

CAPITAL AND LABOR INPUTS IN AFRICA'S GDP GROWTH: A CROSS-COUNTRY ANALYSIS

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Abstract

The functional distribution of income—how national income is shared among the factors of production such as labor, capital, and land—is an essential component of macroeconomic analysis. In the African context, this distribution plays a pivotal role in understanding structural economic disparities and guiding policy toward inclusive growth. Despite its significance, comprehensive data and detailed analysis on functional income distribution remain limited across many African economies. Unlike developed countries where state institutions routinely compile and disseminate statistics on the income shares of capital and labor in Gross Domestic Product (GDP), African countries often lack such mechanisms, leading to gaps in economic planning and research.

This study aims to explore the functional distribution of income in Africa, highlighting the relative contributions and income shares of labor and capital within GDP. It underscores the importance of understanding these dynamics for evaluating wage policies, investment trends, and wealth inequality. By analyzing available data and literature, the research sheds light on the challenges of collecting reliable information and proposes a framework for better monitoring income flows across productive factors. The findings contribute to a clearer picture of income disparities in Africa and suggest pathways to strengthen institutional capacity for economic data reporting and analysis.

Keywords: Functional income distribution, Labor share, Capital share, GDP, African economies

1. INTRODUCTION

The functional distribution of income in Africa is a critical aspect of economic analysis that focuses on how income is distributed among various factors of production. This includes the determination of the relative prices of factors of production and the shares of income accruing to labor, capital, and land. Understanding the dynamics of functional income distribution is essential for comprehending the economic landscape and the factors that influence income disparities within African economies. The analysis of functional income distribution in Africa presents challenges related to the distribution of income between factors of production. However, the provision of information or statistics on functional income distribution at the level of the whole economy, specifically pertaining to the relative shares of owners of capital (or capitalists) and owners of labour (or workers) in the total income or Gross Domestic Product (GDP) is important. For a typical developed country, such statistics are a commonplace thing that is routinely collected and disseminated by state agencies that are statutorily saddled with the responsibility.

However, for many developing countries, especially African countries, the databases of the national statistical agencies do not have statistics on the functional income distribution between the capitalist and worker groups.

But, in view of the importance of information on such functional income distribution, it is highly desirable to explore any other ways of deriving such statistics outside what national statistical agencies are either able or unable to provide. While the need for such alternative ways of "improvising" the information or estimates may not be compelling in the setting of countries with national statistical agencies that collect and disseminate the information, this is not so for a typical African country that does not have a national statistical agency with capacity to do this. In this regard, there is a lacuna in the literature regarding the adoption of alternative methods, outside natural or traditional data collection process, of deriving statistics or numbers on this form of functional income distribution. However, given the fact that the growth accounting framework of analysing the channels of economic growth effects of factors into the capital stock growth and productivity growth channels, being made to "improvise" econometrically generated estimates of numbers on the functional income distribution is therefore necessary, the present study explores this issue and thereby addresses the lacuna.

It is an attempt to fill the aforementioned gaps that have motivated the present study, which has the main objective of estimating the share of owners of capital and labour in GDP in Africa.

2. LITERATURE REVIEW

2.1 Theoretical Literature

As narrated by Banton (2023), Neo-classical growth theory (1950s – 1960s; 1980s – 1990s) posits growth in output to be a function of growth in inputs: capital, labour, and technological progress. Any increase in savings rate leads to only an increase in both the SteadyState level of output per capita and per capita capital stock over time, without growth rate of output. The growth rate of output remains unchanged due to the law of diminishing marginal product of capital because any further capital increase will lead to a fall in output back to the steady state. Also, population growth reduces the steady-state level of capita per head and output per head, as it increases over time, and increases the steady-state growth rate of output.

Long-run growth of output also depends on improvement in technology and an absence of this will allow output per person to converge to a steady state value, which depends positively on the savings rate and negatively on the population growth rate (Dornbusch, Fischer, & Startz, 2011).

As summarized by Banton (2023), the neo-classical growth model predicts that capital accumulation in an economy and how people make use of it is important for determining economic growth. It further predicts that the relationship between capital and labour in an economy determines its total output. Therefore, the production function of the neoclassical growth model is used to measure the economic growth and equilibrium of an economy. This theory emphasises the beneficial role of free markets, open economies, and privatisation of inefficient public enterprises. Its recommended strategy for development is to free markets from state control and regulation so that capital, goods, and services can have total freedom of movement and greater openness to international trade. Also, the notion of good governance has been elaborated in this theory. The basic premise of this perspective is that development outcomes depend on institutions such as property rights, price and market

structures, money and financial institutions, firms and industrial organisations, and the relationship between government and markets. The essence of good governance is to ensure the existence of these institutions and their proper role and functioning (Halperin, 2021).

2.2 Empirical Literature

Giovannoni (2010) used two high-quality and homogeneous datasets from 25 countries, with a data covering 1970 m- 2009. The study documented evidence of a strong and persistent link between the functional and the personal distribution of income on an international scale. The labor share was found to fall or remained constant in 23 countries while wage inequality rose or remained constant in 18 countries. Also, a decreasing labor share and increasing inequality are observed simultaneously in 17 of the 25 countries. The study concluded that the functional distribution of income differs across countries. According to IMF (2007a), globalization is one of several factors that have acted to reduce the share of income accruing to labor in advanced economies, although rapid technological change has had a bigger impact, especially in unskilled sectors.

The study by Ranaldi (2018) examined the relationship between the functional and personal distribution of income by introducing the concept of inequality in income composition. The study found that Inequality in income composition is high when the top and the bottom of the income distribution separately earn two different sources of income. In contrast, it is low when each individual has the same population share of the two sources. Molero-Simarro (2017) investigated the relationship between functional distribution of income and China's Gini index and carried out the analysis for both the pre and post-crisis periods. The study found that there is a link between falling wage share, rising urban households' top incomes, the urban-rural income gap, and the Gini coefficient.

3. METHODOLOGY

This study specifically follows Solow's (1957) growth model, which focuses on how capital accumulation and productivity affect long-run growth. The main idea here is that capital accumulation, labour, and autonomous level of technology have effects on growth. The derivation of the growth accounting framework or equation that forms the basis of the models specified in the study starts from a generalised linear homogeneous production function with a neutral technology of the form:

$$Y = A f(K, L) \dots\dots\dots (1)$$

Where;

Y = GDP or level of output;

K = Capital stock;

L = Labour; and

A = Productivity or technology level.

After taking the total derivative of Equation (3.1), it then becomes:

$$\Delta Y = \frac{\partial Y}{\partial L} \Delta L + \frac{\partial Y}{\partial K} \Delta K + \frac{\partial Y}{\partial A} \Delta A \dots\dots\dots (2)$$

where:

$\frac{\partial Y}{\partial L}$ = MPL or marginal productivity of labour and $\frac{\partial Y}{\partial K}$ = MPK or marginal productivity of capital.

Hence, Equation (3.2) can be written as:

$$\Delta Y = \text{MPL} \cdot \Delta L + \text{MPK} \cdot \Delta K + F(L, K) \dots \dots \dots (3)$$

Dividing equation (3.3) by Y or Af (K, L) gives

$$\frac{\Delta Y}{Y} = \left(\frac{\text{MPL}}{Y}\right) \Delta L + \left(\frac{\text{MPK}}{Y}\right) \Delta K + \frac{\Delta A}{Y} \dots \dots \dots (4)$$

Multiply and divide the first term on the right-hand side by L and the second term by K gives:

$$\frac{\Delta Y}{Y} = \left(\frac{\text{MPL}}{Y} \cdot L\right) \frac{\Delta L}{L} + \left(\frac{\text{MPK}}{Y} \cdot K\right) \frac{\Delta K}{K} + \frac{\Delta A}{Y} \dots \dots \dots (5)$$

It is to be noted that $\frac{\text{MPL}}{Y} \cdot L$ represents the share of labour in total output while $\frac{\text{MPK}}{Y} \cdot K$ is the share of capital in total output. If the share of labour is denoted by $1 - \alpha$ and the share of capital by α , then, Equation (5) can be written as:

$$\frac{\Delta Y}{Y} = (1 - \alpha) \frac{\Delta L}{L} + \alpha \frac{\Delta K}{K} + \frac{\Delta A}{Y} \dots \dots \dots (6)$$

To transform growth rate of output to per capita terms, the growth of labour force (which is assumed to be equal to the growth rate of population) $\frac{\Delta L}{L}$ is subtracted from both sides of Equation 3.6 thus:

$$\frac{\Delta Y}{Y} - \frac{\Delta L}{L} = (1 - \alpha) \frac{\Delta L}{L} + \alpha \frac{\Delta K}{K} + \frac{\Delta A}{Y} - \frac{\Delta L}{L} \dots \dots \dots (6a)$$

Since, by definition, $\frac{\Delta k}{k} = \frac{\Delta K}{K} - \frac{\Delta L}{L}$, then $\frac{\Delta K}{K} = \frac{\Delta k}{k} + \frac{\Delta L}{L}$. Substituting this in Equation 6 yields:

$$\frac{\Delta Y}{Y} - \frac{\Delta L}{L} = (1 - \alpha) \frac{\Delta L}{L} + \alpha \left(\frac{\Delta k}{k} + \frac{\Delta L}{L}\right) + \frac{\Delta A}{Y} - \frac{\Delta L}{L} \dots \dots \dots (6b)$$

Simplifying Equation (3.6b) gives the expression below:

$$\frac{\Delta y}{y} = \alpha \frac{\Delta k}{k} + \frac{\Delta A}{Y} \dots \dots \dots (7)$$

where $\frac{\Delta y}{y}$ is the growth rate of output per person (or $\frac{\Delta Y}{Y} - \frac{\Delta L}{L}$) that measures economic growth.

Under the simplifying assumption that the population and labour force grow at the same rate, $\frac{\Delta y}{y}$ is also the growth rate of output per worker.

Based on (7), the growth rate is the weighted sum of two components: the rate of Total Factor Productivity (TFP) growth, $\frac{\Delta A}{Y}$, and the growth rate of capital-labour ratio or 'capital deepening' component multiplied by the share

of capital owner in capital output, $\frac{\Delta k}{k}$. The first one measures the portion of economic growth attributable to technological progress and the second measures the portion attributable to the rate of capital accumulation. Annual balanced panel data, covering 1996 to 2022 for 54 African countries, were employed in estimating the models and the data for the study were collected from secondary sources that included the World Bank's World Development Indicators, WDI (2023).

4. PRESENTATION AND DISCUSSION OF RESULTS

It would be recalled that the objective of the study, is to derive estimates of the shares of owners of capital, denoted by α , and the owners of labour, denoted by $1 - \alpha$, in the GDP. It is therefore appropriate at this juncture to examine the issue of the relative shares of owners of capital (i.e., capitalists) and owners of labour (i.e., workers) in GDP and this is what is done in this sub-section.

It would be recalled from Section 3 that the two variants of growth accounting equations are the Equations (6) and (7) are now reproduced below as Equation (8) and (9) respectively:

$$\frac{\Delta Y}{Y} = (1 - \alpha) \frac{\Delta L}{L} + \alpha \frac{\Delta K}{K} + \frac{\Delta A}{A} \dots\dots\dots (8)$$

$$\frac{\Delta y}{y} = \alpha \frac{\Delta k}{k} + \frac{\Delta A}{A} \dots\dots\dots (9)$$

where $\frac{\Delta Y}{Y}$ is the growth rate of aggregate output is, $1 - \alpha$ represents the share of owners of labour in total output, α is the share of owners of capital in total output while $\frac{\Delta y}{y}$ is the per capita output growth rate, $\frac{\Delta k}{k}$ is the capital stock growth and $\frac{\Delta A}{A}$ is the productivity growth.

These two equations, i.e. Equations 8 and 9, are estimated, both with their intercepts being suppressed and being included, with the data covering the 1996 – 2021 period of this study and the result is as reported in Table 1. In principle, the coefficients of $\frac{\Delta K}{K}$ and $\frac{\Delta L}{L}$ in Equation 8 estimates are supposed to sum to unity but, in practice, this may not be so, as in the present case where they sum to 1.55 (or 0.87 + 0.68) in the version of the estimates with suppressed intercept while they sum to 1.08 (or 0.55 + 0.53) when the intercept is included. So, as a separate exercise, the two coefficients have to be normalised by constraining their sum to be unity. In the model estimates with suppressed intercept, this is done simply by dividing each by 1.55 to produce 0.56 as the coefficient of $\frac{\Delta K}{K}$ and 0.44 as the coefficient of $\frac{\Delta L}{L}$ that are also reported in the table. In the model estimates that feature the intercept term, this is done simply by dividing each coefficient by 1.08 to produce 0.51 as the coefficient of $\frac{\Delta K}{K}$ and 0.49 as the coefficient of $\frac{\Delta L}{L}$ that are also reported in the table.

Table 1. Estimates of Growth Accounting Equation for Deriving the Shares of Capitalists and Working Class in the GDP

Variable	Intercept	$\frac{\Delta k}{k}$	$\frac{\Delta K}{K}$	$\frac{\Delta L}{L}$	t-statistics	p-value
Estimate of: $\frac{\Delta Y}{Y} = \alpha \frac{\Delta K}{K} + (1 - \alpha) \frac{\Delta L}{L}$	–	–	0.87	0.68	16.95	0.000
$\frac{\Delta Y}{Y} = \alpha \frac{\Delta K}{K} + (1 - \alpha) \frac{\Delta L}{L}$ Adjusted or normalised estimate of:	–	–	0.56	0.44	na	na
Estimate of: $\frac{\Delta Y}{Y} = \gamma + \alpha \frac{\Delta K}{K} + (1 - \alpha) \frac{\Delta L}{L}$	1.45	–	0.55	0.53	9.24	0.000
Adjusted or normalised estimate of: $\frac{\Delta Y}{Y} = \gamma + \alpha \frac{\Delta K}{K} + (1 - \alpha) \frac{\Delta L}{L}$	–	–	0.51	0.49	na	na
Estimate of: $\frac{\Delta y}{y} = \alpha \frac{\Delta k}{k}$	–	0.706	–	–	11.79	0.000
Estimate of: $\frac{\Delta y}{y} = \gamma + \alpha \frac{\Delta k}{k}$	0.94	0.408	–	–	6.00	0.000

Author's Computation, 2023

Explanatory notes: $\frac{\Delta Y}{Y}$ = GDP growth rate, $\frac{\Delta K}{K}$ = Capital stock growth, $\frac{\Delta L}{L}$ = Labour growth, $\frac{\Delta y}{y}$ = per capita GDP growth, $\frac{\Delta k}{k}$ = Per capita capital stock growth, α = Share of capitalists in GDP, $1 - \alpha$ = share of workers in GDP, and γ is the intercept.

As it can be observed from the table, the unadjusted coefficients of $\frac{\Delta K}{K}$ and $\frac{\Delta L}{L}$ in the equation estimated by suppressing the intercept term are 0.87 and 0.68 respectively while the adjusted ones, the coefficients of which are constrained to sum up to 1 or unity, are 0.56 and 0.44 respectively. This means that the share of capitalists in GDP is 0.56 or 56% while the share of workers is 0.44 or 44%, so that the share accruing to owners of capital surpasses the share accruing to workers. But when the intercept is included in deriving the estimates, the unadjusted coefficients of $\frac{\Delta K}{K}$ and $\frac{\Delta L}{L}$ are 0.55 and 0.53 respectively while the coefficients are 0.51 and 0.49 respectively when they are constrained to sum up to 1 or unity. This means that the share of capitalists in the GDP is 51% while the share of workers is 49%, so that the share accruing to owners of capital marginally exceeds the share accruing to workers.

Coming to the estimate of the second variant of growth accounting equation, it is also observed from the table that when the intercept is suppressed in deriving the estimates, the coefficient of $\frac{\Delta k}{k}$ is 0.706, meaning that the

share of capitalists in the GDP is now 70.6% or, approximation, 70% of the GDP, so that the share of workers is only approximately 30% of the GDP. But when the intercept is included in deriving the estimates, the coefficient of $\frac{\Delta k}{k}$ 0.408, meaning that the share of capitalists in the GDP is 40% while the share accruing to the workers is now 60%.

On the whole, the various estimates of the share of GDP accruing to workers are 44%, 49%, 30%, and 60%, with the corresponding share accruing to capitalists being 56%, 51%, 70% and 40% of GDP. Concerning which of these diverse and rather conflicting estimates is the most appropriate, there is no "one word" answer to this. Between those two estimated numbers that are based on the suppressed intercept term and the other two that feature the intercept term, it is to be noted that the former (i.e., whereby the intercept term is suppressed) is more theoretically valid, as the growth accounting equation does not allow (at least, explicitly) for the existence of the intercept term. In essence, the estimates of the two equations featuring the intercept are reported majorly in the spirit of econometric niceties and in order to fulfill all righteousness of reporting all possible estimates, particularly as some may make a case for them and even prefer them to those estimates derived by suppressing the intercept. However, for the purpose of this study, the choice to make is between those two estimates derived from the equation with suppressed intercept term. While the study is not able to assertively rank these two in terms of superiority, the fact is that the one produced by estimating the per capita output growth equation without intercept term (i.e. the coefficient of the per capita capital stock growth variable) seems favoured because it is not derived from the normalisation adjustment as it is the case with the one produced by estimating the aggregate output growth accounting equation without an intercept term.

These estimates that mostly put the share of workers below the share of capitalists, intuitively, may appear implausible on the surface in view of the much larger population of workers vis-à-vis the population of capitalists in a typical African country. However, on a much closer look, the estimates need not be implausible, for several reasons. First, because of relative scarcity of capital, the rental price of capital (i.e., rate of return on capital) should be relatively high and this may compensate for the relative fewness of the population of the capitalists. Second, the definition of those belonging to the capitalist class may be much wider than it is commonly thought, as many self-employed people, particularly those operating in the informal sector of the economy, are not workers in the pure sense of it, but are partly workers and also partly capitalists, in as much as they too self-provide the capital for running their business interests. To make comparison with the real-world actual statistics for the advanced economies and some developing economies too (even though such statistics are hard to come by for many developing economies), the shares of capitalists and workers in the US in 2020 were 40% and 60% respectively while they were 40% and 60% for the UK in 2020; it was 39% and 61% in 2020 for France, 49% and 51% in 2020 for Ukraine; and 65% and 35% in 2020 for Turkey respectively (UNECE, 2020). The shares of

capitalists and workers for the only 2 developing countries (viz: Ukraine and Turkey) very much resemble the ones that this study has econometrically derived, as reported and discussed above.

Concerning which of the four variants of growth accounting equation is to be adopted for the purpose of reconciling the coefficients of explanatory variables in the per capita capital stock growth and productivity growth models with the directly estimated coefficients of the explanatory variables in the per capita GDP growth models,

the study sticks to the coefficient (viz: 0.706) of per capita capital growth $\frac{\Delta k}{k}$ in the second variant of growth accounting equation that is estimated with suppressed intercept term. This is because it is not derived from any process of normalisation or adjustment as it is the case with the 0.56 (with intercept suppressed) and 0.51 (with intercept included) that have been derived from the first variant of growth accounting equation. This estimate is also chosen when compared with 0.40 obtained when intercept is included because it is more theoretically valid than the estimate obtained by including the intercept term.

5. CONCLUSION

The findings provide evidence that the share of GDP accruing to the capitalists exceeds that accruing to workers. Specifically, based on these estimates that are relatively valid on theoretical ground, the capitalists have a share in GDP of between 56% and about 70%, depending on the growth accounting variant employed in the estimation, so that only the remaining share that is between 44% and 30% of GDP accrues to workers. Regarding the findings on the share of owners of capital in GDP, the study found that capitalist share in the GDP is between 56% and 70% (depending on which of the two theoretically valid versions of the growth accounting equation is adopted) so that the remaining share of between 44% and 30% belongs to workers. In addition, the share of owners of capital in GDP ranges between 56% and 70% in Africa, while the share accruing to workers is between the range of 44% and 30%, depending on the specific growth accounting equation employed in deriving the estimates. Other specifications of the growth accounting equation even provide more estimates that are diverse.

Finally, this study provided an econometrically generated estimate of the share of GDP accruing to each of the capitalists and workers, with the share accruing to the capitalist group ranging between 56% to 70% of GDP, so that the remaining share of between 44% and 30% is what accrues to workers, depending on the specific variant of growth accounting that is subscribed to. Ordinarily, this fact about the functional distribution of income statistics is routinely provided by the statistics compilation of state agencies in developed countries. But, in the setting of most developing countries, particularly African countries, this has not often been the case and that is why this study took the initiative of providing the econometrically generated equivalent and this study should be a pioneer in this regard.

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