Applying the Long-Term Growth Model to Myanmar Based on the Growth Trajectory of Vietnam

By

JEON, Injae

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

MASTER OF PUBLIC POLICY

2020

Applying the Long-Term Growth Model to Myanmar Based on the Growth Trajectory of Vietnam

By

JEON, Injae

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

MASTER OF PUBLIC POLICY

2020

Professor Cho, Yoon Cheong

Applying the Long-Term Growth Model to Myanmar Based on the Growth Trajectory of Vietnam

By

JEON, Injae

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

MASTER OF PUBLIC POLICY

Committee in charge:

Professor Cho, Yoon Cheong, Supervisor _____

Professor Kim, Dongseok _____

Approval as of May, 2020

ABSTRACT

Since the launch of wide-ranging economic reforms in 2011, Myanmar has achieved robust economic growth. However, in consideration of existing development challenges such as lack of hard and soft infrastructure and depletion of natural resources, Myanmar's sustainable growth will not be possible without constant reforms. In this regard, the purpose of this study is to simulate the patterns of long-term economic growth and Total Factor Productivity (TFP) growth in Myanmar based on various scenarios by utilizing the World Bank's Long-Term Growth Model (LTGM) to provide policy implications. As for scenarios, this study benchmarks Vietnam, which has shown remarkable economic performance two decades ahead of Myanmar with a similar geographical and economic background.

The results of simulation analyses show TFP growth is the most decisive factor for Myanmar's long-term economic growth, followed by increasing female labour participation. However, to achieve a long-lasting economic growth rate of more than 6%, Myanmar is required to improve all the growth engines, including investment and human capital. Meanwhile, as to TFP growth, increasing an education index shows the most significant impact on TFP growth in Myanmar. According to the results of analyses, policy makers in Myanmar are advised to strengthen policies improving human capacity for sustainable economic growth. This will not only contribute to TFP growth but will also directly affect economic growth. In addition, labour market policies to promote female labour participation is also significant to economic growth until it reaches its target.

In addition to draw policy implications, this study contributes to secure the validity of simulation analysis using LTGM through data calibration. Furthermore, the approach in this study applying LTGM and LTGM-TFP extension could be a reference to policy makers and researchers to utilize the models effectively.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. Introduction

Sustainable economic growth is the logical way for a country to be rich. The real GDP (Gross Domestic Product) per capita in the United States has grown from $3,340 in 1870 to $33,330 in 2000, the second-highest level in the world in 2000, and the average annual growth rate was 1.8% during the period (Barro & Sala-i-Martin, 2004). This long-lasting economic growth is more important than high economic growth rate itself. East Asian miracle economies such as Taiwan, Singapore and South Korea were not made by recording the highest economic growth rates several times, but rather by sustaining a fairly high level of economic growth in the long-term. Since the 2000s, the growth rates of the emerging market and developing economies have begun to outpace those of the advanced economies. As this trend is expected to continue in the future, some countries that succeed in leapfrog among developing economies will be those that sustain long-term economic growth. In this regard, for Myanmar, which is the lastly opened market in Southeast Asia, it must use its limited national resources effectively to maintain its economic growth in the long-term. The central objective of this study is to identify the major drivers that have an impact on the economic growth of Myanmar and to draw policy implications to an efficient allocation of national resources for sustaining the growth. This study applies the World Bank's Long-Term Growth Model (LTGM) to measure the impact of each growth driver by benchmarking Vietnam's growth trajectory for the long-term growth of Myanmar.

Some studies have also tried to find out a way of sustaining the economic growth in Myanmar using simulation analysis for long-term growth. Taguchi & Lar (2015), have used macro-econometric model to draw the importance of intensifying investment and improving TFP for optimal growth path in Myanmar. Meanwhile, using Calibrated General Equilibrium (CGE) model, Roland-holst & Park (2015) have assessed the long-term benefits of economic

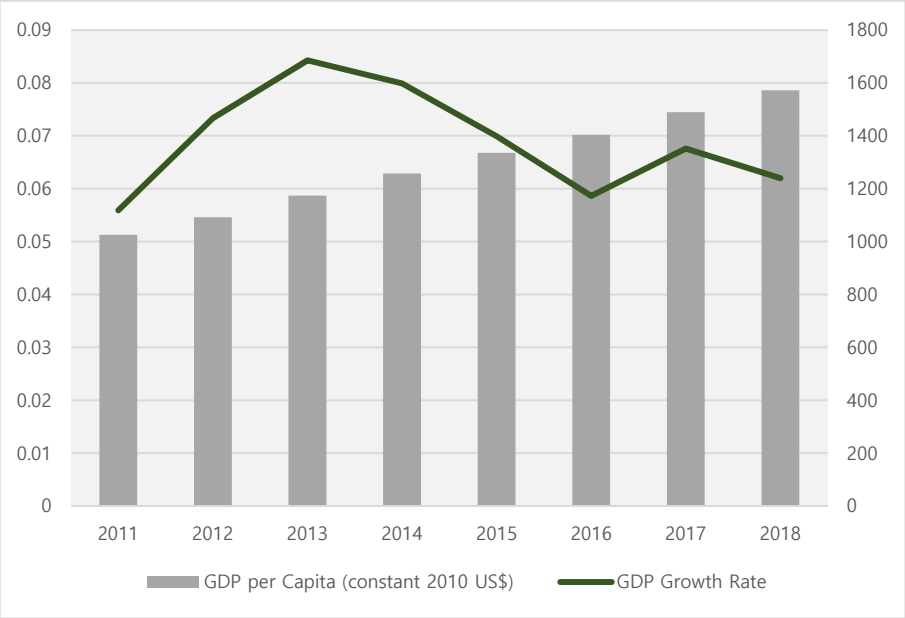
reform and put emphasis on a favourable investment climate including human capital development and regional economic integration. Compared to those studies, this study forecasts Myanmar's long-term growth using LTGM, which directly shows the effect of growth drivers by overcoming data limitation in developing countries. In addition, this study utilizes data after the market opening in 2011 for simulation analyses such as long-term economic growth and TFP growth, while the previous studies were based mainly on data prior to Myanmar's market opening.

It is structured in the following manner. the second half of chapter 1 provides an economic background of Myanmar and the purpose of this study. Chapter 2 reviews major drivers of economic growth and compares them between Myanmar and Vietnam since 1990. Chapter 3 introduces the World Bank's LTGM and Chapter 4 covers methodology including data calibration and scenarios for two simulation analyses. Chapter 5 shows the analyses results and Chapter 6 concludes with policy implications.

1.1 Background of Myanmar

Myanmar, under the military regime that lasted for almost 50 years from 1962 to 2011, it has fallen into the Least Developed Country (LDC). However, since the launch of transitional civilian administration in 2011, Myanmar has undertaken wide-ranging economic, social, and governance reforms (Asian Development Bank, 2017). Thanks to these reform efforts, the lifting of international sanctions and country's strengths such as abundant natural resources, large and cheap labour, and a sizable untapped market, Myanmar has achieved robust economic growth with 6.9% real GDP growth rate on average between 2011-2018 (Figure 1). Myanmar is regarded as a country with great economic potential, but there are also concerned voices about the long-term growth of Myanmar. The lack of hard and soft infrastructure is pointed out

as a significant impediment to Myanmar sustaining high economic growth over the long-term, and the depletion of natural resources that contribute the most to exports, rapid increase in minimum wage and ethnic conflicts are also development challenges (ASEAN+3 Macroeconomic Research Office, 2019; ADB, 2017). Moreover, the expected graduation from the LDCs group would negatively affect Myanmar's economic growth as the country may lose preferential treatment by the international community (United Nations Industrial Development Organization, 2019). Under these constraints, more fundamental improvements are required for Myanmar to lay the foundations for sustainable economic growth.



Source: IMF World Economic Outlook

Figure 1. GDP per Capita and GDP Growth Rate in Myanmar

1.2 Purpose of Research

The purpose of this study is to forecast Myanmar's long-term growth stemming from the change of each growth driver by using the World Bank's LTGM and provides policy implications. The LTGM, an excel-based tool to conduct simulation analysis using the neoclassical growth model, allows policy makers and researchers to measure the impact of

changes in growth drivers such as investment, savings, labour participation and productivity on economic growth and/or poverty. Therefore, the applied model of this study helps design national development policies in the right direction and allocate the nation's limited resources efficiently. LTGM has rarely been used in Myanmar, while it has been widely applied to other countries through the World Bank's country reports. This study also applies the LTGM-TFP extension that is used to provide policy implications to increase TFP of Myanmar. The LTGM-TFP extension is designed to measure the impact of major determinants of TFP growth. Since TFP has the most direct impact on Myanmar's long-term economic growth, it is crucial to find out how much TFP can be increased by improving major determinants, and which determinant plays a major role in TFP growth in the context of Myanmar.

It is necessary to apply scenarios assuming how the major growth drivers will change with or without policy improvement to conduct simulation analyses. Scenarios are usually set in consideration of the country's past performance, development goals and/or the trajectories of other countries as benchmarks. This study applies the level of Vietnam's growth drivers as a benchmark to set Myanmar's long-term growth scenarios because of the common aspects of the political and economic conditions. Vietnam has opened its market about 25 years ahead of Myanmar and shown remarkable development performance through the overall economic reforms.

This study is composed of two main simulation analyses. First, applying five scenarios to LTGM, simulation 1 examines how Myanmar's economic growth rate changes over 2020-2040 if Myanmar reaches the level of major growth drivers in Vietnam. Second, applying two scenarios to LTGM-TFP extension, simulation 2 investigates how the improvement of TFP determinants in Myanmar to the level of Vietnam affects TFP growth rate by 2040. Based on the results, this study draws policy implications for Myanmar's long-term economic growth.

II. Drivers of Economic Growth

Drivers of economic growth include inputs such as capital and labour and the improvement of these inputs' productivity. The following is a brief review of major drivers of economic growth and comparison analysis of the growth drivers between the two countries since 1990 when the performance of Vietnam's economic reforms were clearly shown.

2.1 Review on Major Growth Drivers

After the introduction of the neoclassical growth model by Solow (1956), capital accumulation per capita was considered the most crucial factor to increase output per capita, so saving and investment for capital accumulation was strongly emphasized to economic growth. But, noting that the neoclassical growth model has failed to explain the different speed of economic growth between developed and developing countries, the endogenous growth model stressed human capital and knowledge with their externalities enabling sustainable growth (Romer, 1986; Lucas, 1988). In addition, the new growth theory put emphasis on the role of the idea, allowing firms to gain monopoly rent and not to exit a market, to increase productivity directly linked to economic growth (Romer, 1990; Aghion & Howitt, 1992; Romer, 1993).

Despite the theoretical change, it is generally accepted that capital accumulation still plays an essential role in economic growth. Barro & Sala-i-Martin (1990, 1991, 1992) and Mankiw, Romer & Weil (1992) showed the validity of the neoclassical growth model, modifying the model or its assumption, and the relationship among saving, investment and economic growth was empirically proved (Young, 1995; Attanasio et al., 2000; Hevia and Loayza, 2011).

Along with the capital accumulation, demographic features of the labour market such as the working-age population and the labour force participation are also major factors affecting

the economic growth. Although more output with more labour input is natural, but an important point is whether increasing labour input is possible or not. So, the working-age population rate is associated with the acceleration of economic growth (ADB, 2011). Bloom, Canning, & Fink (2011) argued favourable demographic factors are a critical explanatory of economic growth in East Asia. The recent decline in both mortality and birth rate has led to a shrinking working-age population share, so, in developed countries, labour policies such as extension of retirement age are being implemented in order to increase labour participation, while in some countries, increasing female labour participation is considered a significantly effective way (Park & Shin, 2011; Mckinsey Global Institute, 2015). As female labour participation and the level of economic growth shows a U-shaped relationship, there is much room for improvement generally in middle-income countries (Goldin, 1994; Tam, 2011; Olivetti, 2013).

Human capital represents the quality of labour which includes the ability, skill and knowledge. As aforementioned, in the endogenous growth model and new growth theory, human capital and idea are emphasized for sustainable economic growth (Romer, 1986; Lucas, 1988; Romer, 1990). Human capital contributes to economic growth in that it increases labour productivity, bring about technological innovation and also have a positive effect on the human capital of the next generation. Average years of schooling are generally used in international comparative research to measure the level of human capital (Barro & Lee, 1996; Barro & Lee, 2013). Also, considering the quality of education, the results of international tests are often utilized (Hanushek & Kimko, 2000; Hanushek, Schwerdt, Wiederhold and Woessmann, 2015). Barro and Lee (2015), through panel regression sampling of 76 countries, shows that an increase in average years of schooling positively impacts on economic growth over the last decades.

Productivity, referring to the amount of output compared to the input, accounts for the part

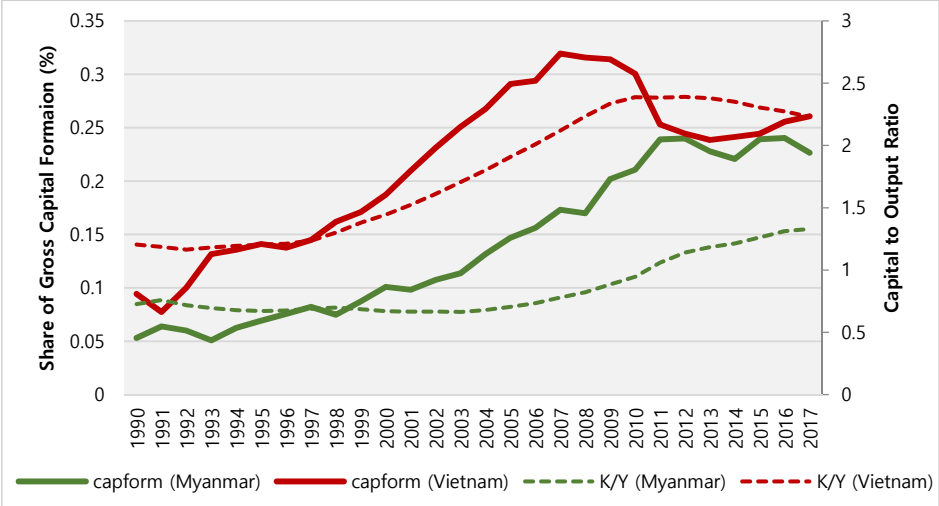
of economic growth that capital and labour inputs cannot explain. The increase in productivity level depends on more output with the same input. Productivity is usually measured as labour productivity or TFP. There is a limit to economic growth by increasing inputs, and thus, sustainable high growth can be achieved by improving productivity. Hall & Jones (1999) and Easterly & Levine (2001) have empirically shown that a economic growth has historically been driven by improved productivity rather than increasing inputs. As the importance of productivity has been further emphasized, numerous researchers have tried theoretically and empirically to find out the determinants of productivity (Isaksson, 2007; Islam, 2008; Loko & Diouf, 2009; Syverson, 2011).

2.2 Comparing Growth Drivers between Myanmar and Vietnam

Since this study simulates the growth drivers' change of Myanmar based on those in Vietnam, this subchapter investigates how the growth drivers have been changed in two countries over the last decades. Vietnam has launched the economic reforms known as *Doi Moi* in 1986, and the performance of reforms has been clearly shown since 1990. Vietnam has been developed from being primarily closed and centrally planned economy to opened and market-oriented economy, and through the long-term economic growth, it has reached middle-income status in 2009 (World Bank, 2017a). Although Vietnam has shown successful economic growth, Vietnam's political system, socio-cultural characteristics, and domestic and foreign economic conditions faced over the past 30 years are different from those of Myanmar. Nevertheless, considering macroeconomic conditions such as industrial structures and labour market demographic factors, transition experience including improved relations with the West, and geographical conditions, benchmarking Vietnam for Myanmar's long-term growth scenarios seems appropriate.

2.2.1 Share of Capital Formation and Capital to Output Ratio

This study analyzes gross share of capital formation (capform) and capital-output ratio (K/Y) of two countries (Figure 2). Myanmar's capital formation share has risen steadily to 22.7%, while that of Vietnam has increased to 31.9% in 2007 and then decreased to around 26.1%. As for capital-output ratio, that of Myanmar has risen since the late 2000s and is around 1.33 in 2017, while Vietnam's capital-output ratio has increased rapidly from 1.2 in 1990 to 2.4 in 2010 following investment expansion and slightly decreased to 2.23 in 2017.



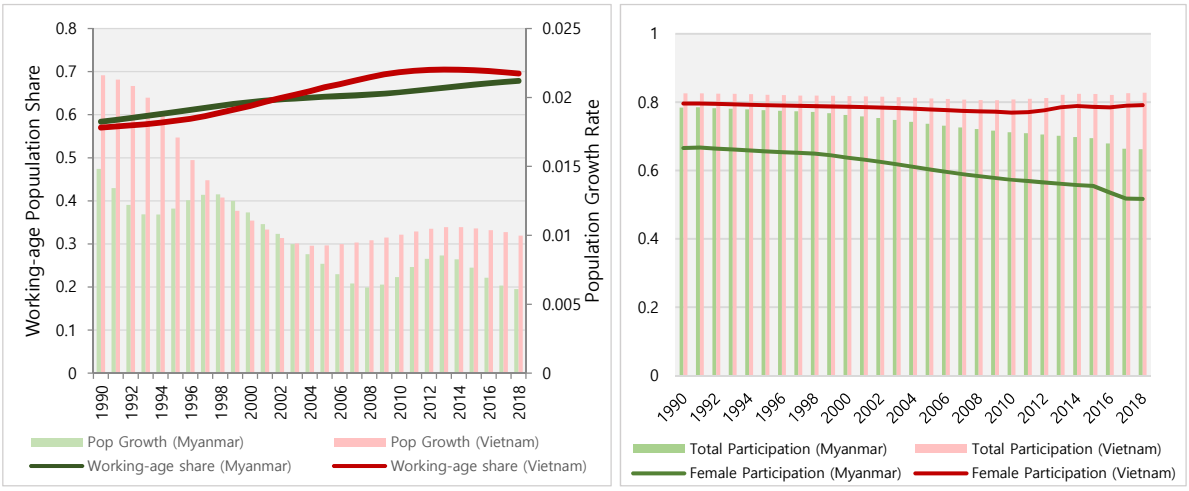
Source: Penn World Table 9.1

Figure 2. Share of Capital Formation and Capital to Output ratio in Myanmar and Vietnam

2.2.2 Working-age Population and Labour Force Participation

Figure 3 shows the working-age population has been steadily increased since 1990 in both countries, and the total population growth rate also has shown a similar trend, although that of Vietnam has been higher during the period. On the other hand, the labour force participation rate has shown a different pattern. While Vietnam's labour force participation rate remains constant from 82.6% in 1990 to 82.7% in 2018, Myanmar's labour force participation rate gradually decreased from 78.4% in 1990 to 66.2% in 2018. This difference appears attributable

to changes in the female participation rate. It has remained constant at around 80% during the period in Vietnam but in Myanmar, dropped steadily from 66.6% in 1990 to 51.7% in 2018.

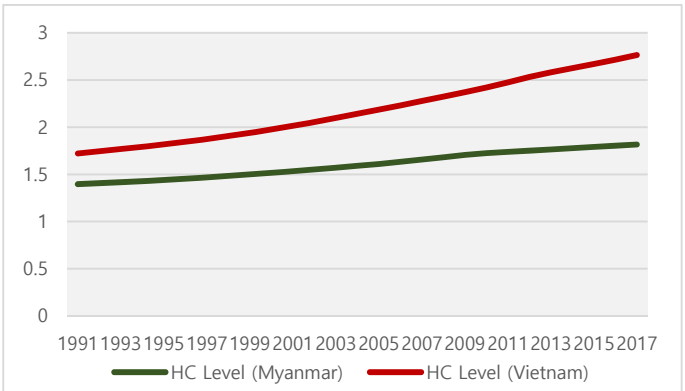


Source: World Development Indicator

Figure 3. Working-age Population and Labour Force Participation in Myanmar and Vietnam

2.2.3 Human Capital

When it comes to the human capital which is based on years of schooling and returns to education, the human capital of Vietnam has been increased more rapidly than that of Myanmar during the sample period. The annual average growth rate was 2% in Vietnam, while it was only 0.9% in Myanmar. Due to different growth rates, the gap in human capital between the two countries has been widening.

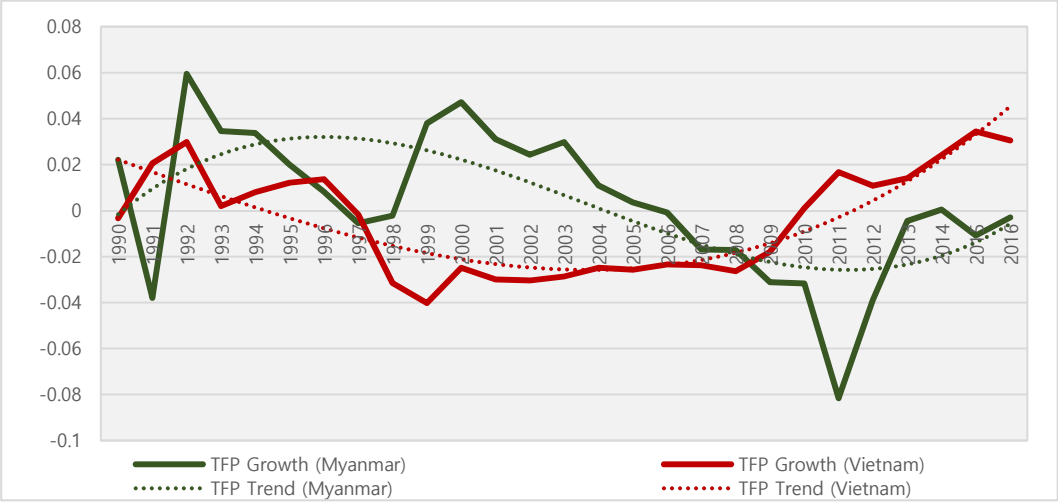


Source: Penn World Table 9.1

Figure 4. Human Capital Growth in Myanmar and Vietnam

2.2.4 Total Factor Productivity

Figure 5 shows a comparison of the TFP growth rate with the cubic-fit time trend of Vietnam and Myanmar. Myanmar's TFP growth rate exceeded that of Vietnam in the 2000s, but the trend was overturned after 2009. Considering the fact that the TFP growth rate is calculated as a residual which is unexplained with capital and labour growth rate in GDP growth rate, Vietnam's low TFP growth rate from the late 1990s to 2010 means that factors accumulation relatively played a more significant role in economic growth during the period. In the case of Myanmar, economic growth which was not explained by factors accumulation was achieved from the late 1990s to 2006, but after that, TFP growth rate had continued to decline to -8.2% in 2011 when the market was opened. Since 2010, Vietnam's TFP growth rate has increased to 3.1% in 2016, while Myanmar remains around 0% in 2016.



Source: Penn World Table 9.1 and Asian Productivity Organization database (2017)

Figure 5. TFP Growth in Myanmar and Vietnam

In summary, Vietnam's investment rate has risen sharply during the last economic growth period, resulting in substantial capital accumulation. Myanmar's investment rate has risen steadily to the level slightly lower than that of Vietnam, but capital accumulation has not progressed much. Working-age population has been increased during the period in both

countries, but Vietnam's labour force participation rate has remained above 80% while that of Myanmar has been decreased following the falling female participation rate. Meanwhile, the level of human capital has grown steadily in both Vietnam and Myanmar, but Vietnam has shown higher growth rates, so the gap has been widened between the two countries. Lastly, Vietnam's productivity has continued to rise since the late 2000s, reaching 2.7% in 2016, but Myanmar has remained at around 0% since market opening. Considering these results, Myanmar's long-term economic growth requires efforts not only to accumulate capital but also an increase in the female labour force participation rate and improve the level of human capital and overall productivity.

III. Long-Term Growth Model by World Bank

The World Bank's Long-Term Growth Model (LTGM) is an excel-based tool to conduct simulation analysis using the neoclassical growth model based on Solow (1956), Swan (1956) and Hevia & Loayza (2011) (Pennings, 2018). Basically, LTGM can be utilized to address 3 policy questions: 1) expected GDP growth by a change of investment 2) required investment to achieve a given growth target 3) expected GDP growth by given savings under the current account balance constraint. In addition to the basic version, the LTGM has been extended to poverty extension: the effect of growth on the poverty rate, public capital extension: the effect of public capital on growth (Devadas & Pennings, 2018) and TFP extension: the effect of major determinants on TFP growth (Kim & Loayza, 2019). Through the LTGM, policy makers can identify key growth drivers and their desired changes, so it helps them design development policies and strengthen the commitment for those policies (Jeong, 2017). Following parts describe the LTGM and LTGM-TFP extension which are used in this study and conduct a literature review on LTGM.

3.1 Model Description

3.1.1 LTGM

To specify the growth drivers in the model, Pennings (2018), decompose the function of GDP per capita growth, as shown in equations (1)~(12). Three building blocks of the LTGM are the Cobb-Douglas production function, capital accumulation by investment and demographic features of labour market. In the below functional form, the aggregate output denotes GDP at period t, A_t is the total factor productivity, K_t is the capital stock, h_t is human capital per worker, L_t is the number of workers and β is the labour share.

$$Y_t = A_t K_t^{1-\beta} (h_t L_t)^{\beta} \tag{1}$$

The total number of workers can be decomposed as

$$L_t = \rho_t \omega_t N_t \tag{2}$$

where ρ_t is the participation rate, ω_t is the working-age population to total population ratio, N_t is the total population.

From equation (1) and (2) the output per capita equation can be realized. y_t^{pc} is per capita term and and y_t are per worker terms.

$$y_t^{pc} = \rho_t \omega_t y_t = A_t \rho_t \omega_t k_t^{1-\beta} h_t^{\beta} \tag{3}$$

Based on equation (3), the growth rate from t to t+1 is as follows.

$$\frac{y_{t+1}^{pc}}{y_t^{pc}} = \frac{A_{t+1}}{A_t} \frac{\rho_{t+1}}{\rho_t} \frac{\omega_{t+1}}{\omega_t} \left[\frac{k_{t+1}}{k_t}\right]^{1-\beta} \left[\frac{h_{t+1}}{h_t}\right]^{\beta} \tag{4}$$

Equation (4) can be re-expressed such that

$$1 + g_{y,t+1}^{pc} = (1 + g_{A,t+1})(1 + g_{\rho,t+1})(1 + g_{\omega,t+1})(1 + g_{k,t+1})^{1-\beta}(1 + g_{h,t+1})^{\beta} \tag{5}$$

To decompose capital per worker growth $(1 + g_{k,t+1})$, the equation (6), referring to capital accumulation where I_t is investment and δ is depreciation rate, can be rewritten as (7)

$$K_{t+1} = I_t + (1 - \delta)K_t \tag{6}$$

$$\left[\frac{K_{t+1}}{L_{t+1}}\right]\left[\frac{L_{t+1}}{L_t}\right] = (1 - \delta)\left[\frac{K_t}{L_t}\right] + \left[\frac{I_t}{L_t}\right] \tag{7}$$

From equation (7), substituting $\left[\frac{L_{t+1}}{L_t}\right] = (1 + g_{N,t+1})(1 + g_{\rho,t+1})(1 + g_{\omega,t+1})$ and dividing both sides by k_t draw equation (8). In addition, the equation (8) can be rearranged as (9) to isolate the capital per worker growth rate.

$$(1 + g_{k,t+1})(1 + g_{N,t+1})(1 + g_{\rho,t+1})(1 + g_{\omega,t+1}) = (1 - \delta) + \frac{\left[\frac{I_t}{Y_t}\right]}{\left[\frac{K_t}{Y_t}\right]} \tag{8}$$

$$(1 + g_{k,t+1}) = \frac{(1-\delta) + \frac{\left[\frac{I_t}{Y_t}\right]}{\left[\frac{K_t}{Y_t}\right]}}{(1+g_{N,t+1})(1+g_{\rho,t+1})(1+g_{\omega,t+1})} \tag{9}$$

Combining equation (5) and (9), the final functional form decomposing output per capita growth is drawn and it is used to do quantitative analysis in this study.

Meanwhile, The relationship between the growth drivers and output per capita growth can be plainly shown through simplification using log-linear approximation $\ln(1 + x) \approx x$. By log-linear approximation, the equation (5) becomes (10) and (9) becomes (11) as follows.

$$g^{pc}_{y,t+1} \approx g_{A,t+1} + g_{\rho,t+1} + g_{\omega,t+1} + (1 - \beta)g_{k,t+1} + \beta g_{h,t+1} \tag{10}$$

$$g_{k,t+1} \approx \frac{\left[\frac{I_t}{Y_t}\right]}{\left[\frac{K_t}{Y_t}\right]} - \delta - g_{N,t+1} - g_{\rho,t+1} - g_{\omega,t+1} \tag{11}$$

Combining equations (10) and (11), the relationship can be realized such that

$$g_{y,t+1}^{pc} \approx g_{A,t+1} + \beta(g_{\rho,t+1} + g_{\omega,t+1} + g_{h,t+1}) + (1-\beta)\left[\frac{\left[\frac{I_t}{Y_t}\right]}{\left[\frac{K_t}{Y_t}\right]} - \delta - g_{N,t+1}\right] \quad (12)$$

Based on the equation (12), Pennings (2018), gives meaningful tips to understand the drivers of growth. First, TFP growth $g_{A,t+1}$ has the most direct impact on economic growth. In addition, growth in labour force participation rate $g_{\rho,t+1}$, working-age population share $g_{\omega,t+1}$, and level of human capital per worker $g_{h,t+1}$ also positively affect GDP per capita growth, but labour share β mitigates the effects. On the other hand, depreciation rate δ and population growth rate $g_{N,t+1}$ reduces the amount of capital per worker, thereby reducing GDP per capita growth, and their impacts are adjusted by capital share $(1-\beta)$. Finally, an increase in the investment rate $\frac{I_t}{Y_t}$ drives output per capita growth $g_{y,t+1}^{pc}$, but its effect is mitigated by capital to output ratio $\frac{K_t}{Y_t}$ and capital share. This implies that it is important to increase productivity, human capital, and labour participation rate for long-term growth because the effect of investment expansion on economic growth will be diminished by the increase in capital to output ratio, unless the output grows faster than capital.

3.1.2 LTGM-TFP Extension

As TFP plays the most decisive role in achieving sustainable economic growth, predicting TFP growth, followed by the improvement of major determinants is crucial to policy design. For this reason, the LTGM -TFP extension is built on the TFP determinant index and regression model by Kim and Loayza (2019). It helps policymakers measure TFP growth following social and economic reform related to each determinant. Also, policymakers utilize the LTGM-TFP to target the index of a specific leader country in the world or region so that they may set policy goals concretely. While the standard LTGM directly demonstrates the importance of TFP in

economic growth, the LTGM-TFP provides guidance on what policy efforts should be made to increase TFP. Utilizing the LTGM-TFP, this study simulates Myanmar's TFP growth based on the assumption that the TFP determinants in Myanmar will increase to the level of Vietnam by 2030 and keep increasing with the same slope afterwards.

The TFP determinant index in LTGM-TFP is composed of five subcomponent indices representing major determinants. Several indicators from different sources such as World Development Indicators, Barro and Lee and OECD are used to construct subcomponent indices, considering comprehensive literature review and data availability (Kim & Loayza, 2019). Detailed information of TFP determinant index is provided in the appendix. Subcomponent indices are innovation index, to measure a capacity to develop new technologies; education index, to disseminate and utilize new technologies in nation's economy; market efficiency index, to foster the efficient allocation of resources throughout the economy; infrastructure index, to facilitate the effective and flexible activity of all the economic players; and governance index, to secure stable social, political and economic condition including effective system of government (Kim & Loayza, 2019; Kim, Loayza & Meza-cuadara, 2016). These five subcomponent indices are combined at the one TFP determinant index using Principal Component Analysis (PCA) to do regression because of multicollinearity among subcomponent indices (Kim & Loayza, 2019).

3.2 Literature Review on LTGM

Since the basic version of LTGM was introduced, it has been utilized for various World Bank Group reports and working papers. Sinha (2017), explores the ways that Bangladesh can maintain high economic growth, using LTGM. The result shows, although Bangladesh has achieved robust economic growth in the last decade, sustaining the growth will be hard without

TFP growth. It also deals with the change of government debt position under the different growth scenarios giving insight to government operation. Mijiyawa (2017) applies LTGM to Guinea to answer the question that what drivers can accelerate growth and the result shows the most important driver for Guinea's long-term growth is TFP growth as same with the result by Sinha (2017). In most other World Bank Group's reports such as Systematic Country Diagnostic (SCD) for Seychelles (2017d), Georgia (2018a) and Zambia (2018b) and Country Economic Monitor (CEM) for Malawi (2017b) and Nepal (2017), LTGM has been utilized to forecast long-term GDP per capita growth under the change of growth drivers or to estimate required investment and TFP growth for targeted economic growth. In Armenia SCD (2017c), using poverty extension version of LTGM, economists of the World Bank simulate the impact of comprehensive policy reform package on poverty reduction. While other reports simulate future events, Jeong (2017) attempts to analyze South Korea's economic growth experience during the last six decades by using LTGM. The results show, although the engines of growth were balanced overall, a main driver was different at each period. Furthermore, Jeong (2017) finds out a way how to calibrate the model to predict well against the actual data.

IV. Methodology

4.1 Data Calibration

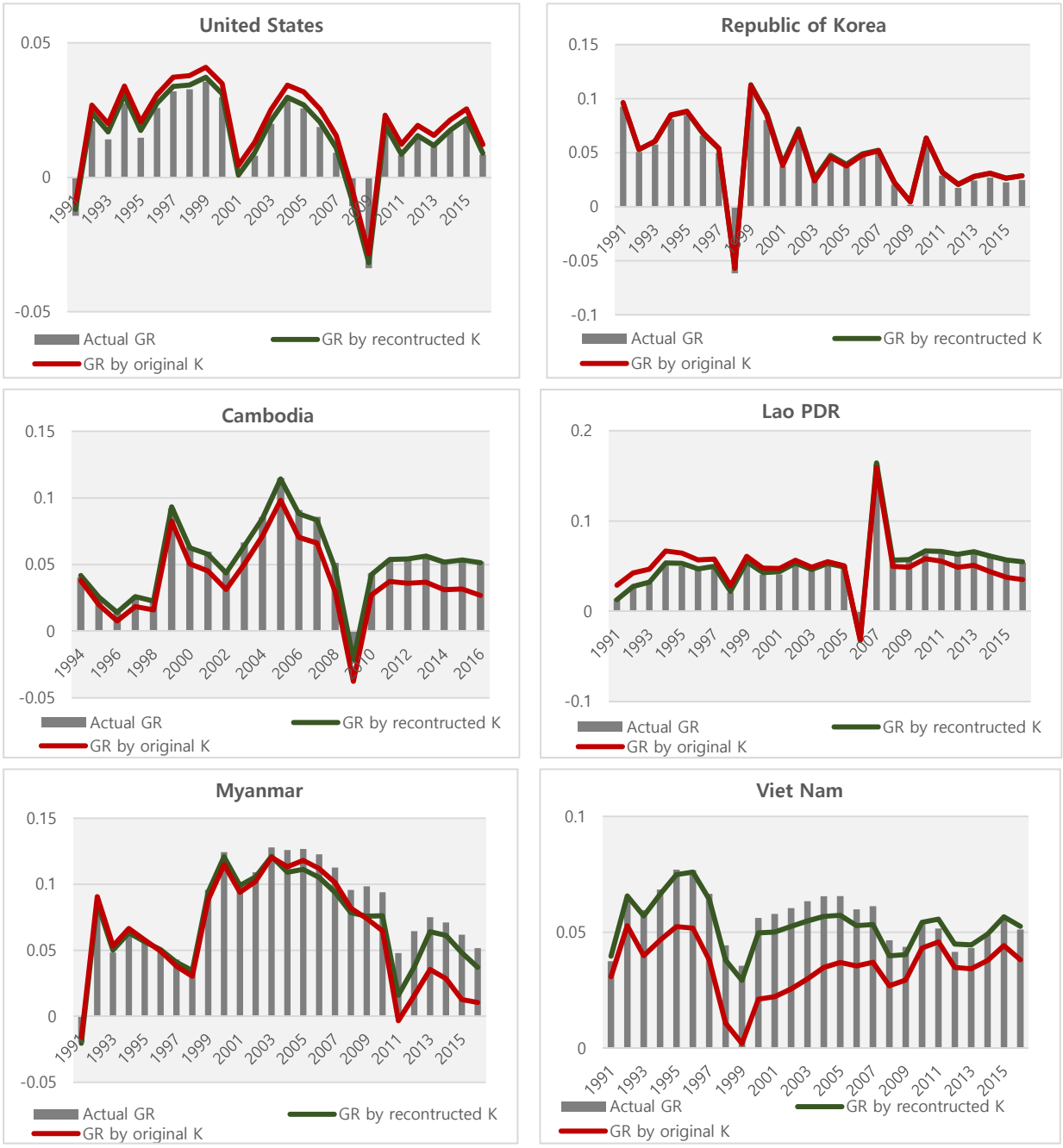
To maintain consistency with LTGM in which Penn World Table (PWT) 9.0 and World Development Indicator (WDI) are the primary data sources, this study uses PWT 9.1 and WDI data to do quantitative analysis for simulation. Compared to PWT 9.0, PWT 9.1 covers more recent data up to 2017, so, it is more suitable for setting up a realistic baseline scenario. Specifically, real GDP at constant 2011 national prices (in 2011 million US$), capital stock at constant 2011 national prices (in 2011 million US$), human capital index based on years of

schooling and returns to education and share of gross capital formation are sourced from PWT 9.1. Total population size, working-age population and labour force participation rate are sourced from WDI. Meanwhile, labour share is sourced from Asian Productivity Organization (APO) database (2017) and TFP growth rate is calculated because PWT 9.1 and WDI do not include them for Myanmar and Vietnam. APO is an intergovernmental organization committed to improving productivity in the Asia-Pacific region and it has conducted productivity measurement projects.

For simulation 1, this paper does not use original capital stock data provided in PWT 9.1 but reconstructs the capital stock using the initial capital stock and average deprecation rate. The reason is, in many developing countries, the growth rates over the last period drawn by the model with original capital stock shows quite low conformity to the real value. It seems to stem from insufficient historical asset composition data in developing countries because the original capital stock in the PWT 9.1 is constructed using different depreciation rates and user costs for each type of asset (Inklaar & Woltier, 2019; Feenstra et al., 2015). On the other hand, with the reconstructed capital stock, the conformity becomes quite reasonable. Figure 6 shows the GDP per capita growth rates of the United States, Korea and Southeast Asia transitional countries (Cambodia, Lao PDR, Myanmar and Vietnam). The United States represents a typical developed country, and South Korea is a country that has experienced rapid economic change. CLMV countries are developing countries and representative transitional economies in Southeast Asia, so they share regional, political and economic characteristics to some extent.

The actual per capita GDP growth rate is a grey bar in figure 6 and green line represents growth rate drawn by the model using reconstructed capital stock while the red line is illustrated by the model using original capital stock. In the United States and South Korea, the red line is consistent with the grey bar well; however, in CLMV countries, there is a quite large gap

between the two. For example, the growth rate of Myanmar based on the model with original capital stock shows less than 2% in 2016, while the actual growth rate is over 5%. In Vietnam, the actual annual average growth rate (AAGR) is 5.1% during the period, but the AAGR based on the model with original capital is 3.5%. On the other hand, the green line shows significantly improved conformity to the actual growth rate in all the CLMV countries.



Source: Penn World Table 9.1 and Asian Productivity Organization Database (2017)

Figure 6. Comparison of GDP per Capita Growth Rate of Selected Countries

Meanwhile, LTGM-TFP extension utilizes the coefficients which are derived from the following regression to measure the effect of TFP determinant index resulting in TFP growth (Kim and Loayza, 2019).

$$\text{Annualized TFP growth}_{c,(t,t-5)} = \beta_0 + \beta_1 \ln(TFP\ Index_{c,t-5}) + \beta_2 \ln(TFP\ level)_{c,t-5} + \theta_c + \delta_t + \varepsilon_{c,t} \quad (13)$$

In equation (13), the dependent variable is annualized TFP growth rate over five years, and independent variables are a time-lagged TFP determinant index which is rescaled from 1 to 100 and a time-lagged TFP level with country fixed effect θ_c and time fixed effect δ_t. Log-transformation allows for a non-linear relationship between the TFP growth and the index. In addition, a time lag of five years is applied in consideration of reverse causality.

For the regression, Kim & Loayza (2019), includes 98 countries across the world as sample and rules out several Asian countries including Myanmar and Vietnam due to lack of TFP level data in PWT 9.0. However, considering a research topic, this study attempts to include six Asian countries, Bangladesh, Cambodia, Myanmar, Nepal, Pakistan and Vietnam to reflect the context of two countries and regional characteristics into the coefficients. So the total sample is 104 countries. Table 1 shows the comparison of the regression results based on different sample sizes and time lags to check the robustness. The sign and significance of coefficients are consistent, so the six Asian countries added sample is used in this study.

Table 1. Regression Analyses Based on Different Samples (Modified from Kim and Loayza (2019))

Dependent variable	**Annualized TFP growth$_{c,(t-\alpha,\,t)}$**			
Num. of countries		**98**		**104**
Num. of observations	477	869	507	923
Time lag (α)	5	3	5	3
		Coefficient (Standard Error)		
$\ln(\text{Index}_{c,t-\alpha})$	**0.049(0.018)*****	0.039(0.014)***	**0.062 (0.020)*****	0.049(0.016)***
$\ln(\text{TFP level})_{c,t-\alpha}$	**-0.099(0.015)*****	-0.120(0.012)***	**-0.103(0.014)*****	-0.106(0.012)***
Constant	**-0.180(0.064)*****	-0.143(0.047)***	**-0.215(0.069)*****	-0.170(0.054)***

			R^2	
Within	0. 3048	0.2729	0.2613	0.2006
Between	0.2749	0.2669	0.2428	0.2191
Overall	0.1586	0.1457	0.1249	0.0959

Note: Standard errors are in parentheses (* p<0.1, ** p<0.05, *** p<0.01).

4.2 Scenarios for Simulation 1

It is necessary to set up an initial value for each variable in 2019 to conduct simulation 1 based on scenarios for 2019-2040. Table 2 shows the initial values comprehensively in Myanmar in 2019. First, capital to output ratio (K/Y) is 1.38 which is extrapolated on the basis of the prior period 1991 – 2017 and investment rate is 23.0%, a 5-year average for the 2013 - 2017 because the investment rate has been stabilized from 2013. The values of demographic factors during the analysis period are sourced from WDI, which are the International Labour Organization (ILO) estimates. The human capital growth rate is 0.9%, a 10-year average for the 2008 – 2017 using PWT 9.1. TFP growth rate, considering the TFP growth trend since 2013, is 0.0% on the assumption that the level of TFP would be maintained.

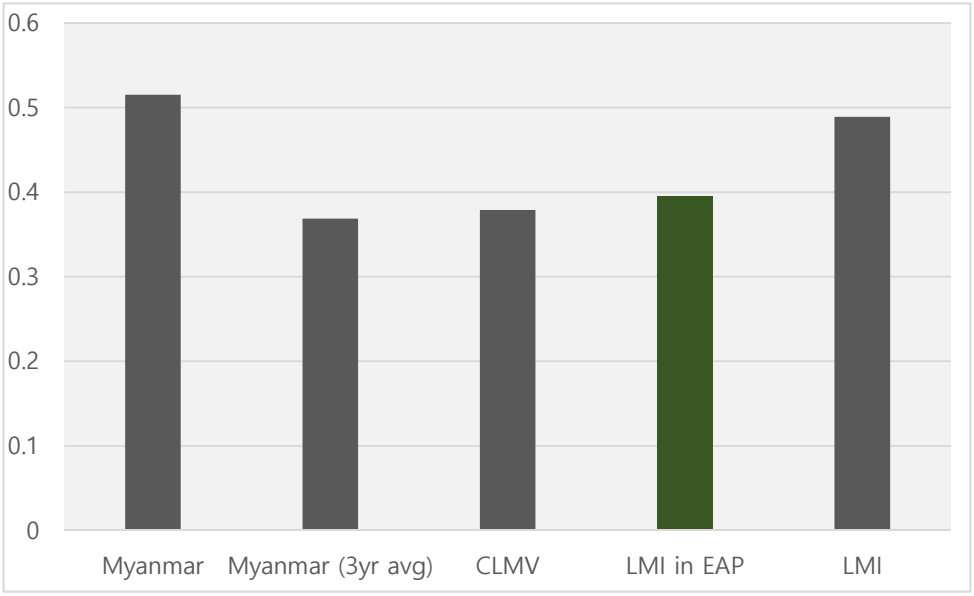
Table 2. Initial Values for Each Variable in 2019

Variable	Source	Value	Note
Initial K/Y	PWT 9.1	1.38	Extrapolation from 2017
Investment rate	PWT 9.1	23.0%	5-year average (2013-2017)
Population growth rate	WDI	0.6%	ILO estimation
Share of male	WDI	48.2%	ILO estimation
Working-age population	WDI	68.1%	ILO estimation
Total participation rate	WDI	66.1%	ILO estimation
Female participation rate	WDI	51.6%	ILO estimation
Male participation rate	WDI	77.0%	ILO estimation
Human capital growth rate	PWT 9.1	0.9%	10-year average (2008-2017)

TFP growth rate		0.0%	
Labour share	PWT 9.1, APO	39.5%	EAP LMI countries average (2016)
Depreciation rate	PWT 9.1	7.8%	20-year average (1998-2017)

Source: Penn World Table 9.1, World Development Indicator and Asian Productivity Organization Database (2017)

Based on the APO database, the labour share of Myanmar increased significantly from 32.2% in 2015 to 51.5% in 2016, so it would be inadequate to simply use the value of 2016 for the long-term growth scenarios. Figure 7 shows the labour share comparison in 2016 among Myanmar, 3-year average of Myanmar, the means of CLMV countries, Lower Middle-Income countries in East Asia & Pacific (LMI in EAP) region and Lower Middle-Income countries (LMI) obtained from PWT 9.1 and APO database. It shows, though the average labour share of all the LMI countries is close to 50%, those of LMI countries in the EAP region, CLMV countries are less than 40%. In addition, considering labour share of Vietnam is still 36.4% in 2016, this study assumes the level of labour share for the long-term growth scenario of Myanmar is 39.5% which is the mean of LMI countries in EAP region.



Source: Penn World Table 9.1 and Asian Productivity Organization Database (2017)

Figure 7. Labour Share Comparison in 2016

According to PWT 9.1, Myanmar's depreciation rate was 10.2% in 2017. Taking the development stage of Myanmar into account, the depreciation rate seems to be higher than in other countries. Korea's average depreciation rate belongs to a range from 2.6% to 4.8% during the period of high economic growth (1960–2000). Vietnam has a value of 2.5% to 8% during 1990-2017, and the 20-year average value (1998-2017) is 4.6%. The depreciation rates of Lao PDR and Cambodia, which are frequently compared to Myanmar due to similar geographical and economic background, are recorded at 6% and 5.5% in 2017. So, rather than applying the depreciation rate in 2017 to long-term growth scenario for Myanmar, this paper use the 20-year average value (1998-2017), 7.8% considering the depreciation rate will be adjusted in the future.

To simulate Myanmar's long-term growth by 2040, five scenarios are constructed on differences of major growth drivers between Myanmar and Vietnam as follows. The scenarios basically assume growth drivers will be improved linearly by 2030 and remain constant over the next ten years.

i) **Investment Scenario:** Figure 2 illustrates that investment rate of Myanmar has risen continuously during last decades and it became 22.7% in 2017, while that of Vietnam decline to 26.1% in 2017 after peaking at 31.9% in 2007. This scenario assumes the investment rate of Myanmar rise up to 26.7%, which is the 10-year average investment rate of Vietnam by 2030, and other growth drivers remain at initial values.

ii) **Female Participation Scenario:** Figure 3 shows the female participation rate of Myanmar continues to decline from 66.6% in 1990 to 51.7% in 2018. On the other hand, that of Vietnam remains steady at around 78% during the period. So, this scenario assumes the level of Myanmar's female participation rate rise up to 79.2%, which is the level of Vietnam in 2018 by 2030 and other growth drivers remain at initial values.

iii) **Human Capital Scenario:** Figure 4 illustrates the human capital index of Vietnam has risen more rapidly than that of Myanmar from 1991. The 10-year average growth rate of Vietnam's human capital is 2%, while Myanmar shows 0.9%. So, this scenario assumes that the human capital growth rate of Myanmar reaches that of Vietnam by 2030 and other growth drivers remain at initial values.

iv) **Total Factor Productivity Scenario (1% or 1.5% growth):** As Figure 5 shows, though the TFP growth rate of Vietnam was 0.1% in 2010, it has improved dramatically from then and became 3.1% in 2016. So, the average value varies greatly depending on the time period selected. The 5-year average value is 2.3%, while the 7-year average value 1.8% and 10-year average value is 0.6%. So, the target TFP growth rate of Myanmar by 2030 is set conservatively as 1.0% and 1.5%. Sinha (2017) also applies same TFP growth rate to the long-term growth scenario for Bangladesh citing the research result of Bernanke and Gurnayak (2002) in which they show that only 5% of the countries in the world have achieved average 2% TFP growth rate from 1965 to 1995. Meanwhile, other growth drivers remain at initial values.

v) **Combined Scenario (investment + human capital + female participation+ TFP 1%):** Ideally, the improvements of growth drivers can be achieved together, so this scenario assumes above four scenarios proceed simultaneously by 2030. In terms of the TFP growth rate, the target is set as 1%

4.3 Scenarios for Simulation 2

Table 2 shows values of TFP determinant index and subcomponent indices in Myanmar and Vietnam in 2014 and descriptive statistics of those indices. The TFP determinant index of

Vietnam is greater than that of Myanmar, and in terms of subcomponent indices, Vietnam is also comprehensively better than Myanmar. The subcomponent indices in order of gap between the two countries are education, governance, infrastructure, market efficiency and innovation. Vietnam shows 1.33 greater than Myanmar in education, while in innovation, Vietnam is only 0.1 greater than Myanmar. This small gap in innovation is reasonable considering innovation seems not to significantly affect TFP level of developing countries over the last decades (Isaksson, 2007)

Table 3. TFP Determinant Index and Subcomponent Indices

Index	Vietnam	Myanmar	Max	Min	Mean	Std
TFP Index	0.00	-1.38	5.87	-3.35	0.00	2.02
Inno index	-0.54	-0.64	5.63	-0.69	0.00	1.00
Edu index	0.57	-0.76	3.18	-1.68	0.00	1.00
Effi index	0.07	-0.27	2.46	-2.47	0.00	1.00
Infra index	0.25	-0.31	3.02	-1.90	0.00	1.00
Gov index	-0.38	-1.15	2.20	-2.73	0.00	1.00

Source: LTGM-TFP Extension Data Sheet

For simulation 2, TFP determinant index scenario and Subcomponent indices scenario assume the indices in Myanmar reach the level of Vietnam by 2030 and they keep increasing following the upward trend. Meanwhile, as LTGM-TFP is constructed on the basis of the statistical analysis covering 1985-2014, thus, the latest values were in 2014 (Kim & Loayza, 2019). The values during 2015-2018 are linearly extrapolated to do simulation analysis starting from 2019.

Table 4 summarizes all the scenarios including variable, initial value and the target value for simulation analyses.

Table 4. Scenarios Summarization

Simulation	Scenario	Variable	Initial Value	Target Value
Simulation 1 - GDP per Capita Growth	**1. Investment Scenario**	Investment Rate	23.0%	26.7%
	2. Female Participation Scenario	Female Participation Rate	51.6%	79.2%
	3. Human Capital Scenario	Human Capital Growth Rate	0.9%	2%
	4. Total Factor Productivity Scenario	Total Factor Productivity Growth Rate	0%	1% or 2%
	5. Combined Scenario	Investment Rate	23.0%	26.7%
		Female Participation Rate	51.6%	79.2%
		Human Capital Growth Rate	0.9%	2%
		Total Factor Productivity Growth Rate	0%	1%
Simulation 2 - TFP Growth	**1. TFP Determinant Index Scenario**	TFP Determinant Index	-1.38(22.20)	0.00(36.95)
	2. Subcomponent Indices Scenario	Innovation Index	-0.64(1.72)	-0.54(3.22)
		Education Index	-0.76(19.75)	0.57(46.84)
		Market Efficiency Index	-0.27(45.21)	0.07(51.86)
		Infrastructure Index	-0.31(32.98)	0.25(44.27)
		Governance Index	-1.15(32.75)	-0.38(48.09)

Note: Rescaled values are in parentheses.

V. Results

In this chapter, the simulation results are shown in the following scenario order: baseline

and investment scenario, female participation and human capital scenario, total factor productivity scenario and combined scenario for simulation 1, and TFP determinant index scenario and subcomponent indices scenario for simulation 2.

5.1 Results of Simulation 1

5.1.1 Baseline and Investment Scenario

Figure 8 shows simulation results based on the baseline and investment scenario. In terms of the baseline scenario, assuming initial values remain constant, the per capita GDP growth rate will continue to fall, reaching 3.4% by 2030 and 2.1% by 2040. On the other hand, investment scenario shows increasing investment rate mitigates the downward trend, showing 4.3% growth rate in 2030 and 3.1% in 2040. AAGR based on the investment scenario during the analysis period is 4.2% while AAGR based on baseline scenario is 3.6%. Thus, increasing investment rate up to the level of Vietnam by 2030 would lead to 0.6 percentage point higher economic growth during the period.

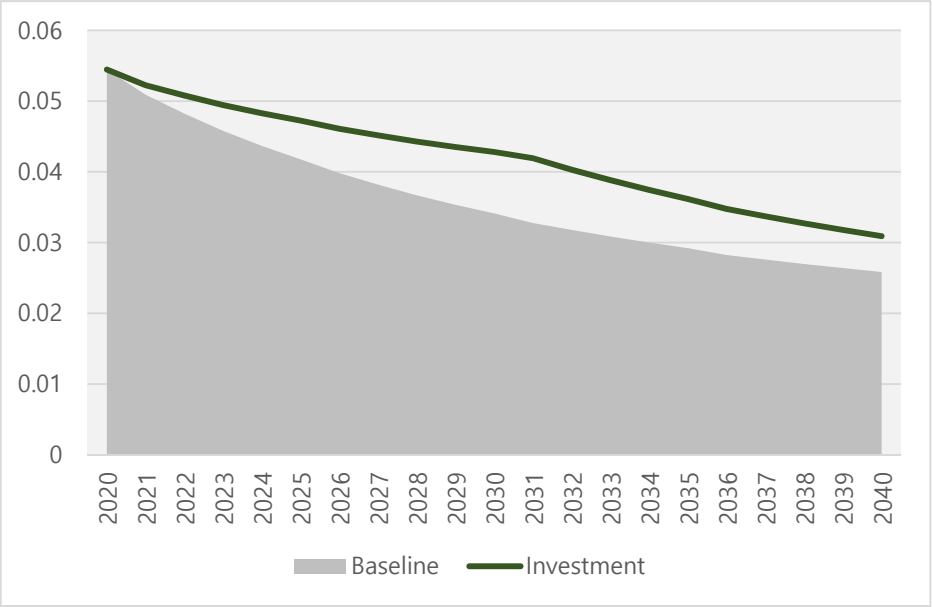


Figure 8. GDP per Capita Growth Rate Based on Baseline and Investment Scenarios

5.1.2 Female Participation and Human Capital Scenario

The female participation scenario in figure 9 shows that labour market polices targeting promotion of female labour force participation can have a significant impact on Myanmar's long-term growth. AAGR based on female participation scenario during 2020-2030 is 5.3% which is 1% higher than baseline scenario. However, the gap of growth rate between the baseline and female participation scenario reduces sharply in 2031 when female participation rate stops increasing because it reaches the level of Vietnam. Meanwhile, human capital growth does not show a marked increase of the growth rate, but this is enough to mitigates the downward trend. The growth rate based on human capital scenario is 4% in 2030 and 3.3% in 2040 and AAGR based on human capital scenario is 4% during the analysis period. Therefore, human capital analysis would lead to 0.5 percentage point higher economic growth than the baseline scenario.

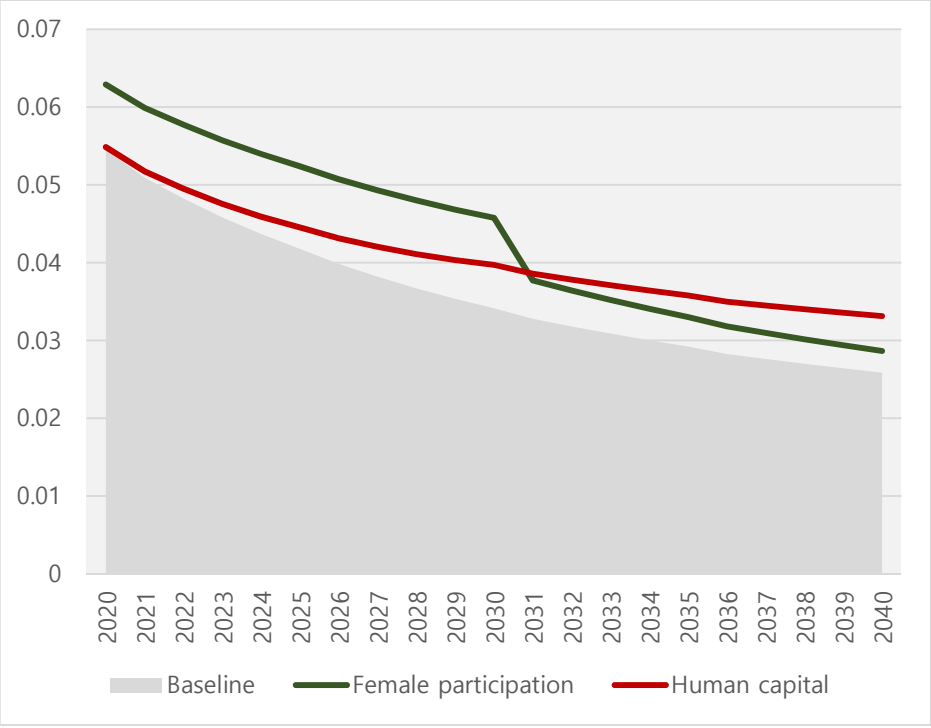


Figure 9. GDP per Capita Growth Rate Based on Baseline, Female Participation and Human Capital Scenarios

5.1.3 Total Factor Productivity Scenario

Figure 10 shows simulation results based on TFP scenarios which are 1% and 1.5% TFP growth. As equation (12) illustrates TFP growth has the most direct impact on economic growth, the magnitude of impact is shown to be the greatest among growth drivers. If TFP growth rate rises to 1% linearly by 2030 and remains, per capita GDP growth rate is 4.8% in 2030, and 4.4% in 2040. The growth rate in 2040 is 1.8% higher than baseline. AAGR during the analysis period is 4.8%, so TFP 1% scenario would lead to 1.2 percentage point higher economic growth than the baseline scenario. Meanwhile, with an 1.5% TFP growth rate, per capita GDP growth rate is 5.5% in 2030 and 5.3% in 2040, and AAGR is 5.4% which is 1.8 percentage point higher than that of the baseline scenario. It shows, without any improvement of other growth drivers, Myanmar will be able to achieve economic growth rates of more than 5% in the long-term by successfully improving TFP.

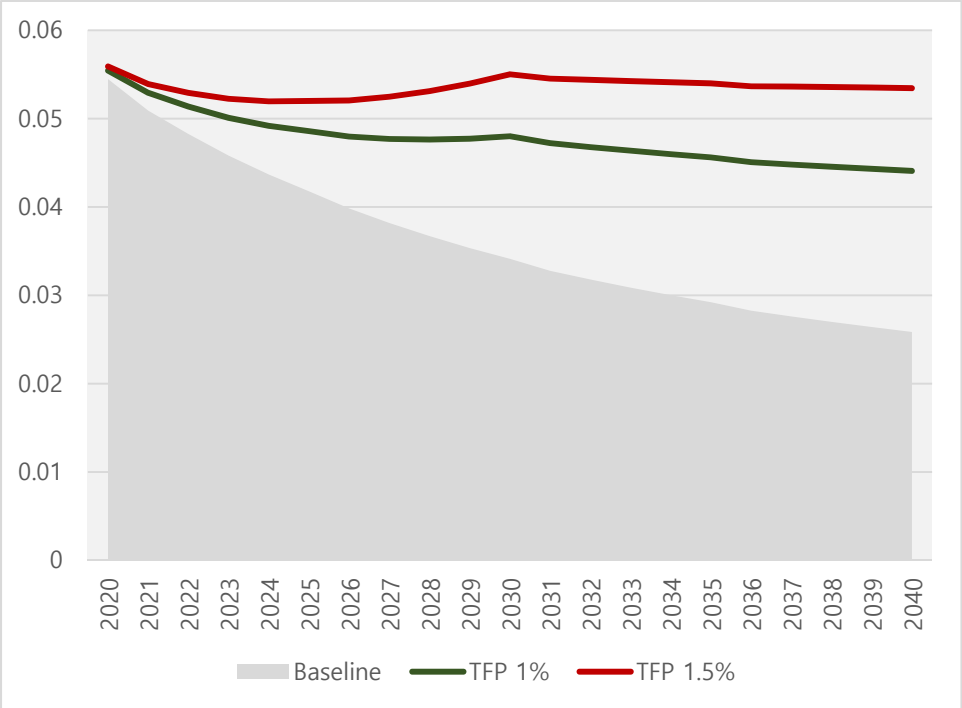


Figure 10. GDP per Capita Growth Rate Based on Baseline and TFP Scenarios

5.1.4 Combined Scenario

In figure 11, the combined scenario where all the above scenarios proceed at the same time including TFP growth with 1% shows ideal long-term growth of Myanmar. Historically, the growth drivers of countries which has shown economic growth in the long-term, has been improved simultaneously, so this scenario could be a realistic option under the positive assumption for Myanmar's economy. GDP per capita growth rate will peak at 7.8% in 2030 thanks to increases in female labour participation and investment, and since then, it would be stabilized. Though the rising trend stops, the growth rate is still maintained over 6% by 2040 thanks to improved human capital growth and TFP growth. AAGR during the analysis period is 6.6% which is 3 percentage point higher than that of baseline scenario. Following this scenario, Myanmar can keep the high economic growth in the long-term and its real GDP per capita will exceed 3,000 US dollar in 2029 and reach to 6,342 US dollar in 2040, so it would belong to the upper middle-income group.

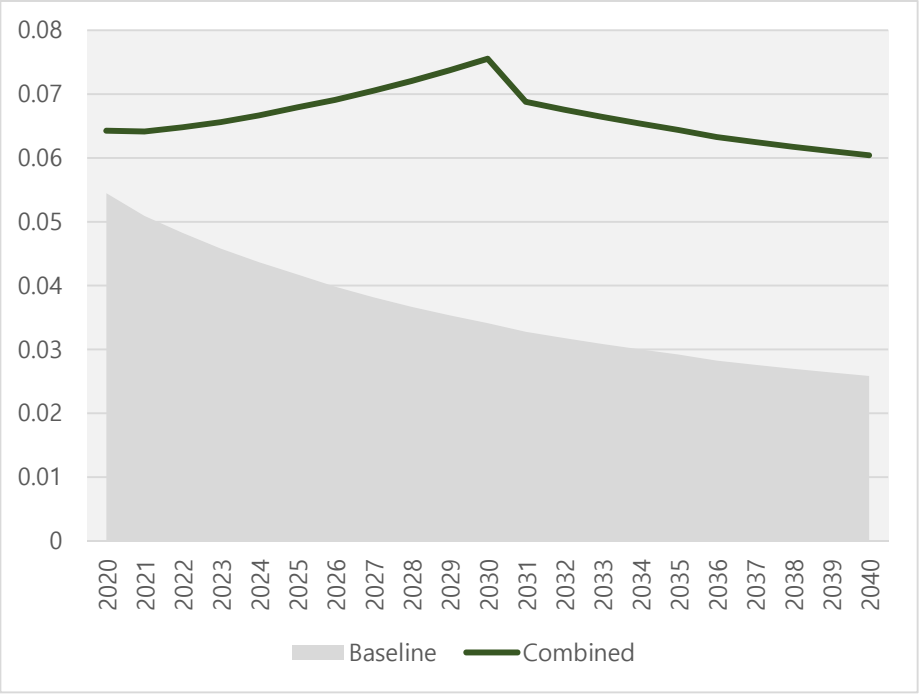


Figure 11. GDP per Capita Growth Rate Based on Baseline and Combined Scenarios

5.2 Results of Simulation 2

5.2.1 TFP Determinant Index Scenario

Figure 12 shows potential TFP growth rate in Myanmar with the increase of TFP determinant index. The growth rate continues to increase since 2019, peak at 0.88% in 2028, and then slowly decline to 0.71% in 2040. AAGR is 0.74% over 2019-2040. Considering growth rate of TFP directly impacts on economic growth rate, the simulated result provides a necessity of policies to improve TFP determinants for Myanmar's long-term growth. However, though the TFP determinant index can be used to estimate the impact by improvement of all the determinants, it is uncertain that which factor has the most significant effect on TFP growth. Given that government's budget and nation's resources are limited, it is important to measure the impact of each subcomponent on the TFP growth rate for drawing policy implications specifically.

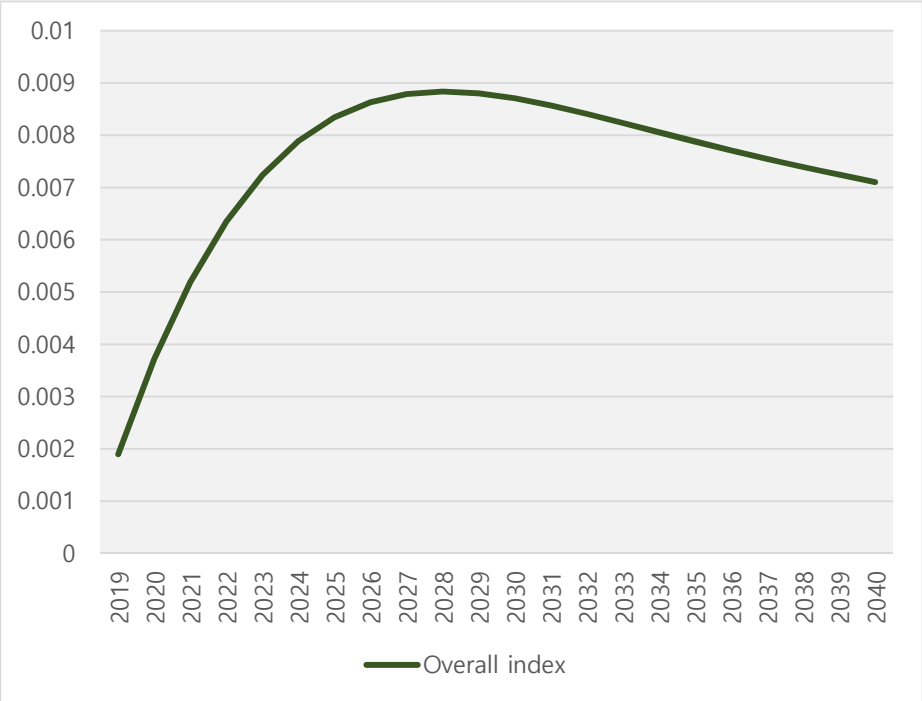


Figure 12. TFP Growth Rate Based on TFP Determinant Index Scenario

5.2.2 Subcomponent Indices Scenario

The impact of each subcomponent index on TFP growth rate is shown in figure 13. Education index which has the largest gap with Vietnam has the greatest effect on TFP growth in Myanmar. The TFP growth rate by education index continue to increase since 2019, peak at 0.48% in 2030, and then slowly declined to 0.43% in 2040. Compared to other indices, Education index leads to the highest AAGR of 0.42% over 2019-2040. Next to education index, governance index contributes to 0.21% AAGR in TFP, infrastructure index to 0.19% and market efficiency index to 0.16% over the same period. Similar gaps with the level of Vietnam in three indices reflect the impacts on TFP growth. Meanwhile, innovation index which has the smallest gap with Vietnam shows the least impact on TFP AAGR of 0.06% over the same period.

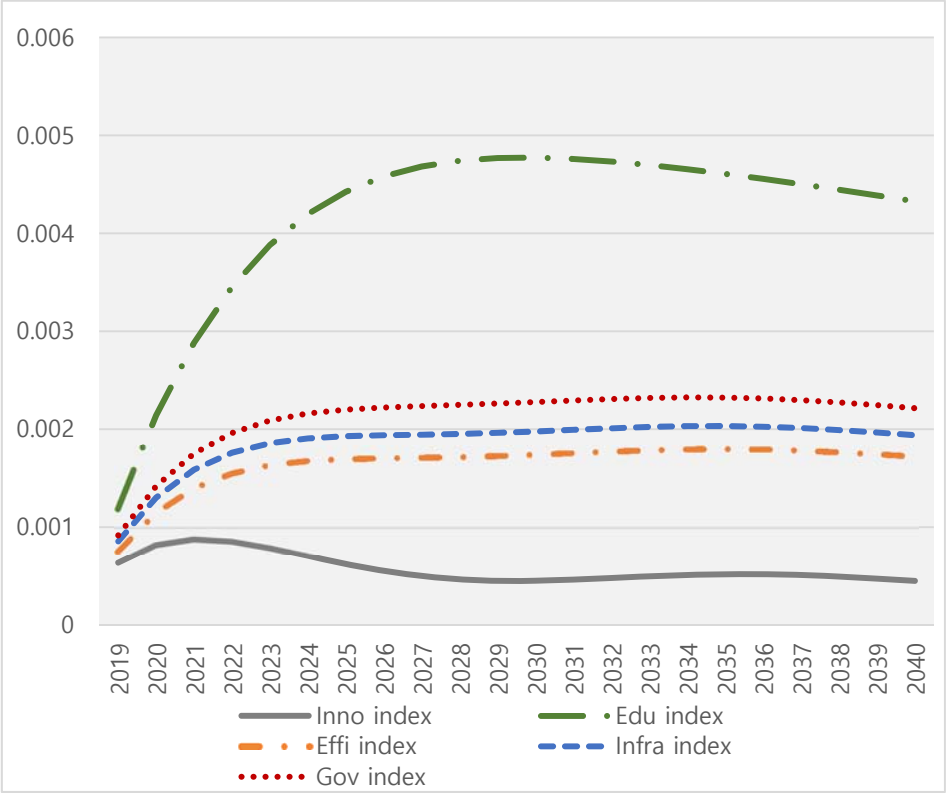


Figure 13. TFP Growth Rate Based on Subcomponent Indices Scenario

VI. Conclusion

Since the launch of wide-ranging economic, social, and governance reforms in 2011, Myanmar has achieved robust economic growth. However, considering existing development challenges such as lack of hard and soft infrastructure and depletion of natural resources, Myanmar's sustainable growth will not be possible without constant reforms in the right direction. In order to draw policy implications for sustainable growth, using the World Bank's Long-Term Growth Model (LTGM), this study simulates the pattern of long-term economic growth based on scenarios assuming improvement of major growth drivers (simulation 1). Furthermore, this study also simulates the pattern of TFP growth based on scenarios assuming advancement of TFP determinants in Myanmar by using LTGM-TFP extension (simulation 2). For intensifying validity of simulation analyses, this study benchmarks Vietnam which has shown remarkable economic performance two decades ahead of Myanmar with similar geographical, economic and political background.

Applying LTGM to simulate Myanmar's long-term growth, this study calibrates capital stock data sourced from PWT 9.1. The reason is, in many developing countries including Myanmar and Vietnam, the growth rates over the last period drawn by the model with original capital stock show quite low conformity to the real value. With the reconstructed capital stock, the conformity becomes reasonable. In addition, for simulation 2, this study calibrates regression coefficients utilized in LTGM-TFP to measure the impacts of TFP determinant index and TFP level on TFP growth rate. That's because original regression analysis rules out several Asian countries including Myanmar and Vietnam in the sample. Thus, this study attempts to include six Asian countries to reflect the context of two countries and regional characteristics into the coefficients and confirms the sign and significance of new coefficients are consistent with the original.

The results of simulation analyses show Myanmar's economic growth rate continue to fall below 3% in 2040 without any improvement of growth drivers, but increasing investment rate and human capital growth rate is effective enough to mitigate the downward trend. Also, considering the low level of the female participation rate in Myanmar, its improvement has a significant impact on economic growth until it reaches the target. The most decisive factor for Myanmar's long-term economic growth is TFP growth. If the TFP growth rate rises to 1% by 2030 and remains, it leads to an annual average economic growth rate of more than 4% in Myanmar during 2020-2040. In addition, under the assumption that other growth drivers will be improved together, Myanmar will be able to achieve annual an average economic growth rate of more than 6% over the next 20 years and belong to the upper-middle-income group.

Regarding TFP growth, with the increase of TFP determinant index, average annual TFP growth rate shows 0.74% over 2019-2040. In addition, among five subcomponent indices, improving an education index has the most significant on TFP growth in Myanmar. As education is directly related to human capital, so the impact on economic growth will be intensified. Meanwhile, the results also show improving governance, infrastructure and market efficiency can lead to TFP growth rate of around 0.18% respectively during the same period.

According to the results of analyses, policy makers in Myanmar are advised to strengthen polices improving human capacity for sustainable economic growth. This will not only contribute to TFP growth but will also directly affect economic growth. In fact, in the Human Capital Index (HCI) by the World Bank, Myanmar shows a lower level of HCI than the average levels of CLMV and ASEAN countries. Besides, according to the Enterprise Surveys by the World Bank, the low education level of labour force is mentioned as a second major factor that negatively affects business activities in Myanmar. In this regard, it is significant to enforce policies to enhance the basic education system and Technical Vocational Education and

Training (TVET) which is directly related to the productivity of workers. In addition, considering the low level of female participation rate in Myanmar, labour market policies to promote female labour participation would be impactful to economic growth by reaching its target. Specifically, polices are needed to support female participation in manufacturing and service sector jobs created in line with the rapid industrialization and urbanization. Meanwhile, as the combined scenario ideally shows, Myanmar can sustain its high economic growth over 6% in the long-term only when it improves growth drivers simultaneously. Therefore, policy makers are also recommended to promote investment by improving market efficiency to encourage private investment including foreign direct investment and by reforming public finance system for efficient public investment. Moreover, In Myanmar, there are factors that can negatively affect governance, such as ethnic conflicts and the balance of power between the military and a civilian government, so unceasing effort to improve governance is also required for sustainable growth.

There are some considerable limitations to this study. First, it may be controversial to benchmark Vietnam for simulation analyses. For example, Vietnam could keep implementing economic reforms while it was maintaining political stability, but Myanmar is at risk of political conflicts between the military and the civil government. Also, Vietnam has greatly expanded trade during last few decades and it has affected directly and indirectly the growth drivers, while it is not guaranteed that Myanmar would achieve such a trade expansion over the analysis period. Nevertheless, the reason why this study set Vietnam as a benchmark is that targeting a specific country is beneficial to establish policy goals concretely, and considering transition experience and regional characteristics, Vietnam is regarded as a relatively appropriate benchmark for Myanmar. Second, the TFP determinant index and subcomponent indices are constructed for countries across the world, so the indices may not be able to accurately

represent the status of Vietnam and Myanmar. It would be necessary to create indices more focused on two countries or Southeast Asian countries to address this issue. Third, other analyses related to public-private capital, saving rate and poverty rate that can be done through LTGM are not used comprehensively. That is because, considering the economic and social status of Myanmar and Vietnam, those analyses do not provide meaningful policy implications, so they are skipped in this study.

Despite some limitations, the contribution of this study is to measure the impact of drivers for the long-term economic growth and TFP growth in Myanmar and draw policy implications. In addition, through data calibration, this study secures the validity of simulation analyses using LTGM and LTGM-TFP extension. Furthermore, the approach applying LTGM and LTGM-TFP extension comprehensively could be a reference to policy makers and researchers to utilize the models effectively.

References

Aghion, P., & Howitt, P. (1992). A Model of Growth through Creative Destruction. *Econometrica*, 60(2), 323-351.

ASEAN+3 Macroeconomic Research Office. (2019). AMRO Annual Consultation Report-Myanmar. Singapore: ASEAN+3 Macroeconomic Research Office.

Asian Development Bank. (2011). Asian Development Outlook 2011: South-South Economic Links. Manila: Asian Development Bank.

Asian Development Bank. (2017). Country Partnership Strategy: Myanmar, 2017-2021 Building the Foundations for Inclusive Growth. Manila: Asian Development Bank.

Attanasio, O. P., Lucio P., & Antonello S. (2000). Saving, Growth and Investment: A Macroeconomic Analysis Using a Panel of Countries. *The Review of Economics and Statistics*, 82(2), 182-211.

Barro, R. J., & Lee, J. W. (1996). International Measures of Schooling Years and Schooling Quality. *American Economic Review*, 86(2), 218-223.

Barro, R. J., & Lee, J. W. (2013). A New Data Set of Educational Attainment in the World, 1950-2010. *Journal of Development Economics*, 104, 184-198.

Barro, R. J., & Lee, J. W., (2015). Education Matters: Global Schooling Gains from the 19th to the 21st Century. Oxford: Oxford University Press.

Barro, R. J., & Sala-i-Martin, X. (1990). Economic Growth and Convergence across the United States, *NBER Working Paper*, No. 3419.

Barro, R. J., & Sala-i-Martin, X. (1991). Convergence across States and Regions. Brookings Papers Economic Activity, 1, 107-182.

Barro, R. J., & Sala-i-Martin, X. (1992). Convergence. *Journal of Political Economy*, 100(2), 223-251.

Barro, R. J., & Sala-i-Martin, X. (2004). Economic Growth (2nd ed.). Cambridge: The MIT Press.

Bernanke, B. S., & Gurnayak, R. S. (2002). Is Growth Exogenous? Taking Mankiw, Romer, and Weil Seriously, Handbook of Economic Growth, *NBER Macroeconomics Annual*, 16, 11-57.

Bloom, D. E., Canning, D., & Fink, G. (2011). Implications of Population Aging for Economic Growth. *NBER Working Paper*, No. 16705.

Cosic, D., Dahal, S., & Kitzmuller, M. (2017). Climbing Higher: Toward a Middle-Income Nepal. *Country Economic Memorandum*, Washington, DC: World Bank Group.

Devadas, S., & Pennings, S. (2018). Assessing the Effect of Public Capital on Growth: An Extension of the World Bank Long-Term Growth Model. *Policy Research Working Paper*, WPS 8604, Washington, DC: World Bank Group.

Easterly, W., & Levine, R. E. (2001). It's Not Factor Accumulation: Stylized Facts and Growth Models. *The World Bank Economic Review*, 15(2), 177–219.

Feenstra, R. C., Inklaar, R., & Timmer, M. P. (2015). The Next Generation of the Penn World Table, *American Economic Review*, 105(10), 3150 – 3182.

Goldin, C. (1994). The U-shaped female labour force function in economic development and economic history, *NBER Working Paper*, No. 4707.

Hall, R., E., & Jones, C. I. (1999). "Why Do Some Countries Produce so Much More Output per Worker than Others?. *Quarterly Journal of Economics*, 114(1), 83–116.

Hanushek, E. A., Schwerdt, G., Wiederhold, S., & Woessmann, L. (2015). Returns to Skills around the World: Evidence from PIAAC. *European Economic Review*, 73, 103-130.

Hanushek, E. A., & Kimko, D. D. (2000). Schooling Labour-Force Quality and the Growth of Nations. *American Economic Review*, 90(5), 1184-1208.

Hevia, C., & Loayza, N. (2011). Savings and Growth in Egypt, *Policy Research Working Paper*, WPS 5529, Washington, DC: World Bank Group.

Inklaar, R., Woltier, P. (2019). What is New in PWT 9.1, GGDC Note.

Isaksson, A. (2007). Determinants of Total Factor Productivity: A Literature Review. *UNIDO Working Paper*, 02/2007.

Islam, N. (2008). Determinants of Productivity across Countries: An Exploratory Analysis. *Journal of Developing Areas*, 42(1), 201-242.

Jeong, H. (2017). Korea's Growth Experience and Long-Term Growth Model. *Policy Research Working Paper*, WPS 8240, Washington, DC: World Bank Group.

Kim, Y. E., Loayza, N., & Meza-Cuadra, C. (2016). Productivity as the Key to Economic Growth and Development. *Research & Policy Briefs*, No. 3. Washington, DC: World Bank Group.

Kim, Y. E., & Loayza, N. (2019). Productivity Growth: Patterns and Determinants across the World. *Policy Research Working Paper*, WPS 8852, Washington, DC: World Bank Group.

Loko, B., & Diouf, M. A. (2009). Revisiting the Determinants of Productivity Growth: What's New?. *IMF Working Paper*, WP/09/25.

Lucas, R. E. Jr. (1988). On the Mechanics of Economic Development. *Journal of Monetary Economics*, 22(1), 3-42.

Mankiw, G., Romer, D., & Weil, D. (1992). A Contribution to the Empirics of Economic Growth. *Quarterly Journal of Economics*, 107(2), 407–437.

McKinsey Global Institute. (2015). The Power of Parity: How Advancing Women's Equality Can Add $12 Trillion to Global Growth.

Mijiyawa, A. G. (2017). Economic Growth in Guinea and How to Accelerate It. *Policy Research Working Paper*, WPS 8214, Washington, DC: World Bank Group.

Olivetti, C. (2013). The Female Labour Force and Long-run Development: The American Experience in Comparative Perspective. *NBER Working Paper*, No. 19131.

Park, D., & Shin, K. (2011). Impact of Population Aging on Asia's Future Growth. *ADB Economics Working Paper Series*, No. 281.

Pennings, S. (2018). Long-Term Growth Model v4.1 - Model Description. World Bank Internal Note.

Roland-holst, D., & Park, C. (2015). Myanmar: Long Term Scenarios for Sustained Macroeconomic Growth. Manila: Asian Development Bank.

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), 71-102.

Romer, P. M. (1993). Idea Gaps and Object Gaps in Economic Development. *Journal of Monetary Economics*, 32(3), 543-573.

Sinha, R. (2017). Long-Term Growth Scenarios for Bangladesh. *Policy Research Working Paper*, WPS 7952, Washington, D.C: World Bank Group.

Solow, R. (1956). A Contribution to the Theory of Growth. *Quarterly Journal of Economics*, 70, 65-94.

Swan, T. (1956). Economic Growth and Capital Accumulation. *Economic Record*, 32, 334-361.

Syverson, C. (2011). What Determines Productivity?. *Journal of Economic Literature*, 49(2), 326-365.

Taguchi, H., & Lar, Ni. (2015). Long-term Projection of Myanmar Economy by Macro Econometric Model. *MPRA Paper*, No. 64412.

Tam, H. (2011). U-shaped Female Labour Participation with Economic Development: Some Panel Data Evidence. *Economics Letters*, 110(2), 140-142.

United Nations Conference on Trade and Development. (2019). The Least Developed Countries Report 2019: The Present and Future of External Development-Finance Old Dependence, New Challenges. New York: United Nations Publication.

World Bank Group. (2017a). Country Partnership Framework for The Socialist Republic of Vietnam. Washington, DC: World Bank Group.

World Bank Group. (2017b). Malawi Economic Monitor: Land for Inclusive Development. Washington, DC: World Bank Group.

World Bank Group. (2017c). Systematic Country Diagnostic: Future Armenia: Connect, Compete, Prosper. Washington, DC: World Bank Group.

World Bank Group. (2017d). Systematic Country Diagnostic: The Republic of Seychelles. Washington, DC: World Bank Group.

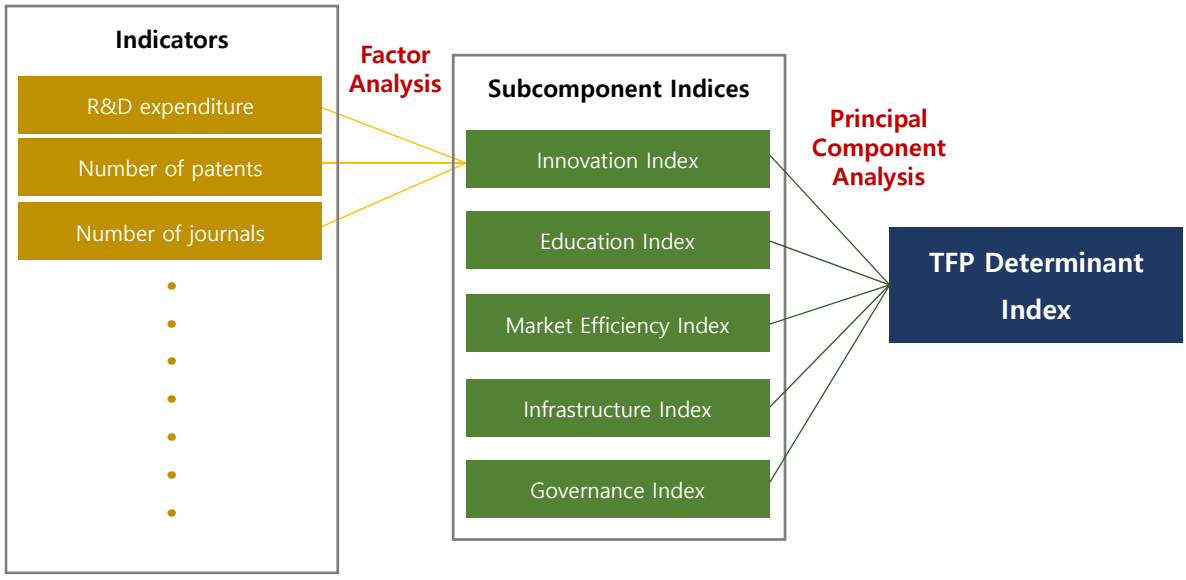
World Bank Group. (2018a). Systematic Country Diagnostic: Georgia: From Reformer to Performer. Washington, DC: World Bank Group.

World Bank Group. (2018b). Systematic Country Diagnostic: Republic of Zambia. Washington, DC: World Bank Group.

Young, A. (1995). The Tyranny of Numbers: Confronting the Statistical Realities of the East Asian Growth Experience. *The Quarterly Journal of Economics*, 110(3), 641-680.

Appendix. TFP Determinant Index Composition

Figure 14 illustrates how TFP determinant index is established and Table 4 shows indicators used to construct subcomponent indices. According to Kim & Loayza (2019), relevant indicators to each subcomponent are combined using factor analysis to capture common variance of the indicators; however, all the subcomponent indices are combined to TFP determinant index using principal component analysis which captures total variance to preserve different features among subcomponent indices.



Source: Kim and Loayza (2019)

Figure 14. Method of Establishing TFP Determinant Index

Table 5. Indicators to Construct Subcomponent Indices

Indicator	Description	Source
1. Innovation Index		
Research and development expenditure (% of GDP)	The effort to create new technologies	World Development Indicator
Number of patents (per 100 people)	The outcome of R&D activities	World Development Indicator
Number of journal articles (per 100 people)	The outcome of R&D activities	World Development Indicator
2. Education Index		

Government expenditure on education, total (% of GDP)	Public investment in foundational human capital	World Development Indicator
Percentage of population aged 25-64 with completed secondary schooling	Educational attainment among workers	Barro and Lee
Percentage of population aged 25-64 with completed tertiary schooling	Educational attainment among workers	Barro and Lee
PISA, average of math, science, and reading	Educational quality	OECD
3. Market Efficiency Index		
Doing Business scores	Market efficiency output	World Bank
Financial Development Index	Financial market efficiency	IMF
Ratio of minimum wage to value added per worker	Labour market efficiency	World Development Indicator
Severance pay for redundancy dismissal (weeks of salary)	Labour market efficiency	World Development Indicator
Share of women in wage employment in the nonagricultural sector (% of total nonagricultural employment)	Labour market efficiency	World Development Indicator
4. Infrastructure Index		
Fixed telephone subscriptions (per 100 people)	Telecommunication	World Development Indicator
Mobile cellular subscriptions (per 100 people)	Telecommunication	World Development Indicator
Electricity production (kWh per 100 people)	Electricity	OECD/IEA
Paved roads (km per 100 people)	Road	IRF
Improved sanitation facilities (% of the population with access)	Water and sanitation	WHO/UNICEF
Improved water source (% of the population with access)	Water and sanitation	WHO/UNICEF
5. Governance Index		
Voice and accountability	Citizens' participation in selecting their government and freedom of expression	World Governance Index
Control of corruption	The extent to which public power is exercised for personal gain	World Governance Index
Government effectiveness	The quality of public services and policy formulation and Implementation	World Governance Index
Political stability	The absence of politically motivated conflict	World Governance Index
Regulatory quality	The ability of the government to formulate and implement regulations that promote private sector development	World Governance Index
The rule of law	The extent to which citizens have confidence in and abide by laws	World Governance Index

Source: Kim and Loayza (2019)