

*Figure 1: World Map Emerging Economies (The World Bank, 2020a)*

BACHELOR THESIS

# IMPACTS OF COVID-19 ON DEVELOPING COUNTRIES AND THE CATCH-UP EFFECT

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## Management Summary

Since its emergence, COVID-19 has disrupted life globally. The World Bank, IMF, and OECD determined the pandemic to have had a severe impact on the world's economy in 2020, even more so than the World Financial Crisis in 2008. Whilst COVID-19 affected all countries, developing markets were especially vulnerable to the crisis due to their high employment rates in the informal sector and lower fiscal capabilities. Whilst forecasts for global economic growth in 2021 are optimistic, the recovery will vary between the different regions and income levels.

This thesis aimed to compare the impacts of the pandemic on the economies of developing and advanced countries. The paper focused on evaluating developing markets' future capabilities to converge their GDP per capita with developed countries through higher GDP growth rates. Therefore, economic growth was analysed per region and income level for 2020, and forecasts for 2021 until 2026 were assessed. Additionally, the long-term impact of the decline of production factors in 2020 and the importance of existing levels of production factors for future development were evaluated.

The findings revealed that the pandemic severely impacted both advanced and emerging economies. However, the crisis affected future growth prospects to varying degrees in the different regions of the world. As advanced economies recover fast, convergence is deemed volatile until 2022, and each region of emerging markets experiences divergent GDP per capita growth for at least one year. While Asian and European emerging markets display higher than average growth, Latin America can sustain growth rates similar to those in advanced economies. In contrast, the African countries and the Middle East struggle the most to reach high growth, mainly exhibiting divergent per capita growth rates in the future. Nonetheless, overcoming the effects of the pandemic is essential for all emerging markets, as a prolonged impact would considerably damage their convergence possibilities. Therefore, the rapid distribution of vaccines, leading to a faster reopening of the economies, is essential.

The current forecast indicates that the decline in production factors during 2020 has a limited impact on future GDP per capita growth. Combined with additional economic contributions provided by governments, this supports a positive outlook for the future. To continue achieving sustained growth, emerging economies need to focus on advancing their level of investment and on further improving and expanding access to education. Lastly, the institutions within emerging countries, such as the rule of law, need to be strengthened. All the mentioned factors have shown a significant relation with

higher growth and were recommended policy measures to support development in emerging economies even before COVID-19. However, since the pandemic is still ongoing, its impact should be re-evaluated continuously to derive the necessary policies to support the global economic recovery.

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**List of Abbreviations**

<b>Abbreviation</b>	<b>Explanation</b>
A	Labour Productivity
COVID-19	Coronavirus Disease
GDP	Gross Domestic Product
GDP per capita	Gross Domestic Product per Capita
GNI	Gross National Income
I	Institutions
ILO	International Labor Organization
IMF	International Monetary Fund
K	Capital
$K_H$	Human capital
$K_P$	Physical capital
L	Labour Endowment
MENA	Middle East and North Africa
NHDI	New Human Development Index
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares Regression
PPP	Purchasing Power Parity



## I Introduction

The Coronavirus disease, also called *COVID-19*, has the world hold its breath. Since its first occurrence on 31 December 2019, the virus has spread rapidly, affecting the majority of countries by March 2020, which led the World Health Organisation to categorise the virus as a global pandemic on 11 March 2020 (Cennimo, 2021). Ever since, the world has been thrown into turmoil. Worldwide, almost 3.5 million people have died, and 168.5 million have been infected with the virus as of 27 May 2021 (Johns Hopkins University & Medicine, n.d.).

Apart from the health disaster stemming from the pandemic, it also had far-reaching consequences for individuals, businesses, and nations. Not only has COVID-19 led to a dramatic number of casualties, but it also presents unprecedented challenges to the value chain of food and the global labour force (ILO, FAO, IFAD, WHO, 2020). Millions of people are in danger of falling into extreme poverty since almost half of the world's 3.3 billion workforce is at risk of losing its livelihood. Furthermore, border closures, trade restrictions, and confinement measures have severely restricted economic activity (ILO, FAO, IFAD, WHO, 2020).

Emerging markets are especially vulnerable to these developments due to the high share of employment in the informal sector, in small firms and jobs incompatible with remote working (Alfaro et al., 2020). Additionally, many developing countries have limited monetary and fiscal policy capabilities to combat these losses, along with inadequate social safety nets and weak public health systems. Furthermore, developing nations have a high exposure to commodity prices and global trade (Ahmed et al., 2020).

The launch of vaccination programmes provides hope for a faster reopening of economies and a return to normal (United Nations, 2021). Two of the world's major economies, China as well as the US, are already on the road to economic recovery. However, the unequal distribution of vaccination doses poses a significant risk to the global economic recovery (United Nations, 2021). The United Nations (2021) stated that growth is delicate and uncertain in several regions, including Sub-Saharan Africa, South Asia, as well as Latin America. Therefore, the output of developing countries in 2021 will remain below pre-pandemic levels and is expected to return to these levels only by 2022 or 2023 (United Nations, 2021).

## 1.1 Problem Statement

While the pandemic started only about 18 months ago, its disruptive aspects have been of significant research interest, focusing on COVID-19's impacts and forecasting possible scenarios of how the crisis will develop. In economics, the disturbance by COVID-19 challenges all areas, namely health, macroeconomics, development, finance, inequality, and political economy (CEPR Centre for Economic Policy Research, n.d.). Accordingly, a lot of research is targeted at observing and describing the real-time effects of the pandemic, as the overall impact of COVID-19 on the world's economy and emerging markets remains uncertain. Therefore, research to understand these issues is essential to evaluate the magnitude of the pandemic's impact on the economy and the difference of this influence between regions.

## 1.2 Research Question

This thesis seeks to analyse the harm caused by the pandemic to global economic growth and the convergence possibility of emerging countries. Therefore, this paper scrutinises the difference in economic growth between developed and emerging markets during 2020 and forecasts the respective growth rates for 2021 until 2026. Furthermore, the thesis evaluates possible reasons and factors of the economy for these expected discrepancies. The analysis is divided into sub-research questions to answer the general research question.

First, this paper strives to assess the pandemic's impact on the growth of economies during its first year, 2020. Second, it evaluates the long-term economic impact on high-income and emerging markets, thereby estimating the convergence possibilities of developing countries between 2021 and 2026. Third, it analyses whether the decline in factors of production during 2020 will have a lasting effect on the gross domestic product (GDP) per capita growth of economies. Lastly, it assesses the factors of production crucial to overcoming a similar crisis in the future. The paper mainly focuses on the difference in the magnitude of effects in high-income countries compared to emerging markets.

## II Methodology

The paper is structured as follows. The theoretical framework provides the background for the analysis, defining the models used in the paper and reviewing the existing literature on the topic. The empirical analysis is based on secondary sources. The data for the GDP per capita and several independent variables stems from the International Monetary Fund's (IMF) databank (World Economic Outlook). It is supplemented by data from the World Bank Database, in particular the World Development Indicators and Worldwide Governance Indicators. Additionally, secondary data from other sources is considered based on topic, such as the International Labor Organization (ILO) for data on working hours.

The findings are structured according to the research questions, and each section is again subdivided into several parts. A more detailed methodology on each approach can be found at the beginning of the respective sections, as well as the results from the calculations and analyses.

First, the research concentrated on the immediate effects of the pandemic on growth rates. For the first section, the analysis of GDP per capita growth in 2020, the individual country data was grouped into World Bank income classes and regions by averaging the GDP per capita data. This aggregate data allows for the comparison of regions and income classes. Additionally, for the relationship between sectors and the GDP per capita growth, an ordinary least squares (OLS) Regression was conducted.

Second, the research focused on the influence of the crisis on longer-term economic growth. The 2021 - 2026 forecasts for GDP per capita growth were compared to a trendline forecast. This trendline was calculated based on the 2001 - 2019 GDP per capita growth trends.

In the third section, an analysis was made of whether the 2020 impacts on growth affect future growth rates. This evaluation was drawn based on an OLS Regression Model.

Lastly, the fourth section was also based on this model, evaluating whether the level of production factors in 2019 contributes to growth in the future. The analysis focused on the income levels defined as high-income and emerging markets throughout the findings, therefore not considering countries with a low-income level.

The findings and the limitations of the research conducted are summarised in the conclusion section of this paper.

### III Theoretical Framework

#### 3.1 Emerging Economies

The term *emerging economies* and the definition of *developing economies* are fluid, and the classification of countries differs between institutions. The term generally refers to a country that is steering its economy to become more advanced. Factors to achieve this goal include rapid growth, high productivity levels, and thereby a growing middle class (CFI Education Inc, n.d.). By investing in higher production capacities, the countries can transfer from the agriculture sector and the export of raw materials to a more industrialised economy (Amadeo, 2020a). Additionally, nations should evolve from a closed to an open economy by engaging in international trade. However, at the same time, they are susceptible to currency fluctuations, interest rates, and inflation (CFI Education Inc, n.d.). As emerging market countries currently generate more than half of the global economic growth, these countries are crucial drivers in advancing the overall world economy (CFI Education Inc, n.d.).

Like the lack of definition for developing economies, there is no uniform way of classifying the countries. For this paper, the approach of the World Bank will be used. This method categorises every country into one of four groups based on its gross national income (GNI) per capita in current USD (Hamadeh & Serajuddin, 2020). The four classifications are low-income, lower-middle-income, upper-middle-income, and high-income countries, as shown in Table 1. This classification is adjusted annually to account for inflation and is updated yearly on 1 July (Hamadeh & Serajuddin, 2020). A detailed overview of countries in each region according to their income group can be found in the Appendix - Table 1.

In this paper, the terms developing economies and emerging economies are used interchangeably and are defined as countries classified in the lower-middle as well as upper-middle-income categories of the World Bank. Similarly, *advanced economies* refer to countries with a high-income level according to the categorisation of the World Bank. Based on this definition, out of the world's 218 countries, 83 are classified as high-income nations, 106 countries are emerging markets, and the remaining 29 are considered low-income countries (The World Bank, 2020a).

Table 1: World Bank Country Classification (Hamadeh & Serajuddin, 2020)

Income Group	Low Income	Lower Middle Income	Upper Middle Income	High Income
GNI per capita in current USD (Atlas Method)	<1,036	1,036 – 4,045	4,046 – 12,535	>12,535

## 3.2 Economic Growth

### 3.2.1 Economic Growth Measurement

Economic growth refers to the increase in a country's income through a rise in production (Nafziger, 2005). The most common method used to measure economic growth is the *Gross Domestic Product (GDP)*, which measures the value of goods and services produced within an economy during a specific amount of time (Ross, 2019). There are three approaches to calculate the GDP, the production approach, the expenditure approach, and the income approach (Callen, 2020). The production approach adds the value-added at each stage during a production process. In contrast, the expenditure approach sums the value of an economy's purchases, such as buying products or investing in machinery (Callen, 2020). Moreover, the income approach sums the incomes earned by the employees and the operating surplus of companies (Callen, 2020). GDP is a core indicator for economic performance and is often used to gauge average living standards or overall economic well-being (Todaro & Smith, 2015). Accordingly, an increasing growth rate in this measure is considered a sign of increasing prosperity (Callen, 2020). Therefore, traditionally, economic development measures focused on increasing output (Todaro & Smith, 2015).

Additionally, the output measure can be further split into *GDP per capita* by dividing the gross domestic product by the country's population (Brock, 2020). However, one limitation of this measure is that non-resident or seasonal workers are not counted in the population, which may over- or understate a country's living standards (OECD, 2013).

Another approach which the World Bank uses is *Gross National Income (GNI)*. This method includes the entire income earned by a country's citizens, including the income earned abroad by nationals and subtracts the income earned by foreigners within the country (Amadeo, 2020b). This measure is used to calculate the levels that define a country's classification into income groups, as shown in section 3.1.

### 3.2.2 Economic Development

The term economic growth is not synonymous with economic development. While economic growth is a requirement for economic development, its existence does not automatically lead to a country's advancement (Callen, 2020). Whereas real GDP growth is used to determine whether the ordinary citizen is better off, it only measures the average improvement within a country (Nafziger, 2005). However, it does not consider the overall enhancement of the standard of living, as an increased output may lead to environmental damage or external costs. Additionally, the distribution of income within a country cannot be measured by the GDP (Callen, 2020). Therefore, mere GDP growth needs to be accompanied by improving living standards for less advantaged people within a country (Nafziger, 2005). Such an endeavour might be achieved by shifting away from the agricultural sector towards the industrial and service sectors (Nafziger, 2005).

Consequently, economic development must be apprehended as a multidimensional process that includes, apart from the acceleration of economic growth, changes in social structures, popular attitudes, and national institutions, as well as the reduction of inequality and the eradication of poverty (Todaro & Smith, 2015). Through these adjustments, an entire social system should evolve from a condition of life that is perceived as unsatisfactory and tuned to diverse basic needs towards a situation that is perceived as materially and spiritually better (Todaro & Smith, 2015).

Therefore, Amartya Sen defines economic development through the capability approach (Fibienger Byskov & Robeyns, 2020). This method focuses on the view that income is not the goal but a means for other purposes or capabilities that lead to development. Human well-being is defined as being healthy, well clothed, well-nourished, literate, long-lived, being able to take part in a community, and having the freedom of choice in what one can become and can do (Todaro & Smith, 2015).

A more appropriate measure to define economic development along the lines of Amartya Sen's view is the *New Human Development Index (NHDI)* developed by the United Nations (United Nations Development Programme, n.d.). The New Human Development Index includes, apart from GNI, indicators to measure knowledge and long and healthy lives. Therefore, a life expectancy index, which considers life expectancy at birth, and an education index are evaluated. The education index comprises the average expected years of schooling and mean years of schooling. This indicator is then used to

rank countries into four tiers according to their level of development (United Nations Development Programme, n.d.).

### 3.2.3 Solow Growth Model

Several models depict how a country can achieve economic growth, and different models stress different causes of growth (Pettinger, 2019a). Solow introduced one of the best-known neoclassical economic growth models in 1956 (Solow, 1956; Todaro & Smith,

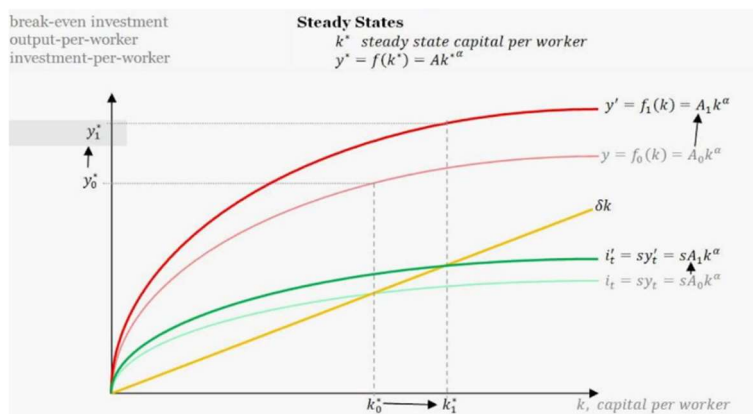


Figure 2: Solow Model of Exogenous Growth (EconomiCurtis, n.d.)

Table 2: Components of Solow Growth Model (Todaro & Smith, 2015; Acemoglu, 2011).

Y	Gross Domestic Product
K	Physical capital and human capital invested
L	Total labour endowment
A	Productivity of labour
$\alpha$	Technology Parameter

2015). According to his theory, GDP relies on the neoclassical aggregate production function, which relates an economy's total output to its production measures. The formula for the Solow growth model is  $y = K^\alpha (AL)^{1-\alpha}$  (Todaro & Smith, 2015).

As can be seen in Table 2,  $y$ = Gross Domestic Product is a function of  $K$ =physical capital and human capital invested,  $L$ =

total labour endowment,  $A$ =productivity of labour, which grows at an exogenous rate, and  $\alpha$  = technology parameter, which also grows exogenously (Todaro & Smith, 2015; Acemoglu, 2011). As capital is a combined measure of physical and human capital, it can also be denoted as  $K_P$  for physical capital invested and  $K_H$  for human capital invested.

Based on this theoretical background, an economy can grow by three factors. First, through capital accumulation, achieved by saving and investment. In turn, this capital is invested into the land and physical equipment of a country ( $K_P$ ) as well as the advancement of human resources ( $K_H$ ). The latter can be enhanced by advancing health, education, and job skills (Solow, 1957). Second, rises in labour quantity lead to higher growth ( $L$ ). The last factor is technological progress, which increases capital and labour productivity (Pettinger, 2019a). All mentioned factors increase the production possibility

frontier, enabling an economy to experience higher growth, as visualised in Figure 2 (Solow, 1957).

There are certainly also criticisms of this model. Banerjee & Duflo (2004) criticise that the aggregate production function assumes that all factor markets are perfect, and all individuals can buy or sell as much as they want to at a given price. Therefore, the market has to allocate all factors of production to maximise total output (Banerjee & Duflo, 2004). Additionally, the Solow residual is responsible for about 50% of historical growth in industrial nations (Todaro & Smith, 2015). Lastly, some developing countries are not able to attract higher levels of investment due to institutional problems such as corruption or insufficient infrastructure (Pettinger, 2019a).

### 3.2.4 Solow Model and Institutions

To address the last criticism of the Solow Growth Model, economists have added an additional factor that influences economic growth within an economy, the level of institutions. Institutions, or governance, is defined by the World Bank as "...the manner in which public officials and institutions acquire and exercise the authority to shape public policy and provide public goods and services" (The World Bank, 2007, p. 67). North and Thomas (1973) researched that economic growth is influenced by institutions as this affects property rights, incentive structure, and transaction costs (North & Thomas, 1973). Additionally, institutions reduce the risk of doing business within a country and thereby make funds available to innovation instead of protecting property rights (Rodrick, 2000). Furthermore, according to a study by Ahmed and Siddiqui (2013), institutions have a considerable and positive influence on economic growth.

Therefore, the factor "institutions", depicted by the letter  $I$ , is added to the analysis of the paper. Overall, the total factors included in this paper entail physical capital, human capital, labour endowment, labour productivity, and institutions. The technology factor is assumed to be exogenously defined and constant and is omitted. Consequently, the aggregate production function applied in the paper is  $y = f(K_P, K_H, L, A, I)$ .

### 3.2.5 Outlook before COVID-19

A World Bank working paper that analysed potential growth before the pandemic revealed that the global financial crisis triggered a period of weak potential growth (Celik et al., 2020). In advanced economies, potential growth slowed to 1.4 percent between 2013 and 2017, a difference of 0.5 percent compared to its long-term average. At the same



time, emerging markets potential output decelerated to 4.8 percent a year, about 0.6 percent lower than its long-term average. This slowdown can largely be explained by weak capital accumulation rates and lower total factor productivity growth (Celik et al., 2020).

Celik et al. (2020) further suggested that the weak potential output may extend into the next decade, slowing on average by another -0.2 percentage points up until 2027. Advanced economies were expected to decline by -0.1 percentage points, whilst potential growth in emerging economies could slow up to -0.5 percentage points (Celik et al., 2020).

Several policy measures were suggested to contradict these developments. On the one hand, labour market reforms are crucial for turning around the decline in growth in advanced economies. On the other hand, for emerging markets, education, health, and labour market reforms support a surge in potential growth. These measures combined could lead to an increase of 0.8 percentage points in economic growth (Celik et al., 2020).

### 3.3 Convergence Theory

The *theory of convergence*, or the *catch-up effect*, states that the wealth and development of emerging economies will eventually converge with advanced economies. Due to higher GDP per capita growth in the developing economies, they are catching up to the level of living standards of developed countries (Kenton, 2021). The higher growth in GDP per capita is brought about by an increased growth rate of productivity in lower-income countries (Abramovitz, 1986).

This theory relies on the Solow growth model, as discussed in section 3.2.3. Countries with the same level of factors of production must ultimately show similar levels of per capita income (Marginal Revolution University, n.d. a). However, this catch-up is conditional on the equal levels of factors of production, such as savings, investment, labour force growth, and productivity growth (Todaro & Smith, 2015). This statement also implies that countries with substandard factors of production, such as weak institutions, will have a more challenging time converging (Marginal Revolution University, n.d. a).

#### 3.3.1 History

For a long time, the world has seen a period of global divergence, which started in the 1800s and was sparked by the industrial revolution (Dervis, 2012). In fact, in the years after 1950, only a few countries, including the east Asian Tigers (Hong Kong,

Singapore, Korea, and Taiwan), experienced a growth rate higher than 4.5 percent (Marginal Revolution University, n.d. b; Bloomenthal, 2021).

The trend reversed in the early 1990s when developing markets experienced a growth in per capita income three times higher than advanced economies (Dervis, 2018a; Larson et al., 2016). The higher growth rates sparked optimism that the output and income levels of the two groups would converge. From the 1990s to the 2000s, otherwise known as the age of hyper-globalisation, trade opportunities were the main factor for convergence (Dervis, 2018a). The per capita GDP of developing economies grew by about 2.5 percentage points over the rates of advanced countries (Dervis, 2018b). Technological advances and the subsequent decline in communication and information costs were leading factors in accelerating the trend. Until 2008, the global export-to-GDP ratio rose from 15 percent to 25 percent (Dervis, 2018a). This progress boosted GDP per capita growth in emerging economies, allowing the nations to grow at 3.5 percentage points over advanced economies (Dervis, 2018b). However, this advancement did not include all countries. Whereas Asian countries, such as India and China, experienced exceptionally high growth rates, many smaller economies could not profit from the development (Dervis, 2018b).

The world financial crisis in 2008 marked a second turning point. Advanced economies experienced a drop in growth rates while developing countries' per capita growth was 4 percent higher (Dervis, 2018a). This difference led to hopes that convergence was accelerating (Dervis, 2018b). However, during the 2013–2016 recovery period in the United States, growth in developing economies slowed to between 1 and 2 percent, compared to the earlier 3 to 4 percent rates. This change slowed convergence in the emerging economies or turned them into divergent GDP growth compared to high-income countries (Dervis, 2018a).

The convergence of nations coincided with a second trend, namely the divergence of incomes worldwide. While developing countries have been growing significantly, the income of millions of people has remained stagnant for the last century, and they have not yet been able to profit from catching up to advanced countries. Simultaneously, the wealthiest people grow more prosperous, leading to increased income inequality both within countries and globally (Dervis, 2012).

### 3.3.2 Causes

Several factors enabled emerging countries to catch up to developed countries.

First of all, the basic economic theory of the law of diminishing returns explains much of the convergence. Since capital in emerging markets is scarce, the return on capital should be higher than in advanced countries, as detailed in Figure 3 (Pettinger, 2019b). Additionally, these high returns should encourage reinvestment, which further fuels growth (Banerjee & Duflo, 2004).

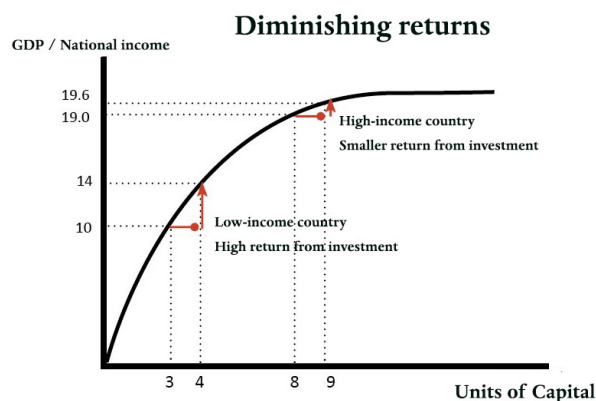


Figure 3: Theory of Diminishing Returns (Pettinger, 2019b)

Second, the law of diminishing returns also applies to advancements in technology. Advanced economies benefit from technological improvements; however, the additional benefit from new technology is limited as their previous standard was already high. Since emerging countries, in general, have a lower technological level to start with, they can adapt to the new technology and undergo a more significant development (Abramovitz, 1986; Pettinger, 2019b)

Third, human capital is another critical influence. Lee (2013) identified knowledge as an additional factor for the growth of late-comer countries. Therefore, educational institutions for local learning and the access to knowledge generated abroad are critical to catching up successfully (Lee, 2013). Lopez-Claros (2015) names Taiwan as an example, where young scholars went abroad to study, particularly in the U.S., allowing the country to assemble qualified and experienced entrepreneurs before it could absorb the knowledge of these students. After 1985, Taiwan used this experience to develop successful enterprises and establish universities to educate its workforce. Thereby, it has increased innovation capability and absorbed foreign technology, pushing the country to high levels of sustained growth (Lopez-Claros, 2015).

In addition to the above factors, globalisation has been a propellant for economic convergence. Several factors explained, such as rising foreign investment and technology adaptation, have been facilitated by the increasing globalisation in recent years (Dervis, 2012).

### 3.3.3 Limitations

The theory has several limiting factors, which Abramovitz (1986) summarises as "social capabilities". These include social, institutional, or political differences between countries, which inhibit the possibility of capturing spillover effects from advanced economies and, therefore, influence or limit growth and constrain the country's possibility to catch up (Bennet, Coleman & Co. Ltd., n.d.).

One factor is the ability to absorb new technologies. Without the relevant competence to adopt technology, the country is limited in its possibility to benefit from technological improvements. The resources to be able to implement technology are provided by the necessary education and training (Abramovitz, 1986; Pettinger, 2019b). To make use of the convergence theory, a country should also be open to competition and trade (Abramovitz, 1986).

Economic policies in developing countries that promote free trade and openness are linked to higher growth, while a closed economy inhibits the possibility to converge (Kenton, 2021). A further limitation is the substantial income gap between advanced and developing countries. This difference signifies that even at a high GDP growth rate of developing economies, it will take a long time to fill the per capita income gap between advanced and emerging countries (Lopez-Claros, 2015).

Additionally, few countries have achieved a high-income status when looking at the past, and income growth has been volatile. This finding contradicts the theory of convergence (Larson et al., 2016). Gill and Kharas (2007) described the rapid development of low-income countries to middle-income countries as a result of cheap labour and technology catch up. However, this early stage is followed by lower growth; a phenomenon also called the middle-income trap. Without new sources of growth, a country might not be able to compete with high-income countries (Gill & Kharas, 2007). Empirical evidence suggests that by 2008 only 13 countries out of 101 countries classified as middle-income in 1960 reached the high-income status (Larson et al., 2016). Among them are Taiwan, Singapore, Korea, as well as Chile. Nevertheless, these cases of upward mobility are the exception rather than the rule. In addition, these countries could converge their economies when the gap between high-income countries and developing economies was not as wide as today. Furthermore, convergence could be stimulated by taking over manufacturing processes, whose attainment was more straightforward. As the gap between the richest and poorer countries has been growing again, like in the period of divergence before the 1990s, catching up is more challenging (Lopez-Claros, 2015).

### 3.3.4 Outlook before COVID-19

The outlook on convergence was uncertain even before COVID-19. Contrary to previous years, countries had only a limited benefit from copying basic manufacturing processes since this source of catch up has already been exhausted (Dervis, 2018b). To achieve convergence, developing economies need to deploy new technologies efficiently, emphasising the need for a knowledgeable workforce. As newer manufacturing processes are growing more complex, a higher skill level is required. For late-comer countries, this impedes the route the Asian manufacturing countries have taken before them (Rodrick, 2017).

Not only are artificial intelligence and robotics more challenging to copy, but they are also able to perform tasks traditionally performed by low wage workers and developing economies may lose their cost advantage (Dervis, 2018b). Additionally, since these technologies require existing skills and infrastructure, adapting them in emerging countries might be more costly and complicated than in advanced countries. As a result, the benefit of diminishing returns is reduced for emerging economies (Dervis, 2018b).

However, the outlook is more nuanced. Emerging economies could adopt robotics and artificial intelligence in their value chains to perform activities in which they lack sufficient skilled labour. The complete automation could lead to more activities being located in emerging economies, based on the condition that firms are willing to invest in these countries. In that case, countries that can learn quickly have the opportunity to converge even further, growing faster in high-tech sectors than advanced economies (Dervis, 2018b).

### 3.4 Forecasts for Economic Growth and Convergence

The World Bank, OECD, and IMF have each published an assessment about the future of the world economy and global growth. In Appendix - Figure 1, a comparison of the estimated real GDP growth rates for 2020 and the global GDP growth rate forecasts for 2021 and 2022 between the three institutions can be found. The following section will explain these views.

Since the pandemic is still ongoing, there is no absolute certainty about the actual economic damage caused (Jackson, et al., 2021a). Whilst there has been a consensus among economists early on that the pandemic will have severe impacts on economies worldwide, without certainty when the health crisis and its economic effect may peak, forecasts are only provisional (Jackson, et al., 2021a; Szmigiera, 2021).

On the one hand, the decline of economic growth during 2020 was caused by a fall in demand, observed in many sectors. No other sector has been as gravely impacted as the travel and tourism industries due to widespread travel restrictions. Other industries affected were the automobile sector, as the daily commute was omitted (Szmigiera, 2021). The subsequent decline in revenue for many companies resulted in a widespread increase in unemployment. Economists fear a downward spiral, as unemployment leads to a further decrease in demand. Governments have tried to counteract this trend with increased government spending on monetary welfare to their citizens and providing safety payments to companies to prevent job losses (Szmigiera, 2021).

In contrast, several sectors have been able to benefit from the crisis. These include e-commerce, food retail, as well as the healthcare industry. This development might help offset some of the damage caused by the crisis (Szmigiera, 2021).

On the bright side, there is hope for a sharp rebound once the pandemic is over (Szmigiera, 2021). End of April 2021, a McKinsey Global survey on the global economy revealed optimism about economic development and brightening prospects on employment levels (McKinsey & Company, 2021). In all regions, respondents were confident about experiencing better economic conditions in the next six months. Expectations for consumer demand are rising, and along with them, the outlook on companies' workforce expansion (McKinsey & Company, 2021).

### **3.4.1 The World Bank Forecast**

#### ***3.4.1.1 Economic Growth***

An early estimate of the World Bank from June 2020 projected that the recession caused by COVID-19 would be the most severe since World War II, with a predicted global decline in GDP of -5.2 percent in 2020. However, in the January 2021 report, they revised the estimate to a slightly less severe decline of -4.3 percent for the past year (Jackson, et al., 2021a). The correction was made due to less severe contraction in advanced economies; however, this recovery is restrained by a resurgence of COVID-19 cases (The World Bank, 2021a). Nonetheless, economic activity during 2020 shrunk because of reduced personal interaction due to movement restrictions, as well as policies that discouraged investment, and uncertainty about the post-pandemic economic landscape. Furthermore, human capital accumulation has been slowed due to interruptions to education. Overall, the crisis is predicted to have long-lasting impacts on economic activity by slowing down the growth of potential output globally (The World Bank, 2021a).

After this shock to the world economy, the World Bank (2021a) expects a subdued recovery. The baseline estimate for global GDP in 2021 is a 4 percent growth, dependent on effective pandemic management and vaccination programmes. Therefore, policymakers will face challenges in the public health sector and budget policies, debt management, as well as structural reform (The World Bank, 2021a). Still, this calculation lies 5.3 percent below projections issued before the pandemic, translating to a lower monetary value worth 4.7 trillion USD. The trend is expected to continue well into 2022, where growth is estimated even lower than the current year at 3.7 percent, less than half of pre-pandemic projections. Additionally, emerging countries' gaps between projections before the pandemic and after are anticipated to be twice as large as developed economies (The World Bank, 2021a). In a more negative estimation, assuming more COVID-19 cases than estimated and a slow vaccination rollout, global growth would contract to 1.6% in 2021 and 2.5% in 2022, a severe decline compared to baseline estimations (The World Bank, 2021a).

#### ***3.4.1.2 Convergence***

The global recession impacted emerging and advanced economies alike, differences arising from the magnitude of the outbreak within a country, susceptibility to

global economic distress, existing poverty, as well as debt levels constraining fiscal response (Jackson, et al., 2021a).

According to baseline estimates, advanced economies' growth is expected to recover, thanks to vaccination programmes and monetary policy accommodation, even as fiscal support declines (The World Bank, 2021a). GDP growth is predicted to be 3.3 percent in 2021 and 3.5 percent in 2022. The rebound of emerging markets seems promising, with a projected 5 percent growth in 2021 and 4.2 percent in 2022. Taking a closer look, it becomes evident that much of this development stems from China's recovery, which is expected to grow 7.9 and 5.2 percent, respectively. Without China, the projections are just 0.1 percentage points over the rates of advanced economies, with 3.4 percent in 2021 and 3.6 percent in 2022. These calculations are a grim outlook for convergence, especially since pre-pandemic projections were 6 percent higher for 2022 output (The World Bank, 2021a).

In emerging markets, the disruptions from the pandemic are even worse than forecasted earlier and led to a severe recession as well as slower recoveries, especially where COVID-19 impacted the economy more severely (The World Bank, 2021a). This slowdown in GDP growth causes per capita incomes to decrease in over 90 percent of emerging countries, erasing five years of per capita income increases. In turn, millions of people were pushed back into poverty, to rates last seen in 2017. Additionally, further poverty reduction is inhibited by the longer-term effects of the pandemic. These include, but are not limited to, an unfavourable effect on long-term productivity, lower levels of investment, a decline in school years, and increasing unemployment (The World Bank, 2021a).

These developments are projected on the baseline of growth. On the one hand, other risks, such as a slow vaccination or an increase in the pandemic, could lead to growth lower than the projected figures. Additional factors are high levels of debt and the threat of bankruptcies, which could derail the generally well-capitalised banking system and increase the risk of a financial crisis. On the other hand, effective vaccines, an efficient rollout, and a slowdown of the pandemic from good management could lead to growth surpassing expectations due to a higher-than-expected demand (The World Bank, 2021a).

To support economic growth in the long term, the World Bank (2021a) suggests reforms to raise the factors of production in emerging markets. These policies include increased investment in both physical and human capital and the support of female



participation in the labour force. These measures could help sustain higher growth levels and averting the pandemic's economic impact (The World Bank, 2021a).

### **3.4.2 The OECD Forecast**

#### ***3.4.2.1 Economic Growth***

In its May 2021 report, the *Organisation for Economic Development (OECD)* (2021b) forecasts brightening economic prospects, thanks to the development of effective vaccines and additional fiscal support. Therefore, 2021 GDP growth is projected at 5.75 percent, which lies 1.55 percent over December 2020s estimates and is also higher than its March 2021 estimates. Similarly, growth rates of global GDP in 2022 are now projected to be 4.5 percent, up 0.5 percent from the last forecast (OECD, 2021b). Whilst output is back to pre-pandemic levels, it does not recover enough to reach estimates made before the pandemic until at least 2022. Even if output improves, living standards within OECD countries will not be back to the projected levels. Therefore, income support is warranted until the high-contact activities are not restricted anymore (OECD, 2021b).

The OECD calculated a decline in global GDP of -3.5 percent for 2020, and even -4.75 percent in its member countries. This decrease is bigger than the shock caused by the World Financial Crisis in 2008. Moreover, in all countries, the brunt of the pandemic had to be borne by the most disadvantaged of the population. Overall, the GDP in the fourth quarter of 2020 still showed a shortfall of almost 4 percent compared to the GDP projected before the pandemic. In term of real income (purchasing power parity (PPP)), this represents a deficit of 5 trillion USD (OECD, 2021b).

The OECD states that the forecasts for 2021 and 2022 are subject to significant uncertainty based on the development of the virus, such as the emergence of new, more contagious variants. Such a strain would require renewed containment measures, which have a high economic cost. In contrast, a faster immunisation would lead to a faster rebound in all economies. Therefore, a significant priority for policymakers should be to deploy vaccinations fast to recover economically, thereby sustain incomes and, most importantly, save lives (OECD, 2021b).

#### ***3.4.2.2 Convergence***

Growth expectations have improved to a different degree across countries. Vaccine rollout in advanced economies has allowed the reopening of contact-intensive

activities. Additionally, the accumulated household savings can advance GDP growth significantly, especially in high-income economies (OECD, 2021b).

In contrast, in emerging countries, the slower vaccine rollout and the need for more containment measures slow down growth in the future, especially in countries where fiscal support is limited. Whilst China is already back on track, other emerging markets, such as India, are expected to have significant shortfalls in GDP compared to projections before the pandemic (OECD, 2021b). These nations are only expected to recover fully once the impact of COVID-19 weakens. Additionally, the increased debt levels of some developing countries have made them more vulnerable to renewed financial shocks. Therefore, international cooperation is necessary to address these debt problems. On the upside, emerging countries can profit from increased demand from advanced economies, which might support growth. The high-income countries should also provide the poorer peers with resources to vaccinate their population, such as financial and medical supplies and necessary knowledge. This does not only help the developing world, but benefits spill over globally (OECD, 2021b).

### **3.4.3 The IMF Forecast**

#### ***3.4.3.1 Economic Growth***

The *International Monetary Fund (IMF)* (2021a) acknowledges that the contraction of -3.3 percent globally was severe and unseen in recent years. However, the fund argues at the same time that it could have been a lot worse. The organisation estimates that the decline could have been three times bigger if there had not been any policy support, as these measures contributed an estimated 6 percent to global growth in 2020. Additionally, thanks to a more robust recovery in the second half of the year, the GDP decline during 2020 is 1.1 percent lower than expected in October 2020. Nonetheless, the road to recovery is still long, and much needs to be done to prevent the divergence of income per capita and the widening of inequality (International Monetary Fund, 2021a).

In its April 2021 report, the IMF (2021a) raised its forecasts compared to the October 2020 outlook for GDP growth to 6 percent in 2021 and 4.4 percent in 2022. According to the IMF, this more robust growth is brought about by fiscal support in advanced economies and the economic revival thanks to vaccination programmes underway in the second half of 2021. In the medium term, global GDP growth is forecasted to moderate to 3.3 percent. On the positive side, due to strong policy responses,

the IMF expects the recession due to the pandemic to leave smaller marks on the global economy than the World Financial Crisis (International Monetary Fund, 2021a).

However, the institution sees significant differences in recovery speed within countries and across borders. Between countries, decisive differentiators have been political action to restrict the spread of the virus, the severity of the pandemic, and policy actions. Countries with a limited ability to respond to the crisis have been impacted more severely, as well as the ones dependent on tourism and commodity exports (International Monetary Fund, 2021a). Within countries, the service sectors and travel, arts, entertainment, sports, and retail suffered severe financial losses due to the pandemic and will struggle to recover. On the other hand, the IMF predicts that industrial companies have benefited from an increased demand for products for the home office and cars, which contradicts the forecast in section 3.4 (International Monetary Fund, 2021a).

Despite strong supporting measures, the labour market is still in recovery, with unemployment rates being about 1.5 percentage points higher than before the pandemic, both in advanced and in emerging economies. However, this development is spread unequally, as workers in the informal sectors, as well as women, youth, and lower-skilled workers, have been impacted more severely since they often work in contact-intensive positions. Therefore, income inequality is expected to have risen in emerging and developed economies alike (International Monetary Fund, 2021a).

#### **3.4.3.2 Convergence**

For developed economies, most are expected to return to similar GDP levels as before the pandemic in 2022. Emerging economies have been impacted more severely and are forecasted to suffer more in the medium term. Therefore, the recovery is likely to take longer, reaching pre-pandemic levels only in 2023. A notable exception is China, which attained its pre-COVID GDP in 2020 (International Monetary Fund, 2021a).

Many emerging market countries have a more unstable fiscal situation and, consequently, are more restricted in supporting livelihoods and overcoming the crisis. These deviating recoveries from the pandemic widen the gap in living standards between developing and advanced economies, as opposed to projections before the pandemic. Cumulative per capita income losses between 2020-2022 are expected to be -11 percent in advanced economies. Emerging economies have a higher loss of about -20 percent, which pushes an estimated 95 million people back into extreme poverty in 2020, and an additional 80 million people are malnourished (International Monetary Fund, 2021a). The

loss in education has also been more severe in developing countries, as they have a lower ability to deal with school closures than advanced economies. The lack of education could have far-reaching consequences for long term inequality, especially for students from low-income households and for women (International Monetary Fund, 2021a).

Strong international collaboration is crucial to ensure that emerging market economies can close the gap between the living standards of high-income economies and their own. The cooperation also includes an appropriate vaccine distribution at affordable pricing for all countries to fight the pandemic. Advanced economies are estimated to have broad vaccine availability in summer 2021, while most other countries only have access during the second half of 2022. Therefore, countries with access to vaccines are exiting the crisis sooner, while restrictions are still necessary in other parts of the world (International Monetary Fund, 2021a). The additional restrictions are likely to increase the pandemic's long-term implications. Therefore, international fiscal support should be provided to countries needing to fund health care and social and infrastructure spending to continue to converge with advanced economies. Emerging markets have been more constrained in their financial support, and higher debt servicing costs are expected to limit their capacity to fight rising inequality and growing poverty (International Monetary Fund, 2021a).

The IMF recommends policies that are sensible even without a pandemic, for example, social protection through unemployment insurance even for the self-employed and informally employed. Additionally, health care facilities need to be strengthened, along with education, early childhood development, and vocational training. Once vaccination is underway and restrictions are lifted, fiscal support should focus on healthcare spending and maintaining a supportive monetary policy. To constrain the long-term effect of the crisis, policymakers need to enhance productive capacity and increase incentives for the effective allocation of productive resources (International Monetary Fund, 2021a).

## **IV Findings**

### **4.1 GDP Growth in 2020**

This section divides the growth of per capita income during 2020 according to the level of income and per region to evaluate the severity of the GDP per capita decline. Additionally, the relationship between the sectors of GDP and this decrease in growth is investigated.

#### **4.1.1 Analysis GDP Growth in 2020**

The GDP per capita growth rates have been analysed for 2020, based on data provided in the World Economic Outlook by the IMF in April 2021. First, the growth rate was calculated by deriving the percentage change of absolute GDP per capita PPP from 2019 to 2020. Following this, the countries have been grouped according to income level and regions as defined by the World Bank (The World Bank, 2020a). Therefore, the aggregate numbers represent the average growth rate of GDP per capita within this classification.

Second, the data was analysed for a relationship between GDP development and the different sectors within an economy. A multiple regression analysis for the sectors was conducted, defining GDP per capita growth in 2020 as the dependent variable. As above, the IMF World Economic Outlook data from April 2021 was used for the per capita growth calculations (International Monetary Fund, 2021c). Additionally, the independent variables included the log of the four sectors as a percentage of GDP. The sectors encompass first agriculture, forestry, and fishing, second industry including construction, third manufacturing, and lastly services. The data was obtained from the World Bank database and represents the variables as of 2019 (The World Bank, 2021k) (The World Bank, 2021b) (The World Bank, 2021c) (The World Bank, 2021d). The dataset includes 151 countries, as countries where no data was provided for 2019 ( $n=44$ ) were excluded from the analysis. To analyse the percentage change in GDP per percentage difference by sector, the sectors were put into a logarithm to receive a log-log regression. One advantage is that this transforms absolute values into a regression that can be interpreted by percentages (Kyaw, 2020). Therefore, the regression results are elasticities, which means a 1 percent increase in the variable  $x_1$  results in a change in GDP growth of  $\beta_1$  percent.

### 4.1.2 Results GDP Growth in 2020

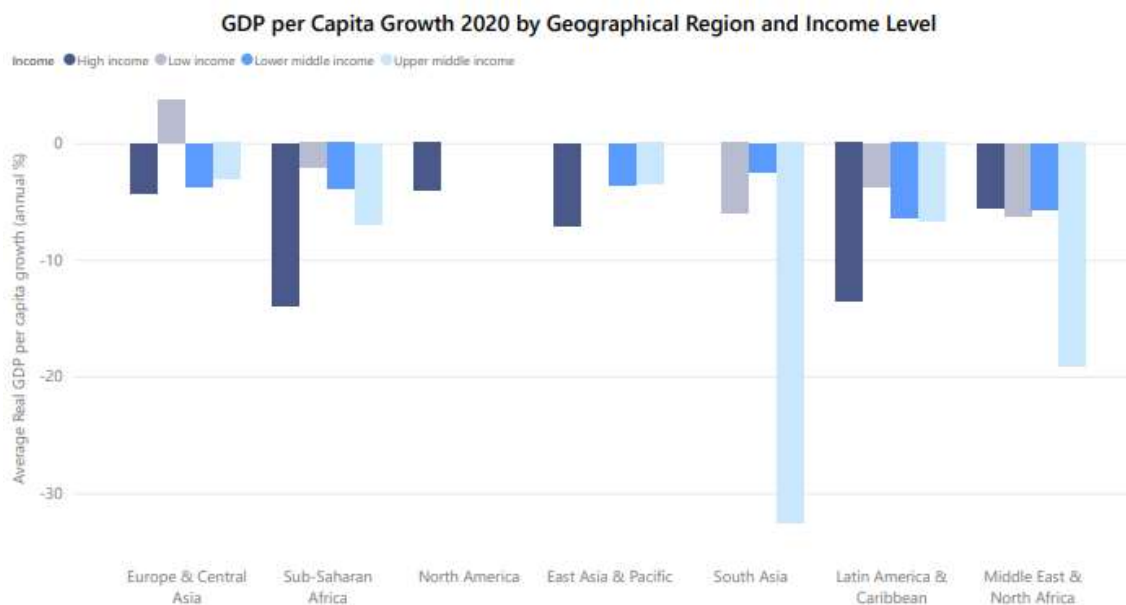


Figure 4: Average GDP per Capita Growth in 2020 (annual %) by Region and World Bank Income levels (International Monetary Fund, 2021d; The World Bank, 2020a)

As shown in Figure 4, during 2020, GDP per capita significantly contracted compared to previous years. High-income countries' growth fell to -5.96 percent, a decline almost twice as large as the severest decrease since 2000. During that time, apart from a setback of -3.65 percent in 2009 after the World Financial Crisis, GDP growth was always positive for high-income countries, growing at an average of 3.45 percent yearly from 2001 onwards. Simultaneously, developing economies' GDP diminished by -5.07 percent, compared to an average annual growth of 4.80 percent from 2001 until 2019. Similar to advanced economies, the most severe collapse in growth occurred due to the World Financial Crisis in 2009. Nonetheless, whilst growth narrowed to 0.42 percent in that year, the average per capita growth rate of emerging economies was never negative during the last twenty years, a trend that was ended by the 2020 growth drop.

Nevertheless, a minority of countries have been able to achieve positive GDP growth during 2020. Of all 151 observations, only 15 percent (24 countries) showed an overall positive GDP growth during the past year. Most of the countries with positive GDP growth are categorized as developing economies. Among them are upper-middle-income nations such as China, Turkey, and Serbia, and lower-middle-income countries like Vietnam, Myanmar, and Egypt. At the same time, only five high-income economies achieved a positive per capita GDP growth, namely Brunei Darussalam, Ireland, Lithuania, Taiwan, and Korea. The countries with the highest per capita growth during

2020 include Guyana, Ethiopia, Taiwan, and Guinea, all growing more than 3.9 percent per capita. An outlier in Figure 4 is the region low-income Europe and Central Asia, which shows positive growth. However, this region only includes Tajikistan, which grew by 3.7 percent during 2020.

Apart from low-income Europe and Central Asia, all regions experienced a negative GDP growth for 2020. Most countries, 85 percent, exhibited a negative growth development for the year. Considering all income groups within a region, the Middle East and North Africa have experienced the most severe decline per capita with an average of -9.01 percent due to critical declines in GDP per capita in Libya, Lebanon, and Iraq, where growth decreased by more than -20 percent during 2020. The severe breakdown in growth in Libya, its economy contracted by an estimated -59 percent, is also part of the explanation for the low growth in the chart of the upper-middle-income countries of the region.

Latin America and the Caribbean's GDP per capita declined by an average of -8.6 percent. High-income countries were impacted more severely in the region, such as Aruba, St. Kitts and Nevis, and Panama, slowing by more than -18 percent. The region of South Asia experienced negative growth of -6.65 percent. Notably, upper-middle-income South Asia experienced a significant collapse in GDP of -32.25 percent. However, this segment only includes one country, the Maldives. In East Asia and the Pacific, the decline was less severe than in its southern neighbours. Overall GDP per capita growth amounted to -4.75 percent. Several major high-income economies, such as Macao, Singapore, Hong Kong, and New Zealand, have decreased significantly. Countries that have been identified as having handled the pandemic well, such as China, Taiwan, and Korea, benefitted from these measures and have been able to achieve positive growth.

North America, comprising the two countries Canada and the United States of America, has declined by -4.09 percent. The US strongly supported its economy with fiscal measures and could limit its decline to -2.81 percent for 2020, compared to Canada, where GDP per capita declined by -5.36 percent.

The region Sub-Saharan Africa has been able to limit its decline to -3.79 percent for the year. Especially low-income countries have been less impacted, with the two countries achieving the highest growth being Guinea and Ethiopia. The lowest decrease was observed in Europe and Central Asia. The overall region's growth declined by -3.73 percent, with all income classes within the region showing only a moderate decrease in growth compared to other regions.

### 4.1.3 Sector Analysis

The regression analysis, shown in Table 3, reveals that both the agriculture and industry sectors did not significantly impact the 2020 per capita growth rates. The charts for the simple linear regression of these two sectors can be found in Appendix - Figure 2 and Appendix - Figure 3. On the other hand, the manufacturing sector contributed positively to GDP per capita growth. The more manufacturing a country had, the higher their GDP during 2020. This relationship allows the interpretation that the manufacturing sector was not

Regression Analysis Sectors of GDP	
<i>Independent Variables</i>	<i>Dependent variable</i>
Sectors, value added (% of GDP)	GDP per capita growth 2020
Agriculture, forestry, and fishing	0.002 (0.006)
Industry (Including construction)	0.001 (0.018)
Manufacturing	0.023** (0.010)
Services	-0.122*** (0.038)
Intercept	0.376* (0.195)
Observations	151
R <sup>2</sup>	0.212
Adjusted R <sup>2</sup>	0.191
Residual Std. Error	0.061 (df = 146)
F Statistic	9.826*** (df = 4; 146)
<i>Significance levels</i>	*p<0.1; **p<0.05; ***p<0.01

*Table 3: GDP per Capita Growth 2020 by Sectors of GDP in 2019 (OLS Regression) (International Monetary Fund, 2021d; The World Bank, 2021b; The World Bank, 2021c; The World Bank, 2021d; The World Bank, 2021k)*

significantly impacted by COVID-19 or at least overcame it faster than other sectors. Per percentage of manufacturing within a country, the economy grew by 0.02 percent. Even though this might seem like a small number, an analysis of the countries with more than 30 percent of their economy in the manufacturing sector shows that these economies could limit their GDP per capita decline to on average -1.42 percent, whilst the other countries declined by -4.9 percent. This development is certainly not only due to the manufacturing sector. However, there clearly is a relationship between higher GDP per capita growth and this sector.

On the opposite, there is a significant negative relationship between the service sector and the GDP per capita of a country. Per percentage of the service sector in the economy, GDP growth decreased by -0.122 percent. As visualised in Figure 5, which depicts the simple linear regression between GDP growth and the service sector, the higher the share of the service sector within an economy, the more severe the impact on GDP growth. In fact, none of the 65 countries that generate more than 58 percent of their



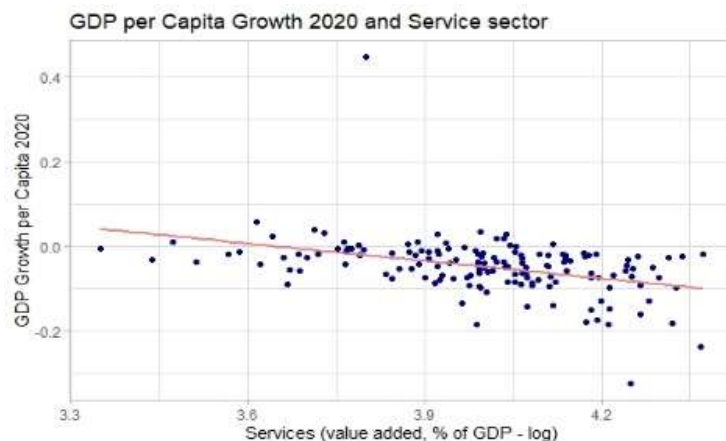


Figure 5: GDP and Service Relationship (OLS Regression)(International Monetary Fund, 2021d; The World Bank, 2021d)

service sector declined only -0.9 percent on average in the same time frame. This difference gets more striking as the percentage of the service sector increases. The 30 countries with a service sector accounting for over 65 percent of GDP experienced a decrease of -9.7 percent. A possible explanation is that the service sector was impacted the most by the COVID-19 restriction measures. These include social distancing as well as reduction of non-essential operations, all impacting the service sector, which is often relying on client contact.

Overall, the model explains about 20 percent of the growth rates per capita ( $R^2=0.212$ ). Therefore, the explanation power of the model is limited, and several other factors impacted GDP growth that are not included in the regression analysis.

GDP through the service sector has achieved a positive per capita growth during the year. Overall, the 109 economies that mainly rely on the service sector (over 50 percent) declined on average by -6.38 percent during the year 2020, whereas the countries (n=42) that relied less on the

## 4.2 GDP and Convergence Forecast Emerging Markets

After looking at the impact of COVID-19 on 2020 growth rates, this section looks at the future of GDP growth between 2020 and 2026. Based on this, the convergence outlook for emerging markets in different regions was analysed for the same period. Additionally, an even longer-term trendline outlook was evaluated.

### 4.2.1 Analysis GDP Forecast

In this section, a GDP forecast is derived from a linear trend model and compared to the forecasts of the IMF during the time from 2019 to 2026. The countries evaluated in the group emerging markets are classified as lower-middle-income and upper-middle-income according to the World Bank country classifications (The World Bank, 2020a). The aggregated values are calculated by using the average values of the countries for the specific year, for example, the average GDP per capita of economies within a region.

First, a trendline was derived by fitting a linear model through the annual real GDP per capita growth values of 2001-2019. This growth trend was extended from 2019 up until 2026. Since this calculation does not consider the decline in GDP growth in 2020 during the COVID-19 pandemic, this trendline is defined as an optimistic estimation of longer-term growth.

Second, a trendline accounting for the COVID-19 effects on growth was derived. The 2019 starting value of the estimation is equal to the value in the optimistic estimation above. However, the GDP per capita growth forecast until 2026 includes the decline of physical capital, labour productivity and labour endowment during the pandemic in 2020. First, the decline in physical capital was calculated by the weakening total investment from 2019-2020 as a share of GDP. Second, the measure for labour endowment is based on the rise in unemployment in 2020 relative to unemployment levels in 2020. Third, labour productivity is affected by the decline in total hours worked by employed workers.

By using the aggregate production function,  $y = f(K_p, K_H, L, A, I)$ , GDP growth is assumed to be a sum of the decline in physical capital, labour productivity and total labour endowment. The calculation measures GDP development if the impact of COVID-19 has a longer-term effect on growth prospects and is a negative estimation of GDP growth. The formula is depicted in Equation 1.

*Equation 1: GDP Decline as Function of Decline in Factors of Production 2020 (Negative Trendline)*

$y = f(K_p = \text{decline in total investment} * \text{investment share of total GDP},$

$A = \text{percentage of working hours lost in 2020 compared to 2019},$

$L = \text{percentage of increase of unemployment in 2020 relative to 2019})$

A visualisation of the two trendlines can be found in Appendix - Figure 5.

The positive and negative trendlines are compared to the IMF forecasts of April 2021, which considers the effect of the COVID-19 pandemic. The IMF uses a different approach to forecast GDP in their world economic outlook database. The estimations are derived by using a bottom-up approach. The individual country teams gather historical data and generate estimations for each country separately. Therefore, the method might differ slightly between each economy (International Monetary Fund, 2021b). The real GDP growth data for the first section was calculated based on the same approach, deriving an optimistic and a pessimistic trendline, which were compared to the IMF forecasts.

However, there are limitations to the linear approach. Both the positive and negative trends assume a linear growth in the potential output, which returns incorrect estimates for a long-run estimate. It omits the short-run fluctuations within a model, and therefore frequently over- or underestimates actual values, which fluctuate more frequently. Additionally, the negative trendline only considers fundamental factors for growth and does not reflect other determinants that impact this measure, such as bankruptcies and effects on education.

### 4.2.2 Results GDP Forecasts

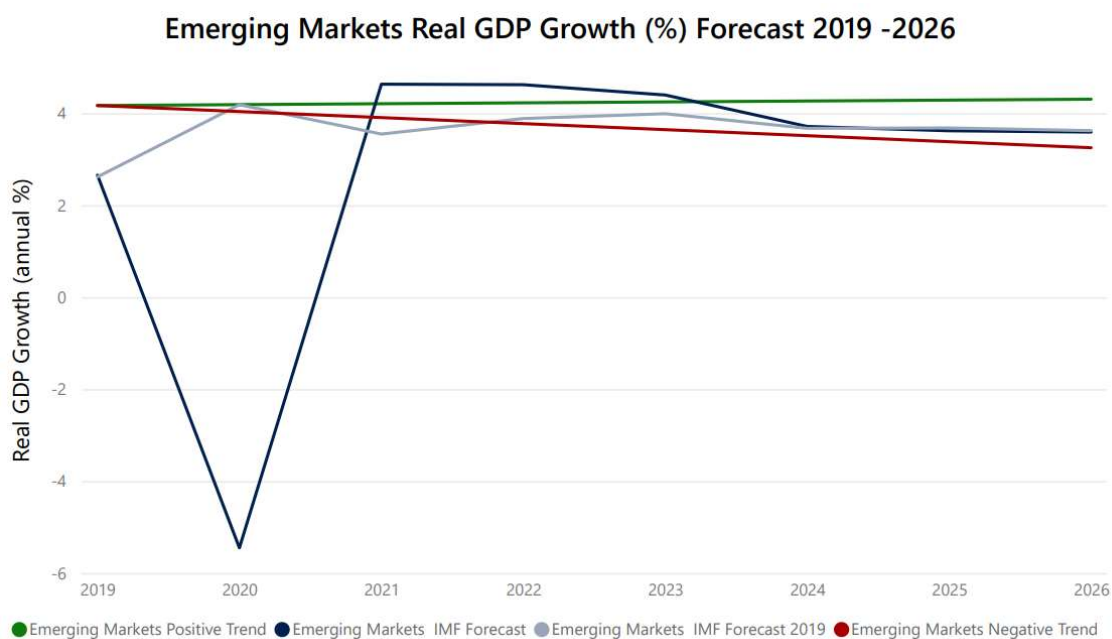


Figure 6: Emerging Markets Real GDP Growth Forecast 2019-2026 (annual %) (International Monetary Fund, 2019b; International Monetary Fund, 2021c)

As shown in Figure 6, without the pandemic's impact, the real GDP growth of aggregate economies is forecasted to grow by about 1.97 percent yearly, starting from a growth of 4.17 percent in 2019. This positive outlook indicates that the growth rate in 2026 amounts to 4.30 percent. On the contrary, if the developments of COVID-19 are considered, and the impacts of lost working hours, unemployment, and decline in investment are expected to continue into the future, growth is expected to decline by -13.11 percent yearly. This indicates a significant slowdown in growth rates, and accordingly, GDP growth in 2026 is forecasted at 3.24 percent, an entire percentage point below the optimistic outlook in the same year.

According to the IMF calculations, the GDP growth of emerging countries did not reach long-term forecasts in 2019. GDP grew at only 2.65 percent during that year compared to the trend forecast of 4.17 percent. In fact, GDP growth lay below the long-term estimation since 2013, which suggests a general deceleration in growth rates, in line with the observations stated in section 3.2.5. However, growth has taken an even more severe hit during 2020, declining by -5.45 percent, a fall from the year before of -8.10 percent. In 2019, the IMF forecasted a renewed acceleration of growth rates of 4.18 percent in 2020, and the pandemic has severely impacted this estimation (International Monetary Fund, 2019a).

Nonetheless, GDP growth is expected to recover as early as 2021, in contrast to the estimations in section 3.4.2.2 and 3.4.3.2. Growth rates in both 2021 and 2022 are estimated to surpass both long-run output and IMF estimates before the pandemic, as illustrated in Figure 6. Growth rates are forecasted at 4.63 and 4.62 percent, respectively, 0.43 percentage points above the optimistic outlook and even 0.73 percent higher than the estimation with COVID-19. According to the current IMF calculations, the fluctuations caused by the pandemic stabilise around 2024, returning to the IMF estimation before the pandemic. However, the longer-term growth rates lie below the long-term GDP growth trendline, signifying a generally slower growth than from 1980 to 2019.

### 4.2.3 Convergence Forecast

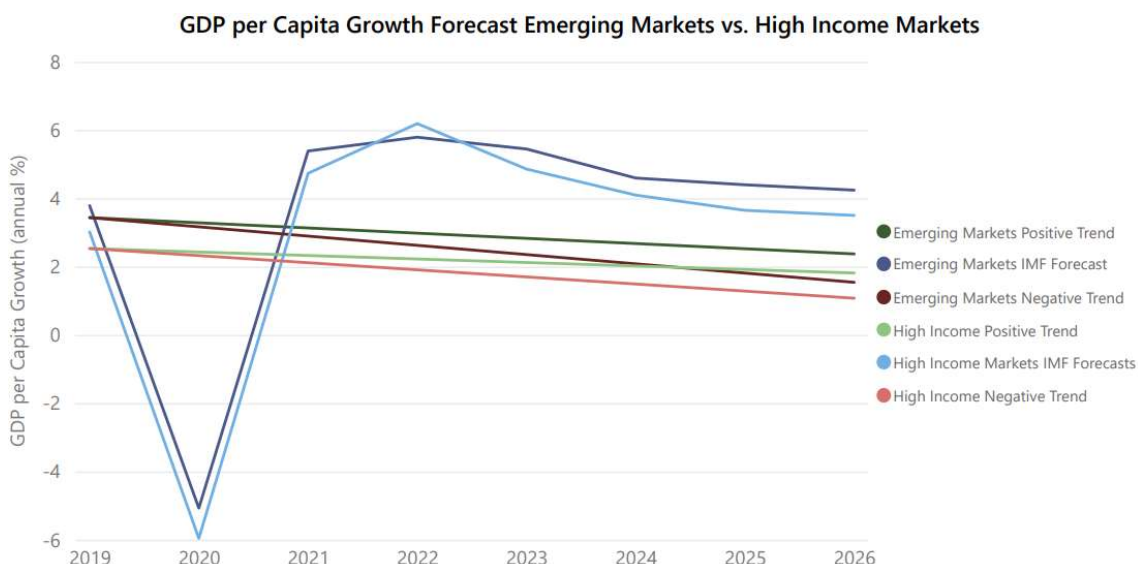


Figure 7: GDP per Capita Growth Forecast, High-Income and Emerging Countries (annual %) (International Monetary Fund, 2021d)

For this analysis, the aggregate growth of GDP per capita of total emerging markets is compared with the aggregate growth of high-income countries of all regions. On the one hand, both the optimistic trendline estimate and the forecast considering COVID-19 are viewed as a longer-term outlook. On the other hand, the IMF forecast is used to analyse short-term convergence over the next few years.

As shown in Figure 7, both high-income and emerging countries have experienced a significant drop in GDP per capita growth during 2020. According to the IMF estimations, high-income GDP growth dropped by -8.98 percent within a year from 2019, declining at -5.96 percent in 2020. This number lies clearly below the long-term growth trendline forecast. However, the growth rates of 2021 and 2022 are higher than estimated

before the pandemic, indicating a recovery of the high-income countries' economies, at rates of 4.73 and 6.18 percent, respectively. This upturn is in line with the expectations of the IMF, World Bank, and OECD. Aggregate GDP per capita growth rates as high as 2022 have not been observed since before the financial crisis. After this initial fast recovery, growth rates are slowing down, with a growth rate of 3.5 percent in 2026. Nonetheless, this is about 1.69 percentage points higher than the positive long-term forecast and 2.43 percentage points above the negative long-term forecast. Over the entire period, between 2020 and 2026, high-income markets' per capita GDP is expected to grow by 3 percent.

First, short-run convergence will be analysed. As shown in Figure 7, even though GDP per capita was impacted severely in 2020, developing countries' GDP declined less severely than high-income countries. This difference suggests that emerging economies have continued their convergence trend, even during the pandemic, but slower than before. However, the advanced economies can boost their recovery again, whilst emerging markets growth is flatter in comparison. In the short run, this will suspend the trend of convergence for overall emerging markets during 2022, as advanced economies grow as much as emerging countries.

After that, the GDP per capita growth rates of high-income countries fall faster but are still significantly over the long-term forecasts. This is similar for emerging markets as well. Therefore, as GDP per capita growth remains at a higher level, the trend of convergence is expected to continue.

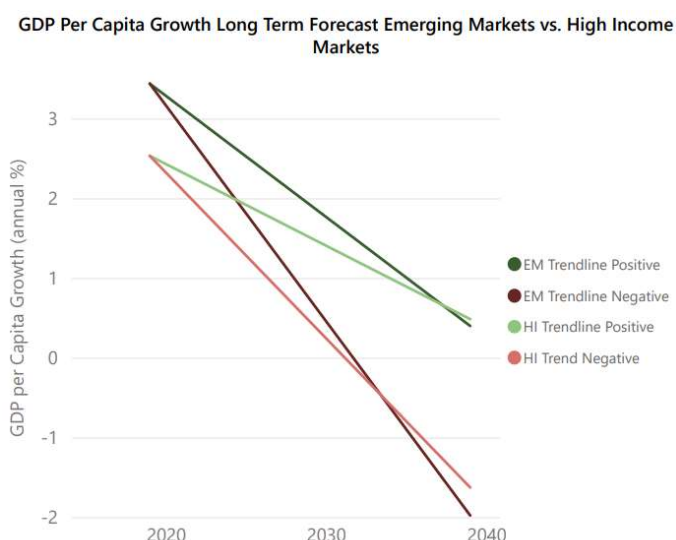


Figure 8: GDP Per Capita Long-Term Trend Forecast (Positive and Negative) (International Monetary Fund, 2021d)

The long-run convergence forecast displayed in Figure 8 shows that both advanced and emerging markets' growth is steadily declining, even in a positive outlook. GDP per capita of emerging economies is decreasing quicker than advanced countries. This development points toward a deceleration in long-term convergence, as the gap in GDP per capita growth is narrowing, prohibiting emerging

countries from outperforming and consequently catching up to advanced economies. On

average, high-income countries GDP per capita decreases by -0.11 percentage points yearly, as opposed to emerging markets, where this number amounts to -0.15 percentage points. If both classifications of countries can return to levels of GDP growth comparable to before COVID-19, the trend of convergence would turn into divergence in the year 2038. Therefore, emerging countries must find other sources to propel growth and sustain higher growth rates or will not reach the same living standards as advanced economies.

If GDP per capita is affected by COVID-19 effects for a longer time, emerging market growth decreases by an additional -0.11 percentage point, while high-income countries are slightly less negatively affected, declining by -0.105 percentage points. In this case, convergence would be even slower. In that case, as GDP per capita declines even faster in emerging countries, divergence would start in 2034.

The scenario where advanced economies can return to the optimistic long-term estimation faster, as projected by the World Bank, OECD, and IMF, due to factors such as a faster vaccination rollout and a more rapid return to total economic activity, would be fatal for the catching up of developing countries. If the emerging countries are trapped in the effects of COVID-19 longer, divergence will approach fast, starting already in 2025. Therefore, international cooperation to support emerging markets and low-income countries is essential to ensure the world population's thriving prosperity and circumvent the last scenario.

### 4.2.4 GDP and Forecast by Region

As the above calculations and explanations are a high-level overview of GDP development and convergence, the calculations for emerging markets were disaggregated to the different emerging market regions. Thereby, an indication of the development of the single regions gives a better idea of the GDP development and convergence for these regions and the countries within them.

#### 4.2.4.1 East Asia and Pacific

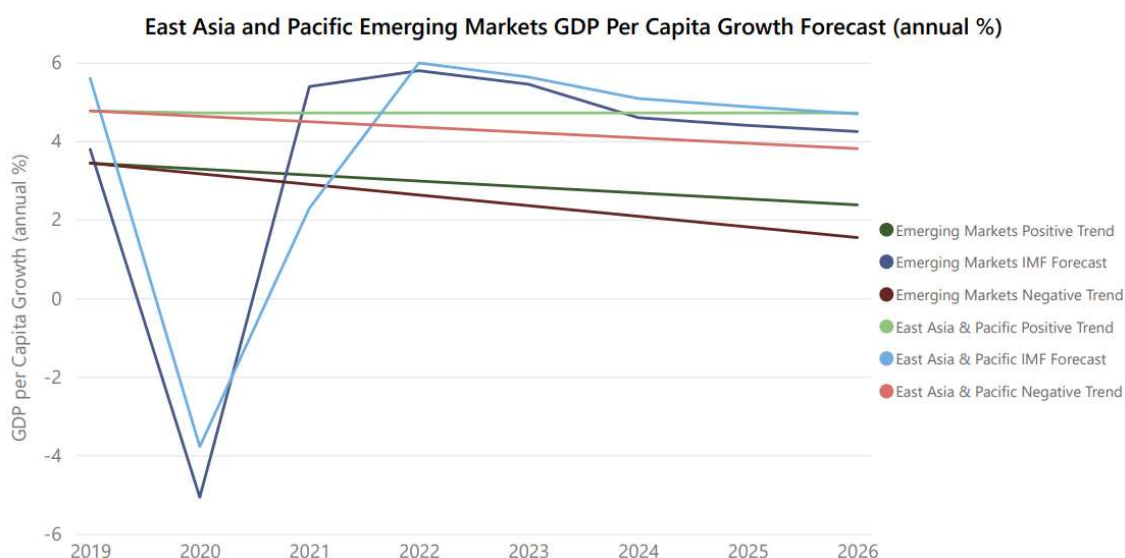


Figure 9: East Asia and Pacific Emerging Markets GDP per Capita Growth Forecast (annual %) (International Monetary Fund, 2021d)

As shown in Figure 9, East Asia and Pacific GDP per capita growth has declined similarly to overall emerging markets (-3.78 percent). However, it takes slightly longer for the region to recover during the following year, catching up to overall emerging countries only in 2022. With a growth of 4.73 percent, advanced economies are quicker to recover than emerging markets with 2.29 percent. This underperformance of the region temporarily halts convergence. It resumes only in 2024, when advanced economies growth slows down, and East Asian and Pacific emerging countries surpass their GDP growth.

This growth is mainly steered by the East Asian countries, namely Vietnam and China, growing on average 7.36 and 7.13 percent between 2020 and 2026. These countries have also been able to sustain positive growth during 2020, albeit their per capita growth amounted to only half their usual growth. Lao People Democratic Republic,



Cambodia, and Indonesia can also return to growth rates of 5 percent during this time, even though they exhibited a negative GDP growth during 2020.

In the long term, GDP per capita growth rates are significantly over total emerging markets and considerably higher than high-income markets. Additionally, the region has not been impacted by COVID-19 as much, shrinking by -0.8 percentage points if the impacts last longer. Overall, the region will continue to converge with developed countries, both in the short-term and longer-term forecast.

#### 4.2.4.2 South Asia

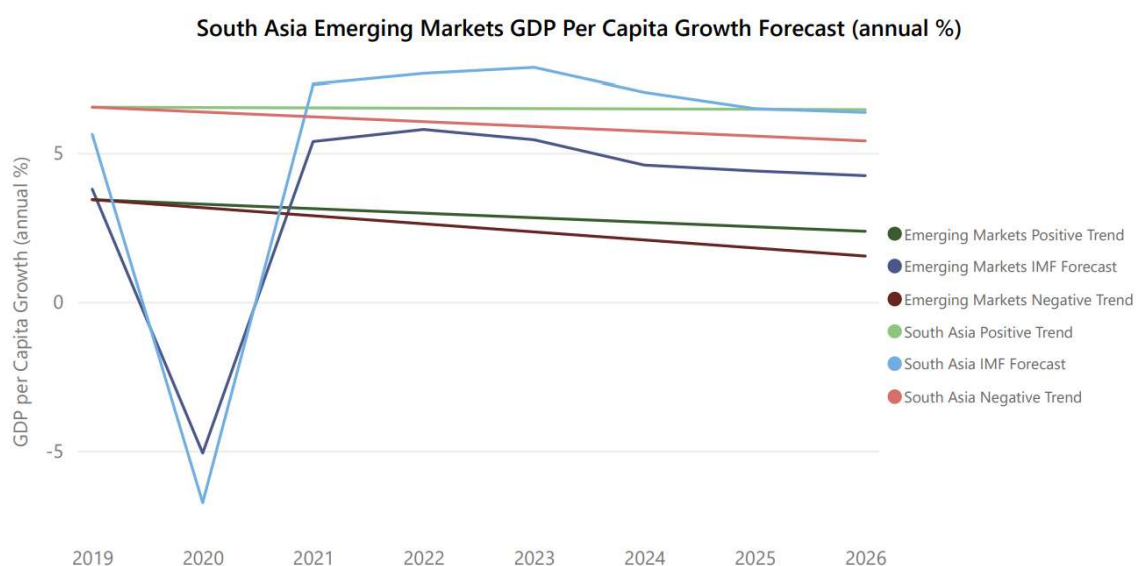


Figure 10: South Asia Emerging Markets GDP per Capita Growth Forecast (annual %)(International Monetary Fund, 2021d)

South Asian emerging markets were affected gravely during 2020, losing -6.73 percent in GDP per capita during the year. This hit is even more severe than in advanced countries. Therefore, the region turned into temporary divergence in 2020 compared to the high-income countries.

As displayed in Figure 10, the countries recover quickly to a high level of GDP per capita growth already in 2021 and sustain this high growth during the following years. In 2021, the average GDP per capita growth amounts to 7.29 percent, driven by exceptionally high growth in India and the Maldives. Until 2026, India will continue to power the region's growth with a mean of 6.54 percent, and is only surpassed by its neighbour Bangladesh, which is forecasted to grow by 7.4 percent. These are the two countries that will drive the recovery. However, the entire region displays a substantial GDP per capita growth.

Consequently, the divergence experienced in 2020 is only a short-term anomaly. After that, the region is forecasted to catch up to advanced economies faster than the average emerging economies. In fact, GDP per capita growth over the entire period of 2020 until 2026 is 1.56 percentage points higher than emerging markets and even 2.13 percentage points higher than high-income economies.

For the long term, the region has had a strong per capita GDP growth over the last twenty years, indicated by the high level of the trendline forecast. Therefore, the economies should also be able to continue their trend of convergence. Even if the growth is impeded by the COVID-19 effects, which amount to -0.14 percent, their high base level of GDP per capita growth ensures the average countries can converge. Nonetheless, COVID-19 should be kept under control to ensure faster convergence. However, especially India has experienced a severe wave of COVID-19 cases in April 2021 (BBC, 2021). This outbreak could further dampen the GDP per capita long-term forecast for the country. If the increase in cases spills over to its neighbouring countries, the entire region will be affected and exhibit lower growth rates than currently forecasted.

#### 4.2.4.3 Europe and Central Asia

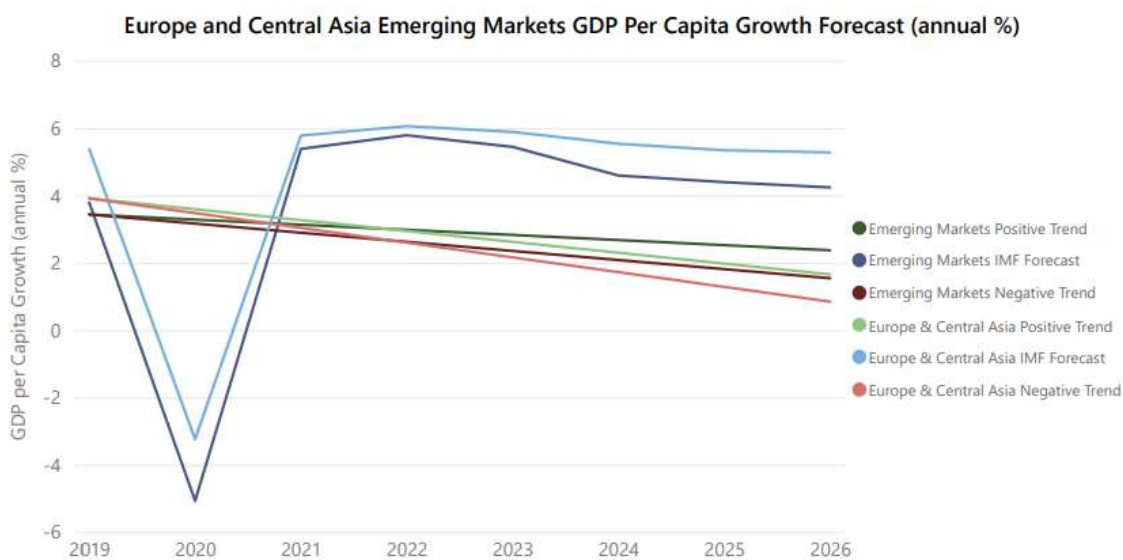


Figure 11: Europe and Central Asia Emerging Markets GDP per Capita Growth Forecast (annual %) (International Monetary Fund, 2021d)

Europe and Central Asian emerging markets have limited their GDP per capita decline during 2020 to -3.7 percent, as displayed in Figure 11. Additionally, the countries can also sustain their higher per capita growth over the next few years, consistently displaying a higher growth rate than other developing countries. Driving countries behind

this development are Eastern and Southern European countries, such as Ukraine, Serbia, Moldova, Bulgaria, and Albania, all achieving an average GDP per capita growth of over 5 percent from 2020-2026. For short-term convergence, these are auspicious numbers, ensuring that the countries can catch up to their developed neighbours.

On the other hand, long-term estimations lie close to the overall emerging markets, and growth rates slow faster than their peers. This points toward a significant slowdown in convergence for the longer term and might even turn into divergence, even if the region can quickly escape the pandemic's longer-term effects and return to optimistic trendline estimations.

#### 4.2.4.4 Middle East and North Africa

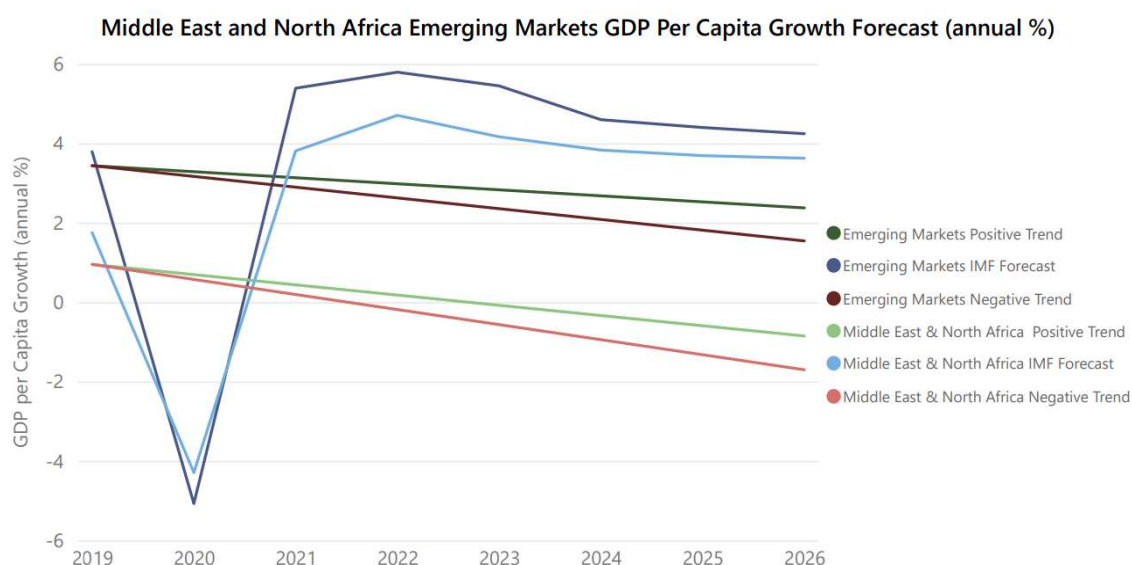


Figure 12: Middle East and North Africa Emerging Markets GDP per Capita Growth Forecast (annual %) (International Monetary Fund, 2021d)

As opposed to the region above, the GDP per capita in the *Middle East and North Africa (MENA)* has started from a lower point in 2019 than in emerging markets. In 2020, the decline in growth could be contained to the rate of overall emerging markets. However, in the future, the growth rates of the Middle East and North African (MENA) emerging markets cannot exceed the average growth of total emerging markets, as seen in Figure 12. Therefore, the region’s average growth is also lower than the per capita growth of developed markets. From 2020 until 2026, the countries grow on average -0.22 percentage points slower than high-income countries and even -0.75 percentage points slower than overall emerging markets.

When comparing the individual countries, only Egypt is able to maintain a growth rate of 4.8 percent, which is comparable to total developing countries. The region has an

average growth of 2.7 percent from 2020 until 2026, with vast differences. Whilst Morocco, Jordan, Iran, and Djibouti are able to sustain an average growth of 3 percent, Tunisia, Algeria, and the West Bank have growth rates below 1.7 percent. Most striking is Algeria, where average growth only amounts to 0.8 percent during that time. In the short term, this does not present a positive outlook on convergence. With growth rates lower than advanced countries, the region will diverge with advanced economies and fall behind its emerging market peers in terms of development. There are differences between the countries, with the countries that are growing higher than three percent being able to keep up with advanced economies, but not with developing markets. Optimism comes only after the year 2025, when GDP per capita surpasses developed markets slightly. If this development can be sustained, there could be some hope for convergence in the future.

However, contradicting this theory, the long-term forecasts for GDP per capita growth are considerably lower than advanced economies. Even though developed countries also have a negative slope in their GDP per capita growth, they can sustain a positive average growth rate until 2026. MENA emerging markets turn into negative growth in 2023 in the long-term optimistic forecast, and under the pandemic's impact even earlier in 2022. The additional strain on growth from COVID-19 amounts to -0.12 percentage points. If growth continues according to the trendline, in 2026, the growth rates amount to -0.85 percent in a positive case and -1.70 percent with the pandemic's impact. Therefore, the outlook that the Middle East and North Africa region is able to start to converge in about five years, as stated in the short-term forecast, is uncertain. Furthermore, this presents a dire outlook for the region's long-term catch-up potential and the region's development in general, as the numbers suggest that the economy is shrinking compared to previous years.

#### 4.2.4.5 Sub-Saharan Africa

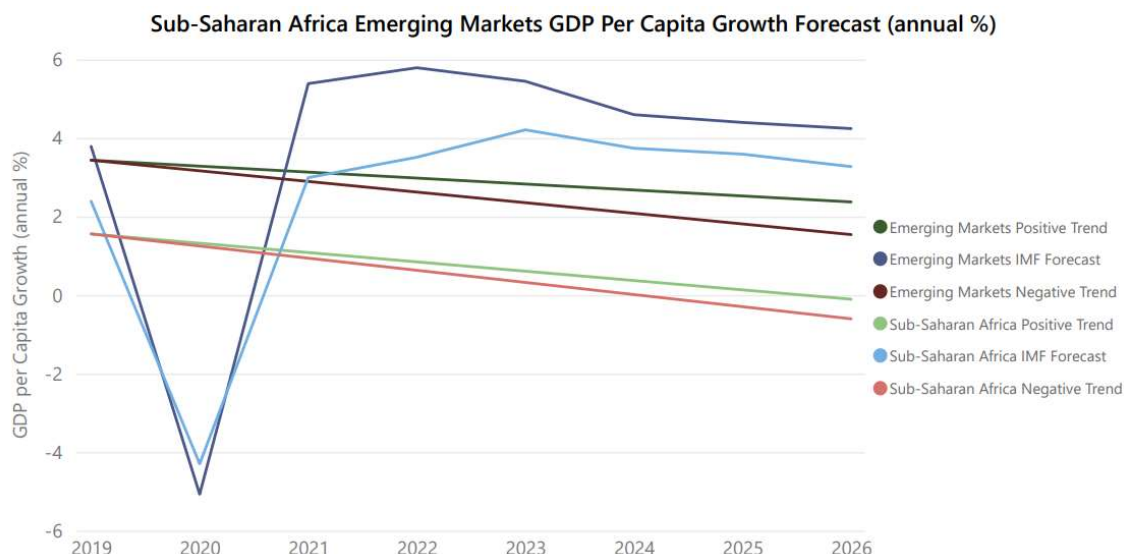


Figure 13: Sub-Saharan Africa Emerging Markets GDP per Capita Growth Forecast (annual %) (International Monetary Fund, 2021d)

As shown in Figure 13, comparable to their neighbouring northern region, Sub-Saharan emerging markets struggle to converge with high-income countries. On the one hand, even though it started with a lower per capita growth in 2019, the region could limit its losses in 2020 and declined less strongly than developed countries and other emerging markets. However, the region's recovery is subdued in the following years, and most countries cannot reach their average GDP per capita growth levels of 2000 until 2019.

On the one hand, Zambia and Equatorial Guinea are forecasted to have a negative average per capita growth between 2020 and 2026. Zambia can return to positive growth rates after 2022, its economy contracting by -0.4 percent on average from 2020 until 2026. More extreme, Equatorial Guinea exhibits negative growth rates until 2026, declining by -3 percent annually.

On the other hand, several countries exhibit above-average growth rates. For example, Senegal and Kenya should grow more than 5 percent annually. Similarly, Ghana, Côte d'Ivoire, and Benin exhibit a per capita growth until 2026 of more than 4 percent. These countries have also significantly limited their losses in growth in 2020, growing slightly or contracting a maximum of -1.1 percent, which lies significantly above the average decline in growth rates of -4 percent. These optimistic forecasts until 2026 will aid their convergence in the short term.

The region grows at about 2 percent annually over the period, more than 1.1 percentage points lower than their peers in emerging economies. This shortfall also signifies a lower growth than advanced countries by 0.58 percentage points, making

catching up difficult. Therefore, over the following years, certainly until 2026, the region will experience a period of divergence, which means the region as a whole will not be able to keep up with global economic development. However, the growth rates are different, which means some countries will diverge more significantly, whilst others with above-average growth rates can sustain the convergence status.

In the long term, the calculations look similar. The long-term trendlines lie below the growth rates of emerging markets and, more importantly, below advanced countries. Even though the Sub-Saharan emerging markets were not impacted as drastically by COVID-19, an effect of -0.7 percentage points on productivity factors, which is lower than other regions, the countries generally exhibit low growth levels, even in positive development. This means that if growth rates continue along with the development of the past twenty years, convergence will be complicated to achieve in the longer term, leaving the region behind other emerging markets.

#### 4.2.4.6 Latin America and the Caribbean

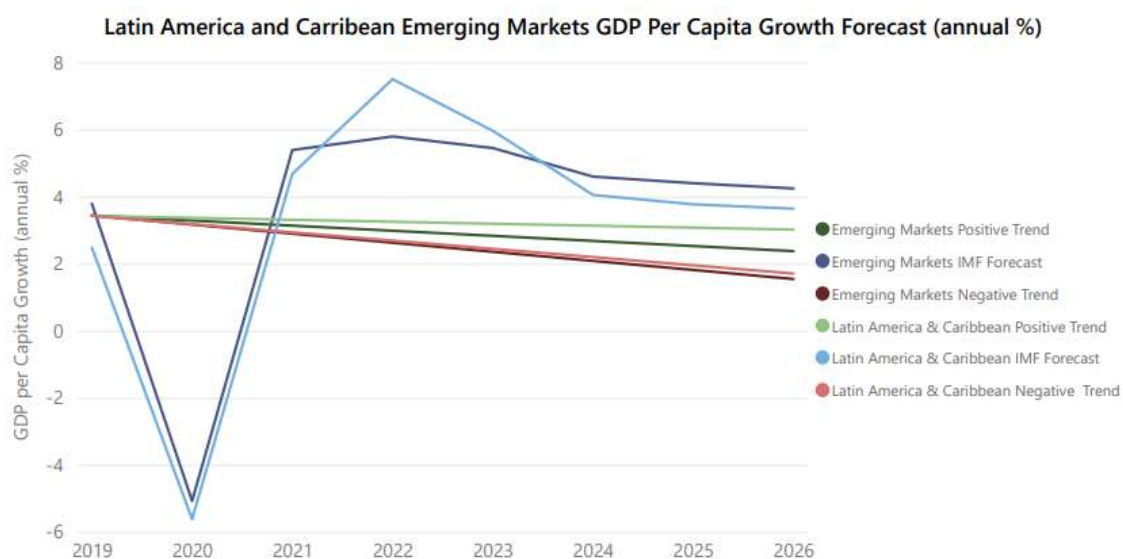


Figure 14: Latin America and Caribbean GDP Per Capita Growth Forecast (annual %) (International Monetary Fund, 2021d)

Lastly, the region of Latin American and Caribbean emerging markets experienced a significant plunge in growth rates during 2020. However, they should achieve a fast recovery during the year 2021, growing at 4.6 percent, especially during 2022, when the region is forecasted to grow at an extraordinary rate of 7.5 percent, as shown in Figure 14. A per capita growth this high was not achieved in the period observed between 1995 until 2019.

After that, this fast recovery is decelerating, with growth returning to its long-term average of about 3.6 percent. Nevertheless, there are vast differences between the different countries. On the one hand, Suriname experienced an inbreak of -13 percent in growth rates during 2020, and even though the country is returning to positive growth the following year, it will not be able to recover enough to return to overall positive growth until 2026. The country's average growth rate is forecasted at -0.02 percent. Therefore, the country's setback during the pandemic will have long-lasting impacts on the future. On the other hand, Guyana can grow an extraordinary 22 percent between 2020 and 2026, more than doubling its GDP per capita PPP of 19,683.73 in 2020 to 53,132.15 in 2026.

If Guyana is taken out of the estimations, the growth outlook for the region is bleaker. The decrease in GDP during 2020 is more severe at -8.01 percent, and recovery is also slower during the following years, averaging only at 4.2 percent compared to 4.9 percent including Guyana. Overall, the region without Guyana, on average, is trailing the growth of advanced countries, keeping up but not converging their growth rates in the short term. The region is growing about 0.5 percent lower than the advanced economies it should be catching up to.

According to the longer-term forecast, however, Latin America and the Caribbean have a more positive outlook on convergence. Its positive trendline is more favourable than overall emerging markets growth, indicating a return to convergence over the longer term. However, the region has been impacted strongly by COVID-19, as seen above. If this negative impact by the pandemic, which lies at 0.12 percentage points, persists, the forecast for convergence is less promising. The region would experience a similar development as overall emerging markets, which turn into a slight divergence in the year 2024. Therefore, the region's future depends on the speed at which the countries can return to pre-pandemic growth levels. According to the IMF forecast, this outlook is relatively subdued and will lie between the positive and the negative trendline.

### 4.2.5 Overall Convergence Outlook by Region

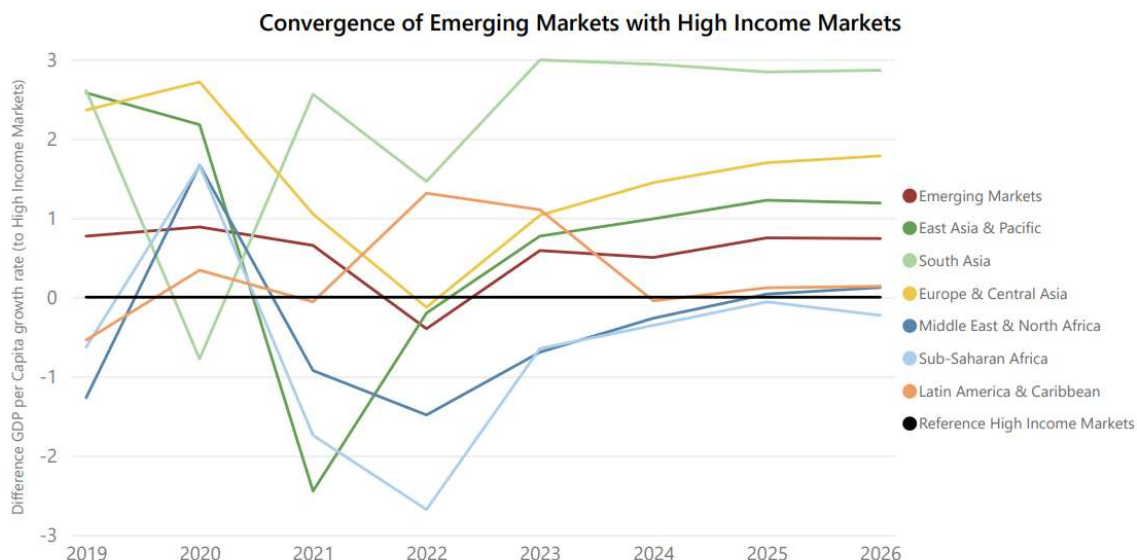


Figure 15: Convergence of Emerging Markets with High-Income Countries (International Monetary Fund, 2021d)

In the short term, between 2020 and 2022, there is a lot of volatility in emerging markets per capita growth rate compared to advanced economies, as shown in Figure 15. Several regions outperformed high-income markets in 2020, such as the Middle East and North Africa, Sub-Saharan Africa and East Asia and the Pacific. However, these regions then take a longer time recovering from the COVID-19 impacts than their wealthier counterparts. On the other hand, the volatility of per capita growth rates or the decline that a country or a region suffered during 2020 is no indication of their possibility to converge. For example, regions impacted more heavily, such as South Asian emerging markets, should rebound quickly and demonstrate above-average growth rates for the coming years.

In general, most emerging countries exhibit at least one year where their growth rates fall behind advanced countries. Therefore, during that time, countries turn into a short, temporary divergence. After these first years of turbulent growth rates, the regions show a trend of growing GDP per capita rates compared to high-income countries. On the one hand, especially the Asian regions, along with Europe, can significantly outperform their peers and advanced economies. On the other hand, even though their growth rates are growing closer to converging towards 2024, the two African regions, including the Middle East, will have a more extended period of divergence, struggling to keep up with advanced economies, let alone grow faster. Lastly, Latin America and the Caribbean can outpace advanced economies in 2022 and 2023. However, they lose ground after 2024



and exhibit growth rates per capita similar to high-income countries. Therefore, measures supporting the development of emerging markets, such as microfinance loans or financial aid, should be targeted at these regions to bolster their growth rates and aid them in advancing their economies.

Overall, total emerging markets should circumvent the negative outlook where they suffer the same decline in GDP per capita as during 2020 and advanced economies return to their long-term forecast. Over the period 2020-2026, developing economies are on average growing 0.53 percentage points faster than the developed world, slowly but steadily advancing their GDP per capita closer to levels of advanced economies. Hypothetically, if emerging markets continue to grow 0.53 percentage points over the rate of advanced economies, they will on average need 271 years to converge to the same GDP per capita levels. This calculation uses the 2020 average GDP per capita of emerging countries of 10,639.76 GDP PPP and 44,569.63 GDP PPP in advanced economies. Indeed, this is a highly generalised calculation. However, it shows the magnitude of convergence that still needs to be achieved to ensure that emerging economies have the same living standards as advanced countries in the future.

### 4.3 COVID-19 Impacts on Factors of Production 2020

In this section, the impact of COVID-19 on the factors of production is monitored. It was analysed whether the negative development of these factors has an impact on future growth rates.

#### 4.3.1 Analysis Impacts of Factors of Production

In this section, the relation between GDP growth in 2021 and the different impacts of COVID-19 is analysed. The direct impact of the virus will be measured by comparing GDP per capita growth data of the IMF per country to percentage changes in factors of production or measures that determine the government intervention into public life, which in turn restricted economic activity. First, the extent of the different measures was evaluated for both emerging markets and high-income countries.

The dependent variable is GDP per capita growth in 2021, with independent variables being total investment decline, school closure, unemployment growth, labour productivity decline, total stringency index as well as economic support, and COVID-19 cases per million, which are all continuous variables. The only discrete variable is the country classification, which either takes the value of 1 if the country is an emerging market or 0 if the country is a high-income market. The regression coefficients between the different measures were determined to analyse the relationship with GDP per capita in 2021.

The variables that were not already denoted as a growth term were transformed into a log form to analyse the impact of a change of 1 percent in a factor of production on the GDP growth rate (log-log regression, see Section 4.1.1). This includes the total stringency index, economic support index, school closures, and COVID-19 cases per million. The other variables, investment decline, labour productivity decline, and employment decline, were already represented as growth terms and were therefore not changed. Unemployment growth is expressed as a negative growth term to be able to compare the term to the other impacts and therefore expresses employment decline. The formula used can be found in Equation 2.

*Equation 2: OLS Regression GDP per Capita Growth by the Decline of Factors of Production 2020*

$  \begin{aligned}  \text{GDP per Capita Growth 2021} = & \beta_{\text{Total Investment decline 2020}} + \beta_{\text{labour productivity decline 2020}} \\  & \beta_{\text{Unemployment growth}} + \beta_{\log(\text{Total Stringency Index})} + \\  \alpha + & \beta_{\log(\text{Economic Support})} + \beta_{\log(\text{Instruction days})} + \\  & \beta_{\log(\text{Covid Cases per Million})} + \\  & \beta_{\text{country classification (Emerging markets=1, High income=0)}}  \end{aligned}  $	<p>                     K<sub>p</sub>= Total Investment Decline                      K<sub>H</sub>= School closure                      L= Unemployment Growth                      A=Labour Productivity decline                      I= Stringency Index &amp; Economic Support                      Covid-19 Cases per Million                 </p>
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For the first factor of production, capital accumulation, the measure “total investment (as % of GDP) decline” was used, based on IMF data. The decline in the investment level between 2020-2019 was calculated (International Monetary Fund, 2021f). Labour productivity decline is defined by the annual percentage of working hours lost during the year of the pandemic (compared to the last pre-crisis quarter, the fourth quarter of 2019), as estimated by the international labour organisation. However, the organisation hedges their forecasts by stating that relevant data is scarce and estimates are subject to substantial uncertainty (International Labor Organization, 2021). Unemployment growth was derived from the World Bank database and is a modelled estimate (The World Bank, 2021).

For the next factor, restrictions due to the pandemic, the University of Oxford developed the stringency index, which considers a wide range of measures that a country’s government imposes in response to the COVID-19 outbreak (Angrist et al. 2021a). The data from 20 separately evaluated measures are aggregated into four indices, ranging from 1 to 100 depending on the level of government restriction. The four indices are an overall government response index, a containment and health index, which measures lockdown restrictions and testing policy, an economic support index, and strictness of lockdown (Angrist et al., 2021a). As the data is updated frequently, the index was averaged for 2020 to measure the stringency during the entire year. The economic support index is measured as part of the stringency index and includes debt relief and income support (Angrist et al., 2021b). Equal to the total stringency index, data used to analyse is an average of 2020 data.

Furthermore, school closure was derived from the UNICEF School Closures database (UNICEF, 2021). The percentage of days the schools were closed was calculated to compare different countries. As nations usually have a different amount of instruction days, this calculation allows to gauge the relative effect. Therefore, the number of days that the schools were fully closed were divided by the number of typical instruction days. Lastly, the total COVID-19 cases per million as of 31 December 2020 were used to estimate the magnitude of the pandemic in different countries (Appel et al., 2021a).

### **4.3.2 Results Impacts of Factors of Production**

COVID-19 has impacted all factors of production negatively during 2020. First, total investment declined by -4.01 percent during 2020. The deterioration was worse in

developed economies, with -4.57 percent compared to emerging countries, where total investment declined only by -3.7 percent.

For the factor labour productivity, this measure decreased by -9.5 percent during 2020. In high-income countries, this number amounted to -8.61 percent, compared to -10.24 percent in developing economies. The observation could be explained by the higher possibility of working from home in more advanced countries, whereas infrastructure to accommodate remote working lacks more in emerging economies. Additionally, unemployment has risen by 1.3 percent during the year, which is, as observed by the IMF, a relatively moderate number given the fall in GDP during 2020. High-income economies have been impacted slightly more, with an unemployment growth of 1.64 percent, and in emerging markets, this number amounted to 1.08 percent. However, countries with a high labour productivity decline also had a significant decline in employment, as the correlation coefficient of the two measures is 0.57. Additionally, countries with more COVID-19 cases and countries with a higher stringency had a more substantial decline in labour productivity and employment (Appendix - Table 3).

Next, the government restrictions on the economy were observed. First, the total stringency index of governments amounted to 52.29 on average. In emerging countries, this was slightly higher with an index of 54.17, as opposed to high-income countries with 49.64. The economic support provided was higher in advanced economies, where the index for debt relief and life support was on average 54.19 percent over the year. In comparison, emerging countries' governments support averaged 36.93, resulting in an average of 44.08. These numbers correlate with the IMF observation that stated that advanced economies received more substantial fiscal support.

Furthermore, the average time the schools were fully closed compared to the typical school year was 46.24 percent, almost half of a school year. Emerging markets closed their schools slightly more often, with schools closed 52.03 percent of the normal instruction days. In comparison, high-income countries closed their schools 38.12 percent of the time.

A striking difference can be seen in the COVID-19 cases per millions of people in a country. As of 31 December 2020, worldwide, there were 18,319.66 infections in a million people. This number is significantly higher in high-income markets, where on average, 29,112 people were infected. In contrast, emerging markets populations were affected less severely, with 10,674.5 cases per million. The COVID-19 cases per million correlated with both the stringency index (0.23) and the school closures (0.33), indicating

that countries that were impacted more significantly by COVID-19 had more stringent government measures in place and closed schools more readily.

Regression 2021 by Impact COVID on Factors of Production 2020	
Dependent variable: GDP per Capita Growth 2021	
Country Classification	0.0004 (0.008)
2020 Total Investment Decline	0.041 (0.035)
Labour Productivity Decline	-0.097 (0.094)
Unemployment Growth	0.121 (0.291)
Total Stringency index	0.013 (0.023)
Economic Support (Institutions)	0.014 ** (0.007)
School closure	-0.009 (0.006)
COVID Cases per million	0.001 (0.002)
Constant	-0.074 (0.097)
Observations	113
R <sup>2</sup>	0.111
Adjusted R <sup>2</sup>	0.042
Residual Std. Error	0.029 (df = 104)
F Statistic	1.615 (df = 8; 104)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 4: GDP per Capita Growth 2021 by Factors of Production Impact 2020 (OLS Regression) (Angrist, et al., 2021a; Angrist, et al., 2021b; Appel, et al., 2021a; International Labor Organization, 2021; International Monetary Fund, 2021d; International Monetary Fund, 2021e; International Monetary Fund, 2021f; UNICEF, 2021)

growth rates in 2021 is the economic support provided through income support and debt relief. Per percent more debt relief provided, GDP is growing 0.014 percent more. Additionally, emerging markets are able to profit more from containment measures during 2020, as these countries showed a stronger relationship with GDP growth, as seen in Appendix - Table 4. In the longer term, countries with a decline in total investment during 2020 have a more significant recovery of 2026 GDP per capita growth, shown in Appendix - Table 5.

As shown in Table 4, GDP per capita in 2021 is hardly impacted by the shocks to the factors of production in physical and human capital, or the containment measures imposed by the government. Most independent variables have no significant relationship with GDP per capita growth in 2021, including the total investment decline during 2020, the decline in labour productivity, and unemployment growth. These non-significant variables also include the government restrictions (Stringency index) and the impact on education (Instruction days). A possible explanation is that the forecasted GDP per capita is expected to recover quickly, and therefore these factors are not weighing down on the recovery rates. Additionally, these observations do not differ between high-income and emerging markets, as the country classification variable does not have a significant p-value.

The one measure that influences

#### **4.4 Existing Levels of Factors of Production**

After analysing the impacts that the negative development of factors of production have on future growth rates, it will be gauged which factors of production are crucial to help economies regain sustained economic growth in the future. This evaluation is conducted using the absolute levels of the production factors in 2019, before the pandemic started, in contrast with the analysis of the relative decline of the factors during 2020 in section 4.3.

##### **4.4.1 Analysis Level of Factors of Production**

An OLS Regression analysis was carried out to analyse the relationship between the different levels of the factors of production and the GDP per capita growth in the future, namely in the near term after the pandemic in 2021 and further along in 2026.

There are several regressions. The dependent variable is either the GDP per capita growth in 2021 or 2026 and is labelled accordingly. All independent variables are continuous, except for the country classification, which takes either the value of one for emerging markets or zero for high-income markets. Therefore, this is a discrete variable used to distinguish whether the regression coefficient differs depending on the country classification.

First of all, to evaluate whether emerging markets are converging with advanced economies during the year analysed, the GDP per capita level in 2000 was included in the calculation (International Monetary Fund, 2021g). The expectation for convergence is a negative and significant beta since this indicates that more prosperous countries in 2000 now exhibit lower growth rates.

Furthermore, the other independent variables have been chosen to represent the factors of production according to the Solow Model, as shown in Section 3.2.3. The factor physical capital is represented by the variable total investment as a percent of GDP. It is stated as a ratio of total investment in current local currency and GDP in local currency (International Monetary Fund, 2021f). Furthermore, the variable labour is measured in employment rate, which was calculated by subtracting the percentage of unemployment relative to the total labour force within a country from 100 (International Monetary Fund, 2021e). This calculation results in the rate of total employment relative to the labour force.

Additionally, to determine the size of the labour force relative to other age groups, the data for population share that is working age is used (The World Bank, 2021e). For the following independent variable, human capital, the education index compiled by the UNESCO Institute for Statistics was used. This represented an average of mean years of

schooling for adults and expected years of schooling for children, represented as an index obtained compared to the maximum achievement possible (UNESCO Institute for Statistics, 2020). Lastly, to measure institutions, the estimations of the World Bank for the government effectiveness, the rule of law, control of corruption, and regulatory quality were compiled and averaged for each country to receive one indicator representing the institutions within that economy (The World Bank, 2021g; The World Bank, 2021h; The World Bank, 2021i; The World Bank, 2021j).

To exclude causation errors, all data for the independent variables are sourced from 2019. This allows the analysis of which factor of production is most crucial to overcome the pandemic. Additionally, to draw a conclusion of how a change of 1 percent in the independent variable affects the GDP per capita growth in percent, the independent variables are measured as a logarithm (log-log regression, see section 4.1.1). The formula for the regression is shown in Equation 3.

*Equation 3: OLS Regression GDP per Capita Growth by Factors of Production Levels 2019*

$  \begin{aligned}  &GDP \text{ per capita growth } 2021 / 2026 = \\  &\alpha + \beta_{\log(GDP \text{ growth } 2000)} + \beta_{\log \text{ total investment}} + \\  &\beta_{\log \text{ rate of employment}} + \beta_{\log \text{ population share working age}} + \\  &\beta_{\log \text{ Education level}} + \beta_{\log \text{ institution level}} + \\  &\beta_{\text{country classification (Emerging markets=1, High income=0)}}  \end{aligned}  $	<p>K<sub>P</sub>= Total Investment                  K<sub>H</sub>= Education index                  L = Rate of employment                  &amp;Population Share Working Age                  I = Mean of Institution indicator</p>
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As the last step, interaction variables are introduced into the model to view the impact of the independent variables specifically on emerging markets. As an example of how the interaction variables were calculated, the total investment is used. The value for the factor country classification is 0 if the country is a high-income market and 1 if the country is an emerging market. This variable "country classification" is then multiplied with the factor "total investment", which means only the emerging markets have a value in the interaction term. The interaction term is helpful to test the hypothesis that there is a different relation between the independent variables, such as total investment with high-income markets compared to emerging markets.

Some factors were excluded from the analysis. Most importantly, as the analysis focuses on high-income and emerging markets, 28 low-income markets were excluded. Furthermore, countries where information was lacking, such as no data for GDP per capita or the independent variables, were not considered in the analysis. Therefore, the total number of countries evaluated amounts to 137. During the analysis, non-significant factors with a p-value under 0.1 will only be discussed briefly, as they are assumed not to impact the dependent variable, GDP per capita, significantly.

#### 4.4.2 Results Level of Factors of Production

The level of factors of production was different between high-income economies and emerging markets. First, the total investment level is an average of 25.73 percent of GDP across all countries. In emerging markets, this is actually higher with 26.79 percent of GDP, compared to high-income economies with 23.95 percent. In contrast, unemployment is lower in advanced economies. The rate of people in employment, as a percentage of the total workforce, amounts to 94.77 percent in these nations. In emerging economies, unemployment is more widespread, with 91.84 percent of people in employment.

High-income countries have a higher share of working-age population with 66.59 percent of the total population, compared to developing economies with 64.19 percent. Since the population in emerging markets is generally younger, this observation might be surprising. When taking a closer look, emerging markets have a younger population indeed, but a significant share (29 percent of the population) is aged between 0-14, and only 7 percent of people are over 65 (Appendix - Figure 9). In advanced economies, these ratios amount to 18 percent of children and 15 percent of the population being older than 65 (Appendix - Figure 8). Therefore, at the moment, the high-income economies still have a higher share of people of working age.

Additionally, more prosperous economies have a significantly higher level of mean years of schooling and expected years of schooling, amounting to an average index of 84.25. The overall average is 71.16, and emerging markets only have an index of 63.34. This value also correlates with a country's institutions, as these two factors have a significant correlation coefficient of 0.63. Resultingly, countries with better government institutions also have a better education system, which is a coherent conclusion based on the fact that the government authorities primarily oversee education. When considering institutions only, the average level of the index amounts to 2.2. High-income economies have stronger governance, with an average of 3.12, whereas emerging markets only have an index of 1.64 as of 2019. This points towards weaker government effectiveness, rule of law, regulatory quality, and control of corruption in these countries.



The regression analysis of 2021 is displayed in Table 5. The results for the same regression for the year 2026 can be found in Appendix - Table 9.

The emerging countries slope for per capita growth is -0.052 percent lower than for high-income countries in 2021. Accordingly, convergence is temporarily offset, as countries with a higher real GDP in 2000 have a higher GDP per capita growth in 2021. However, as seen in Appendix - Table 9, this observation is reversed in 2026. Nations with a higher GDP level in 2000 exhibit a lower growth in 2026 ( $\beta = -0.014$ ), which indicates that emerging countries can return to catching up to advanced economies.

Variables that had a significant positive interaction with GDP per capita 2021 include the level of total investment, where a 1 percent higher level of investment impacts GDP growth by 0.094 percent. The impact of these levels is even higher in the long term, as in 2026, a 1 percent increase results in 0.014 percent higher growth. The other significant variable is the level of education in 2019, where the relation of a 1 percent higher level amounts to a higher growth of 0.11 percent within a country in 2021. It will also continue to positively impact GDP per capita growth in the year 2026 of 0.02 percent.

In contrast, the levels of institution and the employment rate within a country have a significant negative impact on GDP growth. First, per percentage of people employed compared to the overall working-age population, GDP declines by -0.275 percent, which is a significant impact. A possible explanation is that countries with a high level of employment in 2019 had a higher surge in unemployment during the year 2020 and will

2021 Regression Level Factors of Production 2019	
	<i>Dependent variable:</i>
	2021
GDP per Capita 2000	0.026** (0.012)
Total Investment	0.094*** (0.021)
Rate of Employment	-0.275** (0.117)
Working Age Population Share	0.079 (0.099)
Education	0.113** (0.047)
Institution	-0.190*** (0.020)
Country Classification	-0.052** (0.026)
Constant	0.175 (0.148)
Observations	132
R <sup>2</sup>	0.613
Adjusted R <sup>2</sup>	0.591
Residual Std. Error	0.074 (df = 124)
F Statistic	28.049*** (df = 7; 124)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 5: GDP per Capita Growth 2021 by Factors of Production in 2019 (OLS Regression) (International Monetary Fund, 2021d; International Monetary Fund, 2021e; International Monetary Fund, 2021f; International Monetary Fund, 2021g; The World Bank, 2021e; The World Bank, 2021g; The World Bank, 2021h; The World Bank, 2021i; The World Bank, 2021j; UNESCO Institute for Statistics, 2020)

therefore grow less than countries that did not. There seems to be some validity to this assumption, as the two variables, the employment rate in 2019 and unemployment growth in 2020, have a correlation coefficient of 0.07. However, this would need further research. Additionally, the impact of this variable subsides, as the rate of employment does not have a significant impact on growth expectations for 2026.

Second, the finding that the level of institution has a negative relationship with GDP per capita growth in 2021 is surprising. This variable impacts growth by -0.19 percent per percentage increase in the index of institution. In contrast, the IMF, World Bank, and OECD highlighted that the reason for the milder effect on the economy during 2020 was the strong government support. In 2026, this observation reverses as better institutions positively impact growth, which is more in line with expectations ( $\beta = 0.008$ ).

## V Conclusion

The thesis intended to discuss the impact of COVID-19 on developing countries and their possibility to converge with advanced economies.

Although forecasts before the pandemic already pointed towards slower development of GDP growth in the next decade, the impact of the crisis was severe. A similar development was not seen in the last twenty years, not even during the World Financial Crisis. In 2020, most countries experienced a decline in GDP per capita, with growth in all world regions developing negatively. Nonetheless, this decrease in productivity could have been a lot worse, as the governments' fiscal support prevented graver outcomes.

On the one hand, the service sector reduced growth during 2020, possibly since the activity in the sector was restricted the most by containment measures compared to other sectors. On the other hand, countries with a higher share in manufacturing experienced a less severe decline in GDP growth as this sector of the economy positively affected growth.

When looking into the future, the pandemic was damaging for convergence in the short term, even though the outlook on catching up was uncertain before COVID-19. The growth of advanced economies is expected to recuperate during 2021 due to vaccination programmes and additional fiscal support. Furthermore, the accumulated savings could further support this development. In contrast, even though overall growth rates of emerging economies recover in 2021, each emerging market region will experience at least one year of divergence compared to high-income countries between 2020 and 2022.

However, there are decisive differences between regions. Whilst South Asian emerging markets experienced the worst decline in growth during 2020, the region recovers quickly and can catch up significantly. In contrast, East Asia and the Pacific outperformed high-income economies in 2020 but are slower to recover and continue their convergence trend only in 2023. Similarly, Europe and Central Asian emerging economies experienced a short divergence period in 2022 but can afterwards return to grow faster than advanced economies. Latin America and the Caribbean display the opposite development, with better recovery in 2022 and 2023 but returning to growth rates similar to high-income countries afterwards. Struggling the most with convergence are certainly the regions Middle East and North Africa, and Sub-Saharan Africa. Whilst they declined less severely than other emerging countries in 2020, they consistently underperform high-income economies from 2021 to 2026 and do not show favourable

growth rates in the long-term forecast. These estimations are based on current IMF forecasts, which are optimistic outlooks for global economic growth.

However, if emerging countries are affected longer by COVID-19 impacts, the outlook for catching up is more critical. The worst-case scenario for global convergence is advanced economies returning to normal growth rates quickly and developing economies being impacted by the pandemic longer with lower growth rates. In this case, most regions fall into divergence, as overall emerging markets would reach this point in 2024.

An indication that emerging markets can avoid this scenario is the limited relationship between the decline of production factors in 2020 and the future growth prospects. This result suggests that the pandemic will have limited impacts on per capita growth in the future, which is good news for both advanced economies and especially emerging countries. Therefore, the worst-case scenario for long-term convergence is less likely. Nonetheless, emerging countries need to find new sources of sustained growth. If the growth rates of developing economies progress according to the overall long-term trend forecast, their growth rates decline faster than high-income countries and turn into divergence in 2038.

To achieve a higher per capita GDP growth, a focus must be put on production factors that significantly support future growth. The investment in physical and human capital is crucial, and in the longer term, effective institutions are also important. Therefore, it is suggested to prioritise advancing the rule of law, government effectiveness, regulatory quality, and control of corruption within a country, to improve institutions and consequently attract higher levels of investment. Additionally, the availability and quality of education need to be enhanced to ensure a knowledgeable workforce within a country, which is essential for catching up in the longer term. In the short term, economic support does limit the impact of the pandemic and should therefore be continued.

Therefore, to ensure the prosperity and advancement of living standards in emerging countries, the measures suggested even before the crisis, such as investment into education and the health system, are certainly reasonable to pursue further. Additionally, to offset the pandemic's impacts faster, a priority should be to ensure that developing countries support their economies through fiscal measures. Another crucial factor is the quick distribution of vaccines worldwide, not just in advanced economies, as the World Bank, IMF, and OECD recommended. Through vaccination, the pandemic can

be reined in and its long-term impact limited, which benefits the entire world's economy and highlights the importance of international collaboration.

### 5.1 Limitations

The research faced several limitations. One limitation lies in the differentiation between economic growth and economic development, explained in section 3.2.2. This thesis uses GDP per capita growth to analyse economic well-being, which is a limited view on total economic development. Economic advancement needs to benefit the country's whole population, which can not only be measured by economic growth.

Furthermore, it must be noted that the forecasting method is only one possible outcome and relies on calculations by the IMF for past trends for the long-term estimations. Therefore, unforeseen factors or events which may drastically turn events in the future cannot be included. Additionally, a trend analysis using past values neglects the short-term fluctuations that GDP exhibits. Accordingly, it is an estimation and not a precise forecast of future GDP per capita growth.

Additionally, the data of GDP 2021-2026 derived from the IMF is an approximate forecast composed by its individual country officers. Therefore, the estimation approach used by these separate teams might differ slightly. Furthermore, the IMF is more optimistic in projecting global growth. Compared to the World Bank, the IMF calculations are 1.2 percent more optimistic for aggregate global GDP growth and expect 0.12 percent more growth than the OECD. Consequently, if the economy takes longer to recover, the IMF has most likely overstated growth figures.

Another limitation of the analysis is that the models cannot wholly explain the global growth (as explained by  $R^2$  of the OLS Regression). This observation is also a limitation of the Solow Model, as explained in Section 3.3.3. Therefore, other variables that were not included in the model can impact countries' GDP per capita growth.

## 5.2 Further Research

To fully comprehend the challenges faced by emerging markets and assess COVID-19's effect on the world economy and developing countries, further research into the subject should be conducted.

First, the definitive effects that the pandemic had on growth will only become apparent a few years after the pandemic. As this paper was limited by time constraints, the ultimate impact of the pandemic must be observed and reassessed in the future.

Second, as the global COVID-19 situation continues to evolve constantly, the development of economic growth in emerging markets needs to be further monitored. Additionally, other factors that impacted GDP and were affected by the pandemic should be studied. The research should expand on the impact on the overall development of countries, evaluating not only GDP but also the effects of the pandemic on the NHDI or inequality index.

Third, to enhance the understanding of the situation within specific economies, the research can be narrowed to evaluate the effects of the pandemic on an individual country. This study aids to define the optimal strategy to overcome the crisis for that nation.

Lastly, as vaccination programmes are deemed essential to relieving the COVID-19 impact on emerging markets, further research should study the importance of effective governance concerning the distribution of vaccines and the availability of doses.

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## VII Appendix

### 7.1 Appendix 1: Theoretical Framework

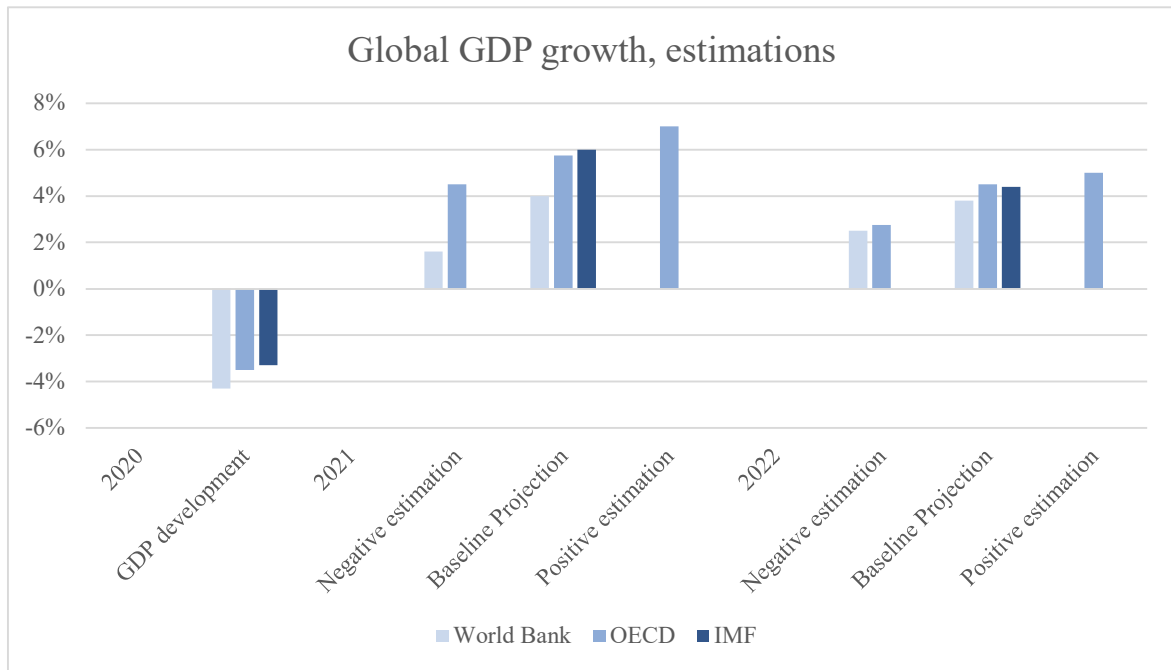
Appendix - Table 1: Country Classification according to Region and Income (The World Bank, 2020a)

Middle East & North Africa	21	North America	3	South Asia	8	Sub-Saharan Africa	48
<b>High income</b>	<b>8</b>	<b>High income</b>	<b>3</b>	<b>Low income</b>	<b>1</b>	<b>High income</b>	<b>2</b>
Bahrain		Bermuda		Afghanistan		Mauritius	
Israel		Canada		<b>Lower middle income</b>	<b>6</b>	Seychelles	
Kuwait		United States		Bangladesh		<b>Low income</b>	<b>23</b>
Malta				Bhutan		Burkina Faso	
Oman				India		Burundi	
Qatar				Nepal		Central African Republic	
Saudi Arabia				Pakistan		Chad	
United Arab Emirates				Sri Lanka		Democratic Republic of Congo	
Low income				<b>Upper middle income</b>	<b>1</b>	Eritrea	
Syrian Arab Republic				Maldives		Ethiopia	
Yemen, Rep.						The Gambia	
<b>Lower middle income</b>	<b>6</b>					Guinea	
Algeria						Guinea-Bissau	
Djibouti						Liberia	
Egypt						Madagascar	
Morocco						Malawi	
Tunisia						Mali	
West Bank and Gaza						Mozambique	
<b>Upper middle income</b>	<b>5</b>					Niger	
Iran						Rwanda	
Iraq						Sierra Leone	
Jordan						Somalia	
Lebanon						South Sudan	
Libya						Sudan	
						Togo	
						Uganda	
						<b>Lower middle income</b>	<b>18</b>
						Angola	
						Benin	
						Cameroon	
						Cape Verde	
						Comoros	
						Congo.	
						Cote d'Ivoire	
						Eswatini	
						Ghana	
						Kenya	
						Lesotho	
						Mauritania	
						Nigeria	
						Sao Tome and Principe	
						Senegal	
						Tanzania	
						Zambia	
						Zimbabwe	
						<b>Upper middle income</b>	<b>5</b>
						Botswana	
						Equatorial Guinea	
						Gabon	
						Namibia	
						South Africa	



<b>East Asia &amp; Pacific</b>	<b>38</b>	<b>Europe &amp; Central Asia</b>	<b>58</b>	<b>Latin America &amp; Caribbean</b>	<b>42</b>
<b>High income</b>	<b>15</b>	<b>High income</b>	<b>38</b>	<b>High income</b>	<b>17</b>
Australia		Andorra		Antigua and Barbuda	
Brunei		Austria		Aruba	
French Polynesia		Belgium		Bahamas	
Guam		Channel Islands		Barbados	
Hong Kong		Croatia		British Virgin Islands	
Japan		Cyprus		Cayman Islands	
Macao SAR, China		Czech Republic		Chile	
Nauru		Denmark		Curacao	
New Caledonia		Estonia		Panama	
New Zealand		Faroe Islands		Puerto Rico	
Northern Mariana Islands		Finland		Saint Kitts and Nevis	
Palau		France		Sint Maarten (Dutch part)	
Singapore		Germany		St. Martin (French part)	
South Korea		Gibraltar		Trinidad and Tobago	
Taiwan		Greece		Turks and Caicos Islands	
<b>Low income</b>	<b>1</b>	Greenland		Uruguay	
Korea, Dem. People's Rep.		Hungary		Virgin Islands (U.S.)	
<b>Lower middle income</b>	<b>12</b>	Iceland		<b>Low income</b>	<b>1</b>
Cambodia		Ireland		Haiti	
Kiribati		Isle of Man		<b>Lower middle income</b>	<b>4</b>
Laos		Italy		Bolivia	
Micronesia, Fed. Sts.		Latvia		El Salvador	
Mongolia		Liechtenstein		Honduras	
Myanmar		Lithuania		Nicaragua	
Papua New Guinea		Luxembourg		<b>Upper middle income</b>	<b>20</b>
Philippines		Monaco		Argentina	
Solomon Islands		Netherlands		Belize	
Timor-Leste		Norway		Brazil	
Vanuatu		Poland		Colombia	
Vietnam		Portugal		Costa Rica	
<b>Upper middle income</b>	<b>10</b>	Romania		Cuba	
American Samoa		San Marino		Dominica	
China		Slovakia		Dominican Republic	
Fiji		Slovenia		Ecuador	
Indonesia		Spain		Grenada	
Malaysia		Sweden		Guatemala	
Marshall Islands		Switzerland		Guyana	
Samoa		United Kingdom		Jamaica	
Thailand		<b>Low income</b>	<b>1</b>	Mexico	
Tonga		Tajikistan		Paraguay	
Tuvalu		<b>Lower middle income</b>	<b>4</b>	Peru	
		Kyrgyzstan		Saint Lucia	
		Moldova		Saint Vincent and the Grenadines	
		Ukraine		Suriname	
		Uzbekistan		Venezuela, R.B.	
		<b>Upper middle income</b>	<b>15</b>		
		Albania			
		Armenia			
		Azerbaijan			
		Belarus			
		Bosnia and Herzegovina			
		Bulgaria			
		Georgia			
		Kazakhstan			
		Kosovo			
		Montenegro			
		North Macedonia			
		Russia			
		Serbia			
		Turkey			
		Turkmenistan			

Appendix - Figure 1: Global GDP Growth Forecast Comparison, World Bank, International Monetary Fund, OECD (The World Bank, 2021a; International Monetary Fund, 2021a; OECD, 2021a)



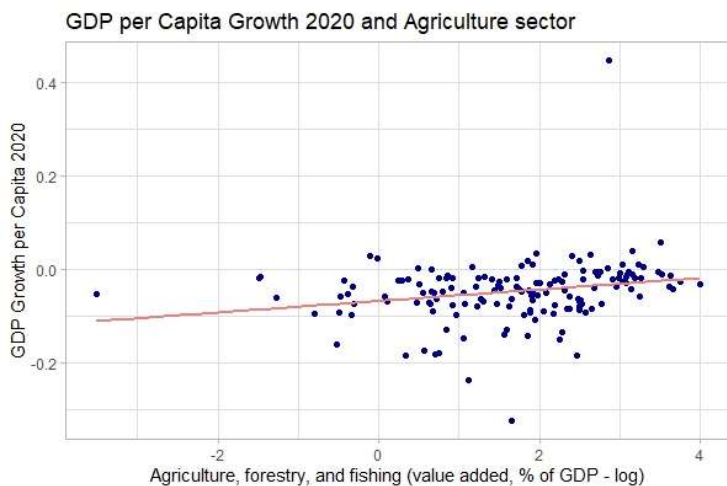
### 7.2 Appendix 2: OLS Regression Sectors of GDP

Appendix - Table 2: Correlation Coefficients (GDP Growth 2020, Agriculture, Industry, Manufacturing, Services) with Significance Levels (International Monetary Fund, 2021d; The World Bank, 2021b; The World Bank, 2021c; The World Bank, 2021d; The World Bank, 2021k)

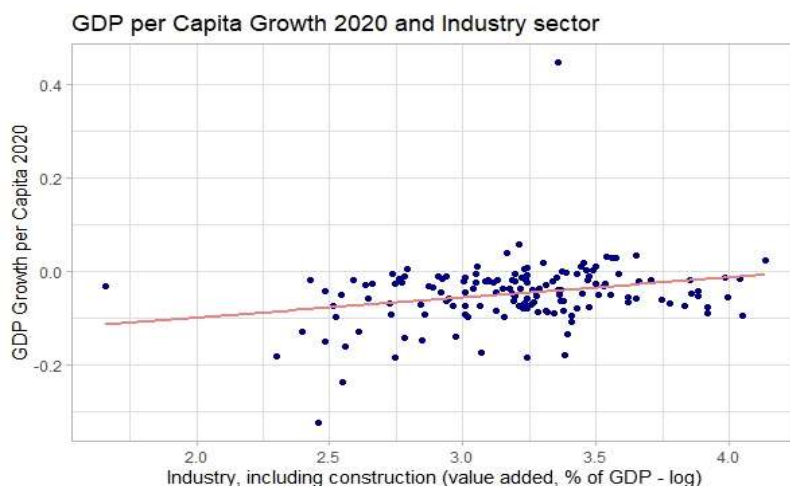
Correlation Table with Significance levels	GDP per Capita Growth 2020	Agriculture, forestry, and fishing value added (% of GDP) 2019 (1)	Industry (including construction) value added (% of GDP) 2019 (2)	Manufacturing value added (% of GDP) 2019. (3)	Services value added (% of GDP) 2019. (4)
GDP per Capita Growth 2020	1.00				
Agriculture (1)	0.28***	1.00			
Industry (2)	0.21*	-0.26**	1.00		
Manufacturing (3)	0.21*	-0.21**	0.46****	1.00	
Services (4)	-0.42****	-0.65****	-0.46****	-0.15	1.00

Significance levels -p < .0001 \*\*\*\*, p < .001 \*\*\*, p < .01 \*\*, p < .05 \*

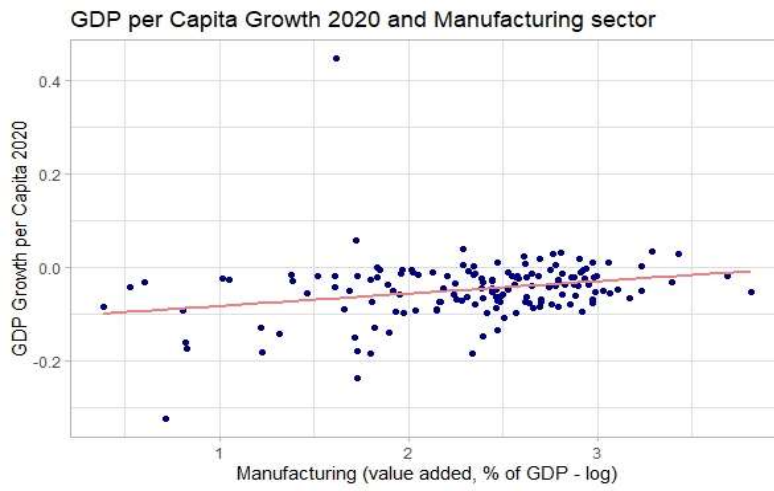
Appendix - Figure 2: GDP per Capita Growth and Agriculture, Forestry, Fishing, value added (% of GDP) (OLS Regression) (International Monetary Fund, 2021d; The World Bank, 2021k)



Appendix - Figure 3: GDP per Capita Growth and Industry (including Construction), (OLS Regression) value added (% of GDP) (International Monetary Fund, 2021d; The World Bank, 2021c)

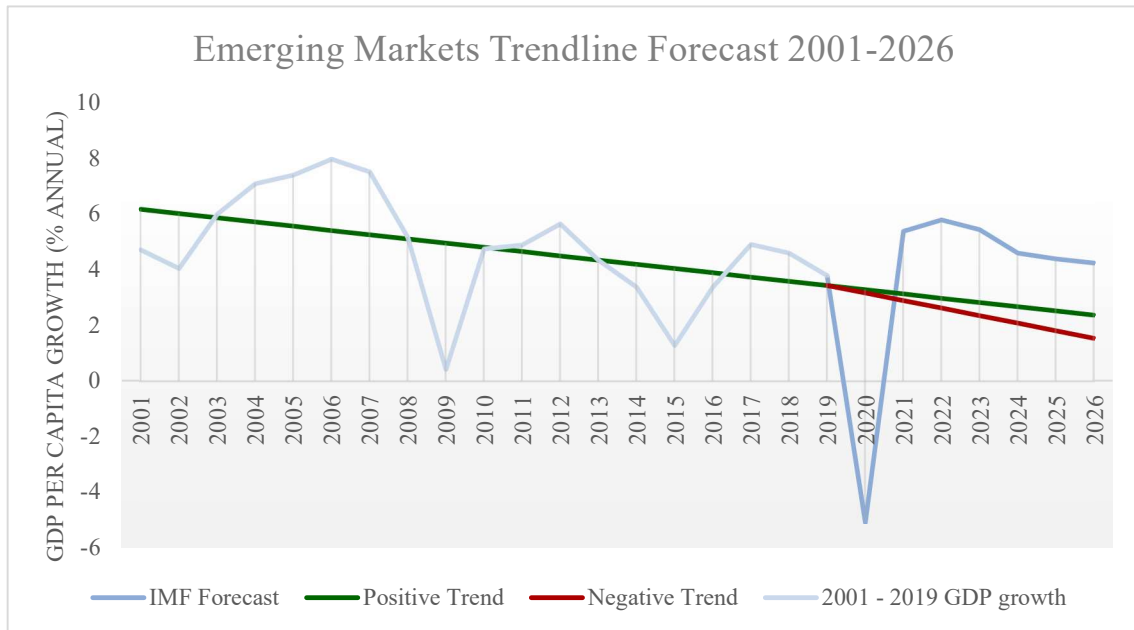


Appendix - Figure 4: GDP per Capita Growth and Manufacturing value added (% of GDP)(OLS Regression) (International Monetary Fund, 2021d; The World Bank, 2021b)

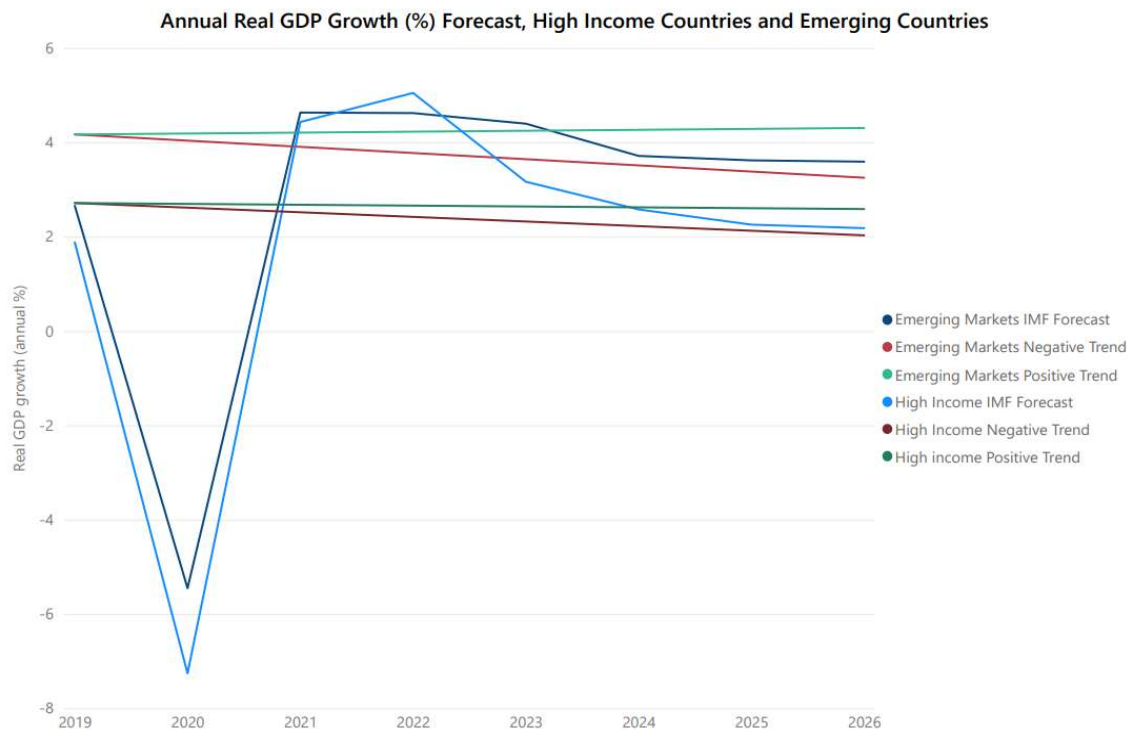


### 7.3 Appendix 3: GDP per Capita Forecast

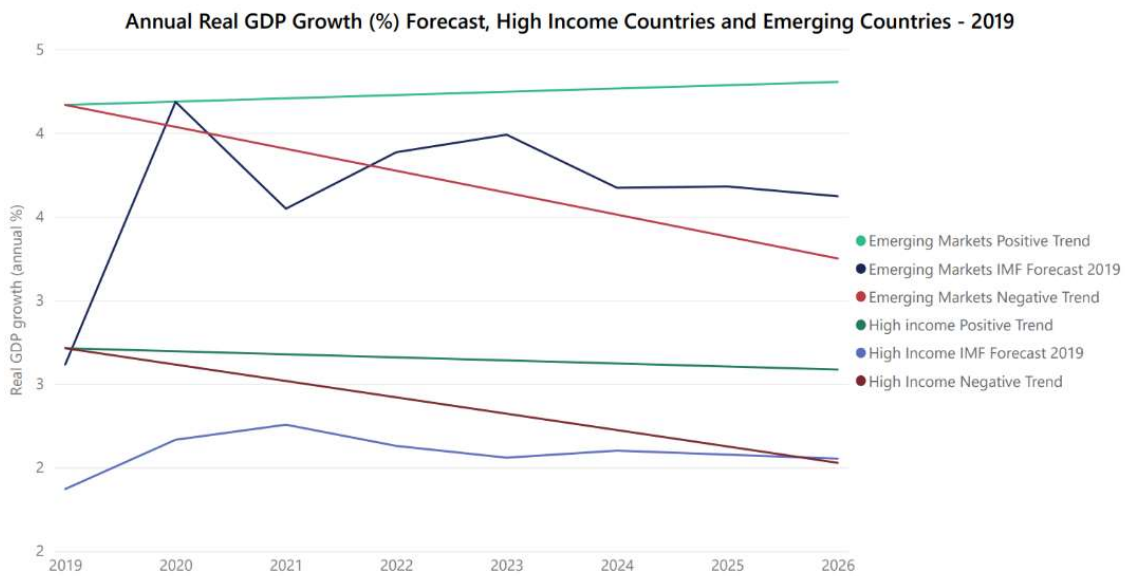
Appendix - Figure 5: Emerging Market Trendline Forecast 2001 - 2026 (GDP per Capita Growth, annual %)(International Monetary Fund, 2021d)



Appendix - Figure 6: Real GDP Growth Forecast, High-Income Countries and Emerging Countries (annual %) (International Monetary Fund, 2021c)



Appendix - Figure 7: Real GDP Growth Forecast High-Income Countries and Emerging Countries, 2019 IMF Forecast levels (annual %) (International Monetary Fund, 2019b)



### 7.4 Appendix 4: OLS Regression Decline Factors of Production 2020

*Appendix - Table 3: Correlation Coefficients Impacts of Factors of Production 2020 (Angrist, et al., 2021a; Angrist, et al., 2021b; Appel, et al., 2021a; International Labor Organization, 2021; International Monetary Fund, 2021d; International Monetary Fund, 2021e; International Monetary Fund, 2021f; UNICEF, 2021)*

	1	2	3	4	5	6	7	8	9	
GDP per Capita Growth 2021	1	1.00								
GDP per Capita Growth 2026	2	0.44****	1.00							
Total Investment Decline	3	0.13	0.26**	1.00						
Labour productivity decline	4	-0.13	0.02	0.06	1.00					
Unemployment growth	5	-0.02	0.18	0.15	0.57****	1.00				
log Stringency index	6	0.07	0.05	-0.04	-0.71****	-0.31***	1.00			
log Economic Support	7	0.25**	-0.02	0.01	-0.10	-0.11	-0.02	1.00		
log School Closure	8	-0.06	0.10	-0.09	-0.59****	-0.37****	0.63****	-0.08	1.00	
log COVID Cases per Million	9	0.11	-0.19*	0.05	-0.39****	-0.33***	0.23*	0.28**	0.33****	1.00

*Appendix - Table 4: GDP per Capita Growth 2021 by Factors of Production Impact 2020 (OLS Regression with interaction) (Angrist, et al., 2021a; Angrist, et al., 2021b; Appel, et al., 2021a; International Labor Organization, 2021; International Monetary Fund, 2021d; International Monetary Fund, 2021e; International Monetary Fund, 2021f; UNICEF, 2021)*

<b>Regression 2021 by Impact of 2020</b>	
<i>Dependent variable: GDP per Capita Growth 2021</i>	
Country Classification	-0.354 (0.215)
2020 Total Investment Decline	-0.016 (0.050)
Interaction 2020 Total Investment Decline	0.114 (0.074)
Labour Productivity Decline	-0.233 (0.144)
Interaction Labour Productivity decline	0.259 (0.206)
Unemployment Growth	0.257 (0.403)
Interaction Unemployment Growth	-0.347 (0.630)
Total Stringency index	-0.041 (0.041)
Interaction Stringency Index	0.209* (0.121)
Economic Support (Institutions)	0.009 (0.019)
Interaction Economic Support	0.016 (0.047)
School closure	-0.008 (0.010)
Interaction School Closure	-0.013 (0.031)
COVID Cases per million	0.003 (0.005)
Interaction Covid Cases	-0.001 (0.012)
Constant	0.123 (0.164)
Observations	113
R <sup>2</sup>	0.160
Adjusted R <sup>2</sup>	0.030
Residual Std. Error	0.029 (df = 97)
F Statistic	1.229 (df = 15; 97)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

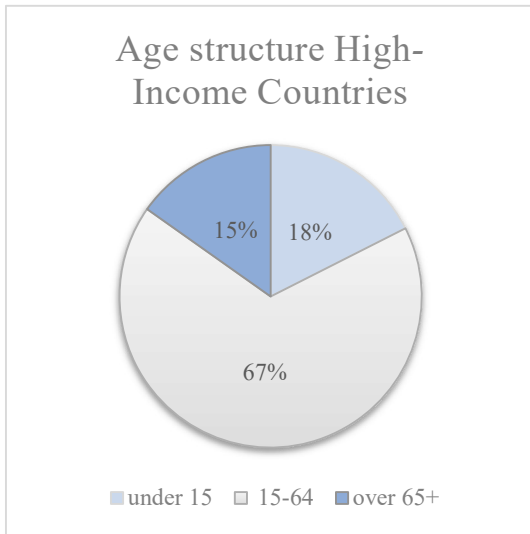


*Appendix - Table 5: GDP per Capita Growth 2026 by Factors of Production Impact 2020 (OLS Regression without Interaction) (Angrist, et al., 2021a; Angrist, et al., 2021b; Appel, et al., 2021a; International Labor Organization, 2021; International Monetary Fund, 2021d; International Monetary Fund, 2021e; International Monetary Fund, 2021f; UNICEF, 2021)*

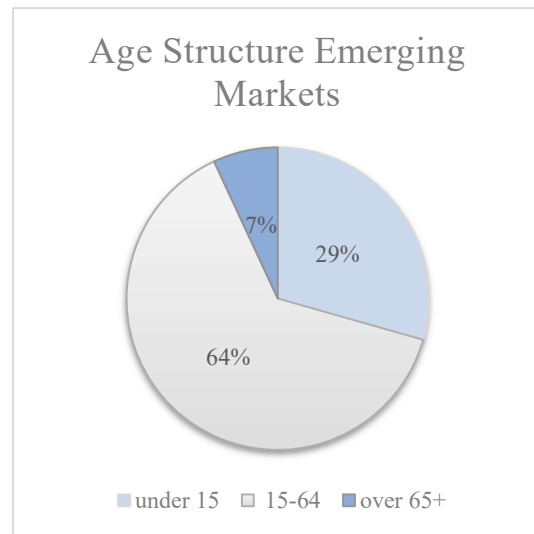
<b>Regression 2026 by Impact of 2020, without interaction</b>	
<i>Dependent variable: GDP per Capita Growth 2026</i>	
Country Classification	0.006 (0.004)
2020 Total Investment Decline	0.051 *** (0.018)
Labour Productivity Decline	0.002 (0.049)
Unemployment Growth	0.155 (0.151)
Total Stringency index	-0.003 (0.012)
Economic Support (Institutions)	0.005 (0.004)
School closure	0.006 (0.003)
COVID Cases per million	-0.002 (0.001)
Constant	0.056 (0.050)
Observations	113
R <sup>2</sup>	0.188
Adjusted R <sup>2</sup>	0.125
Residual Std. Error	0.015 (df = 104)
F Statistic	3.003 *** (df = 8; 104)
<i>Note: *p&lt;0.1; **p&lt;0.05; ***p&lt;0.01</i>	

<b>Regression 2026 by Impact of 2020</b>	
<i>Dependent variable: GDP per Capita Growth 2026</i>	
Country Classification	-0.234 ** (0.109)
2021 Total Investment Decline	0.006 (0.025)
Interaction2020 Total Investment Decline	0.087 ** (0.037)
Labour Productivity Decline	-0.083 (0.073)
Interaction Labour Productivity decline	0.116 (0.105)
Unemployment Growth	0.174 (0.204)
Interaction Unemployment Growth	0.004 (0.319)
Total Stringency index	-0.047 ** (0.021)
Interaction Stringency Index	0.146 ** (0.062)
Economic Support (Institutions)	-0.003 (0.009)
Interaction Economic Support	0.021 (0.024)
School closure	0.004 (0.005)
Interaction School Closure	-0.003 (0.016)
COVID Cases per million	0.002 (0.002)
Interaction Covid Cases	-0.007 (0.006)
Constant	0.212 ** (0.083)
Observations	113
R <sup>2</sup>	0.273
Adjusted R <sup>2</sup>	0.161
Residual Std. Error	0.015 (df = 97)
F Statistic	2.431 *** (df = 15; 97)

*Appendix - Figure 8: Age Structure High - Income Markets (The World Bank, 2021e; The World Bank, 2021m; The World Bank, 2021n)*



*Appendix - Figure 9: Age Structure Emerging Markets (The World Bank, 2021e; The World Bank, 2021m; The World Bank, 2021n)*



### 7.5 Appendix 5: OLS Regression Level of Factor of Production 2019

*Appendix - Table 7: Correlation Coefficients Levels of Factors of Production 2019 (International Monetary Fund, 2021d; International Monetary Fund, 2021e; International Monetary Fund, 2021f; International Monetary Fund, 2021g; The World Bank, 2021e; The World Bank, 2021g; The World Bank, 2021h; The World Bank, 2021i; The World Bank, 2021j; UNESCO Institute for Statistics, 2020)*

		1	2	3	4	5	6	7	8
GDP per Capita Growth 2021	1	1.00							
GDP per Capita Growth 2026	2	0.15	1.00						
log GDP per Capita	3	0.13	-0.41****	1.00					
log Total Investment	4	0.50****	0.24**	-0.02	1.00				
Log Rate of Employment	5	-0.19*	0.12	0.06	0.07	1.00			
Log Working Age Population share	6	0.12	0.12	0.44****	0.07	0.06	1.00		
Log Education Index	7	0.02	-0.13	0.74****	-0.06	0.07	0.43****	1.00	
Log Institution	8	-0.51****	-0.08	0.55****	-0.32***	0.19*	0.24**	0.63****	1.00

*Appendix - Table 8: GDP per Capita Growth 2021 by Factors of Production 2019 (OLS Regression without Interaction Terms)(International Monetary Fund, 2021d; International Monetary Fund, 2021e; International Monetary Fund, 2021f; International Monetary Fund, 2021g; The World Bank, 2021e; The World Bank, 2021g; The World Bank, 2021h; The World Bank, 2021i; The World Bank, 2021j; UNESCO Institute for Statistics, 2020)*

<b>Regression Level Factors of Production 2019 with Interaction Terms 2021</b>	
	<i>Dependent variable:</i>
	2021
Country Classification	0.451*** (0.169)
GDP per Capita 2000	0.028** (0.013)
Total Investment	-0.003 (0.048)
Interaction Total Investment	0.257** (0.123)
Rate of Employment	-0.111 (0.353)
Interaction Rate of Employment	-0.333 (0.850)
Working Age Population Share	-0.219 (0.188)
Interaction Working Age Population	1.323*** (0.501)
Education	0.057 (0.187)
Interaction Education	-0.068 (0.447)
Institution	-0.076 (0.080)
Interaction Institution	-0.276 (0.194)
Constant	-0.237 (0.208)
Observations	132
R <sup>2</sup>	0.674
Adjusted R <sup>2</sup>	0.641
Residual Std. Error	0.070 (df = 119)
F Statistic	20.527*** (df = 12; 119)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

*Appendix - Table 9: GDP per Capita Growth 2026 by Factors of Production 2019 (OLS Regression without Interaction Term)(International Monetary Fund, 2021d; International Monetary Fund, 2021e; International Monetary Fund, 2021f; International Monetary Fund, 2021g; The World Bank, 2021e; The World Bank, 2021g; The World Bank, 2021h; The World Bank, 2021i; The World Bank, 2021j; UNESCO Institute for Statistics, 2020)*

*Appendix - Table 10: GDP per Capita Growth 2026 by Factors of Production 2019 with Interaction (OLS Regression with Interaction Term)(International Monetary Fund, 2021d; International Monetary Fund, 2021e; International Monetary Fund, 2021f; International Monetary Fund, 2021g; The World Bank, 2021e; The World Bank, 2021g; The World Bank, 2021h; The World Bank, 2021i; The World Bank, 2021j; UNESCO Institute for Statistics, 2020)*

<b>Regression Level Factors of Production 2019 2026</b>	
	<i>Dependent variable:</i>
	2026
Country Classification	-0.002 (0.005)
GDP per Capita 2000	-0.014*** (0.002)
Total Investment	0.014*** (0.004)
Rate of Employment	0.017 (0.021)
Working Age Population Share	0.071*** (0.017)
Education	0.015* (0.008)
Institution	0.008** (0.004)
Constant	0.220*** (0.026)
Observations	132
R <sup>2</sup>	0.416
Adjusted R <sup>2</sup>	0.383
Residual Std. Error	0.013 (df = 124)
F Statistic	12.615*** (df = 7; 124)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

<b>Regression Level Factors of Production 2019 with Interaction Terms 2026</b>	
	<i>Dependent variable:</i>
	2026
Country Classification	0.042 (0.031)
GDP per Capita 2000	-0.011*** (0.002)
Total Investment	0.008 (0.009)
Interaction Total Investment	0.018 (0.022)
Rate of Employment	0.014 (0.064)
Interaction Rate of Employment	0.043 (0.155)
Working Age Population Share	-0.012 (0.034)
Interaction Working Age Population	0.269*** (0.091)
Education	0.009 (0.034)
Interaction Education	-0.018 (0.081)
Institution	-0.007 (0.015)
Interaction Institution	0.039 (0.035)
Constant	0.164*** (0.038)
Observations	132
R <sup>2</sup>	0.471
Adjusted R <sup>2</sup>	0.418
Residual Std. Error	0.013 (df = 119)
F Statistic	8.845*** (df = 12; 119)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01