

A cross country analysis of components of economic growth through the growth accounting approach

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Abstract. *The method of growth accounting has been widely used for examining the components of economic growth for different countries. This method comprises of determining the relative shares of capital accumulation and Total Factor Productivity (TFP) in GDP growth (though the share of other factors can be also considered). This paper attempts to analyze the share of capital accumulation and TFP growth in economic growth for four countries groups – low income, lower-middle income, upper-middle income and high-income (as classified by the World Bank), over the time period 1991-2019. From the results obtained, it can be concluded that the share of TFP growth has been relatively less as compared to the share of capital accumulation, except for lower-middle income countries. Also, lower and upper-middle income countries have made considerable progress in economic growth, as compared to the other two country groups. The results indicate that there is significant scope for boosting TFP growth by focusing on increased efficiency of labour and capital, which would definitely contribute to the long-term growth process.*

Keywords: economic growth, capital deepening, total factor productivity, Solow residual, growth accounting.

JEL Classification: D24, E22, O47.

1. Introduction

One of the central focuses of economic theory is the study of economic growth and identifying its components. The phenomenon of economic growth relates to a sustained increase in the income or per capita income of the economy in the medium- or long-term period. The process of economic growth is influenced by different types of factors and for attaining a sustained economic growth, a careful study of the determinants of growth is of utmost importance. The major factors affecting economic growth are rate of capital formation, technological progress, population growth, foreign trade, skill development, government policies, socio-cultural structure, etc. The state also plays an important role in the growth process. Such policies of the government which provide a conducive environment for investment contribute to economic growth whereas policies which lead to distortion in resource allocation can be detrimental to the growth process. Thus, various economic as well as non-economic factors influence the economic growth of a country.

A lot of literature is available on economic growth, its components and determinants. Since long, economists have been analyzing the factors determining economic growth, based on both theoretical and empirical approaches. To begin with, Harrod (1939), focused on the role of capital accumulation, and stated that the growth rate of a country depends upon the savings rate and the incremental capital-output ratio of that country. In later theories, labour force growth rate and technical progress were also taken to be important factors affecting economic growth. According to Solow (1957), the growth rate of a country can be decomposed into two parts-growth of factors weighted by factor shares, and the “Solow residual”, which denotes technical progress.

There are two approaches for studying the determinants of economic growth of a country. First approach is to find the determinants of economic growth by fitting growth regressions. These determinants may include rate of capital formation, technological progress, population growth, foreign trade, skill development, government policies, etc. Second approach is based on the growth accounting technique, in which the researcher tries to decompose growth into two parts- the share of capital accumulation and Total Factor Productivity (TFP) in GDP growth. This study relates to second approach.

The remaining part of paper is divided into five sections. Section 2 provides the theoretical framework for growth accounting methodology. Section 3 describes a selected review of literature. The data and methodology used in this study are given in Section 4. Section 5 presents the data analysis and results of the study. The last section presents the conclusion.

2. Theoretical framework

Solow (1957) has put forward the method of growth accounting. This method focusses on decomposing the growth process and analyzing what percentage of growth can be attributed to growth in capital- human as well as physical capital and what percentage of growth can be attributed to productivity growth. It essentially focusses on assessing the relative contributions of capital, labor and technology to the economic growth of a country.

The concept of labor productivity, which essentially means output per worker, can be denoted as $y = Y/L$, where Y refers to total output and L refers to labor input. However, the increase in productivity can be the result of both capital accumulation and technological progress.

To analyze this concept, we start by taking the linearly homogeneous Cobb-Douglas production function:

$$Y = AK^\alpha L^{1-\alpha} \quad (1)$$

where K refers to capital input and A is a parameter which refers to the state of technology.

Dividing both sides by L , we obtain

$$y = Ak^\alpha \quad (2)$$

The above equation shows that output per worker (y) depends positively on both the parameter A as well as the capital stock per worker, i.e., $k = K/L$. It can be seen that parameter A is also a measure of productivity. This is because it depicts the labor productivity, as well as how productively of all the factors are used in a country. Thus, A is called Total Factor Productivity (TFP).

Now, let G depict economic growth, i.e., the growth rate of per person output. If it is assumed that the rate of increase in population is equal to the rate of increase in labor force, then G depicts the rate of growth of per worker output.

Taking logs and differentiating with time both sides of equation (2), we obtain the growth rate ($G = \dot{y}/y$) as

$$G = \dot{A}/A + \alpha \dot{k}/k \quad (3)$$

From the above equation, it is clear that the growth rate (G) can be decomposed into two parts: the growth rate of TFP (\dot{A}/A) and the rate of “capital-deepening” ($\alpha \dot{k}/k$). The first part shows the effect of technological progress and the second part shows the effect of capital accumulation. The exercise of growth accounting is concerned with determining the shares of these two parts.

Since output (Y), capital (K) and worker (L) can be directly observed, but the value of A cannot be directly observed, its value is calculated by residual method. In this method, it is assumed that α is share of capital in national income, which is equal to one minus the share of labour compensation in GDP at current national prices, i.e. the variable “labsh” in the Penn World Table. Once the value of $\alpha \dot{k}/k$ is obtained, TFP growth rate can be calculated using following expression:

$$\dot{A}/A = G - \alpha \dot{k}/k \quad (4)$$

From equation (4), it can be noted that TFP growth is a residual value, which can be calculated by subtracting the contribution of capital accumulation from the rate of growth of output. For this reason, TFP growth is also called the Solow residual.

3. Literature review

There is a wide literature which is available on the determinants of economic growth, taking account of the factors which affect the growth process. The growth accounting methodology has been used in various empirical studies. Some of the studies have been considered below.

Bosworth and Collins (2003) have focused on the use of the techniques of growth accounting and growth regressions for finding the determinants of economic growth and the related issues of measurement and procedural consistency. Data for 84 countries for the time period 1960 to 2000 has been taken and both the approaches have been used. The paper concludes that both the approaches yield consistent and useful results and the differences between them arise because of various factors such as measurement error, differences in definition of data, and exclusion of other variables in the regression analyses. The major reasons for the cross-country variation in growth can be traced to variation in initial economic conditions of countries and the policies of government.

Patnaik and Pundit (2016) have analyzed the factors of economic growth in India for the period 1980-2013 and projected the growth of factors of production and the growth of per worker GDP from 2013 to 2030. Using the growth accounting approach for the time period 1980-2013 they found that though capital has contributed significantly to growth, TFP has assumed more importance in recent times. Both human capital and infrastructure capital also are important for growth. The authors conclude that the future growth rate is not likely to decline if the reform in government policy encourages the investment in education and infrastructure and abolishes obstacles in the optimum utilization of capital and labor, which can ultimately increase productivity.

Iradian (2007) has analyzed the sources of economic growth in the transition economies of Commonwealth of Independent States (CIS). Using the growth accounting approach for the time period 1991-2006, he concluded that as compared to other fast growing economies the growth of TFP was significantly higher for the former Soviet Union. It also predicted that the medium term growth can be significantly boosted by efficient utilization of underutilized labor along with the faster capital formation.

Gupta (2007) has analyzed the growth accounts for India based on time period 1960-2004. The paper concludes that TFP significantly explains economic growth. The growth rate of productivity started accelerating in the 1980s and was estimated between 3 to 4.5 percent in 2000s. As per the accounting estimates, decompositions and period-wise trends, growth in India is being triggered by overall improvement in efficiency (TFP) rather than input accumulation growth.

Bosworth and Collins (2007) have compared the recent economic performances of India and China using the growth accounting technique. The growth accounts have been prepared for the agriculture, industry and services sectors as well as for the aggregate economy for the period 1978-2004. The authors conclude that there is equal contribution of capital accumulation and TFP to growth of per worker output over the entire time period in both the countries. However, the magnitude of per worker output growth in China is quite higher

than that of India at the aggregate level as well as in three sectors. However, post 1993, the acceleration in growth in China was concentrated in the industrial sector, whereas, in India, it was concentrated in the service sector.

Bosworth, Collins and Virmani (2007) have analyzed the factors of economic growth in Indian economy using the growth accounting framework. The growth accounts have been constructed for the economy as a whole, and also sector wise- agriculture, industry, manufacturing and services for the period 1960-2004. The paper concludes that the rapid growth has been the result of expansion of the service sector and is not based on growth in the manufacturing sector. At the same time, physical capital accumulation has not shown impressive growth and illiteracy continues to remain high.

Lee and Hong (2012) used the growth accounting framework for analysing the growth pattern of Asian economies. The authors found that growth in capital accumulation has contributed to growth of these countries during the period of last three decades. However, the contributions of TFP and education are lower. According to the study the projection of GDP growth for the next two decades would be lower than their historical performance. However, the GDP growth can substantially be raised through reforms in various sectors such as research and development (R & D), education and property rights. Owing to rapid expansion, by 2030, these developing Asian countries will account for about two thirds of the world economy, doubling its share in 2009.

Kim and Park (2018) have examined the role of total factor productivity (TFP) growth in middle-income countries, using cross-country panel data for 1975-2014. They found that as a country moves from middle-income to high-income, the contribution of TFP growth increases. They also concluded that the lower population, human capital, weak currency, catch-up effect, and R & D growth are important sources of TFP growth. Also, in the TFP growth models for middle-income countries, there have not been any systematic differences.

Malik and Masood (2018) have investigated the variations in productivity and economic growth for North African and Middle Eastern Region from 1971 to 2014, using Penn World Table data. They concluded that there have been large variations in growth in oil-producing economies, which is the result of fluctuations of the prices of oil and oil products. The study suggests that in most of the oil-producing countries, growth rates of GDP per worker are quite negligible because of rapid growth in population and labour force. The growth rate in this region can be attributed to capital accumulation, and the role of total factor productivity (TFP) is not very significant. There is convergence in labour productivity and per capita GDP growth.

Thus, it can be seen that there have been studies, both country specific as well as based on a comparative analysis of selected countries, which have identified the various components of growth based on the growth accounting framework. However, this paper is an attempt to identify the detailed pattern in contributions of capital accumulation and TFP growth to economic growth in respect of four income-groups of countries: lower income, lower-middle income, upper-middle income and high income, over the last 29 years, as per the latest available data.

4. Data and methodology

The growth accounting exercise is conducted for 39 countries (depending on data availability for the time period), grouped into four categories: low income, lower-middle income, upper-middle income and high-income. This is the World Bank classification, based on their Gross National Income (GNI) per capita (current US\$) calculated using the Atlas method on July 1st 2019. Table 1 lists the countries in the sample by categories. The time period considered is 1991-2019. Data from the Penn World Table has been used. Growth accounting procedure was carried out by using equation 4 as given in Section 2.

Table 1. List of countries selected for study

| Low income countries | Lower-middle income countries | Upper-middle income countries | High-income countries |
|--------------------------|-------------------------------|-------------------------------|-----------------------|
| Burundi | Egypt | Argentina | Australia |
| Burkina Faso | India | Brazil | Canada |
| Central African Republic | Indonesia | China | France |
| Guinea | Morocco | Colombia | Germany |
| Mozambique | Nigeria | Malaysia | Italy |
| Niger | Philippines | Mexico | Japan |
| Sudan | Ukraine | Russian Federation | Rep. of Korea |
| Sierra Leone | Angola | South Africa | Spain |
| Chad | Kenya | Thailand | United Kingdom |
| Togo | | Turkey | United States |

5. Data analysis and results

Before undertaking the growth-accounting exercise for different countries, the descriptive statistics for real GDP, labor force and capital for the four country groups are obtained, results for which are shown in Table 2.

Table 2. Descriptive statistics

| | Real GDP | Labour Force | Capital |
|--------------------------------------|----------|--------------|----------|
| Low income countries | | | |
| Mean | 21959.33 | 4.290718 | 0.601468 |
| Median | 11243.40 | 3.779239 | 0.514687 |
| Maximum | 182462.6 | 11.01796 | 1.311576 |
| Minimum | 3717.545 | 1.131681 | 0.163609 |
| Std. Dev. | 31895.13 | 2.376052 | 0.283750 |
| Skewness | 3.253117 | 0.746297 | 0.244913 |
| Kurtosis | 13.74985 | 2.668121 | 1.847865 |
| Jarque-Bera | 1907.841 | 28.25061 | 18.93875 |
| Probability | 0.000000 | 0.000001 | 0.000077 |
| Lower-middle income countries | | | |
| Mean | 983801.8 | 77.71453 | 0.683253 |
| Median | 467753.0 | 23.26265 | 0.661198 |
| Maximum | 9163052 | 497.6157 | 1.530739 |
| Minimum | 52167.18 | 6.864369 | 0.157983 |
| Std. Dev. | 1509180 | 132.1115 | 0.295881 |
| Skewness | 3.144484 | 2.323394 | 0.243806 |
| Kurtosis | 13.87560 | 6.819814 | 2.145155 |
| Jarque-Bera | 1696.671 | 388.9739 | 10.41164 |
| Probability | 0.000000 | 0.000000 | 0.005485 |
| Upper-middle income countries | | | |
| Mean | 2201788 | 105.9402 | 0.680090 |
| Median | 991718.1 | 28.18900 | 0.677215 |
| Maximum | 20572606 | 799.3066 | 1.175672 |

| | Real GDP | Labour Force | Capital |
|------------------------------|----------|--------------|-----------|
| Minimum | 184449.1 | 7.009089 | 0.062010 |
| Std. Dev. | 3467097 | 218.8093 | 0.247030 |
| Skewness | 3.559207 | 2.612858 | -0.395168 |
| Kurtosis | 16.19344 | 7.967547 | 2.522635 |
| Jarque-Bera | 2687.501 | 621.6495 | 10.19460 |
| Probability | 0.000000 | 0.000000 | 0.006113 |
| High income countries | | | |
| Mean | 3594613 | 39.21074 | 0.783353 |
| Median | 2295230 | 25.30408 | 0.822106 |
| Maximum | 20563592 | 158.2996 | 1.066418 |
| Minimum | 557552.4 | 7.635435 | 0.202338 |
| Std. Dev. | 4194455 | 37.09300 | 0.190328 |
| Skewness | 2.584730 | 2.002698 | -0.674941 |
| Kurtosis | 8.772471 | 5.933857 | 2.670789 |
| Jarque-Bera | 725.5406 | 297.8628 | 23.32764 |
| Probability | 0.000000 | 0.000000 | 0.000009 |

Source: Calculated by authors.

5.1. Growth accounting exercise for low income countries

The growth accounting exercise is carried out for the for low income countries, in respect of three decades, i.e., 1991-2000, 2001-2010 and 2011-2019, as well as for the overall time period, 1991-2019. The results are presented in Table 3.

Table 3. Components of GDP growth (in %) for low income countries

| Country | Time period | Growth Rate | TFP Growth | Capital Deepening |
|--------------------------|-------------|-------------|------------|-------------------|
| Burundi | 1991-2000 | -2.81 | -2.61 | -0.19 |
| | 2001-2010 | -0.15 | -0.59 | 0.44 |
| | 2011-2019 | -0.15 | -0.75 | 0.60 |
| | 1991-2019 | -1.02 | -1.28 | 0.26 |
| Burkina Faso | 1991-2000 | 2.77 | 1.10 | 1.67 |
| | 2001-2010 | 5.09 | 2.66 | 2.43 |
| | 2011-2019 | 2.23 | -0.56 | 2.79 |
| | 1991-2019 | 3.44 | 1.19 | 2.25 |
| Central African Republic | 1991-2000 | -0.58 | 1.50 | -2.07 |
| | 2001-2010 | 0.01 | 1.17 | -1.16 |
| | 2011-2019 | -2.63 | -2.78 | 0.15 |
| | 1991-2019 | -1.08 | -0.03 | -1.04 |
| Guinea | 1991-2000 | 1.99 | 0.78 | 1.21 |
| | 2001-2010 | 0.77 | -2.94 | 3.71 |
| | 2011-2019 | 3.19 | -0.40 | 3.59 |
| | 1991-2019 | 1.98 | -0.79 | 2.77 |
| Mozambique | 1991-2000 | 3.86 | 3.69 | 0.17 |
| | 2001-2010 | 5.14 | 2.89 | 2.25 |
| | 2011-2019 | 2.47 | -2.88 | 5.35 |
| | 1991-2019 | 4.03 | 1.50 | 2.54 |
| Niger | 1991-2000 | -1.24 | 0.43 | -1.67 |
| | 2001-2010 | 0.89 | 0.58 | 0.32 |
| | 2011-2019 | 3.00 | 1.75 | 1.25 |
| | 1991-2019 | 0.99 | 1.05 | -0.06 |
| Sudan | 1991-2000 | 1.09 | 0.74 | 0.35 |
| | 2001-2010 | 3.58 | 1.29 | 2.29 |
| | 2011-2019 | 1.49 | 1.68 | -0.19 |
| | 1991-2019 | 2.29 | 1.46 | 0.84 |
| Sierra Leone | 1991-2000 | -8.41 | -7.60 | -0.81 |
| | 2001-2010 | 4.70 | 4.53 | 0.18 |
| | 2011-2019 | 2.28 | 0.73 | 1.56 |
| | 1991-2019 | 0.00 | -0.23 | 0.23 |

| Country | Time period | Growth Rate | TFP Growth | Capital Deepening |
|---------|-------------|-------------|------------|-------------------|
| Chad | 1991-2000 | -1.35 | -0.24 | -1.11 |
| | 2001-2010 | 7.73 | 3.07 | 4.66 |
| | 2011-2019 | -1.14 | -2.43 | 1.29 |
| | 1991-2019 | 1.94 | 0.19 | 1.75 |
| Togo | 1991-2000 | -2.03 | -1.09 | -0.94 |
| | 2001-2010 | -0.15 | -0.06 | -0.09 |
| | 2011-2019 | 6.64 | 5.77 | 0.87 |
| | 1991-2019 | 1.36 | 1.43 | -0.07 |

Source: Calculated by authors.

It can be seen from Table 3 that most of the low income countries recorded growth rate around 2 per cent, with Burundi and Central African Republic recording negative growth rates. Except in the case of Niger, Sudan and Togo, the contribution of capital accumulation to growth was more as compared to TFP growth.

5.2. Growth accounting exercise lower-middle income countries

Table 4. *Components of GDP growth (in %) for lower-middle income countries*

| Country | Time period | Growth Rate | TFP Growth | Capital Deepening |
|-------------|-------------|-------------|------------|-------------------|
| Angola | 1991-2000 | -1.83 | -3.92 | 2.09 |
| | 2001-2010 | 6.33 | 5.84 | 0.48 |
| | 2011-2019 | -1.90 | -1.14 | -0.76 |
| | 1991-2019 | 0.82 | 0.33 | 0.49 |
| Egypt | 1991-2000 | 2.13 | -0.79 | 2.92 |
| | 2001-2010 | 1.92 | -0.22 | 2.14 |
| | 2011-2019 | 1.81 | 0.71 | 1.10 |
| | 1991-2019 | 1.94 | -0.12 | 2.06 |
| Indonesia | 1991-2000 | 1.34 | -1.22 | 2.56 |
| | 2001-2010 | 3.47 | 1.78 | 1.69 |
| | 2011-2019 | 3.04 | 1.00 | 2.05 |
| | 1991-2019 | 2.63 | 0.55 | 2.08 |
| India | 1991-2000 | 4.31 | 2.65 | 1.66 |
| | 2001-2010 | 5.52 | 2.12 | 3.40 |
| | 2011-2019 | 5.56 | 2.54 | 3.02 |
| | 1991-2019 | 5.02 | 2.35 | 2.68 |
| Kenya | 1991-2000 | -2.47 | -1.80 | -0.67 |
| | 2001-2010 | 1.87 | 0.86 | 1.01 |
| | 2011-2019 | 1.53 | 1.04 | 0.49 |
| | 1991-2019 | 0.36 | 0.07 | 0.29 |
| Morocco | 1991-2000 | -0.41 | -1.21 | 0.80 |
| | 2001-2010 | 3.60 | 1.51 | 2.09 |
| | 2011-2019 | 3.61 | 1.70 | 1.91 |
| | 1991-2019 | 2.44 | 0.83 | 1.61 |
| Nigeria | 1991-2000 | -0.72 | -0.51 | -0.21 |
| | 2001-2010 | 4.47 | 5.08 | -0.62 |
| | 2011-2019 | -0.64 | 0.80 | -1.44 |
| | 1991-2019 | 1.19 | 1.90 | -0.71 |
| Philippines | 1991-2000 | 0.61 | -0.11 | 0.72 |
| | 2001-2010 | 2.46 | 1.93 | 0.53 |
| | 2011-2019 | 4.18 | 1.87 | 2.32 |
| | 1991-2019 | 2.33 | 1.19 | 1.15 |
| Ukraine | 1991-2000 | -1.73 | -0.88 | -0.85 |
| | 2001-2010 | 3.00 | 3.43 | -0.43 |
| | 2011-2019 | 2.26 | 1.62 | 0.64 |
| | 1991-2019 | 1.87 | 2.02 | -0.15 |

Source: Calculated by authors.

The growth accounting exercise is carried out for lower-middle income countries, in respect of three decades, i.e., 1991-2000, 2001-2010 and 2011-2019, as well as for the overall time period, 1991-2019. The results are presented in Table 4.

In the case of lower-middle income countries, India witnessed the highest growth rate, whereas Angola and Kenya recorded low growth rates. However, except in the cases of Nigeria and Ukraine, the contribution of capital deepening to economic growth was as larger as compared to that of TFP growth.

5.3. Growth accounting exercise upper-middle income countries

Table 5. Components of GDP growth (in %) for upper-middle income countries

| Country | Time period | Growth Rate | TFP Growth | Capital Deepening |
|--------------------|-------------|-------------|------------|-------------------|
| Argentina | 1991-2000 | 2.27 | 1.33 | 0.95 |
| | 2001-2010 | 0.98 | 1.54 | -0.56 |
| | 2011-2019 | -1.12 | -1.60 | 0.48 |
| | 1991-2019 | 0.55 | 0.24 | 0.31 |
| Brazil | 1991-2000 | 1.47 | 0.52 | 0.95 |
| | 2001-2010 | 1.23 | 1.26 | -0.03 |
| | 2011-2019 | -0.26 | -0.68 | 0.42 |
| | 1991-2019 | 0.81 | 0.35 | 0.46 |
| China | 1991-2000 | 5.62 | 1.69 | 3.94 |
| | 2001-2010 | 8.15 | 3.39 | 4.76 |
| | 2011-2019 | 4.07 | 0.06 | 4.01 |
| | 1991-2019 | 5.94 | 1.72 | 4.21 |
| Colombia | 1991-2000 | 0.01 | -0.34 | 0.36 |
| | 2001-2010 | 1.14 | 0.80 | 0.34 |
| | 2011-2019 | 2.28 | 0.73 | 1.55 |
| | 1991-2019 | 1.14 | 0.42 | 0.72 |
| Mexico | 1991-2000 | 0.55 | 0.13 | 0.42 |
| | 2001-2010 | -0.28 | -0.67 | 0.39 |
| | 2011-2019 | 0.41 | 0.21 | 0.20 |
| | 1991-2019 | 0.12 | -0.22 | 0.34 |
| Malaysia | 1991-2000 | 3.38 | -0.30 | 3.68 |
| | 2001-2010 | 2.27 | 1.67 | 0.60 |
| | 2011-2019 | 2.44 | 1.11 | 1.33 |
| | 1991-2019 | 2.59 | 0.73 | 1.86 |
| Russian Federation | 1991-2000 | 1.54 | 2.93 | -1.39 |
| | 2001-2010 | 3.94 | 3.57 | 0.37 |
| | 2011-2019 | 1.37 | 1.00 | 0.37 |
| | 1991-2019 | 2.43 | 2.55 | -0.12 |
| Thailand | 1991-2000 | 3.13 | 1.18 | 1.95 |
| | 2001-2010 | 2.73 | 2.31 | 0.42 |
| | 2011-2019 | 3.27 | 2.29 | 0.98 |
| | 1991-2019 | 2.99 | 1.92 | 1.06 |
| Turkey | 1991-2000 | 2.98 | -0.14 | 3.13 |
| | 2001-2010 | 3.70 | 0.70 | 3.00 |
| | 2011-2019 | 2.96 | 0.80 | 2.16 |
| | 1991-2019 | 2.91 | 0.20 | 2.70 |
| South Africa | 1991-2000 | 0.59 | 0.47 | 0.12 |
| | 2001-2010 | 1.68 | 0.94 | 0.74 |
| | 2011-2019 | -0.37 | -0.72 | 0.35 |
| | 1991-2019 | 0.83 | 0.36 | 0.47 |

Source: Calculated by authors.

The growth accounting exercise is carried out for upper-middle income countries, in respect of three decades, i.e., 1991-2000, 2001-2010 and 2011-2019, as well as for the overall time period, 1991-2019. The results are presented in Table 5.

Table 5 shows that for almost all upper-middle income countries, the contribution of capital accumulation to economic growth was relatively more as compared to that of TFP growth. During 1991-2019, China recorded the highest GDP growth rate, while other countries growth rate was between 0.5 per cent and 3 per cent.

5.4. Growth accounting exercise high-income countries

Table 6. *Components of GDP growth (in %) for high income countries*

| Country | Time period | Growth Rate | TFP Growth | Capital Deepening |
|-------------------|-------------|-------------|------------|-------------------|
| Australia | 1991-2000 | 2.18 | 1.36 | 0.82 |
| | 2001-2010 | 0.62 | -0.27 | 0.88 |
| | 2011-2019 | 0.70 | 0.26 | 0.43 |
| | 1991-2019 | 1.22 | 0.50 | 0.73 |
| Canada | 1991-2000 | 1.86 | 1.28 | 0.58 |
| | 2001-2010 | 0.33 | -0.29 | 0.62 |
| | 2011-2019 | 0.88 | 0.50 | 0.38 |
| | 1991-2019 | 1.02 | 0.48 | 0.54 |
| Germany | 1991-2000 | 1.30 | 0.57 | 0.73 |
| | 2001-2010 | 0.43 | 0.10 | 0.34 |
| | 2011-2019 | 0.58 | 0.50 | 0.08 |
| | 1991-2019 | 0.82 | 0.41 | 0.40 |
| Spain | 1991-2000 | 1.05 | 0.39 | 0.66 |
| | 2001-2010 | 0.57 | -0.34 | 0.91 |
| | 2011-2019 | 0.86 | 0.46 | 0.41 |
| | 1991-2019 | 0.80 | 0.16 | 0.64 |
| France | 1991-2000 | 1.33 | 0.82 | 0.51 |
| | 2001-2010 | 0.78 | 0.20 | 0.59 |
| | 2011-2019 | 0.64 | 0.32 | 0.32 |
| | 1991-2019 | 0.91 | 0.43 | 0.47 |
| United Kingdom | 1991-2000 | 2.40 | 1.52 | 0.88 |
| | 2001-2010 | 0.75 | 0.24 | 0.51 |
| | 2011-2019 | 0.50 | 0.37 | 0.13 |
| | 1991-2019 | 1.24 | 0.73 | 0.51 |
| Italy | 1991-2000 | 1.82 | 0.76 | 1.05 |
| | 2001-2010 | -0.50 | -1.01 | 0.52 |
| | 2011-2019 | -0.26 | -0.24 | -0.02 |
| | 1991-2019 | 0.33 | -0.17 | 0.50 |
| Japan | 1991-2000 | 1.14 | -0.23 | 1.36 |
| | 2001-2010 | 0.59 | 0.27 | 0.33 |
| | 2011-2019 | 0.31 | 0.43 | -0.12 |
| | 1991-2019 | 0.69 | 0.14 | 0.54 |
| Republic of Korea | 1991-2000 | 5.04 | 1.55 | 3.49 |
| | 2001-2010 | 3.49 | 1.58 | 1.91 |
| | 2011-2019 | 1.67 | 0.52 | 1.15 |
| | 1991-2019 | 3.38 | 1.20 | 2.18 |
| United States | 1991-2000 | 2.31 | 1.38 | 0.93 |
| | 2001-2010 | 1.64 | 0.64 | 1.00 |
| | 2011-2019 | 0.94 | 0.65 | 0.29 |
| | 1991-2019 | 1.60 | 0.84 | 0.76 |

Source: Calculated by authors.

The growth accounting exercise is carried out for high income countries, in respect of three decades, i.e., 1991-2000, 2001-2010 and 2011-2019, as well as for the overall time period, 1991-2019. The results are presented in Table 6.

From Table 6, it is clear that, as in the previous cases, the contribution of capital deepening to economic growth was more for all countries, except for United Kingdom. Also, Republic of Korea recorded the highest growth rate among this group of countries, while Italy recorded the lowest. On performing the calculations for the growth rate and its components for the overall time period 1991-2019, as well as for sub-periods 1991-2000, 2001-2010 and 2011-2019, the results shown in Table 7 are obtained.

Table 7. Growth rate (%) for different country groups over sub-periods

| Time Period | Low income | Lower-middle income | Upper-middle income | High income |
|-------------|------------|---------------------|---------------------|-------------|
| 1991-2000 | -0.67 | 0.14 | 2.16 | 2.04 |
| 2001-2010 | 2.76 | 3.63 | 2.55 | 0.87 |
| 2011-2019 | 1.74 | 2.16 | 1.50 | 0.68 |

Source: Calculated by authors.

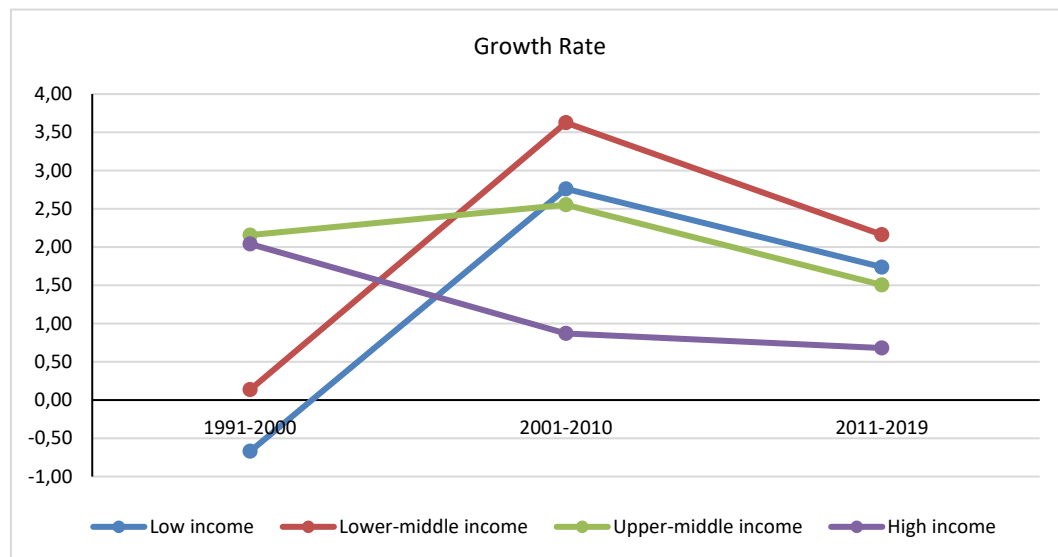


Table 7 shows that all country groups recorded the highest growth rates during the sub-period 2001-2010, except the high income countries group, which recorded the highest growth during 1991-2000. Lower-middle income countries recorded highest growth rate of 3.63% during 2001-2010.

Table 8. TFP Growth rate (%) for different country groups over sub-periods

| Time Period | Low income | Lower-middle income | Upper-middle income | High income |
|-------------|------------|---------------------|---------------------|-------------|
| 1991-2000 | -0.33 | -0.87 | 0.75 | 0.94 |
| 2001-2010 | 1.26 | 2.48 | 1.55 | 0.11 |
| 2011-2019 | 0.01 | 1.13 | 0.32 | 0.38 |

Source: Calculated by authors.

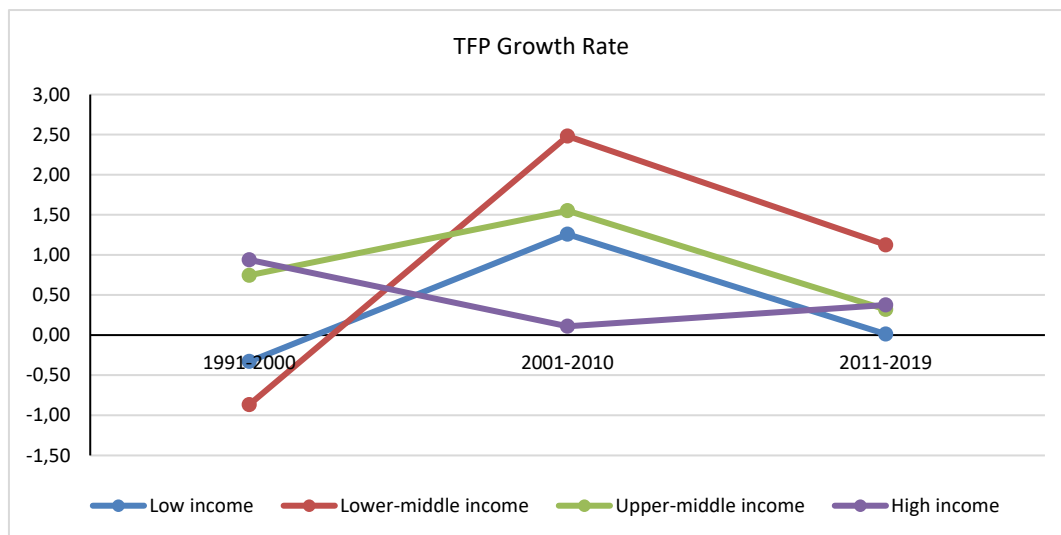


Table 8 reveals that TFP growth rate was negative for low income and lower-middle income countries during 1991-2000. Also, lower-middle income countries recorded the highest TFP growth rate during 2001-2010.

Table 9. Capital Deepening Growth rate (%) for different country groups over sub-periods

| Time Period | Low income | Lower-middle income | Upper-middle income | High income |
|-------------|------------|---------------------|---------------------|-------------|
| 1991-2000 | -0.34 | 1.00 | 1.41 | 1.10 |
| 2001-2010 | 1.50 | 1.14 | 1.00 | 0.76 |
| 2011-2019 | 1.73 | 1.04 | 1.19 | 0.31 |

Source: Calculated by authors.

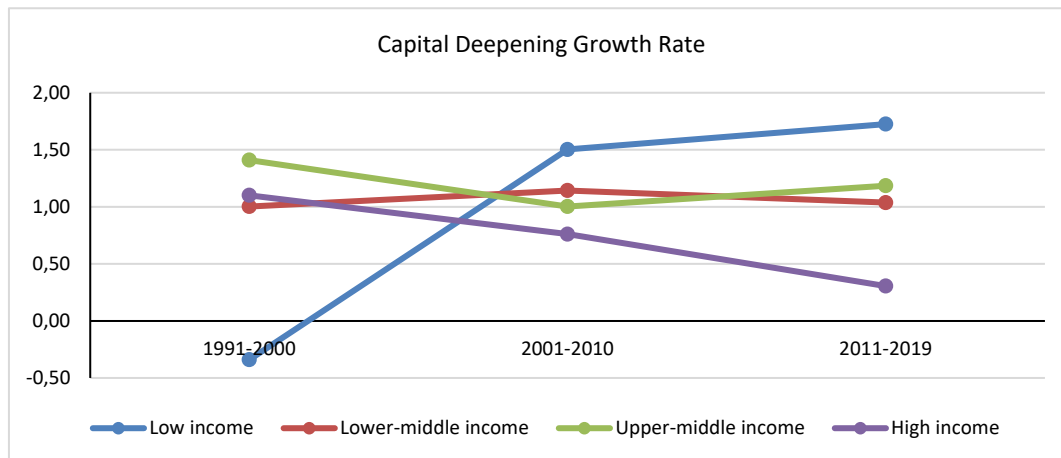
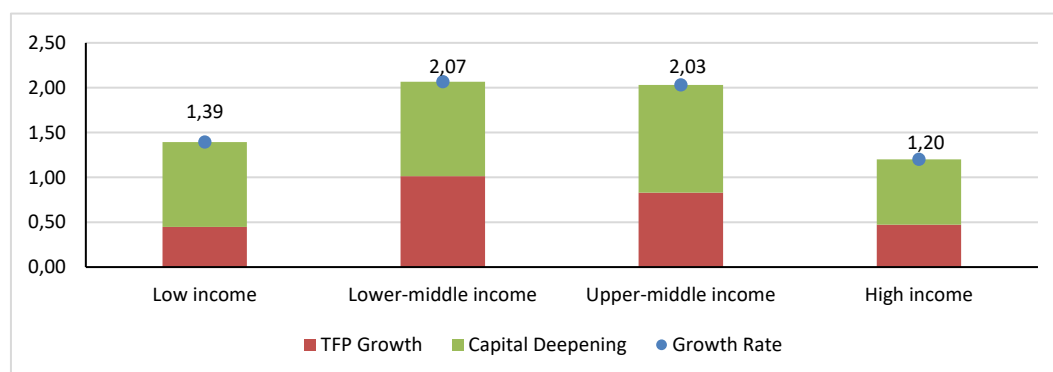


Table 9 shows that low income countries made a considerable progress in capital accumulation and recorded the highest growth during 2011-2019. However, there was a continuous decline in the capital deepening growth rate for high income countries.

To have an overview of the components of GDP growth for the overall time period, i.e., 1991-2019, the averages are calculated, depicted in Figure 1.

Figure 1. Components of GDP growth (in %) for different country groups, 1991-2019

On examining the average figures for different country groups over 1991-2019, it can be observed that the middle income country groups recorded growth rate higher than the other two country groups. The lowest growth rate was for high income countries. To examine the components of GDP growth more closely, the percentage shares were calculated, and the results are given in Table 10.

Table 10. Percentage shares for contribution of TFP Growth and Capital accumulation to economic growth for different country groups (1991-2019)

| Country group | TFP Share (%) | Capital Share (%) |
|---------------------|---------------|-------------------|
| Low income | 32.15 | 67.85 |
| Lower-middle income | 49.02 | 50.98 |
| Upper-middle income | 40.82 | 59.18 |
| High income | 39.38 | 60.62 |
| AVERAGE | 40.34 | 59.66 |

Source: Calculated by authors.

From table 10, it can be concluded that the contribution of TFP growth is relatively lower for all country groups, as compared to the share of capital deepening. However, for lower-middle income countries, both TFP growth and capital accumulation have almost the same share, whereas for low income countries, capital share is quite higher as compared to TFP share.

6. Conclusion

On performing the growth accounting exercise for different country groups, it can be observed that TFP growth had a relatively lesser share in GDP growth as compared to capital growth for all country groups except for lower-middle income countries. Middle income countries have made considerable progress in economic growth, especially during 2001-2010. High income countries witnessed a decrease in the growth rate during the sub-periods. On an average, TFP share and capital share were 40 per cent and 60 per cent, respectively. Thus, it can be seen that there is significant scope for boosting TFP growth by increasing the efficiency of factors of production, which would definitely lead to increase in the economic growth.

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