 1. It can be seen from the Table that human capital which has attracted attention of the researcher since the introduction of new growth theory impacted significantly the growth of TFP for the sampled countries. The point estimate suggests that an increase of one unit in human capital index would contribute about 0.27 in the growth of TFP. It implies that the sampled emerging economies shall focus on educating their huge population in order to increase the stock of human capital stock and hence the growth of TFP would be influenced positively. Next, the results have revealed that employment level which is used as a proxy for labor force has adversely affected the growth of TFP. This confirm the earlier results that only human capital or skill labor force is much more beneficial from the growth perspective. Ordinary labor force in majority of the cases especially in the developing world is unskilled and therefore could not contribute the growth or development process. A positive and statistically significant relationship is observed between the growth of GDP and TFP growth. High growing economies have the opportunity and potential to speed their TFP growth by devising and implementing various policies such as in high R&D expenditures. No doubt that high R&D guarantees improved TFP growth. The results show that the impact of stock of physical capital on the growth of TFP is although positive, but however this impact is not statistically significant at standard level. Surprisingly, our results could not support the hypothesis that the stock of physical capital is deemed important for the growth of TFP. The possible reason behind the insignificant role played by physical capital in accelerating the growth of TFP is indeed very hard to pin-down as the available literature is strongly in favor of positive relationship between physical capital and TFP growth. However, one of the possible reasons could be that the available physical capital is not enough to cast a significant impact on TFP growth. Therefore, the sampled countries are suggested to pay attention and take steps in order to increase the stock of physical capital so that to make its contribution towards TFP growth visible and significant.

The overall explanatory power of the estimated model is quite strong indicating that the fitted models explain significant variation in the growth of TFP. Adjusted R-Squared ranges 0.73 and 0.82 for the pooled least squares and fixed effects models respectively. Similarly, the joint significant test (F-test) for all estimated model is significant at standard level shows that estimated models fits the data well and efficiently.

6. Conclusions and Recommendation

This paper investigates the impact of various factors on the growth of TFP. Emerging economies located in the Asian region have been selected and for searching the relationship. Panel econometric techniques are employed and the data utilized were spanning from 1955 to 2012

constituting 57 annual observation. This study can also be extended to Central Asian (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan) economies as the role of the these states is expected to be more critical in the coming years as these countries are opening their economies.

The study found that the growth of TFP can be enhanced by focusing on some key determinants. Among others, the stock of human capital that comes as the most important factor which has impacted the growth of TFP not only positively but also significantly. The study also confirmed the superiority of the stock of human capital over both physical capital and labor force which are the key inputs to production the Solow growth model[41]. Physical capital and labor force are although important; however, their contribution towards the growth of TFP is unexpected in the current study. The Growth of GDP ensures a rise in TFP growth. And it is possible because high growing economies are relatively in a better position to devise and implement policies that suits the TFP growth such as R&D and other developmental programs. From policy perspective sounds efforts are needed on the part of policy makers to pay attention to different determinants of TFP growth in general and towards human capital stock in particular. No doubt focusing on these determinants would help them to grow fast in the long-run through increasing TFP.

emp	Number of persons engaged (in millions)	PWT, 9.5
hc	Index of human capital per person, based on years of schooling and returns to education	PWT, 9.5
gdp	Real GDP at constant prices (in mil. 2011US$)	PWT, 9.5
K	Capital stock at constant prices (in mil. 2011US$)	PWT, 9.5
TFP	TFP at constant national prices (2011=1)	PWT, 9.5

Appendix Table 2: Variables Description and Data Sources

[41] Solow, "A Contribution to the Theory of Economic Growth."

References

Acemoglu, D., Aghion, P., & Zilibotti, F. (2006). Distance to frontier, selection, and economic growth. *Journal of the European Economic association*, *4*(1), 37-74.

Acemoglu, D., Johnson, S., & Robinson, J. A. (2005). Institutions as a fundamental cause of long-run growth. *Handbook of economic growth*, *1*, 385-472.

Aghion, P., & Howitt, P. (1990). *A model of growth through creative destruction* (No. w3223). National Bureau of Economic Research.

Aghion, P., Ljungqvist, L., Howitt, P., Howitt, P. W., Brant-Collett, M., & García-Peñalosa, C. (1998). *Endogenous growth theory*. MIT press.

Barro, R. J. (1991). Economic growth in a cross section of countries. *The quarterly journal of economics*, *106*(2), 407-443.

Barro, R. J. (2001). Human capital and growth. *American economic review*, *91*(2), 12-17.

Benhabib, J., & Spiegel, M. M. (1994). The role of human capital in economic development evidence from aggregate cross-country data. *Journal of Monetary economics*, *34*(2), 143-173.

Chen, C., Lan, Q., Gao, M., & Sun, Y. (2018). Green total factor productivity growth and its determinants in China's industrial economy. *Sustainability*, *10*(4), 1052.

Chen, P. P., & Gupta, R. (2009). An investigation of openness and economic growth using panel estimation. *Indian Journal of Economics*, *89*(355), 483.

Edwards, S. (1998). Openness, productivity and growth: what do we really know?. *The economic journal*, *108*(447), 383-398.

Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer (2015), "The Next Generation of the Penn World Table" American Economic Review, 105(10), 3150-3182, available for download at www.ggdc.net/pwt

Grossman, G. M., & Helpman, E. (1991). Quality ladders in the theory of growth. *The review of economic studies*, *58*(1), 43-61.

Hall, R. E., & Jones, C. I. (1999). Why do some countries produce so much more output per worker than others?. *The quarterly journal of economics*, *114*(1), 83-116.

Hill, R. C., Griffiths, W. E., & Lim, G. C. (2018). *Principles of econometrics*. John Wiley & Sons.

Isaksson, A. (2007). Determinants of total factor productivity: a literature review. *Research and Statistics Branch, UNIDO*.

Jajri, I. (2007). Determinants of total factor productivity growth in Malaysia. *Journal of economic Cooperation*, *28*(3), 41-58.

Jona-Lasinio, C., Schiavo, S., & Weyerstrass, K. (2019). How to revive productivity growth?. *EconPol Policy Report*, *3*(13).

Klenow, P. J., & Rodriguez-Clare, A. (1997). The neoclassical revival in growth economics: Has it gone too far?. *NBER macroeconomics annual*, *12*, 73-103.

Krugman, P. (1994). The myth of Asia's miracle. *Foreign affairs*, 62-78.

Lucas, R. E. (2002). The industrial revolution: Past and future. *Lectures on economic growth*, 109-188.

Miller, S. M., & Upadhyay, M. P. (2000). The effects of openness, trade orientation, and human capital on total factor productivity. *Journal of development economics*, *63*(2), 399-423.

Nelson, R. R., & Phelps, E. S. (1966). Investment in humans, technological diffusion, and economic growth. *The American economic review*, *56*(1/2), 69-75.

Rivera-Batiz, L. A., & Romer, P. M. (1991). International trade with endogenous technological change. *European economic review*, *35*(4), 971-1001.

Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of political economy*, *94*(5), 1002-1037.

Romer, P. M. (1990). Endogenous technological change. *Journal of political Economy*, *98*(5, Part 2), S71-S102.

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

Tahir, M., & Azid, T. (2015). The relationship between international trade openness and economic growth in the developing economies: Some new dimensions. *Journal of Chinese Economic and Foreign Trade Studies*, *8*(2), 123-139.

Well, D. N. (2007). Accounting for the effect of health on economic growth. *The quarterly journal of economics*, *122*(3), 1265-1306.

Young, A. (1992). A tale of two cities: factor accumulation and technical change in Hong Kong and Singapore. *NBER macroeconomics annual*, *7*, 13-54.