

Malaysia's Economic Growth and Transition to High Income

An Application of the World Bank Long Term Growth
Model (LTGM)

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Abstract

This paper studies economic growth in Malaysia, with the purpose of assessing the potential to attain the status and characteristics of a high-income country. Future economic growth is simulated under a business-as-usual baseline, where the growth drivers follow their historical or recent trends, and under different scenarios of reform, using the World Bank Long-Term Growth Model (LTGM). Under the business-as-usual baseline, Malaysia's GDP growth is expected to decline from 4.5 to 2.0 percent over the next three decades, following the country's transition to high income in 2024 (which might be delayed due to the effects

of COVID-19). This decline is partly due to demographics, but also a declining marginal product of private capital and slowing growth rates of total factor productivity and human capital. Strong reforms are required for Malaysia to grow beyond what is expected based on historical trends, especially for human capital, female labor force participation, and total factor productivity. In the strong reform scenario, based on growth drivers achieving a target corresponding to the 75th percentile of high-income countries, GDP growth is expected to have a substantially higher trajectory, reaching 3.6 percent by 2050.

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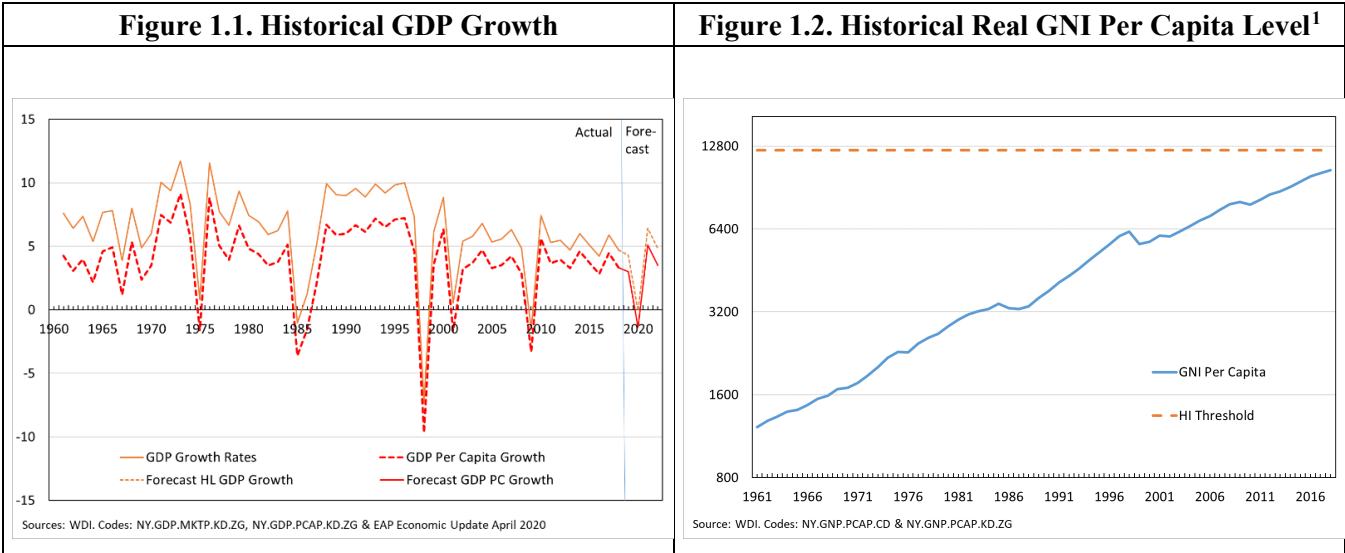
Keywords: Economic growth, human capital, investment, labor force participation, total factor productivity, innovation, education, market efficiency, infrastructure, institutions, Malaysia

JEL: D24, G14, G18, H54, I15, I25, J16, O16, O33, 043, 053

Note: The views expressed herein are those of the authors and do not necessarily reflect the views of the World Bank, its Executive Directors, or the countries they represent. We appreciate comments from Yew Keat Chong, Firas Raad, Richard Record, Shakira Binti Teh Sharifuddin, and seminar participants at the World Bank. To download the Long Term Growth Models, visit www.worldbank.org/LTGM

Introduction

Over the past few decades, Malaysia has recorded strong and sustained growth, apart from during periods such as the Asian financial crisis in 1997, the global financial crisis in 2009 and – more recently – the COVID-19 pandemic in 2020 (Figure 1.1). As the economic effects of the COVID-19 pandemic will hopefully be short-lived, this paper looks through the current growth volatility to focus on long-run trends. Malaysia’s long-run growth performance has supported remarkable gains in social and economic development, with a nine-fold increase in per capita income over the last seven decades. The country is expecting to transition to high-income status in the near future (Figure 1.2), where high income is based on the World Bank’s cross-country classification. This paper studies Malaysia’s long-run economic growth prospects as it attains the status and characteristics of a high-income economy.



The Government of Malaysia’s long-run and medium-run growth strategies are outlined in its Shared Prosperity Vision (SPV) 2030 and 12th Malaysia Plan (respectively). The SPV and Malaysia plan go beyond high-income status, also ensuring growth is both sustainable and equitable. The October 2019 SPV sets out “a commitment to make Malaysia a nation that achieves sustainable growth along with fair and equitable distribution.”² The SPV blueprint proposes targets across key growth areas: regional inclusion, the role of SMEs, human capital, labor market and workers’ compensation, and social capital and well-being. The 12th Malaysia Plan, the next five-year national development plan, is slated for 2021-2025, and will be released in 2020. It aims to be aligned to SPV 2030, covering the areas of economic

¹ Methodology for Figure 1.2: Calibrate the levels to GNI per capita Atlas method (NY.GNP.PCAP.CD) for 2018, and then cast backwards using real GNI growth (NY.GNP.PCAP.KD.ZG). Dotted line shown is the 2019-20 high income threshold.
² The new government that assumed administration at the end of February 2020 has pledged to ensure the continuity of SPV 2030.

empowerment (growth drivers and enablers), environmental sustainability, and social re-engineering (essentially improving the well-being of the people and social cohesion).

This paper simulates Malaysia’s long-run growth prospects using the World Bank Long-Term Growth Model (LTGM), a suite of spreadsheet-based tools building on the celebrated Solow-Swan growth model (Loayza and Pennings 2018, and Hevia and Loayza 2012). The Long-Term Growth Model – Public Capital Extension (LTGM-PC) is used as the base model (Devadas and Pennings 2018), which allows for private and public investment to have different effects on growth. Human capital and TFP growth are endogenized using LTGM’s Human Capital extension (LTGM-HC) and TFP extension (LTGM-TFP), respectively. The LTGM-HC combines average years of schooling by age cohort with the quality of education and health components to determine human capital. In the LTGM-TFP (Kim and Loayza 2018), the TFP growth rate is calculated as the composite effect of TFP determinants: innovation, education, market efficiency, infrastructure, and institutions. The models are described in more detail in Appendix 1 and most are available for download at www.worldbank.org/LTGM.

Our first result concerns a Malaysia’s business-as-usual baseline growth path, where the growth drivers —public and private investment-to-GDP ratios, total factor productivity (TFP), human capital, and labor force participation rates — follow their historical or recent trends (future demographic projections taken from the United Nations (UN)). We find trend GDP growth in Malaysia is likely to fall from around 4.5 percent in 2020 to 2.0 percent in 2050, driven mostly by demographics, falling private investment effectiveness and declining TFP growth. Declining growth is common among peer countries as they transition to high-income status.

However, this decline in growth is not destiny, and our second finding is that it can be partially offset by economic reforms. Specifically, we simulate weak, moderate, and strong reforms for each growth driver, with targets set with reference to the distribution of those values among high-income (HI) countries. While weak reforms have little effect (relative to the baseline), moderate and strong reforms generate growth in 2050 that is 1.5 to 1.8 times that in the business-as-usual baseline (respectively).

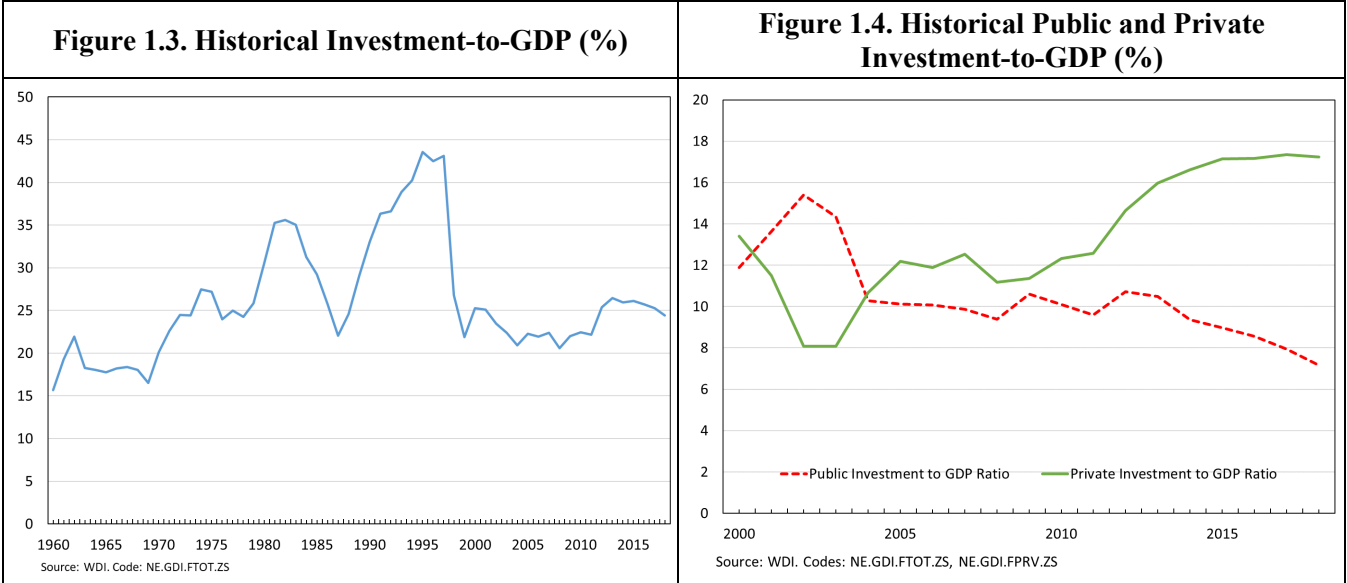
The rest of the paper is organized as follows. Section 1 presents the historical developments for each growth driver. Section 2 discusses the assumptions regarding growth drivers and parameters used in the baseline simulation. Section 3 shows the baseline GDP growth trajectory over the next three decades and analyzes the contribution of each growth driver to both current growth rates and changes in the growth rate over 2020-50. Section 4 presents the impact on GDP growth of the different levels of reforms for each determinant of growth: “weak” reform benchmarking at the 25th percentile among high-income countries;

“moderate” reform, at the 50th percentile; and “strong” reform, at the 75th percentile. Section 5 discusses the implications for GDP growth when the effects of all growth drivers are combined for each scenario of weak, moderate, and strong reform. The conclusion provides a summary of main findings and policy implications.

1. Historical developments in growth drivers

In this section we review the historical drivers of growth in Malaysia through the lens of LTGM. First, we describe historical trends in GDP growth and GDP per capita growth, which provide context for future growth performance. Then we discuss the historical path of the investment-to-GDP ratios (both public and private), TFP growth, human capital growth, demographics, and the labor force participation rate, which help us calibrate the future paths of these growth drivers.

Post-2000, GDP growth in Malaysia has averaged 5% (Figure 1.1), but growth has slowed relative to the faster rate in the 1990s. Slower growth rates as countries develop are however common, as we discuss in more detail in Section 3. Malaysia has also experienced a relatively steady rate of per capita GDP growth of 3.3% over the past 20 years. These growth rates have allowed the real GNP per capita level to double since the mid-1990s. However, otherwise steady growth has been marked by slowdowns resulting from the Asian Financial Crisis in 1997, the 2009 Global Financial Crisis, earlier recessions around 1985 and 1975, and the recent 2020 COVID-19 pandemic (based on forecasts).



High income status is defined by the World Bank as countries with GNI per capita above \$12,376 in 2019-20 (measured at Atlas exchange rates). In 2018, Malaysia’s GNI per capita was at \$10,460 (Figure 1.2)

and historical trends suggest that Malaysia is expected to pass the threshold in the mid-2020s. However, this projection might be delayed due to the effect of COVID-19, causing a reduction in the forecasted growth in 2020 and possibly in the early 2020s (Figure 1.1).³

Aggregate investment-to-GDP has averaged 24% over the last two decades (Figure 1.3), with public investment trending down and private investment trending up (Figure 1.4). During the late 1980s and 1990s, investment rates in Malaysia increased rapidly, reaching over 40% of GDP just before the 1997 Asian financial crisis. High private investment-to-GDP rates were buoyed by the First Industrial Master Plan (1986-1995), and liberalization and deregulation in the economy. In the 1990s, excessive investments also occurred in certain sectors, especially the property sector. After the Asian financial crisis, the investment-to-GDP ratio declined, with the fall mostly due to lower levels of private investment (not shown). In the last 10 years, investment-to-GDP has averaged 24.6%. A closer look at the split between public and private investment shows that public investment has been declining since 2012, falling from around 11% to 7% of GDP in 2018. This is reflective of the government's fiscal consolidation plan. At the same time, some rebalancing has been observed with private investment rising from 15% to 17% of GDP.

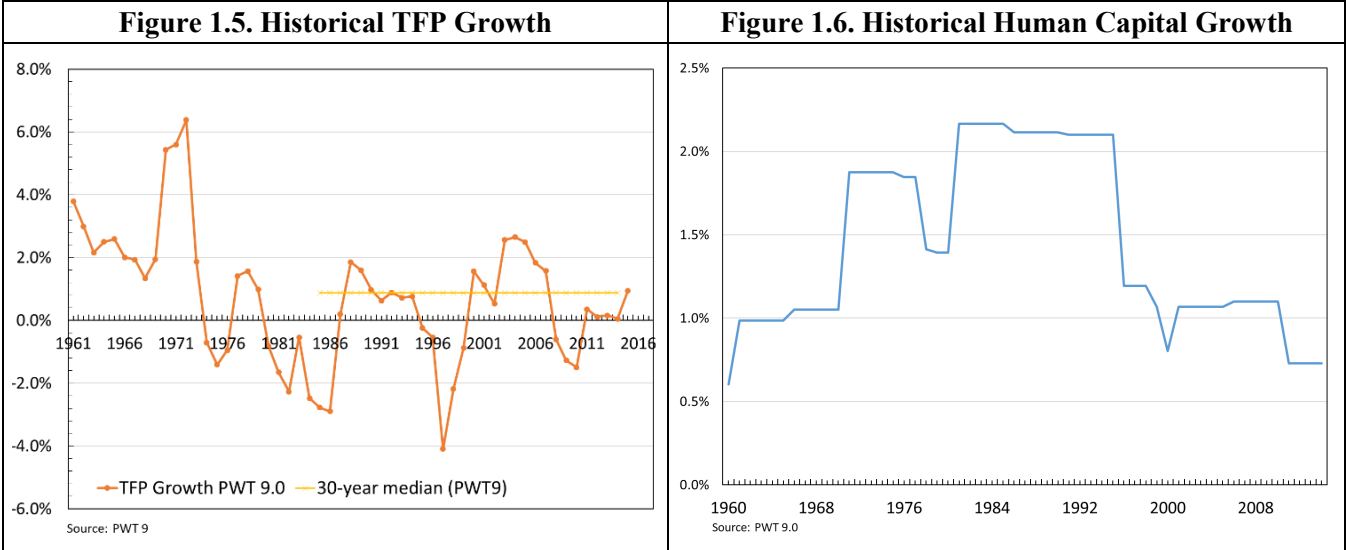
The median TFP growth over the past 30 years (1985-2014) is 0.9% (Figure 1.5). Since TFP is calculated as a residual – growth less factor accumulation – it is volatile and oscillates with the economic cycle.

The human capital growth rate has experienced a downward trend since the early 1990s and it has averaged roughly 0.6-0.7% in the 2010-2014 period (Figure 1.6). Human capital is commonly measured using the average years of schooling, though in our forward-looking simulations we use a broader measure based on the World Bank Human Capital Index that includes schooling quality and population health. In the 1980s and early 1990s, human capital grew at around 2% but now has slowed to 0.6%. As it is harder to increase the average years of education when people are already well educated, countries often experience a slowing growth rate of human capital over time. We expect this trend will continue for Malaysia as it moves to high income status.

Total population growth was close to 1.3% over the past 5 years, after experiencing a downward trend since 1990 (Figure 1.7). Before 1990, population growth averaged 2.5-3%. Slower population growth is typical of developing economies that transition into high-income economies and is expected to continue. Slowing population growth also affects the share of population of working age (15-64), which in turn affects the size of the labor force (Figure 1.8). The share of the population between the ages 0 to 14 has

³ World Bank (2020) projects a growth rate of -0.1% under the baseline and -4.6% under a low-case scenario for 2020.

been declining, due to falling fertility, which has led to a “demographic dividend”: the share of the population of working age grew by around 0.6% over 1965-2010, and then accelerated to 1% in the 2000s (Figure 1.9). Analytically, the LTGM suggests this demographic dividend contributed at least 0.3ppts to GDP growth throughout this period.⁴ Since 2010, we can observe a declining growth rate of the share of the population of working age (Figure 1.9), which has recently approached zero. This is the result of an aging population --- fewer children and longer life expectancy ---and is a characteristic of an economy transitioning to high income status. Examples of population aging can be found in developed economies like Japan, the Republic of Korea and Western Europe, and is expected to continue.



Historically, the labor force participation rate has been stable at around 64%, until 2010 when it increased to 68% by 2018 (Figure 1.10). This is mostly due to higher female labor force participation (FLFP), which increased from about 46% in the 1990-2010 period to 55% by 2018. In contrast, male labor force participation has remained relatively constant at around 80% since 1990. Despite the increase in recent years, Malaysia’s FLFP is still lagging its regional peers like Thailand, China, and Singapore and as well as high-income peers (Figure 1.11). Higher rates of FLFP increase the labor supply in the economy, and hence the level of GDP per capita.

⁴ Analytically, the 0.6ppts of growth in the working age to total population ratio will be multiplied by the labor share of income, which is 50%, resulting in about 0.3ppts to GDP growth each year.

Figure 1.7. Historical Total Population Growth (%)

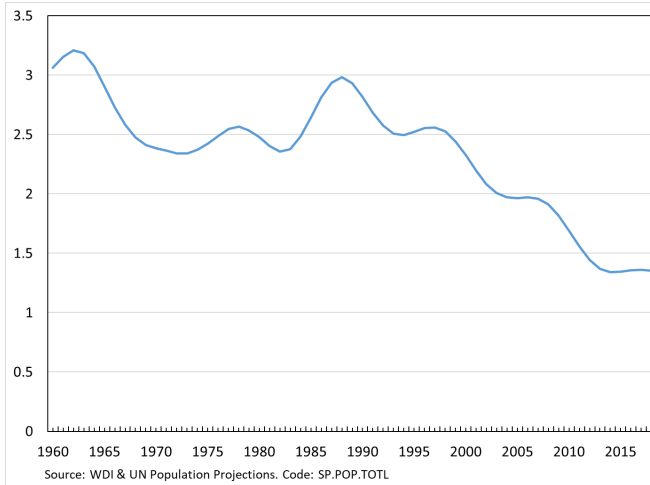


Figure 1.8. Historical Population Age Cohort Shares (%)

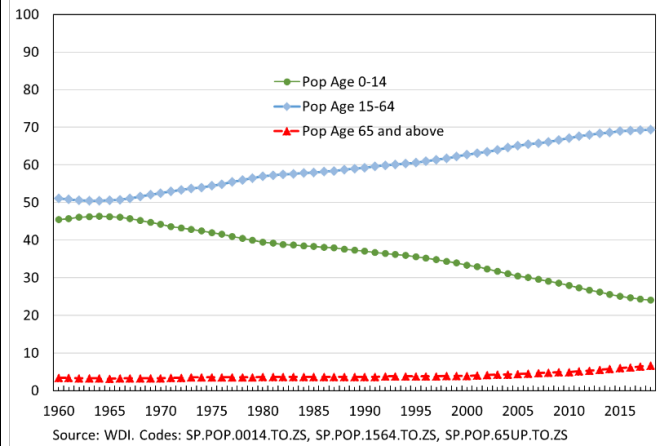


Figure 1.9. Historical Growth in the Working Age-to-Population Share (%)

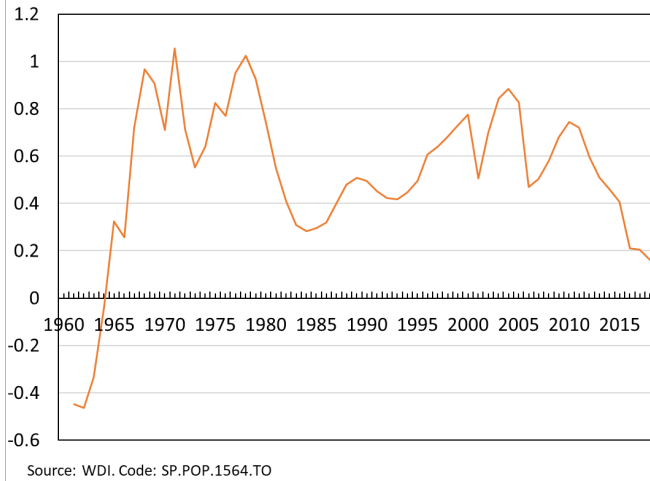


Figure 1.10. Historical Labor Force Participation (%)

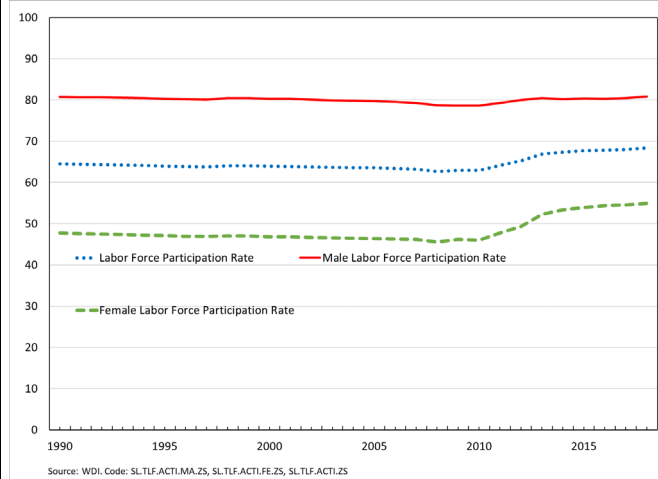
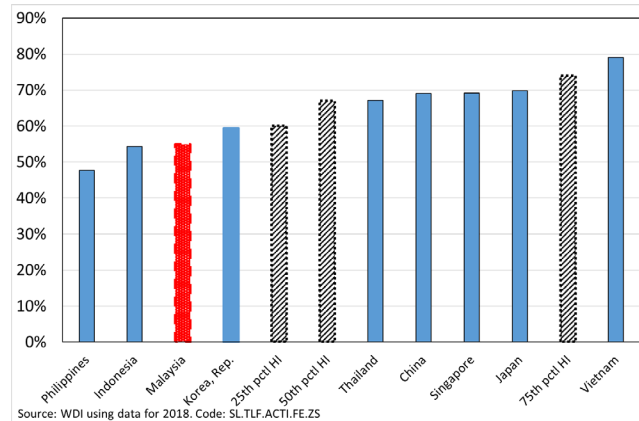


Figure 1.11. Comparative Female Labor Force Participation in East Asia (%)



2. Growth drivers in the business-as-usual baseline

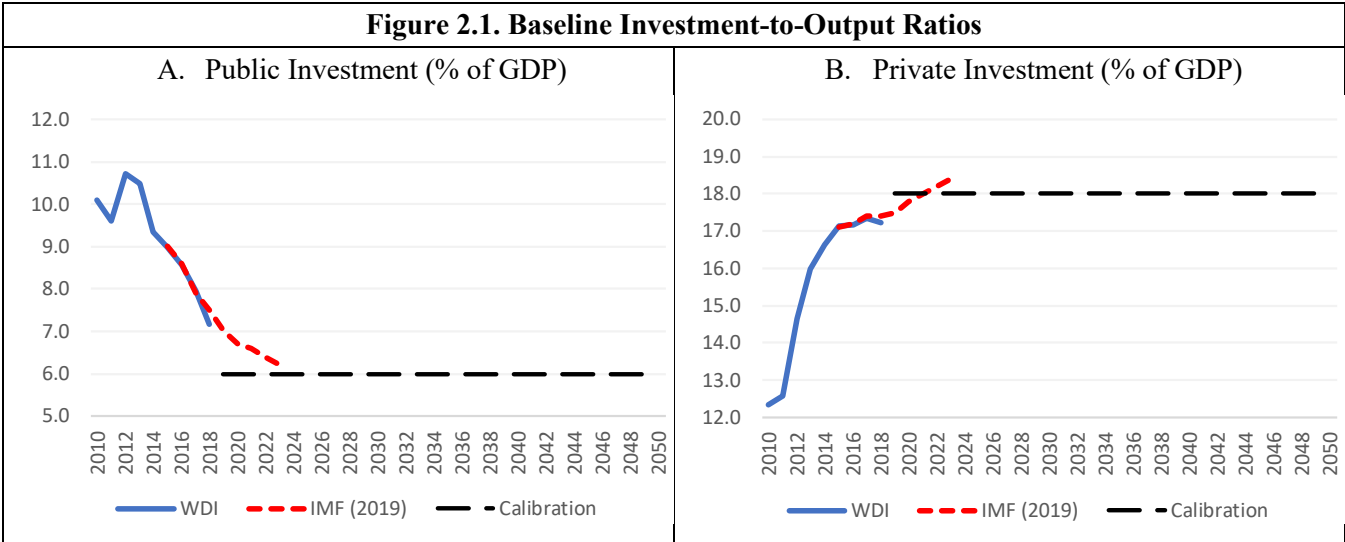
In this section we explore the assumptions that are required to calibrate the LTGM-PC to simulate Malaysia’s business-as-usual baseline over 2020-50. To create a business-as-usual baseline for the Malaysian economy in the long run, we need to calibrate the future paths of the growth drivers like investment, the growth of both TFP and human capital, as well as other key parameters. These assumptions are summarized in Table 2.1. We calibrate the LTGM-PC as the foundation of the analysis and add the LTGM-TFP extension and the LTGM-HC extension to simulate TFP growth and human capital growth, respectively. Additionally, short-to-medium term forecasts produced by the IMF in its Article IV report help us calibrate the future paths of public and private investment. We use population growth projections (by age cohort) from the UN for demographic trends until 2050. The remaining projections are determined by assuming that long-term trends in Malaysia remain constant and by performing some steady state calculations. The labor share of income is calibrated to 50%, which is close to its value from Penn World Tables version 9.0 (PWT 9).

Table 2.1. Summary of Assumptions for the Malaysia Business-as-Usual Baseline

Variable	Baseline	Source/Comments
Labor Share	50.0%	Similar to the 2014 PWT 9 figure of 53%
Depreciation Rate (aggregate)	5.8%	PWT 9 figure for 2014
Capital-to-Output Ratio	2.25	At steady state value
Human Capital Growth	0.6%–0.1%	Calculated using the LTGM Human Capital Extension
TFP Growth	0.9%–0.6%	Similar to the last 15-year average and the last 30-year median using PWT 9
Investment-to-GDP Ratio	24%	Based on projections of public and private-investment-to-GDP
Public Investment-to-GDP Ratio	6.0%	Based on recent trend and IMF projection up to 2023
Private Investment-to-GDP Ratio	18.0%	Based on recent trend and IMF projection up to 2023
Population Growth	1.3%–0.4%	UN Population projections (via WB HDN)
GDP Growth 2020-50	4.5%–2.0%	4.6% is MTI forecast for 2020 and 4.8% is the IMF Oct. 2019 WEO projections average for 2020-23.
Atlas GNI PC Level	US\$ 10,460	World Bank WDI for 2018

Investment-to-GDP is assumed to remain around 24% given recent trends and the IMF Article IV projections for the next few years. For the baseline, we calibrate public investment-to-output and private investment-to-output ratios (I^G/Y and I^P/Y) of 6 percent and 18 percent respectively (Figure 2.1). This is based on projections made by IMF (2019), which forecast that I^G/Y declines from 7 percent in 2019 to

6.2 percent by 2023, and I^P/Y increases from 17.5 percent to 18.4 percent over the same five-year period.⁵ The calibrations are consistent with (i) the gradual downward trend in I^G/Y in recent years amid fiscal consolidation, and (ii) a rebalancing towards private investment.⁶



The baseline projections put Malaysia between the 75th and 90th percentiles of the distribution of I^G/Y among high-income countries and at the 50th percentile for I^P/Y (Table 2.2). Generally, I^G/Y declines and I^P/Y increases as countries move from lower to higher country income group classifications. One reason underlying the comparatively high I^G/Y in Malaysia is that public investment includes investment spending by state-owned enterprises (SOEs).⁷ While the classification of expenditure by SOEs as public investment may differ country-to-country, there are some indications that public investment tends to be higher in countries that have a significant presence of SOEs.⁸

⁵ These baseline projections by the IMF assume GDP growth of 4.8 percent, debt-to-GDP remaining around 50 percent, a fiscal deficit around 3 percent, and roughly stable revenue mobilization rates over the next five years.

⁶ Our projections, indicative of longer-term trends, are also consistent with the near-term projections of the government for I^G/Y , but higher in the case of I^P/Y . Ministry of Finance Malaysia (2019) estimates I^G/Y and I^P/Y at 6.5 percent and 16.8 percent respectively for 2019 and forecasts these ratios at 6.1 percent and 16.3 percent respectively for 2020.

⁷ Known as non-financial public corporations (NFPCs) in Malaysia, these enterprises are public sector agencies undertaking the sale of industrial and commercial goods and services. They include government-owned and/or government-controlled companies. The government’s monitoring and reporting are focused on major NFPCs, which have government ownership of more than 50 percent of total equity, minimum annual sales of at least MYR100 million and/or significant impact to the economy (Ministry of Finance Malaysia 2018).

⁸ In a list of 21 countries with the highest shares of SOEs among their top 10 firms and which also have at least 10 firms on the Forbes Global 2000 list (Kowalski et al. 2013), Malaysia is ranked fifth. Among the top 10 countries on this list (China, United Arab Emirates, the Russian Federation, India, Malaysia, Saudi Arabia, Indonesia, Brazil, Norway and Thailand), we calculate the median value for average I^G/Y over 2006-2015 as 7 percent. Our calculations also indicate that the baseline projection of 6 percent for Malaysia’s I^G/Y is slightly below the 75th percentile value for average I^G/Y over 2006-2015 (6.8 percent) of high-income fuel-based economies (fuel exports/merchandise exports >15 percent).

Table 2.2: Investment-to-Output Ratios by Country Income Groups, Average over 2006-2015 (percent)

Income group	P10	P25	P50	P75	P90
Public investment-to-output, I^G/Y					
High	2.3	3.1	4.0	4.8	6.8
Upper middle	3.2	4.2	5.4	6.7	10.8
Lower middle	2.7	3.6	5.6	7.7	11.5
Low	4.7	5.8	7.0	8.6	11.5
Private investment-to-output, I^P/Y					
High	13.7	15.9	18.2	19.8	22.3
Upper middle	12.9	16.0	17.7	21.0	23.7
Lower middle	7.8	13.8	16.3	21.5	25.2
Low	7.6	11.2	12.8	18.4	22.6
Investment-to-output, I/Y					
High	18.9	20.3	22.5	23.8	27.3
Upper middle	19.4	21.3	24.2	27.3	32.6
Lower middle	15.9	17.9	23.0	28.2	31.1
Low	13.5	18.4	22.3	24.6	33.0

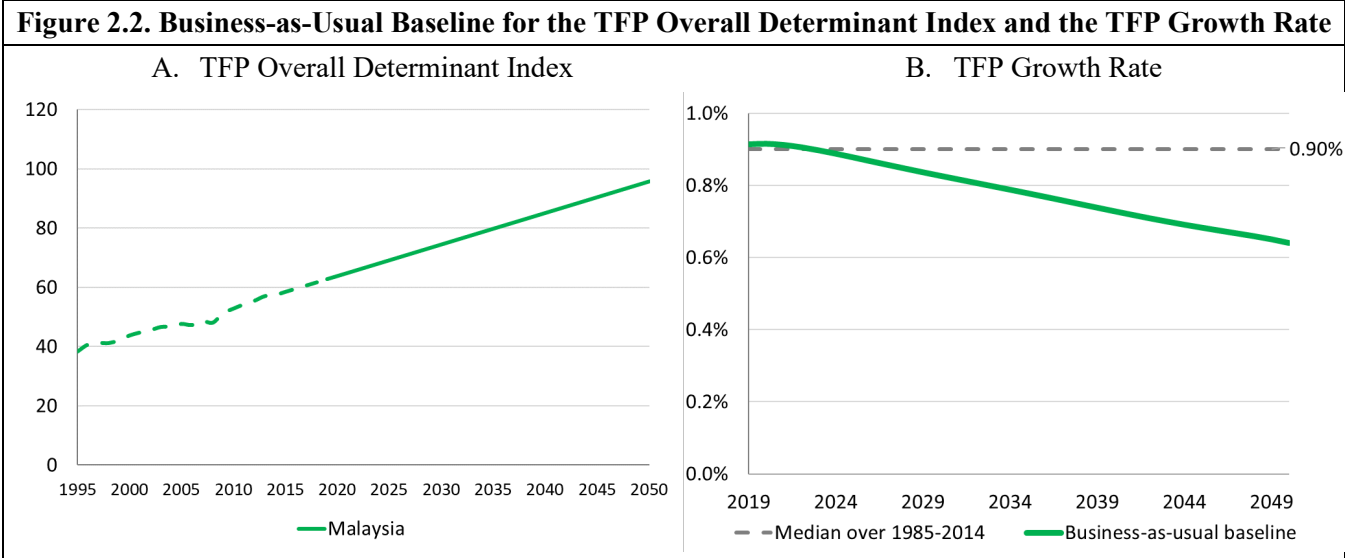
Notes:

- Data reported are 10-year average (2006-2015) investment to GDP shares at various percentiles (from 10 to 90) of each income group distribution.
- The sample comprises 144 countries: 43 high income, 38 upper-middle-income, 34 lower-middle-income and 29 low income. Countries are categorized into income groups based on World Bank classification.
- I/Y data is obtained from WDI. I^G/Y and I^P/Y are calculated by splitting the WDI data on I/Y using public and private investment shares of total investment from the IMF Fiscal Affairs Department Investment and Capital Stock Database (which has data available up to 2015).
- Our baseline projections for Malaysia places it between the 75th and 90th percentiles of the high-income country distribution for I^G/Y , and at the 50th percentile for I^P/Y .

The efficiency of public investment, as reflected by the Infrastructure Efficiency Index (IEI) in the LTGM-PC, is high in Malaysia. Malaysia's IEI score of 0.877 puts it at about the 50th percentile among high-income countries. This indicates that infrastructure in Malaysia is well-constructed and of high quality, which is supported by the World Economic Forum's survey on infrastructure quality for its Global Competitiveness Index – Malaysia ranked 21 of 137 countries in 2017/18. Given the high base, the potential growth impact from improvements in this measure of efficiency is limited, and so we assume quality is constant at its current rate in the baseline and all scenarios.

The IEI is best thought of as capturing public capital construction quality, which does not capture other less quantifiable, but important, aspects of public capital quality like poor project selection or an inflated cost of construction. We are, thus, unable to properly examine the implications of improvements on these elements in the model, especially, in the context of cross-country comparisons. However, it does not mean that these elements are not important for Malaysia. For instance, IMF (2019) notes that fiscal

vulnerabilities include reliance on off-budget spending, and weaknesses in project appraisal, approval and costing (Malaysia scores lower than the OECD average in terms of its procurement systems).



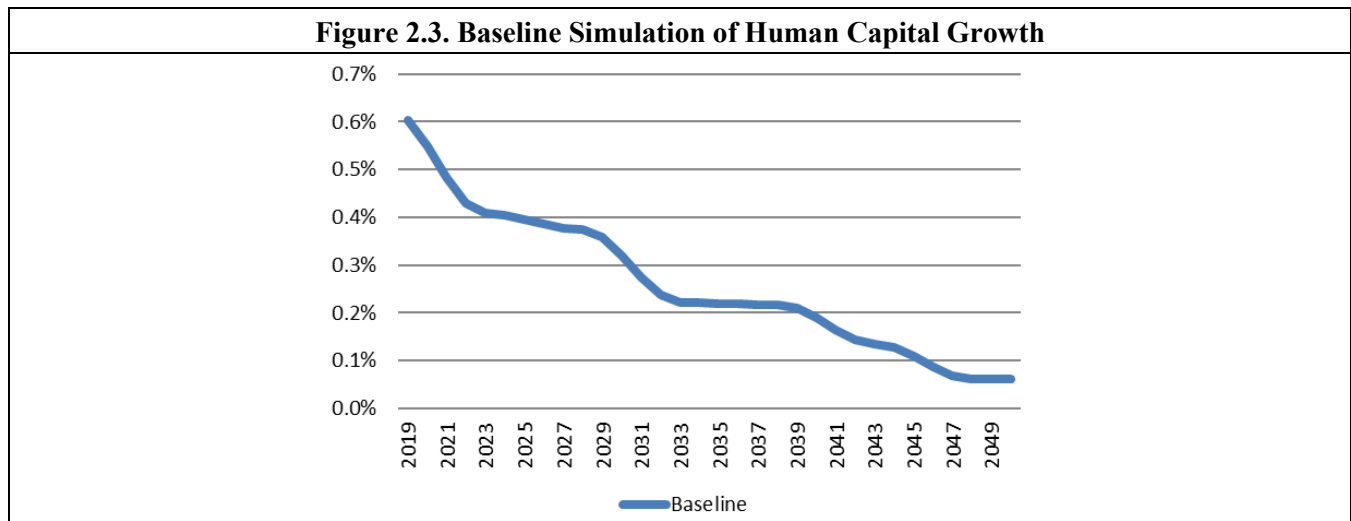
Total factor productivity (TFP) growth is assumed to be at the historical growth rate of 0.9%, the median over the period 1985-2014, in 2019 and decline to 0.6% for the period of 2020-2050. This baseline TFP growth rate was generated using the LTGM-TFP extension (Kim and Loayza 2019) which assesses a country’s potential for improving TFP growth depending on its determinants – innovation, education, market efficiency, infrastructure, and institutions. For the business-as-usual baseline, we assumed the TFP overall determinant index, the composite index of the subcomponent indexes for the five categories of the determinants, keeps increasing with the historical trend of the last 10 years. Specifically, we applied the average annual change in the overall determinant index over 2009-2018 to the period of 2019-2050 as shown in Figure 2.2A. With this assumption, we simulated TFP growth using the LTGM-TFP extension. Figure 2.2B shows that the TFP growth rate is expected to decrease gradually from around 0.90% to 0.64% over the next three decades.

We assume that future human capital growth begins at 0.6% in 2020 and declines to about 0.1% in 2050 (Figure 2.3). The human capital growth path for the baseline is produced using the LTGM-HC extension. We assume the average expected years of schooling in the future is the same as that of today’s children, 12.2 years. Because today’s new workers are better educated than older workers moving to retirement, the average human capital of the workforce increases over time – despite no increase in schooling of children -- leading to a positive human capital growth rate. The declining rate of human capital growth is because the average education quantity increases over time, and so the boost to the average from higher-skilled young workers is smaller. Human capital also includes the quality of education, as well as health. The

health of the population is measured by adult survival rates (ASRs), which is the probability that a 15-year-old will reach their 60th birthday, and stunting rates, defined as the fraction of 5 years old that are not stunted (see equation below).

$$\begin{aligned}
 h_t^{HCI} &= \text{Schooling}_t \times \text{Health}_t \\
 &= e^{\phi(YrsSchool_t \times Quality_t - 14)} \times e^{\frac{[Y_{Stunt}(NotStunted_t - 1) + \gamma_{ASR}(ASR_t - 1)]}{2}}
 \end{aligned}$$

In the baseline, we assume that schooling quality remains at its original level of 0.75, ASRs stay at 0.88 and the not stunted rate stays at 0.79. Data on the health and education variables are taken from the World Bank’s Human Capital Project.⁹ Due to a lack of historical data, we also assume that those rates apply to the whole working-age population, and so schooling quality and health make no contribution to human capital growth in the baseline. In terms of growth rates, human capital grows at about 0.6% in 2019-2020 and it slowly declines to under 0.1% by 2050. The return to education is assumed to be 12%.



The capital-to-output ratio is assumed to be at its steady state value of around 2.3. The steady state capital-to-output ratio is calculated as the ratio of the investment share of GDP to the sum of trend GDP growth and depreciation rate (see equation below).¹⁰ We divide total capital into public and private shares from the IMF Fiscal Affairs Department Investment and Capital Stock Database 2017, resulting in 1.14 for the public capital-to-output ratio (Kg/Y) and 1.11 for the private capital-to-output ratio (Kp/Y), respectively.

⁹ See <https://www.worldbank.org/humancapital>.

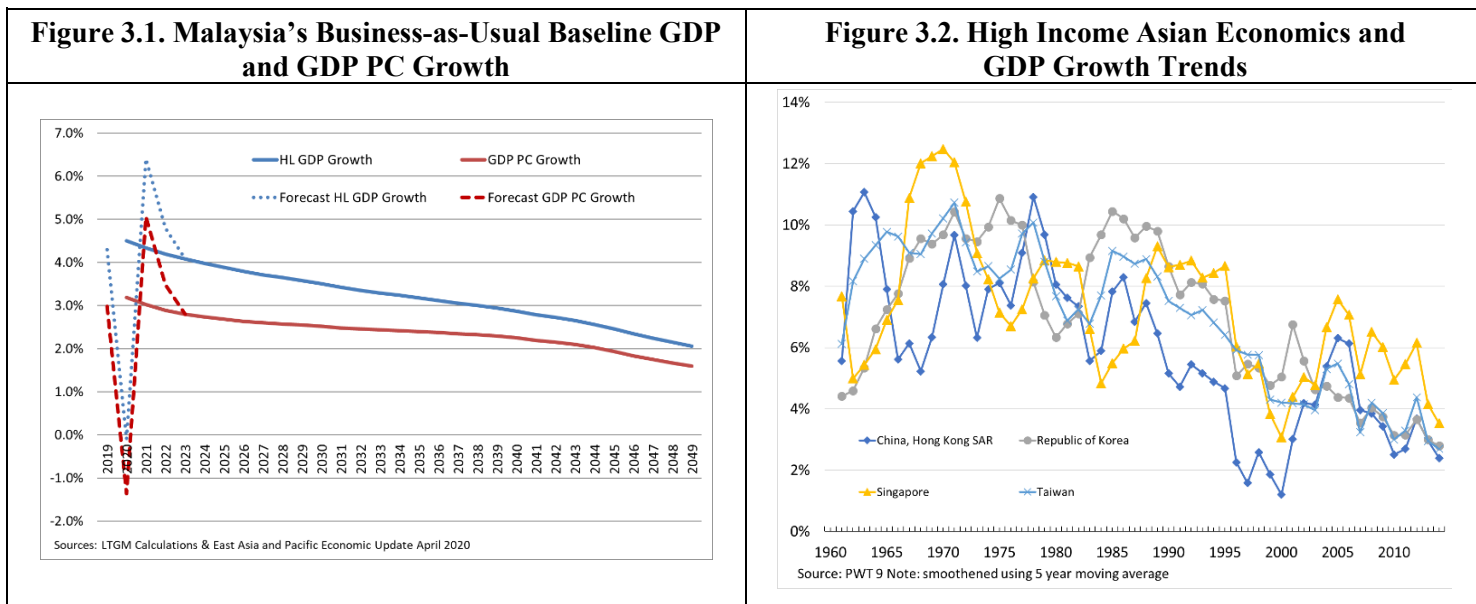
¹⁰ The GDP growth rate used is the average of 4.6% in the past 10 years, and the depreciation rate 5.8% from PWT 9. An alternative approach is to calibrate the capital-to-output ratio using Penn World Tables data, which would have generated a total capital-to-output ratio of around 3, and a lower growth rate over the next few years. But that growth rate was inconsistent with other information, such as recent growth history and forecasts by policy institutions, so we chose the steady-state approach instead.

$$\frac{K}{Y} = \left(\frac{I}{Y}\right) / (g_y + \delta) = \frac{0.242}{0.046 + 0.058} \approx 2.28$$

3. Business-as-usual baseline growth in Malaysia over 2020-2050

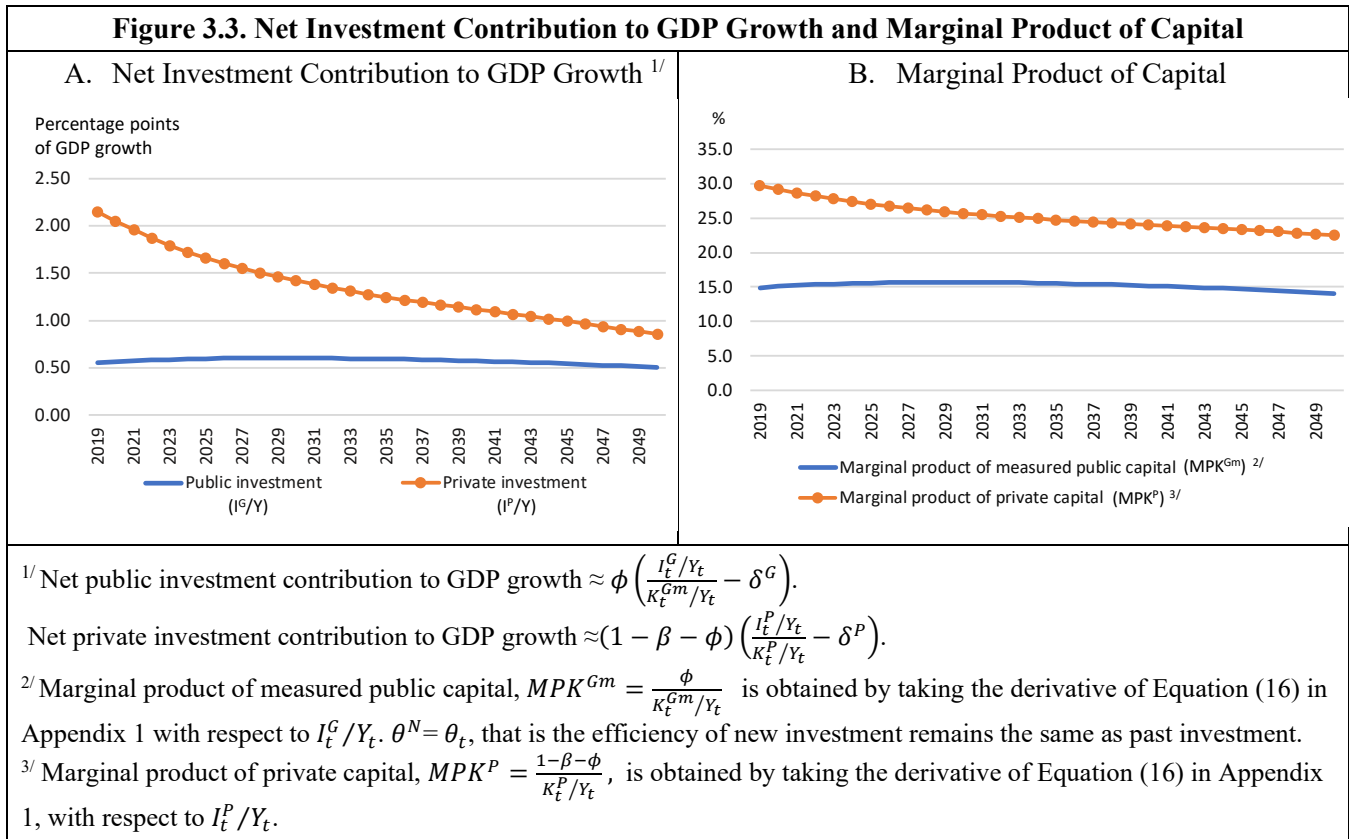
Under a baseline or business-as-usual growth path, Malaysia’s trend GDP growth would slow from 4.5 percent today to 2.0 percent by 2050 (Figure 3.1). The business-as-usual baseline in the LTGM measures the potential growth rate of the economy and is not a forecast of actual growth. Naturally, actual growth in 2020 is expected to be much lower than potential growth, due to the COVID-19 pandemic (dotted lines in Figure 3.1). But, hopefully, the pandemic will not have much effect on the long-run growth potential that is the focus of this paper. This section explains the drivers of current growth, the reasons for the declining trend, and, also, a comparison with some peer countries. Using this baseline simulation, Malaysia will achieve high-income status by 2024, but this is likely to change due to the prospective economic downturn caused by COVID-19 on the Malaysian economy.

A declining GDP growth rate, as projected in the baseline for Malaysia over 2020-50 is typical of economies transitioning to HI status. Figure 3.2 shows smoothed growth rates since 1960 for four economies that made the transition to high income status (Hong Kong SAR, China; Korea; Singapore; and Taiwan, China). All four economies experienced substantial slowdowns in growth rates. Therefore, it should not be surprising if Malaysia also has slowing growth over the next 30 years. Indeed, slower GDP growth rates are a characteristic of high-income economies.



What explains current trend growth rates?

Private investment, followed by productivity growth, are the largest drivers of current economic growth. Current growth rates can be decomposed using a log-linear approximation of the production function as in Devadas and Pennings (2019) (Equation 16). Private investment is the most important growth driver, with a net contribution of about 2ppts of the current 4.5 percent GDP growth (Figure 3.3, graph A). Private investment makes such a large contribution because of the current low private capital-to-output ratio – driven by many years of low private investment following the Asian Financial Crisis – which increases the current marginal product of private capital (Figure 3.3, graph B). Note, however, that both the marginal product and growth contributions change over time, which we discuss in detail below. After private investment, the next largest contribution is from TFP growth, with a contribution of 0.9ppts. Next, population growth and public investment each contribute around 0.65ppts, with human capital growth contributing 0.3ppts.¹¹



¹¹ Changes in the working-age to total population ratio contribute approximately zero as Malaysia is in the middle of a transition between a demographic dividend and an aging population (see Figure 1.9). Labor force participation is assumed to be constant in the baseline, and so makes no contribution.

Why is the baseline growth rate declining?

A natural explanation for the declining baseline GDP growth rate might be declining population growth. While this falling population growth is part of the explanation, GDP per capita growth also falls from 3.2% to 1.5% over the same period (Figure 3.1). The same set of peer countries in Figure 3.2 also experienced declining GDP per capita growth (not shown).

To understand what is driving the fall in baseline growth, we run counterfactual simulations where the path of each growth driver (or its marginal product, for investment) is kept constant at current levels. Table 3.1 depicts the impact of each driver on the fall in GDP growth. These are normalized contributions, which means that the individual contributions, which are shown in Appendix Figures 2.1-2.12, are scaled so that they add up to the total fall in growth over 2020-50. The normalization is necessary because over the long term, the model is substantially non-linear.¹²

As foreshadowed above, population growth is expected to fall by 0.8ppts over 2020-50 which has a normalized contribution of around 0.6ppts to the total baseline fall in GDP growth over the same period. Declining population growth reduces the growth of the labor force, which directly reduces GDP growth. This reduces also the marginal product of capital (which is proportional to the capital-to-output ratio), which reduces the effect of investment on growth.¹³

Table 3.1 Understanding the Drivers of Malaysia’s Falling Economic Growth Rates

	Total Fall GDP Growth (2020-2050)	
Baseline	-2.5ppts	100%
	Normalized Contribution	Normalized Share of Fall in Growth
Population Growth	-0.63ppts	20%
WATP Growth	-0.33ppts	11%
TFP Growth	-0.40ppts	13%
HC Growth	-0.39ppts	12%
Public Investment (falling marginal product)	-0.04ppts	1%
Private Investment (falling marginal product)	-1.37ppts	43%

Source: Authors’ calculations.

¹² Because the model is nonlinear, the sum of the effects of changing growth drivers one-by-one is not equal to the total change in growth when the growth drivers change together. This is especially true over the long term when K_t^{Gm}/Y_t and K_t^P/Y_t change.

¹³ This direct effect is about 0.4ppts of GDP growth, with the indirect effect via the effectiveness of investment being the rest.

Declining population growth affects GDP growth and GDP per capita growth differently (in contrast, other growth drivers have the same effect on GDPPC and GDP growth).¹⁴ Falling population growth actually raises per capita GDP growth: a 1ppts fall in population growth rate reduces the denominator (“per capita”) by 1ppt, but reduces GDP growth by less than 1 percentage point. In the baseline, GDPPC growth falls by 1.66% in the baseline, but only 1.88% with constant population growth (Appendix Figures 2.1-2.2).

The falling working age-to-total population ratio (WATP ratio) reduces GDP and per capita GDP growth in the mid-2020s and also late 2040s (Appendix Figures 2.3-2.4). The growth rate of the WATP falls by 0.6ppts by the end of the simulation period, resulting in a contribution of 0.33ppts to the overall fall in GDP growth over 2020-50.

Falling TFP growth and HC growth over 2020-50 both account for around 0.4ppts of the fall in the GDP growth over 2020-50. The median TFP growth rate over 1985-2014 is 0.9% (the value for the counterfactual), and the baseline TFP growth rate is expected to decrease from 0.9% to 0.6% over the next three decades (Figure 2.2B above). Human capital growth falls from 0.6% (the value in the counterfactual) to 0.1% in the baseline, a 0.5ppts decline (Figure 2.3 above). While this decline in human capital growth is larger than that of TFP, GDP growth rates are also less sensitive to human capital, resulting in similar contributions (Appendix Figures 2.5-2.8).

Overall, the declining effectiveness of private investment makes the largest contribution to falling GDP growth in the baseline (1.4ppts, or 40% of the total). In contrast, changing public investment effectiveness makes little contribution. Investment rates (public and private) are constant in the baseline, but they can still contribute to declining growth through changing marginal products. The marginal product of private capital is currently very high, reflecting low rates of private investment after 2000 and solid historical growth rates. As private investment is now higher, and growth is slower, the marginal productivity of private investment is expected to fall through 2050 back to more normal levels.

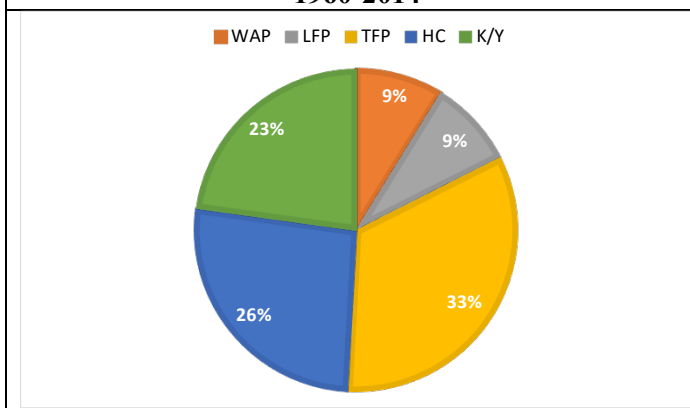
In our model, the initial private capital-to-output ratio, K^P/Y is relatively low at 1.14 (about the same as the public capital-to-output ratio K^{Gm}/Y of 1.11), thus allowing for a much higher marginal product of private capital. However, with high I^P/Y at a constant 18 percent, K^P/Y also increases faster than K^G/Y (which increases only slightly, due to a public investment share-to-GDP of 6%). As such in the baseline the marginal product of private capital shows a larger decline, and the GDP growth effect of I^P/Y falls more noticeably over time.

¹⁴ Note however, that the *normalized* contributions of the other growth drivers will be different for GDP and GDPPC growth.

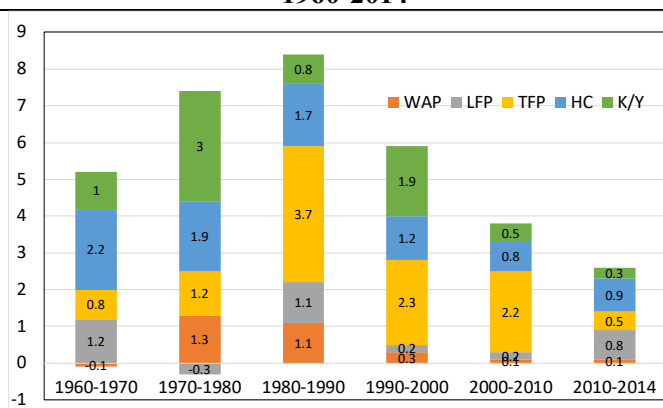
Box Article 1. Republic of Korea's Economic Growth Experience

This box aims to summarize the Republic of Korea's economic growth experience as it transitioned to high-income status. Jeong (2017) argues that the historical growth drivers in Korea were diverse, but it was total factor productivity (TFP) growth and human capital growth that helped sustain its development (Box Figure 1), and these were more important than physical capital accumulation. Real GDP per capita growth averaged almost 6% over 1960-2014, with exceptionally fast growth in the 1970s and 1980s. Korea first gained high-income status in the mid-1990s and growth slowed after 2000, which is a characteristic of high-income economies.

Box Figure 1: Historical Drivers of Growth in Korea, 1960-2014



Box Figure 2: Historical Economic Growth in Korea, 1960-2014



Source: Jeong (2017)

Box Figure 1 shows the main economic growth drivers in Korea over time: i) TFP growth (33%), ii) human capital growth (26%), iii) capital deepening (23%), iv) growth in the working age to total population ratio (9%) and v) more involvement of both men and women in the labor force which boosted growth (9%).

Box Figure 2 is a historical account of Korean economic growth divided by decades from 1960 to 2014. Korea grew more due to human capital, labor force participation and working age to total population growth in the 1960s. In the 1970s, physical capital accumulation was the most important driver of growth, followed by human capital growth. From the 1980s onwards – the period that corresponds to Malaysia's current development level - total factor productivity growth was the most important growth driver. TFP growth accounts for 3.7ppt of about 8% growth in the 1980s, 2.3ppt of 6% average GDP PC growth in the 1990s, and 2.2% of 4% in the 2000s.

4. Scenario analysis (analysis of shocks to each growth driver)

In this section, we study the impact on growth from shocks to investment, human capital growth, TFP growth, and FLFP. These are based on, or with reference to, 25th, 50th, and 75th percentiles among high-income countries (“aspirational goals”). Weak reform scenarios for some factors will be above the baseline. Additionally, we include a short box on the impact of rebalancing between public and private

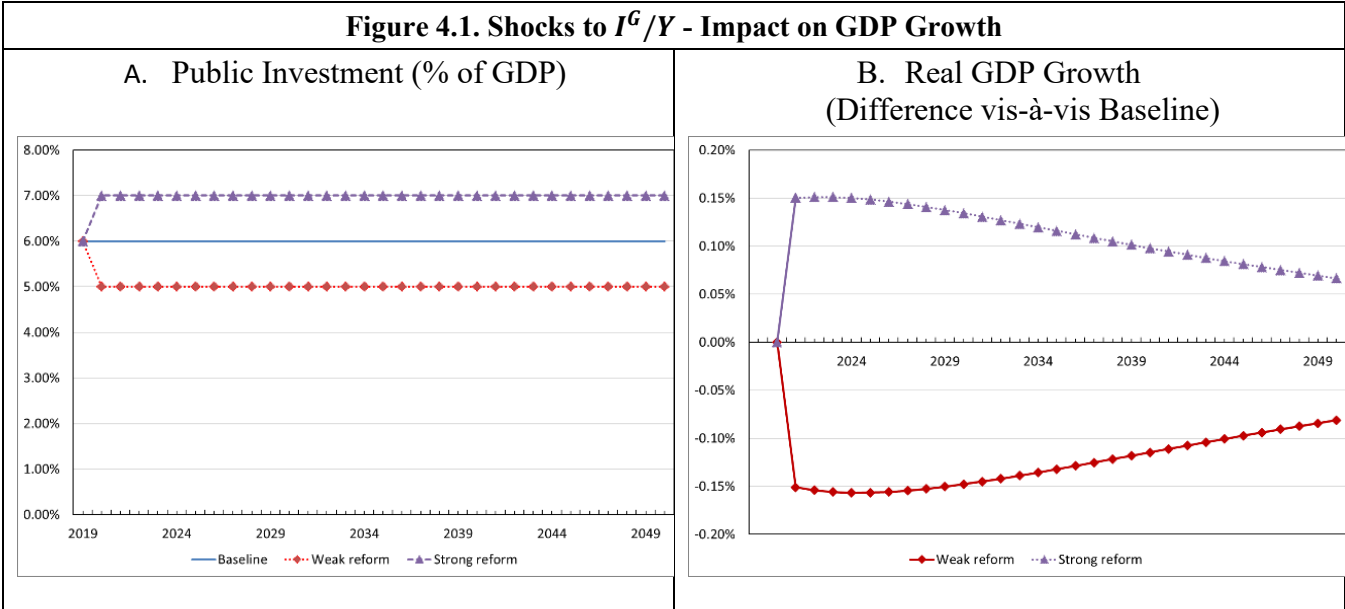
investment (unchanged total investment), when discussing investment shocks to better understand their relative effects.

4.1 Public and Private Investment Scenarios

4.1.1 Shocks to Public Investment

We consider two alternative public investment scenarios: a 1ppt GDP increase in public investment (strong reform), and a 1ppt GDP fall in public investment (weak reform). The +1ppt shock, which could reflect strong revenue mobilization reforms amid faster fiscal consolidation than the baseline, brings I^G/Y to the 90th percentile of the high-income country distribution. The -1ppt shock could reflect faster fiscal consolidation than the baseline, but with poor revenue mobilization reforms, it would take public investment as a share of GDP to the 75th percentile.

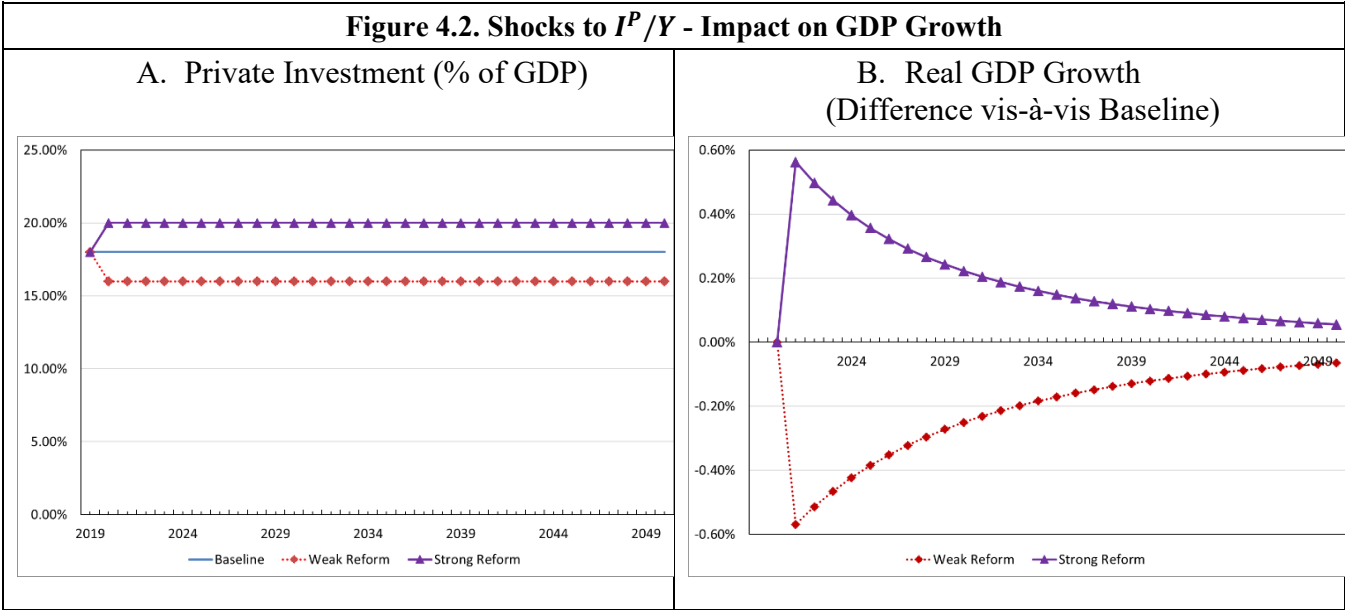
When we shock the public investment-to-GDP ratio by increasing it from 6% to 7%, GDP growth is boosted by approximately +0.15ppts over 2021-2030 and approximately +0.10 over 2031-2050. A roughly symmetric effect on growth, but in the opposite direction, occurs with a decrease in public-investment-to-GDP from 6% to 5%. Figure 4.1 Panel A illustrates the shocks to I^G/Y comprising strong reform (+1ppt) and weak reform (-1ppt) scenarios; and graph B, the effects on GDP growth vis-à-vis the baseline. I^P/Y is unchanged from the baseline in these simulations.



4.1.2 Shocks to Private Investment

We consider larger shocks than we did for I^G/Y , as I^P/Y is higher and varies more across high-income countries. The +2ppts shock, which we assume occurs as the government delivers reforms that strengthen the ecosystem for private investment and promotes a rebalancing of investment, brings I^P/Y to the 75th percentile of the high-income country distribution while the -2ppts shock, reflecting insufficient reforms amid fiscal consolidation, takes it to the 25th percentile and is also approximately Malaysia’s average over 2010-2018.

When we shock the private investment-to-GDP ratio by increasing it from 18% to 20%, GDP growth is boosted by approximately +0.36ppts over 2021-2030. But the growth effect falls off sharply – by about two-thirds to +0.11ppts over 2031-2050. A decrease in private investment-to-GDP from 18% to 16% reduces GDP growth by -0.39ppts over 2021-2030 and -0.13ppts over 2031-2050. Graph A of Figure 4.2 illustrates the shocks associated with strong reform and weak reform respectively to I^P/Y , comprising +/- 2ppts, and graph B the effects on GDP growth vis-à-vis the baseline. I^G/Y is unchanged from the baseline in these simulations.

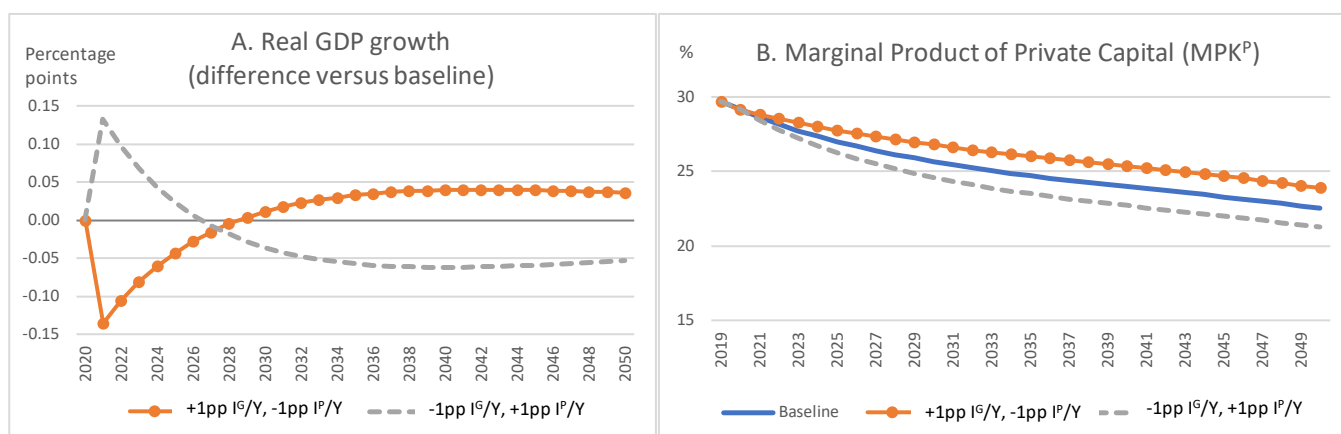


Box Article 2. Rebalancing Components while keeping I/Y unchanged - A Comparison of the effects of I^G/Y and I^P/Y on GDP Growth

We consider two scenarios, in which total I/Y remains unchanged from the baseline at 24 percent. In the first scenario, we increase I^G/Y by 1ppt to 7 percent and reduce I^P/Y to 17 percent from 2020. There is an initial decline in GDP growth vis-à-vis the baseline (line with marker in graph A of Box Figure 3) given the loss of private investment impact at a high MPK^P but the differential turns positive by 2029 and remains so thereafter because K^P/Y rises more slowly compared to the baseline and MPK^P is therefore higher (line with marker in graph B of Box Figure 3).

In the second scenario, we reduce I^G/Y by 1ppt to 5 percent and increase I^P/Y to 19 percent from 2020. In contrast to the first scenario, there is an initial increase in GDP growth vis-à-vis the baseline, but the differential turns negative by 2027 (dotted line in graph A of Box Figure 3), as K^P/Y rises more quickly compared to the baseline and MPK^P declines faster (dotted line in graph B of Box Figure 3).

Box Figure 3. Rebalancing Investment Components – Impact on GDP Growth



4.2 Total Factor Productivity Growth

We model three TFP scenarios with different levels of reform by benchmarking Malaysia against high-income countries. The simulations include a weak reform scenario which targets a low value over a long period, a strong reform scenario which targets a high value over a short period, and a moderate reform scenario in the middle. We assume each subcomponent index for innovation, education, market efficiency, infrastructure, and institutions, which are identified as main determinants of TFP based on a literature review (Kim and Loayza 2019), increase linearly to the 25th, 50th, and 75th percentiles among high-income countries for the scenarios of weak, moderate, and strong reforms, respectively. The number of years to reach the target is 75th (long), 50th, and 25th (short) percentile, respectively, in the distribution of years that the high-income countries took from the Malaysia's current level (in 2018) to the target. For example, for the strong reform scenario for education, there are 5 high-income countries which achieved the target

of 77.53 (75th percentile in the education index and Sweden’s current level). There is variation in the number of years these countries took from the current Malaysia’s level (52.07 in 2018) to the target. We then calculated the 25th percentile among the years the 5 countries took, 20 years, as the duration to reach the target for Malaysia. Table 4.1 lists Malaysia’s values for each component of the TFP index, the different targets and number of years to target.

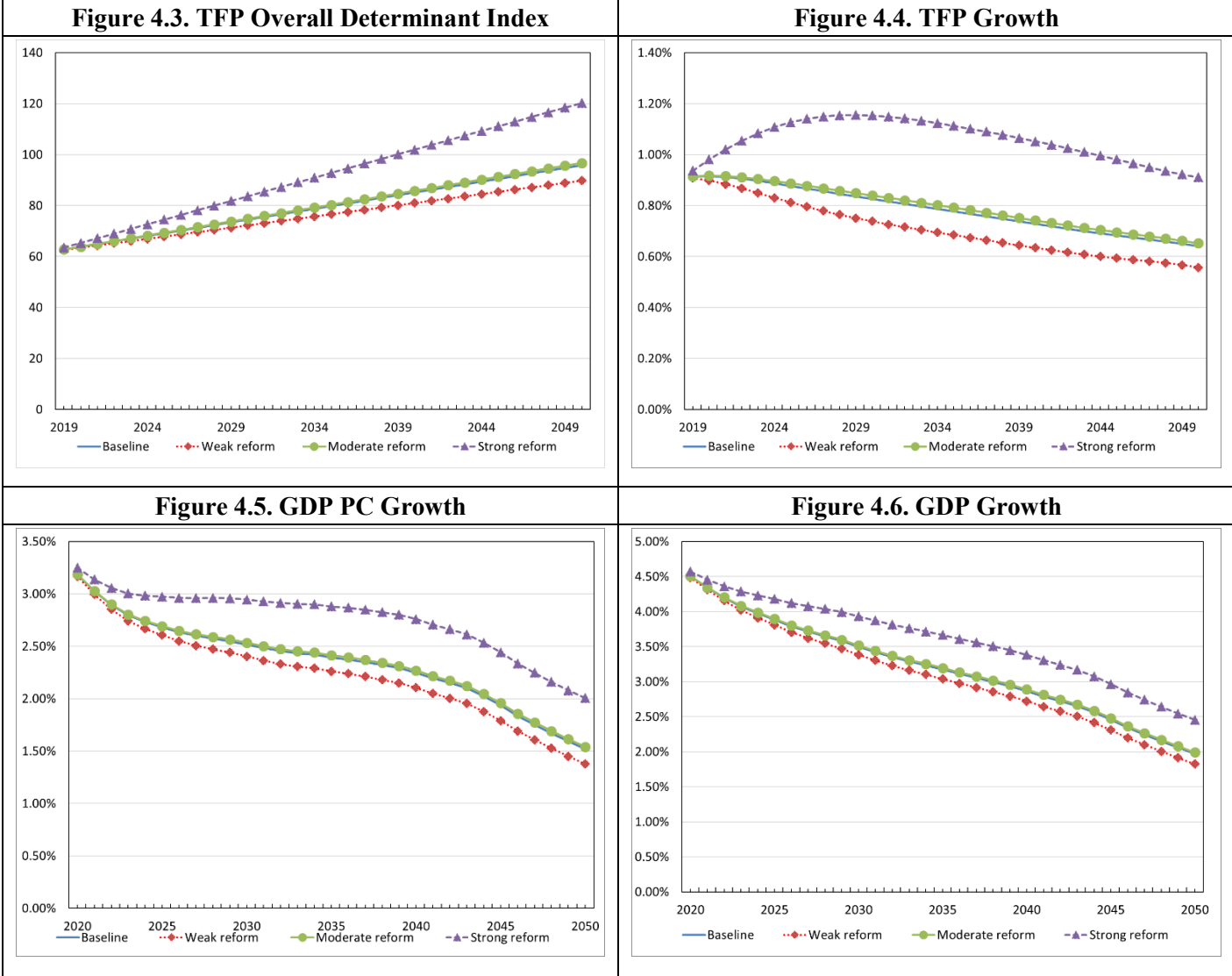
Table 4.1. Scenarios of weak, moderate, and strong reforms for the projection of TFP growth for 2020-2050

	Sub-components of the TFP Index				
	Innovation	Education	Market Efficiency	Infrastructure	Institutions
Malaysia in 2018					
	24.79	52.07	85.26	60.20	69.45
Scenario 1. Weak reform					
Target value	21.03	60.28	71.66	60.47	72.99
Country	-	Spain	-	Portugal	Slovakia
Years to target	- ^a	8	- ^b	1	16
Scenario 2. Moderate reform					
Target value	40.24	71.49	86.89	68.68	82.22
Country	France	Netherlands	Italy	Finland	France
Years to target	9	21	2	13	19 ^c
Scenario 3. Strong reform					
Target value	59.46	77.53	90.98	73.93	91.70
Country	Denmark	Sweden	Germany	Switzerland	Germany
Years to target	10	20	4	16 ^d	39 ^e
<p>^{a, b} The subcomponent indexes are assumed to increase over the next 3 decades with Malaysia’s historical trend of the last 10 years (2009-2018).</p> <p>^{c, e} All high-income countries achieved Malaysia’s current level before 1985, the initial year in our database. We used the path of Japan of which the institutions index is the closest (74.01) in 1985 to the current Malaysia’s level (69.45). The institutions index of Japan is assumed to linearly increase in 2019 and onwards with the average annual change of the last 10 years (2009-2018).</p> <p>^d All high-income countries achieved Malaysia’s current level before 1985, the initial year in our database. We use the path of Slovenia of which the infrastructure index is the closest (62.62) in 1985 to the current Malaysia’s level (60.20).</p> <p>Note 1. All indexes range from 1, the worst performance, to 100, the best.</p> <p>Note 2. See Appendix 1: LTGM-TFP or Kim and Loayza (2019) for more details on the construction of the determinant indexes.</p>					

Only in the strong reform scenario are the growth rates of TFP, GDP, and GDP per capita expected to exceed those of the business-as-usual baseline. Figure 4.3 shows the path of the TFP determinant index under the scenarios of weak, moderate, and strong reforms and Figures 4.4-4.6 show the results of the simulations for the growth of TFP, total GDP, and GDP per capita (respectively). In the weak-reform

scenario, the growth rates are lower than those of the business-as-usual baseline. The moderate reform-reform scenario leads to growth rates very similar to the baseline. Only with the strong-reform scenario, the growth rates of TFP, total GDP, and GDP per capita are expected to be higher than those of the baseline.

Figure 4.3-4.6. Simulated paths of the TFP overall determinant index and growth rates of TFP, GDP, and GDP per capita under the scenarios of weak, moderate, and strong reforms



Source: Authors’ calculations.

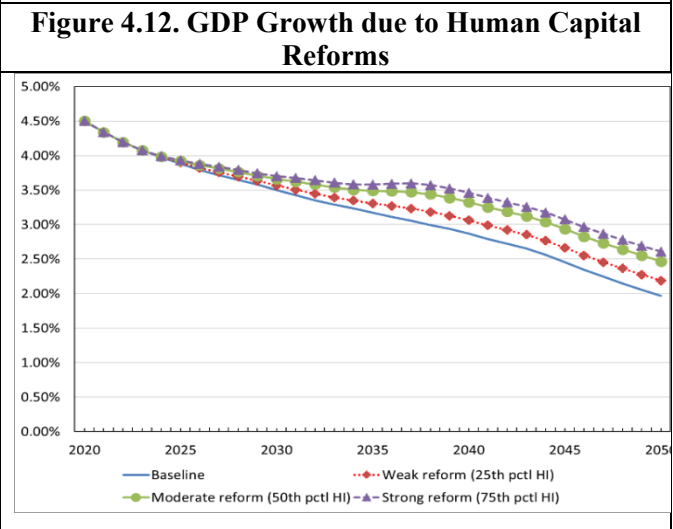
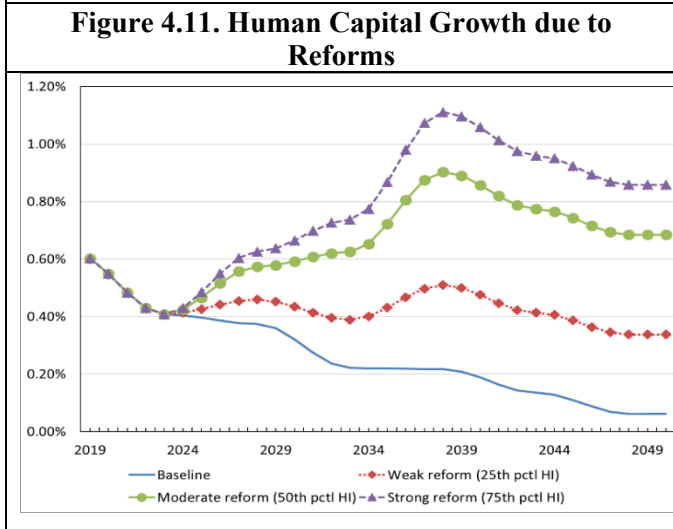
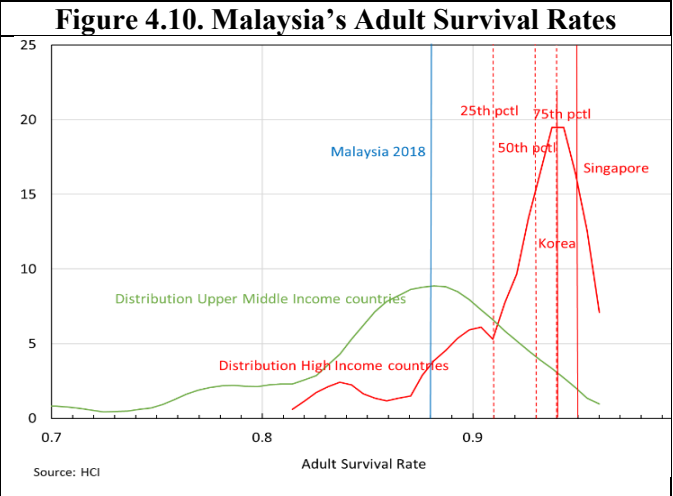
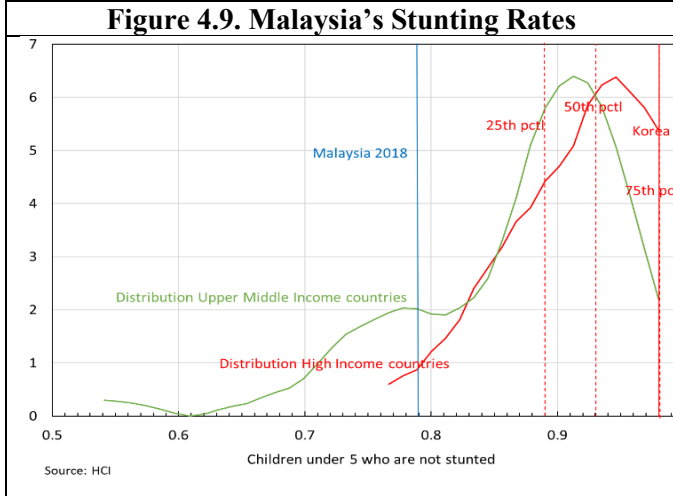
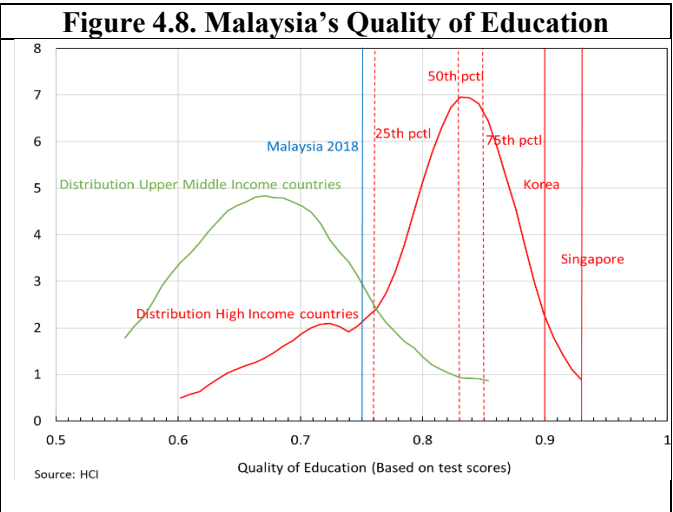
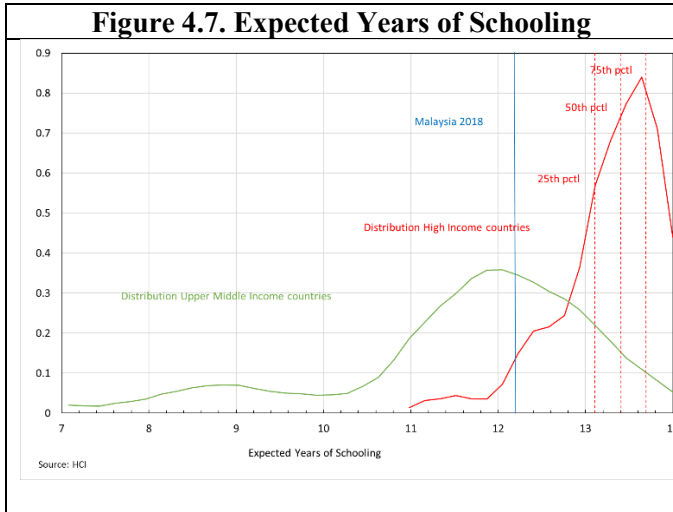
The key message of the simulations is that the improvement of the TFP overall determinant index needs to be large and fast enough to maintain or accelerate TFP growth. In our econometric model for the LTGM-TFP extension, the change in TFP growth rate depends on changes in TFP determinant subcomponent indexes of innovation, education, market efficiency, infrastructure, and institutions, as well as the initial level of TFP. A larger projected change in TFP growth rate occurs with larger proportional increases in

the TFP determinant subcomponent indexes and lower initial levels of TFP (see Kim and Loayza 2019). In Malaysia's case, the current TFP overall determinant index is higher than in other developing countries on average; increasing it further is harder than in other countries with lower levels of the overall index. Also, Malaysia's current level of TFP is moderately high as compared to other developing countries. For these reasons, achieving higher TFP growth in Malaysia is more difficult than in the past and in comparison to many other developing countries. Only with the scenario of strong reform, the growth rates of TFP, GDP, and GDP per capita are expected to be higher than those of the business-as-usual baseline.

4.3 Human Capital Growth

This subsection models shocks to the quantity of education, quality of education, and health components (adult survival rates and children under 5 years of age who are not stunted) to the 25th, 50th, and 75th percentiles of high-income economies. The distribution of those four components are explored in Figure 4.7-4.10 below and it can be observed that Malaysia is behind other high-income economies in all four areas. We perform two sets of simulations: first by shocking all the components together to the different high-income percentiles, and second by shocking each HC component to the high-income country median one-at-a-time – to investigate the quantitative importance of each component.

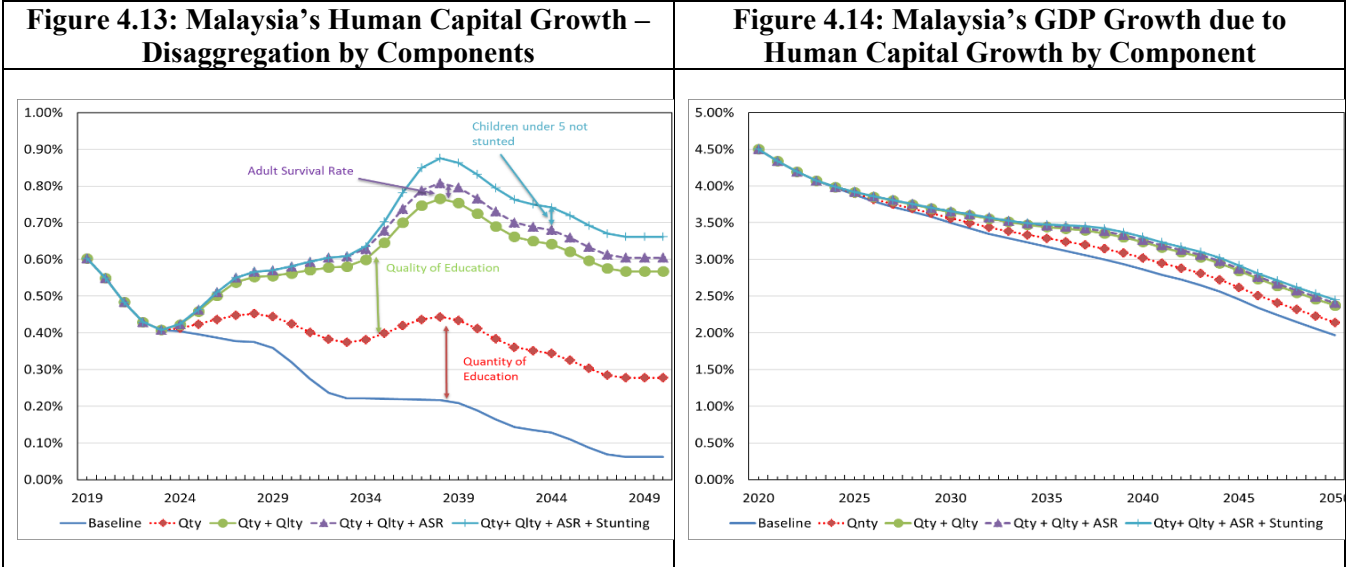
By shocking the components of quality and quantity of education and health components of human capital to the 25th, 50th, and 75th percentiles of high-income economies, GDP growth is boosted by roughly 0.10ppts, 0.30ppts, and 0.40ppts on average during the 2020-2050 period (Figures 4.11-4.12). The dynamics are also important. This immediate policy change causes no change in the growth rates of human capital or GDP until the mid-late 2020s, which is when the oldest children who were affected by the policy change start to join the labor force. Even then, the effects are small as the oldest cohort of children spent the majority of their education under the old regime, and so only enjoy a fraction of the benefits. It takes until almost 2040 for the reforms to have their full effect: when today's toddlers – who received the full benefit of the reforms – start to join the labor market.



Sources: Figure 4.7-4.10 from Human Capital Index; Figure 4.11, 4.12 from authors' calculations.

To understand the effect of each human capital component, we shock each component to the 50th percentile of the HI distribution one-by-one (Figure 4.13). On average over 2020-50, a higher quality of education

boosts GDP growth by 0.14ppts, an increase in the years of schooling boosts growth by 0.10ppts, increasing the adult survival rate boosts growth by 0.02ppts, and lowering stunting rates among children under 5 boosts growth by 0.02ppts (Figure 4.14). Quantity and quality of education provide the biggest boost to economic growth in long run.¹⁵ In numerical terms, the high-income-median targets are 13.4 expected years of schooling, 83% quality of education, adult survival rate of 93% and the fraction of children not stunted under 5 of 93%. These improvements in human capital growth components prevent the decline in human capital growth in the baseline and instead boost it from 0.6% to 0.7% by 2050 (instead of falling to 0.1%).¹⁶



Source: Authors' calculations.

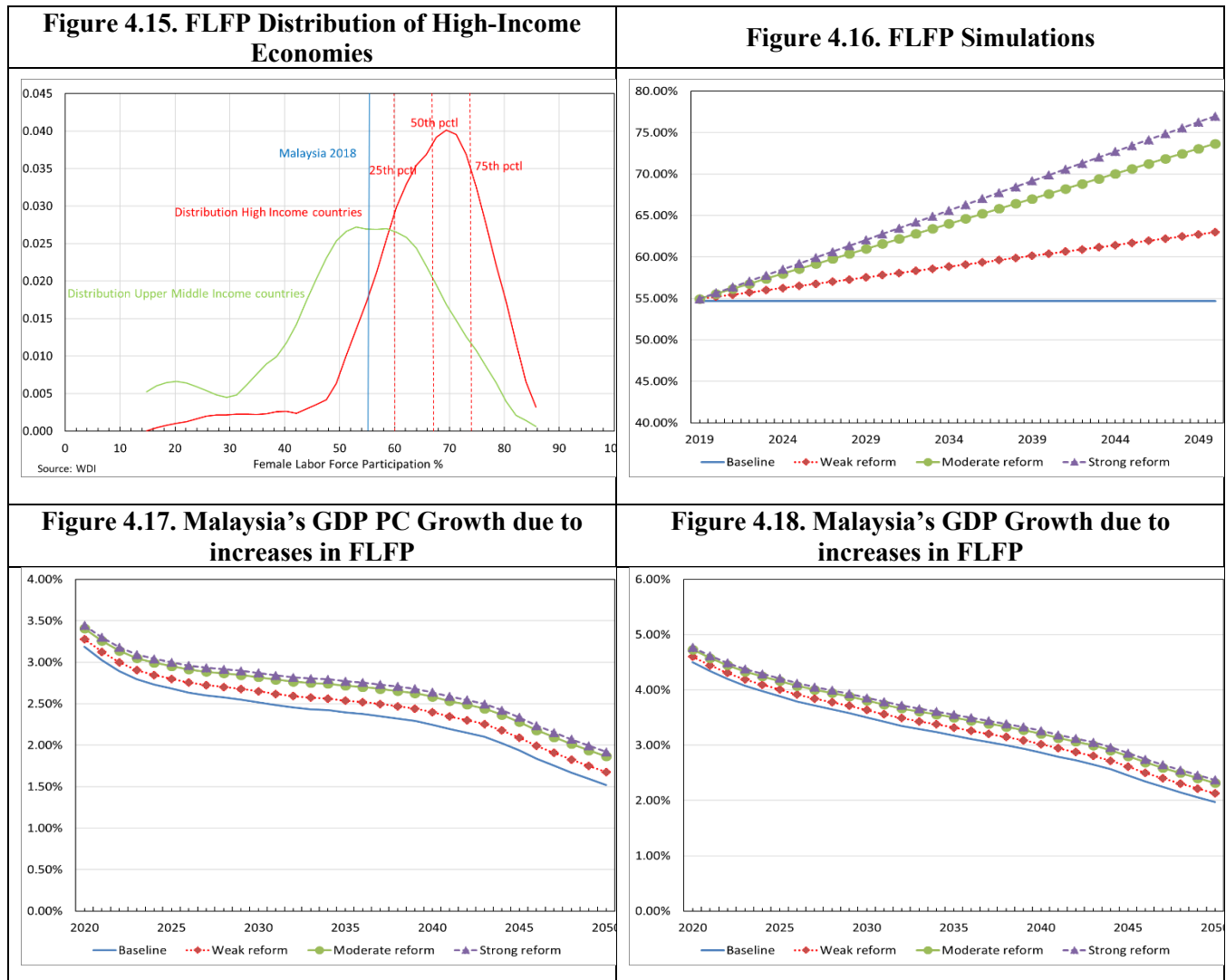
4.4. Female Labor Force Participation

An increase in female labor force participation (FLFP) to the 25th, 50th and 75th percentiles of high-income economies boosts average GDP growth over 2020-50 by 0.14ppts, 0.31ppts, and 0.36ppts, respectively, relative to the business-as-usual baseline with unchanged FLFP. The FLFP rate in Malaysia is 55% as of 2018, which is low in comparison to its regional peers (see Figure 1.11) and also to its high-income peers (see Figure 4.15). We simulate increases from the current FLFP of 55% to the 25th (weak reform), 50th (moderate reform), and 75th (strong reform) percentiles of FLFP of high-income economies, for which the number of years to reach the target is 75th (long), 50th, and 25th (short) percentiles, respectively, in the distribution of years that the high-income countries took from the Malaysia's current level (in 2018) to

¹⁵ However, it should be noted that the health components improve the standards of living of Malaysians as a whole and by being healthy, they are able to learn and improve their educational attainment and also be healthier workers. The LTGM-HC does not include the indirect effect of health on growth via high education.

¹⁶ This simulation is similar to that in the June 2019 Malaysian Macroeconomic Monitor, the differences being that (i) baseline has changed slightly to include a downward trend in TFP growth and (ii) quantity of education is also shocked.

the target.¹⁷ We find that these increases in FLFP boost GDP growth by about 0.15ppts, 0.30ppts, and 0.40ppts over 2020-50, respectively, relative to the business-us-usual baseline with unchanged FLFP (Figures 4.17-4.18).



Source: Authors' calculations.

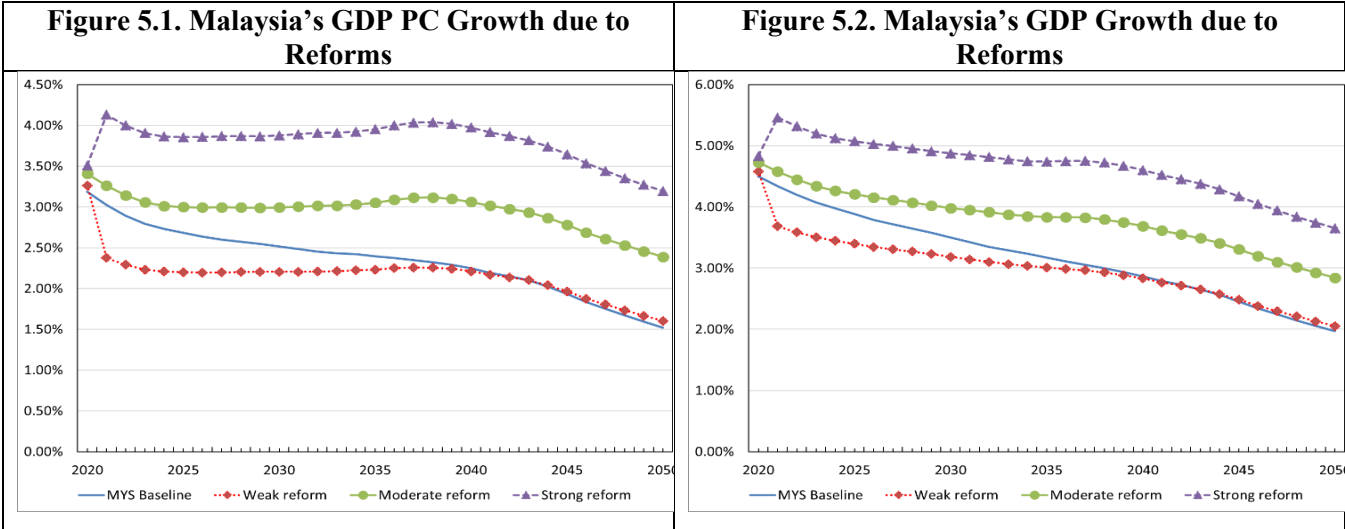
5. Combined Shocks to Generate Weak, Moderate and Strong Reform Growth Paths

Malaysia is heading to high income status in the next decade and the business-as-usual baseline suggests that GDP growth will more than halve over the 2020-50 period. More importantly for living standards, GDP per capita growth is also expected to halve over the same period. While this is common among

¹⁷ For example, in the weak reform, the target FLFP is 62% which is the 25th percentile among HI countries and of Croatia in 2018. For calculating a target duration to reach 62%, we identified 8 high-income countries which show the path of FLFP from Malaysia's current level to the target (55% to 62%) within the time period of our database (1990-2018). Then the target duration was calculated at 27 years, which is the 75th percentile in the years the 8 countries took to reach from 55% to 62%. With the same approach, the moderate reform scenario targets 69% (Spain in 2018) over 23 years, and the strong-reform scenario, 74% (Netherlands in 2018) over 27 years¹⁷ (Figure 4.16).

economies making the transition to high income status, slowing growth can – at least partially – be offset by pro-growth reforms.

In this section, we simulate the combined growth effects of a *package* of reforms affecting human capital growth, TFP growth, female labor force participation rate and/or investment. The components of the package of reforms are the same as those discussed individually in Section 4; here we combine their effects. The results are shown in Figures 5.1 and 5.2.



Source: Authors’ calculations.

In the weak reform scenario, based on increasing the growth determinants to the 25th percentile of high-income countries (as above), growth is around 0.6ppts lower than the baseline in the early 2020s, but converges to the baseline by around 2040. The initial fall in growth is due mostly to lower investment rates: a fall in public investment (relative to the baseline) of around 1ppt of GDP, and a fall in private investment (relative to the baseline) of around 2ppts of GDP. These have an immediate negative effect on growth – especially the cut in private investment – given that the marginal product of private capital is initially very high. Slower TFP growth, which is lower in the weak reform scenario than the baseline, also makes a small negative contribution. The catchup in the medium term is driven mostly by human capital, where even weak-reform boosts growth relative to business as usual– albeit with a lag. The human capital lag is driven by the time it takes better educated, healthier children to grow up to become more productive workers.

In the moderate reform scenario, growth is higher at all horizons and averages 0.6ppts higher over 2020-50. Public and private investment stays constant in the moderate reform scenarios (as in the baseline), which is why the change in growth around 2020 is small. In addition, the moderate-reform TFP growth is very similar to baseline, and so makes little contribution in either direction. Consequently, the boost to

growth in the first 10-15 years in the moderate reform package is mostly due to higher FLFP. After that, the boost to growth increases further as today's children, with higher human capital, start to join the labor force around 2035-40. While GDP growth does still decline, it does so at a reduced rate and the downward trend in GDP per capita growth is checked until 2040.

Finally, in the strong reform scenario, based on growth determinants at the 75th percentile of high-income countries, growth is about around 1.5ppts higher than the baseline over 2020-2050. The decline in GDP growth (relative to 2020) is delayed until 2042, and GDP per capita growth is higher than its 2020 rate at almost all horizons. Growth increases initially to 5.5%, mostly based on higher private (and public) investment. Higher TFP growth and FLFP boost GDP growth as well, joined by human capital after around 2035-40. It should be noted, however, that such a path represents the most optimistic path for growth and reforms.

6. Conclusions

The main findings of the paper can be summarized as follows. With the business-as-usual baseline, the GDP growth rate is expected to fall from 4.5% to 2.0% over the next 30 years (2020-2050), which covers the period of the country's transition to high-income status and beyond. This decline is partly due to demographics, but the other main causes are 1) a smaller contribution from private investment as private capital accumulates and its marginal product declines, and 2) the gradual moderation in the growth rates of TFP and human capital, for which continuous improvements at a high growth rate become more difficult as their levels increase.

Under the scenario of weak reform, the GDP growth rate is expected to decrease from 4.5% to 2.0% over the next 30 years, which is similar to the result of the baseline. The impact is minimal compared to the baseline because the expected paths of growth drivers under this scenario are similar to those of the baseline. Under the scenario of moderate reform, the GDP growth rate is expected to decrease from 4.5% to 2.9%, which is around 1.5 times the GDP growth rate of the baseline in 2050. Under the scenario of strong reform, GDP growth rate is expected to decrease from 4.5% to 3.6%, which is around 1.8 times higher than that under the baseline in 2050. Higher overall investment-to-GDP due to a better fiscal position and private investment ecosystem supports growth in the short-to-medium term but its weakening incremental effect must be offset by other factors. The strong reform scenario clearly illustrates how the stronger contributions emanating from growth in human capital (0.28ppts growth increase with respect to the baseline, or 39% of the growth differential), TFP (0.02ppts or 30%), and female labor force

participation rate (0.30ppts or 24%) can, to some extent, mitigate the diminishing returns to physical capital accumulation over the long term (7% of the growth differential vis-à-vis the baseline).

The policy implications are derived from these results. Strong reforms are required to grow beyond what is expected based on historical trends, especially for human capital (the quantity and quality of schooling, and health), female labor force participation, and TFP. If Malaysia stays at the current level of educational quality and health (similar to the 25th percentile of high-income countries), human capital will not contribute much to economic growth. Improving human capital requires more focus on enhancing learning outcomes, improving child nutrition, and providing adequate protection through social welfare programs (World Bank 2018). Current female labor force participation is lower than the 25th percentile of high-income countries, which is the benchmark of the weak-reform scenario. Increasing it requires reducing or eliminating barriers to economic opportunities for women through legal reforms, introducing more economic and societal support for parents, and addressing gender norms and attitudes that perpetuate disparities (World Bank 2019). Strong reforms to increase TFP growth require efforts from diverse stakeholders. Our study shows that the gap between Malaysia's current level (in 2018) and a target corresponding to the 75th percentile of high-income countries is relatively small for market efficiency but becomes increasingly wider for innovation, infrastructure, education, and institutions. Some of them, such as education and institutions, are expected to require two decades or more to improve to the target level of high-income economies. As these determinants are intercorrelated, sustainable collaboration and cooperation among the government, private sector, and civil society will be necessary.

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Appendix 1. The Long Term Growth Model and Extensions

The Long Term Growth Model (LTGM) project is a series of Excel-based tools to analyze long-term growth scenarios building on the celebrated Solow-Swan Growth Model. The tool can also be used to assess the implications of growth (and changes in inequality) for poverty rates. The focus of the tool is on simplicity, transparency, and ease of use: there are no macros, and the very low data requirements mean the tool can be applied in almost any country. The tool is useful for planning/vision documents and country reports, but it is not designed for short-term forecasting. The building blocks of growth are savings, investment, and productivity, but the model also analyzes human capital, demographics, the external sector (external debt, FDI, CAB) and labor force participation by gender.

LTGM-Public Capital Extension (LTGM-PC)

Underlying the simulations in this paper is the following base model, reproduced here in an abridged manner from Devadas and Pennings (2019). All the simulations are run using the Excel-based toolkit constructed based on this model.

1.1 The production function

We assume a Cobb-Douglas specification, where the public and private capital stocks have unitary elasticity of substitution. The following production function at time, t :

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

Each firm takes technology (TFP), A_t and public services S_t as given, that is, these are externalities to the firm. K_t^P is the private capital stock, $h_t L_t$ is effective labor, which can be further decomposed into h_t , human capital per worker and L_t , the number of workers. $1 - \beta$ and β are private capital and labor income shares. Next, we consider the following specification for public services S_t :

$$S_t = \left[\frac{G_t}{K_t^{P\zeta}} \right]^\phi \quad (2A)$$

G_t is the efficient physical public capital stock – the public capital that is actually used in production. ζ captures whether public capital is subject to congestion (or not). ϕ is the *usefulness* of public capital (more technically the elasticity of output to efficient public capital).

$$G_t = \theta_t K_t^{Gm} \quad (2B)$$

Due to corruption, mismanagement or pork-barreling, only a fraction $\theta_t \leq 1$ of measured public capital is useful for production. The measured capital stock K_t^{Gm} is what is recorded in international statistical databases, constructed using the perpetual inventory method. θ_t is the average *efficiency/quality* of the public capital stock. Equations (1), (2A) and (2B) can be written in a more conventional production function as:

$$Y_t = A_t(\theta_t K_t^{Gm})^\phi (K_t^P)^{1-\beta-\zeta\phi} (h_t L_t)^\beta \quad (3)$$

Population and labor force growth

Equation (3) can be translated into per worker terms by dividing both sides by L_t :

$$y_t \equiv \frac{Y_t}{L_t} = A[\theta_t(L_t)^{1-\zeta} k_t^{Gm}]^\phi (k_t^P)^{1-\beta-\zeta\phi} h_t^\beta \quad (4)$$

where y_t is output per worker and k_t^P is private capital per worker and k_t^{Gm} is measured public capital per worker (note the lower case). $L_t = \varrho_t \omega_t N_t$, where N_t is total population, ω_t is the working age-population ratio and ϱ_t is the labor participation rate (labor force-to-working age population ratio). The above equation can then be used to calculate growth rates of output per worker from t to $t + 1$:

$$\frac{y_{t+1}}{y_t} = \left[\frac{\omega_{t+1} \varrho_{t+1} N_{t+1}}{\omega_t \varrho_t N_t} \right]^{(1-\zeta)\phi} \left[\frac{A_{t+1}}{A_t} \right] \left[\frac{\theta_{t+1}}{\theta_t} \right]^\phi \left[\frac{k_{t+1}^{Gm}}{k_t^{Gm}} \right]^\phi \left[\frac{k_{t+1}^P}{k_t^P} \right]^{1-\beta-\zeta\phi} \left[\frac{h_{t+1}}{h_t} \right]^\beta \quad (5)$$

Equation (5) can be rewritten in terms of growth rates from t to $t + 1$:

$$1 + g_{y,t+1} \quad (6)$$

$$= [(1 + \Gamma_{t+1})^{(1-\zeta)\phi}] (1 + g_{A,t+1}) (1 + g_{\theta,t+1})^\phi (1 + g_{k^{Gm},t+1})^\phi (1 + g_{k^P,t+1})^{1-\beta-\zeta\phi} (1 + g_{h,t+1})^\beta$$

where the growth rate of a variable x from t to $t + 1$ is denoted by $g_{x,t+1}$, and Γ is the growth rate of the number of workers:

$$1 + \Gamma_{t+1} = (1 + g_{\varrho,t+1})(1 + g_{\omega,t+1})(1 + g_{N,t+1}) \quad (7)$$

$1 + \Gamma_{t+1}$ drops out from equation (6) in the congestion default ($\zeta = 1$).

To obtain output per capita, y_t^{PC} from equation (4), $y_t^{PC} \equiv \frac{Y_t}{N_t} = \frac{Y_t}{L_t} \varrho_t \omega_t$. Rewriting this equation in terms of growth rates:

$$1 + g_{y,t+1}^{PC} = (1 + g_{y,t+1})(1 + g_{\varrho,t+1})(1 + g_{\omega,t+1}) \quad (8)$$

To obtain output growth, we multiply (8) with population growth:

$$1 + g_{Y,t+1} = (1 + g_{y,t+1}^{PC})(1 + g_{N,t+1}) \quad (9)$$

1.2 Public and private capital accumulation, and changes in the efficiency/quality of public capital

The *measured* quantity of public capital (as in international statistical databases) accumulates according to a standard capital accumulation identity, with the next period's stock coming from the previous period's undepreciated stock, $(1 - \delta^G)K_t^{Gm}$ (where δ^G is the public capital depreciation rate) and new public investment, I_t^G .

$$K_{t+1}^{Gm} = (1 - \delta^G)K_t^{Gm} + I_t^G \quad (10)$$

The gross growth rate of measured public capital (not per worker) is:

$$K_{t+1}^{Gm}/K_t^{Gm} = (1 - \delta^G) + \frac{I_t^G/Y_t}{K_t^{Gm}/Y_t} \quad (11)$$

The growth rate of measured public capital *per worker*, which enters equation (6), is:

$$1 + g_{K^{Gm},t+1} \equiv \frac{K_{t+1}^{Gm}/L_{t+1}}{K_t^{Gm}/L_t} = \frac{(1 - \delta^G) + \frac{I_t^G/Y_t}{K_t^{Gm}/Y_t}}{(1 + g_{Q,t+1})(1 + g_{\omega,t+1})(1 + g_{N,t+1})} \quad (12)$$

The stock of efficiency-adjusted public capital (which is actually used in production) evolves based on the previous period's efficiency-adjusted undepreciated stock and efficiency-adjusted new investment $\theta_t^N I_t^G$.

$$G_{t+1} = (1 - \delta^G)G_t + \theta_t^N I_t^G \quad (13A)$$

θ_t is the average efficiency of existing public capital (rather than the efficiency of new investment). Substituting $G_t = \theta_t K_t^{Gm}$ into Equation 13A and rearranging as 13B, one can see the θ_{t+1} evolves as a weighted average of the quality of existing public capital θ_t , and the quality of new investment θ_t^N .

$$\theta_{t+1} = \theta_t \frac{(1 - \delta^G)K_t^{Gm}}{(1 - \delta^G)K_t^{Gm} + I_t^G} + \theta_t^N \frac{I_t^G}{(1 - \delta^G)K_t^{Gm} + I_t^G} \quad (13B)$$

As such, the quality/efficiency of the stock of public capital only changes when the quality of new investment projects is different from that of the existing public capital stock: $\theta_t^N \neq \theta_t$. Using equation (13B), the growth in quality which enters equation (6) can be written as follows:

$$1 + g_{\theta,t+1} \equiv \frac{\theta_{t+1}}{\theta_t} = \left[(1 - \delta^G) + \frac{\theta_t^N}{\theta_t} \frac{I_t^G/Y_t}{K_t^{Gm}/Y_t} \right] / (K_{t+1}^{Gm}/K_t^{Gm}) \quad (14)$$

The quantity of private capital follows the same accumulation process as public capital. But with δ^P as the private capital depreciation rate, and I_t^P as private investment. The growth rate of private capital per worker is as follows:

$$1 + g_{k^P,t+1} = \frac{(1 - \delta^P) + \frac{I_t^P/Y_t}{K_t^P/Y_t}}{(1 + g_{\theta,t+1})(1 + g_{\omega,t+1})(1 + g_{N,t+1})} \quad (15)$$

1.3 Analysis of the drivers of growth

To better understand and simplify the analysis of the drivers of growth, we take a log-linear approximation of equation (6). Specifically, equations (12), (14) and (15) are substituted into equation (6). Then, taking logs and using the approximation $\ln(1 + g) \approx g$ (for small g) we arrive at the following:

$$\begin{aligned} g_{y,t+1}^{PC} \approx & g_{A,t+1} + \beta(g_{\theta,t+1} + g_{\omega,t+1} + g_{h,t+1}) - (1 - \beta)(g_{N,t+1}) + \phi \left[\theta_t^N \frac{I_t^G/Y_t}{\theta_t K_t^{Gm}/Y_t} - \delta^G \right] \\ & + (1 - \beta - \zeta\phi) \left(\frac{I_t^P/Y_t}{K_t^P/Y_t} - \delta^P \right) \end{aligned} \quad (16)$$

1.4 Implementation

The future growth rates of the labor participation rate ($g_{\theta,t+1}$), the working age-population ratio ($g_{\omega,t+1}$), population ($g_{N,t+1}$) and pure TFP ($g_{A,t+1}$), are exogenously determined. The growth rate of measured public capital per worker ($g_{k^{Gm},t+1}$) is given by equation (12), using the growth rate of the public capital stock (equation (11)) as an intermediate step. Private capital per worker growth ($g_{k^P,t+1}$) is as given by equation (15). The growth rate of the efficiency of public capital ($g_{\theta,t+1}$) as given by equation (14) using the growth rate of the public capital stock (equation (11)) as an intermediate step.

Finally, the model is closed by updating public capital-to-output using equation (17) and the private capital-to-output ratio using equation (18) (with the growth rates in per-worker terms):

$$\frac{K_{t+1}^{Gm}}{Y_{t+1}} = \frac{K_t^G}{Y_t} \frac{(1 + g_{k^{Gm},t+1})}{1 + g_{y,t+1}} \quad (17)$$

$$\frac{K_{t+1}^P}{Y_{t+1}} = \frac{K_t^P}{Y_t}$$

LTGM – Total Factor Productivity Extension (LTGM-TFP)

The LTGM-TFP is an Excel-based companion to the standard LTGM that helps users assess a country’s potential for improving its TFP growth rate over the next few decades. The LTGM-TFP toolkit combines a country’s scores for innovation, education, market efficiency, infrastructure, and institutions—which have been shown in the literature to affect TFP growth—into a new “TFP determinant index”. Based on a fixed-effects regression model, the “TFP determinant index” then quantifies the future path for TFP growth in the LTGM-TFP toolkit for each country. That TFP growth path can be fed into the standard LTGM or LTGM-PC spreadsheets to determine paths for GDP growth or poverty reduction. The detailed methodology is described in the companion working paper (please cite when using the toolkit: Kim and Loayza 2019). The brief summary of the methodology is as follows.

First, we calculate annual TFP growth rates by differencing the log-transformed TFP levels of year t and $t-1$ using TFP level data from Penn World Table 9.0.

Second, we construct a subcomponent index for each category of TFP determinants using a factor analysis. For each category, we select indicators based on whether they measure an important characteristic, have been used in the literature, and have data available across countries and over time.

1) Innovation index

We choose the following indicators: Public and private expenditure on R&D as a percentage of GDP ($R\&D_{c,t}$) as an indicator of the effort to create new technologies; and the number of patent applications by residents and nonresidents ($patent_{c,t}$) and the number of scientific and technical journal articles ($article_{c,t}$) as indicators of the outcome of R&D activities. The constructed index is as follows.

$$Innov_{c,t} = 0.41 * z(R\&D_{c,t}) + 0.34 * z(patent_{c,t}) + 0.39 * z(article_{c,t}),$$

where $z(X)$ is standardized X , $\frac{X - \text{mean}(X)}{\text{standard deviation}(X)}$; c is country; and t is year

2) Education index

We choose the following indicators: Government expenditure on education as percentage of GDP ($eduexp_{c,t}$) as an indicator of public investment in foundational human capital; the shares of population aged 25 and over with completed secondary education ($secondary_{c,t}$) and with completed tertiary education as indicators of educational attainment among workers ($tertiary_{c,t}$);

and a standardized international test score ($pisa_{c,t}$) – a single average of scores in math, science, and reading on the Programme for International Student Assessment (PISA) – as an indicator of educational quality. The constructed index is shown below.

$$Edu_{c,t} = 0.20 * z(eduexp_{c,t}) + 0.36 * z(secondary_{c,t}) + 0.36 * z(tertiary_{c,t}) + 0.39 * z(pisa_{c,t})$$

3) Market efficiency index

We select the World Bank Doing Business scores ($business_{c,t}$) as an indicator of output market efficiency, which measure the regulatory environment in terms of ease for firms to start a business, trade across borders, register property, get credit, and the like. We choose the International Monetary Fund (IMF) Financial Development Index ($financial_{c,t}$) as an indicator of financial market efficiency, which measures the level of financial development by including the size and liquidity of financial markets, ease for individuals and firms to access financial services, and the ability of financial institutions to provide services at low costs with sustainable revenues. As indicators of labor market efficiency, we construct a composite index, using factor analysis, consisting of minimum wage (% of value added per worker) ($minwage_{c,t}$), severance pay for redundancy dismissals (weeks of salary) ($severance_{c,t}$), and the share of women in wage employment in the nonagricultural sector ($women_{c,t}$) from World Bank databases. The constructed index is shown below.

$$Effi_{c,t} = 0.43 * z(business_{c,t}) + 0.43 * z(financial_{c,t}) - 0.34 * z(labor_{c,t}),$$

$$where\ labor_{c,t} = 0.45 * z(minwage_{c,t}) + 0.47 * z(severance_{c,t}) - 0.47 * z(women_{c,t})$$

4) Infrastructure index

We select fixed-telephone and mobile subscriptions (per 100 people) ($tele_{c,t}$; $mobile_{c,t}$); the length of paved roads (km per 100 people) ($road_{c,t}$); electricity production (kw per 100 people) ($elec_{c,t}$); and access to an improved water source and improved sanitation facilities (% of population) ($water_{c,t}$; $sanit_{c,t}$).

$$Infra_{c,t} = 0.23 * z(tele_{c,t}) + 0.14 * z(mobile_{c,t}) + 0.21 * z(road_{c,t}) + 0.21 * z(elec_{c,t}) +$$

$$0.22 * z(\text{water}_{c,t}) + 0.23 * z(\text{sanit}_{c,t})$$

5) Institutions index

We select the World Bank Worldwide Governance Indicators. These include measures of voice and accountability (citizens' participation in selecting their government and freedom of expression) ($va_{c,t}$); control of corruption (the extent to which public power is exercised for personal gain) ($cc_{c,t}$); government effectiveness (the quality of public services and policy formulation and implementation) ($ge_{c,t}$); political stability (the absence of politically motivated conflict) ($ps_{c,t}$); regulatory quality (the ability of government to formulate and implement regulations that promote private sector development) ($rq_{c,t}$); and the rule of law (the extent to which citizens have confidence in and abide by laws) ($rl_{c,t}$).

$$\begin{aligned} Inst_{c,t} = & 0.18 * z(va_{c,t}) + 0.19 * z(cc_{c,t}) + 0.19 * z(ge_{c,t}) + 0.16 * z(ps_{c,t}) + 0.18 \\ & * z(rq_{c,t}) + 0.19 * z(rl_{c,t}). \end{aligned}$$

Third, we combine the five subcomponent indexes into a single overall index using the principal component analysis.

$$\begin{aligned} Index_{c,t} = & 0.43 * z(Innov_{c,t}) + 0.44 * z(Edu_{c,t}) + 0.46 * z(Effi_{c,t}) + 0.47 * z(Infra_{c,t}) \\ & + 0.43 * z(Inst_{c,t}). \end{aligned}$$

Lastly, to quantify the relationship between the overall determinant index and TFP growth, we build a regression model in which TFP growth rate is a function of a time-lagged overall determinant index and a time-lagged TFP level with country- and time-effects (equation below). We rescale the overall index to be from 1, representing the lowest performance, to 100, the best across countries over the last three decades.

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

where $\text{Annualized TFP growth}_{c,(t,t-5)}$: annualized TFP growth over t-5 and t

$Index_{c,t-5}$: overall determinant index, rescaled 1 to 100

$rtfpna_{c,t-5}$: TFP level (2011 = 1)

θ_c : country effect

δ_t : time effect

$\varepsilon_{c,t}$: residuals

The regression results are presented in the table below. This fixed-effect regression model is used to build the LTGM-TFP.

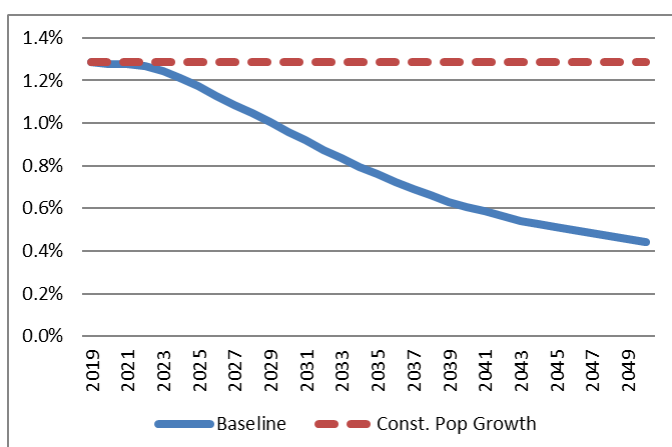
Dependent variable:	<i>Annualized TFP growth</i> $_{c,(t-5,t)}$
Number of observations:	477
Number of groups (countries):	98
Country effects	Fixed
Regressors (below):	Coefficient (SE)
$\ln(Index_{c,t-5})$	0.050 (0.0183) ***
$\ln(TFP\ level)_{c,t-5}$	-0.099 (0.0151) ***
<i>Year 1999</i>	-0.006 (0.0034)
<i>Year 2004</i>	0.004 (0.0034)
<i>Year 2009</i>	-0.001 (0.0045)
<i>Year 2014</i>	-0.004 (0.0063)
<i>(Reference year: 1993)</i>	
<i>Constant</i>	-0.180 (0.0636) ***
R^2 :	
Within	0.3048
Between	0.2749
Overall	0.1586
SE = Standard error; *: significant at 10%; **: significant at 5%; ***: significant at 1% level Note: Hausman test rejects the null hypothesis (Ho: coefficients are consistent under both random and fixed effects) with Chi-square 22.90 and p-value less than 0.01. The R^2 in the case of the fixed-effects estimator does not consider the explanatory contribution of the country-specific constants (which is why its overall value is lower than in the other cases).	

LTGM – Human Capital Extension (LTGM-HC)

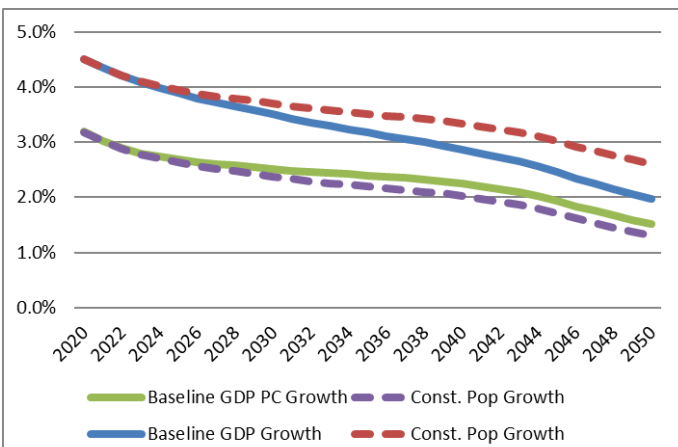
An extension, based on the World Bank Human Capital Index, allows for an analysis of the long-run growth effects of improved learning quality and health outcomes. Education quality here is measured using normalized test scores and is embodied in each child when they are in school. Education quantity is measured as the average years of schooling. The health of the population is approximated in two ways. First, the Adult Survival Rate (ASR) is the fraction of current 15-year-olds who would survive to age 60, assuming that the current age-specific mortality rates apply throughout their lifetime. Second, the stunting rate is measured as the fraction of 5-year-old children who have a height that is more than 2SDs below the median. The simulations assume that other growth drivers, besides human capital (e.g. investment, productivity), continue at their historical trend rates.

Appendix 2. Extra graphs explaining the declining GDP growth in the baseline

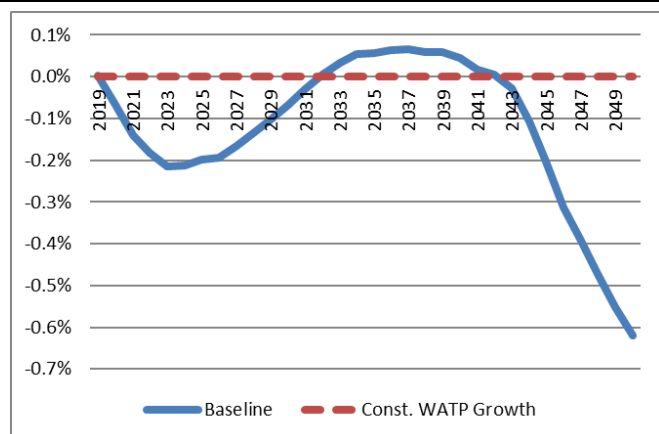
Appendix Figure 2.1. Constant Population Growth counterfactual



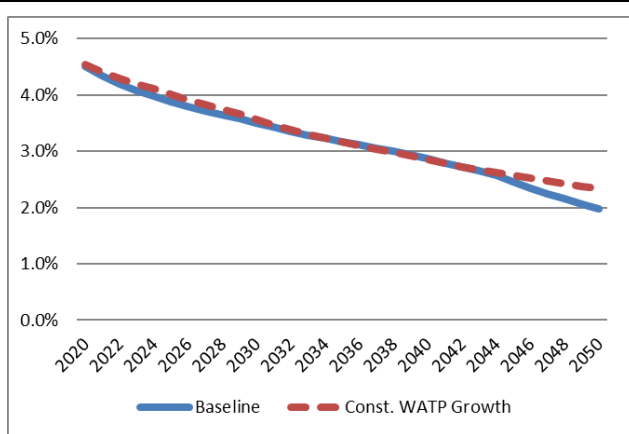
Appendix Figure 2.2. Graph Effect of Population Growth on GDP Growth



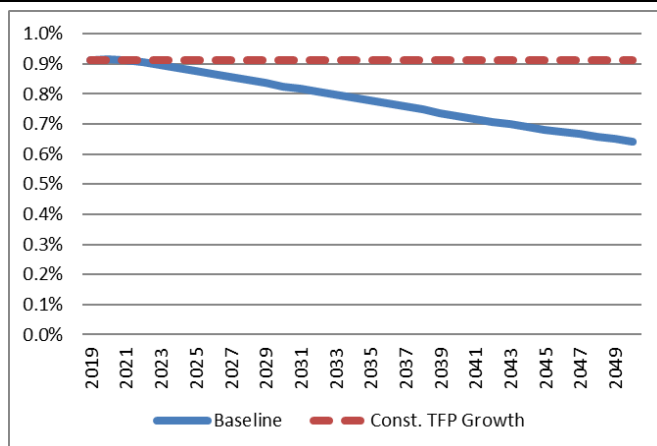
Appendix Figure 2.3. Constant working age to population



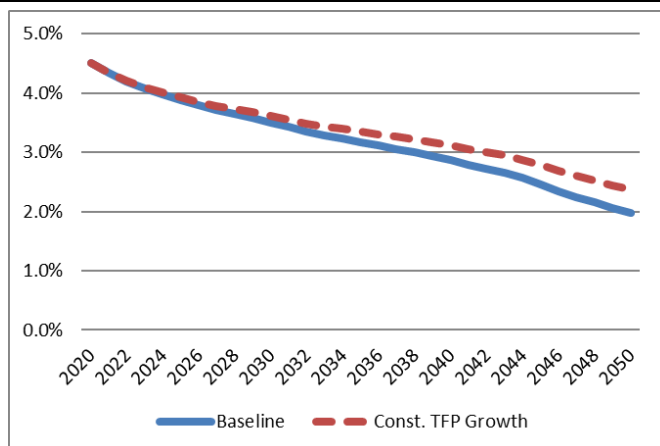
Appendix Figure 2.4. Graph Effect of WATP Growth on GDP Growth



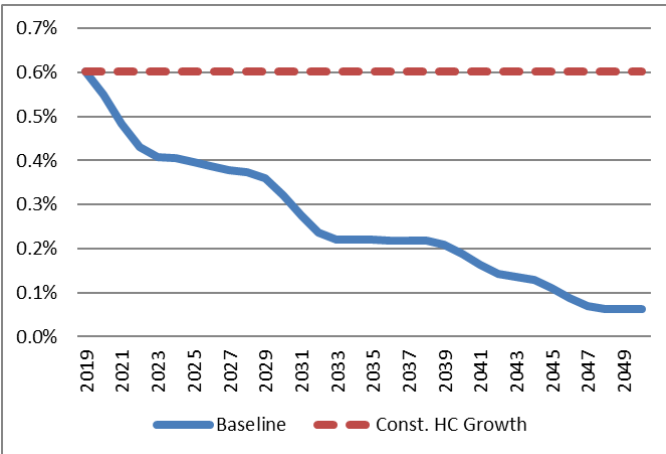
Appendix Figure 2.5. TFP growth: constant rate at the historical median



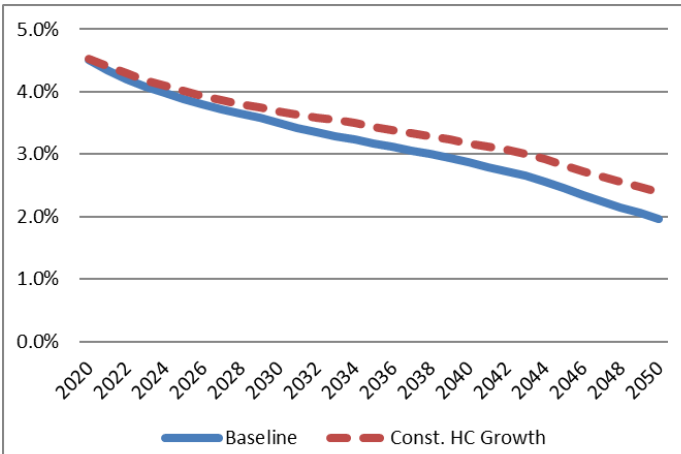
Appendix Figure 2.6. Effect on GDP growth of the two TFP growth paths: constant rate at the historical median



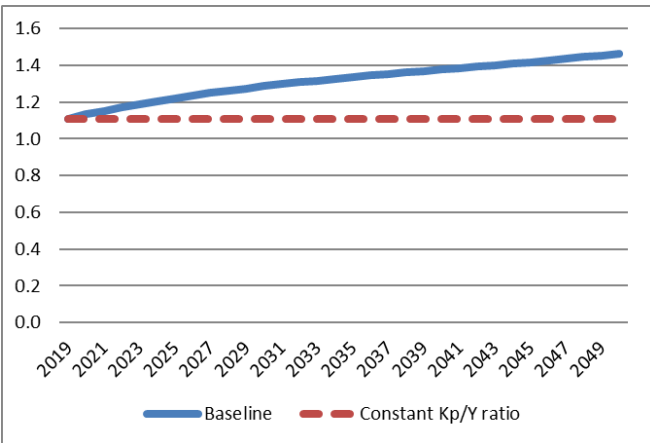
Appendix Figure 2.7. Constant HC growth



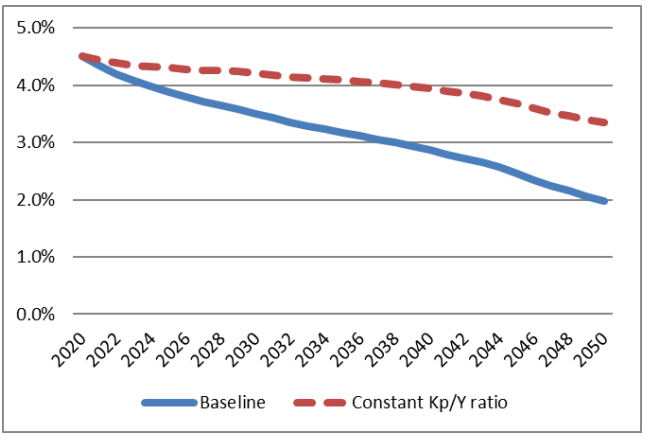
Appendix Figure 2.8. Effect of Constant HC Growth on GDP Growth



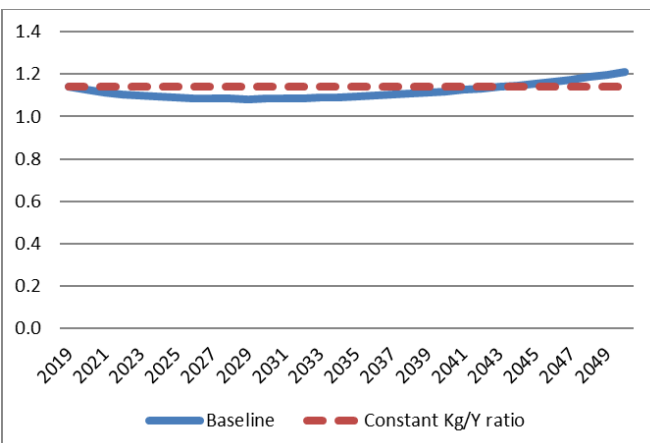
Appendix Figure 2.9. Constant Private Capital to Output Ratio



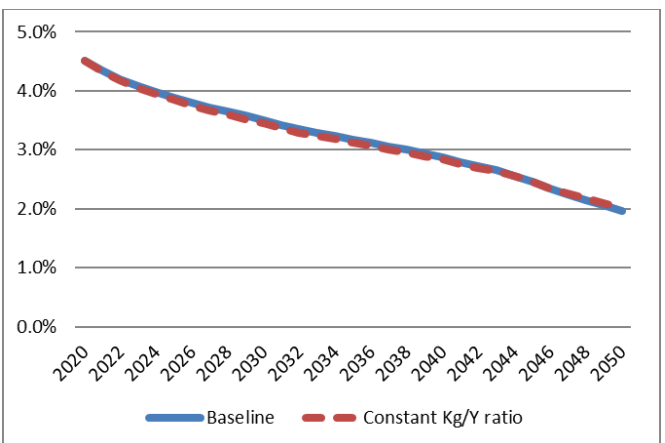
Appendix Figure 2.10. Effect of Constant Private Capital to Output Ratio on GDP Growth



Appendix Figure 2.11. Constant Public Capital to Output Ratio



Appendix Figure 2.12. Effect of Constant Public Capital to Output Ratio on GDP Growth



Source: Authors' calculations.