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Article

The Lion on the Move Towards the World Frontier: Catching Up or Remaining Stuck?

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Abstract

The striking reversal reported by the Sub-Saharan African (SSA) economy from the early 1990s through 2015 has been well documented by now. What is less known is whether this resurgence has translated into a gradual process of convergence to the U.S. level. With the benefit of major upgrades in the source data, we employ well-tested and familiar methods in the development literature to sort out the quantitative importance of the fundamentals behind the process of convergence. While the SSA growth revival has generated local pride, foreign envy and enthusiasm from international policy makers, our results suggest a more sober tone. In 2010, per capita income and labour productivity levels relative to the U.S. are well below those reported during the pre-1990 period. Regardless of the way in which human capital is measured, relative factor input endowments constitute the primary force that held back the SSA relative labour productivity—a major departure from conventional wisdom. While the story from the sectoral level remains broadly consistent with the one obtained from the aggregate level, additional insights emerge. These include disproportionately lower relative levels of sectoral labour productivity that led to a considerably slow and atypical process of structural transformation. Although relative intersectoral labour productivity gaps have been reduced, sources of allocative inefficiency remain large. We argue that all indications point to a combination of favourable shocks behind the SSA wakening pulse rather than a set of economic fundamentals that feature a genuine economic development. The burst of the commodity prices in the mid-2014 that coincided with a sharp weakening of the performance of this economy constitutes a compelling counterfactual.

Key words: convergence, productivity, capital formation, structural change

JEL classification: N10, O47, O55, O57

1. Introduction

The considerable uncertainty that hangs over the Sub-Saharan African (SSA) economy at present has touched off a strenuous debate among economists about whether improvements

in the economic record over the 1990–2015 period can be sustained or are just reminiscent of the one-time event experienced during the oil boom of the 1970s. A consensus is now emerging that something fundamental has changed with the optimistic proponents pointing to government actions for ending armed conflicts, improving macroeconomic conditions, and creating a favourable business climate as the causal factors behind the reversal in the SSA fortune (Pattillo *et al.*, 2005; Johnson *et al.*, 2010; McKinsey Global Institute, 2010). In this view, economic reforms have produced a profound change in the SSA economy, leading to a sustained improvement in growth prospects from the early 1990s through 2015.

Sceptics remain, however, arguing that the success observed during this period reflects a series of favourable, but temporary, shocks triggered by the global race for commodities and natural resources, making the SSA's growth revival 'fragile' (Arbache and Page, 2010; Sindzingre, 2013). This argument is buttressed by the view that the majority of the SSA economies are becoming service economies without having had proper experience of industrialisation that is at the core of development.

The debate has intensified recently with the recognition by the economics profession that the state of Africa's statistical infrastructure raises considerable doubts on the reliability of the reported figures. This factor adds to the considerable uncertainties about the economic performance of the continent (Devarajan, 2013; Jerven, 2013a,b). The situation is not, however, as hopeless as it may appear at first. All of the studies cited above predate some recent high profile data developments that placed the issue of reliability at centre stage. For example, the latest edition of the Penn World Tables (PWT 9.0) was prepared on the basis of major upgrades in the concepts and methods of the underlying national accounts of the different participating countries to the 2011 round of the International Comparison Program (ICP). While these upgrades contributed to correct the methodological flaws identified in the ICP 2005, they also led to a striking narrowing of the international income differences (Deaton and Aten, 2017). These efforts coincided with a development of the Africa Sector Database (ASD), a novel source data integrated to national accounts which offer the advantage to compile consistent data series on output and inputs for the whole economy and its constituent sectors. The ASD also made a considerable effort to address some important reliability issues ranging from the coverage of informality to the construction of constant-price series using sector-specific Purchasing Power Parities (PPPs) (de Vries *et al.*, 2015).

With the benefit of hindsight and enhanced source data that capture some of the most important episodes of the economic development of the SSA economy, this paper revisits the long-term pattern of the SSA's relative economic performance with an emphasis on the 'level'. This aspect has been neglected by the recent literature on the SSA economy, yet it has huge implications on our understanding of the SSA's development path now and in the future. We combine a top-down approach that performs a development accounting exercise at the macroeconomic level with a bottom-up approach that traces the sources of the SSA's relative productivity gap to its sectoral origins.

There are several advantages in combining these two approaches. First, with an emphasis on capital intensity and total factor productivity (TFP) for the whole economy, the top-down approach highlights the quantitative importance of these two channels for achieving convergence to the world frontier. Second, the bottom-up approach moves beneath the aggregate data to quantify the relative importance of within-, reallocation- and

between-effects. Examples of the insights offered by these effects include the quantitative role of structural transformation which constitutes another channel for convergence—alongside capital intensity and TFP. Third, combining these two approaches also offers the possibility to assess the consistency between the insights gained from the top-down approach and those gained from the bottom-up approach. For example, if capital intensity and/or TFP are the primary source of the relative gap in the aggregate labour productivity, then the within-effects need to be quantitatively important under the bottom-up approach.

The combination of the top-down and the bottom-up approaches contribute to addressing the following set of questions. First, do the empirical regularities identified as part of a top-down approach that are applied for a wide range of developing economies make their way into the SSA economy? If not, what sort of deviation does the SSA economy offer? Second, of the competing ways to achieve convergence—capital intensity, TFP and structural transformation—which ones are quantitatively the most important? Finally, to paraphrase the title of the present paper, is the SSA gradually converging to the world frontier or is it still stuck? The answers to these questions can possibly have far-reaching policy implications. The value of this paper, therefore, rests on the premise that drawing together fresh insights on stylised facts of the SSA economy is both useful for future research and interesting for policy-making.

Our results considerably nuance the recent narrative on the SSA economy. First, from the top-down perspective, the SSA's relative GDP per capita declined steadily from almost 14.6% in 1970 to a historical low of 4.5% in 1998. The turnaround at the turn of the new millennium brought the ratio back to 8.4% in 2010—less than 40% of the 10 percentage points of the relative real per capita income lost during the 1970–1998 period. This suggests that the tide that has lifted the SSA economy since 1998 has not been strong enough to recover the ground lost during the earlier period, let alone to catch-up with the world frontier. The results point to the presence of weak fundamentals illustrated by a disproportionately lower relative level of capital intensity that contributes to holding back relative labour productivity—the primary source of real income per person gap. Depending on the measure of human capital, the contribution of factor endowments to the relative labour productivity gap ranges between 68% (considering only years of schooling) and 81% (considering the joint effects of years of schooling and cognitive skills). This result stands in sharp contrast with the conventional wisdom which highlights the primary role of the differences in TFP levels in the cross-country relative labour productivity gap (see, for example, Hsieh and Klenow, 2010; Jones and Romer, 2010).

While some of the results obtained from the bottom-up approach complements those obtained from the top-down perspective, others are completely novel. For example, within-effects represent an important source of the productivity gap at the sectoral level, indicating that sectors generally report important gaps in terms of capital intensity and TFP. The other source behind the lack of convergence is attributable to the reallocation-effects. This suggests the presence of an atypical process of structural transformation, in which resources move towards sectors with relatively low productivity. The only comforting news offered by the bottom-up approach is the presence of a positive contribution of the between-effects to convergence towards the world frontier, but these are not large enough to wipe out the negative contribution of within- and reallocation-effects. Considered together, our results suggest that the SSA remained stuck and no real sign of convergence emerges from the data, largely due to weak economic fundamentals. The slowdown reported by this economy

in the wake of the 2014 burst of the commodity prices bubble speaks favourably for this argument.

This paper complements the nascent literature on the resurgence of the SSA economy, which has been investigated in terms of 'growth' and not 'level'. Klenow and Rodríguez-Clare (1997), Hall and Jones (1999), Caselli (2005), and Hsieh and Klenow (2010) applied this approach of level accounting to a large sample of economies at different stages of economic development. We extend this strand of literature in two important directions. First, the application of this approach to the SSA economy allows us to highlight insights at a level of resolution never attained before for a set of SSA economies. Second, we assess whether our results remain sensitive to alternate measures of human capital which contrast education attainment (whether students attended school) with cognitive skills (whether students effectively learned). In this sense, our work is closer to a recent strand of literature that used the notion of cognitive skills as a novel measure of human capital in the development accounting exercise (Gundlach *et al.*, 2002; Erosa *et al.*, 2010; Hanushek and Woessmann, 2012; Caselli, 2016; Cubas *et al.*, 2016).[1]

The bottom-up approach, which rests on a decomposition formula devised by Caselli and Tenreyro (2006), quantifies the relative importance of within-, between-, and reallocation-effects in the convergence of the SSA aggregate labour productivity to the U.S. frontier. Thus, our formula that stresses the notion of relative performance differs from those employed by McMillan *et al.* (2014) and de Vries *et al.* (2015) who place the focus on the performance of the SSA economy per se without any consideration on whether the SSA gets closer to the world frontier. While this decomposition is similar to the one employed by Harchaoui and Üngör (2016) for the same set of SSA economies, its application in the present paper offers the possibility to validate some of the insights obtained from the top-down approach.

The remainder of the paper is organised as follows. Section 2 outlines a convergence accounting framework that traces the sources that drive the labour productivity level gap between the SSA and the U.S. Section 3 describes the data sources and our adjustments to the data. Section 4 presents the results of the convergence analysis at the aggregate level. Section 5 examines the sectoral convergence. Section 6 concludes.

2. Convergence accounting

The convergence accounting exercise that we employ in this paper proceeds with a dual track approach. We begin with the top-down approach which quantifies the proximate sources of the relative gap in terms of GDP per capita and those behind the relative labour productivity gap. This approach is complemented by the bottom-up approach that sorts out the proximate sources of convergence using sectoral data.

2.1 Aggregate framework

We consider a variant of the development accounting exercise which nests the sources of change in real GDP per capita (q_t^{SSA}) with those underlying labour productivity. GDP per

1 While we are unaware of any attempt that applies the development accounting exercise to a set of SSA economies, Cho and Tien (2014) have presented a GDP per capita growth decomposition for a selection set of SSA countries.

capita can be decomposed into three components: demographic factors, i.e., how many people in the total population are available for work, namely, the demographic dividend (n_t^{SSA})[2]; labour market activity which is tracked by the employment rate—the fraction of the potential labour force (representing the population between 15 and 64 of age) that is employed (e_t^{SSA}); and the efficiency with which employed workers are utilised in the economy, i.e., labour productivity (y_t^{SSA}). Formally:

$$q_t^{SSA} = y_t^{SSA} \times e_t^{SSA} \times n_t^{SSA}, \tag{1}$$

$q_t^{SSA} \equiv (Y_t/N_t)^{SSA}$, $y_t^{SSA} \equiv (Y_t/E_t)^{SSA}$, $e_t^{SSA} \equiv (E_t/N_t^{15-64})^{SSA}$ and $n_t^{SSA} \equiv (N_t^{15-64}/N_t)^{SSA}$, where Y_t, E_t, N_t^{15-64} and N_t represent, respectively, real GDP, employment, working-age population and total population in the SSA economy at time t.

We further apportion labour productivity, y_t^{SSA}, between endowments and TFP using the following constant returns to scale Cobb–Douglas technology:[3]

$$Y_t^{SSA} = A_t^{SSA}(K_t^{SSA})^{\alpha}((hE)_t^{SSA})^{1-\alpha}, \tag{2}$$

where A, K, h and α are, respectively, TFP, the stock of physical capital, human capital per worker and capital factor income share. Following Caselli (2005), we re-write (2) in an intensive form to arrive at the following decomposition of labour productivity:

$$y_t^{SSA} = A_t^{SSA}(k_t^{SSA})^{\alpha}(h_t^{SSA})^{1-\alpha}, \tag{3}$$

where $k(\equiv K/E)$ represents capital deepening. Expressing the SSA performance relative to that of the U.S. leads to the following re-write of GDP per capita and labour productivity:

$$\frac{q_t^{SSA}}{q_t^{US}} = \frac{y_t^{SSA}}{y_t^{US}} \times \frac{e_t^{SSA}}{e_t^{US}} \times \frac{n_t^{SSA}}{n_t^{US}}, \tag{4}$$

and

$$\frac{y_t^{SSA}}{y_t^{US}} = \frac{A_t^{SSA}}{A_t^{US}} \times \left(\frac{k_t^{SSA}}{k_t^{US}}\right)^{\alpha} \times \left(\frac{h_t^{SSA}}{h_t^{US}}\right)^{1-\alpha}, \tag{5}$$

which constitute the metric to track the relative performance of the SSA economy over time.

2 The term demographic dividend tracks the reduction in the proportion of non-productive dependents in the population which can result from: (i) the fall in the fertility rate (made possible by significant reductions in child/infant mortality rates) and/or (ii) an extension in average life expectancy that translates into an increase in the portion of the population that is in the working-age group (Bloom and Williamson, 1998).

3 We use the same value of α for both the SSA and the U.S. since the Cobb–Douglas framework suffers from the unit-invariance problem when the factor shares are indexed by country. Sturgill (2014) shows that development accounting with the Cobb–Douglas aggregate production function is invalid without the assumption of the same factor shares across the countries.

2.2 Sectoral Framework

We have, so far, outlined an aggregate framework that quantifies how much of the real GDP per capita convergence is attributable to labour productivity, labour utilisation and demographic dividend. Labour productivity is further decomposed into capital deepening, human capital and TFP. We now turn our attention to the sectoral sources of the aggregate labour productivity convergence.

We perform a convergence decomposition exercise using the same approach employed by Caselli and Tenreyro (2006) in their convergence accounting exercise for Europe.[4] The decomposition tracks three channels to the aggregate convergence:

$$\underbrace{\Delta \frac{y_t^{SSA} - y_t^{US}}{y_t^{US}}}_{\text{Aggregate convergence}} = \underbrace{\sum_{j=1}^{J} \bar{s}_{j,t}^{SSA} \Delta \left(\frac{y_{j,t}^{SSA} - y_{j,t}^{US}}{y_t^{US}} \right)}_{\text{Within-sector convergence}} + \underbrace{\sum_{j=1}^{J} \overline{\left(\frac{y_{j,t}^{SSA}}{y_t^{US}} \right)} \Delta s_{j,t}^{SSA} - \sum_{j=1}^{J} \overline{\left(\frac{y_{j,t}^{US}}{y_t^{US}} \right)} \Delta s_{j,t}^{US}}_{\text{Labor reallocation convergence}} + \underbrace{\sum_{j=1}^{J} \left(\bar{s}_{j,t}^{SSA} - \bar{s}_{j,t}^{US} \right) \Delta \left(\frac{y_{j,t}^{US}}{y_t^{US}} \right)}_{\text{Between-sector convergence}}, \quad (6)$$

where aggregate labour productivity of country $i(= SSA, US)$ at time t constitutes a weighted sum of the sectoral labour productivity levels, $y_t^i = \sum_{j=1}^{J} s_{j,t}^i y_{j,t}^i$, with $s_{j,t}^i$ representing the share of employment of sector j ($j = 1,2,..,J$) in the overall economy and the operators Δ and $\bar{}$ are defined as $\Delta x_{j,t} = x_{j,t} - x_{j,t-1}$ and $\bar{x}_{j,t}^i = \frac{x_{j,t}^i + x_{j,t-1}^i}{2}$.

The term 'within-sector convergence' captures the productivity catch-up of each sector with the corresponding one in the U.S., weighted by the average employment share in that sector. This term captures differences in capital intensity, differences in average human capital per worker and TFP differences. Therefore, sectors converge when capital intensity (including human capital) tends to equalise and/or when technology flows from more productive to less productive sectors.

The term 'labor reallocation convergence' quantifies the part of convergence caused by the movement of employment from one sector to another. In other words, this term measures the contribution of structural transformation to the convergence process. Each sector is weighted by its relative labour productivity. The contribution is positive only when labour is reallocated to the most productive sectors and at least in the same proportions in which the U.S. is actually reallocating total employment. This effect is outweighed if the U.S. reallocates its workers to sectors with higher labour productivity relative to their counterparts.

4 Kim (1998) and Caselli and Coleman (2001) study similar decompositions to investigate the regional convergence using the historical data for the U.S.; and Enflo and Rosés (2015) employ a similar framework using the historical data for the Swedish counties.

The term 'between-sector convergence' measures the contribution to the convergence in productivity levels across sectors. This term suggests that, if productivity of the sectors in which the SSA has a disproportionate share of labour converges to the overall productivity of the U.S. economy, then convergence can potentially occur. Put differently, advances in solving allocative inefficiencies can become a source of convergence.

While the above formula can be applied to the entire ς to τ period, it requires a slight modification to accommodate the split of this period between the sub-periods ς to ς' and ς' to τ. Following Caselli and Tenreyro (2006), Equation (6) is re-written in a way to capture a revival or deterioration during the ς to τ compared to ς to ς'. First, within-sector convergence during the ς to τ period ($WSC_{\varsigma-\tau}$) is decomposed as

$$WSC_{\varsigma-\tau} = \underbrace{\sum_{j=1}^{J} \bar{s}^{i}_{j,\tau} \Delta_{\varsigma'-\tau}\left(\frac{y^{i}_{j,t} - y^{US}_{j,t}}{y^{US}_{t}}\right)}_{WSC_{\varsigma'-\tau}} + \underbrace{\sum_{j=1}^{J} \bar{s}^{i}_{j,\tau} \Delta_{\varsigma-\varsigma'}\left(\frac{y^{i}_{j,t} - y^{US}_{j,t}}{y^{US}_{t}}\right)}_{WSC_{\varsigma-\varsigma'}},$$

where $\bar{s}^{i}_{j,\tau} = \frac{s^{i}_{j,\tau} + s^{i}_{j,\varsigma}}{2}$. Second, labour reallocation convergence during ς to τ ($LRC_{\varsigma-\tau}$) is decomposed as

$$LRC_{\varsigma-\tau} = \underbrace{\sum_{j=1}^{J} \overline{\left(\frac{y^{i}_{j,\tau}}{y^{US}_{\tau}}\right)} \Delta_{\varsigma'-\tau} s^{i}_{j,\tau} - \sum_{j=1}^{J} \overline{\left(\frac{y^{US}_{j,\tau}}{y^{US}_{\tau}}\right)} \Delta_{\varsigma'-\tau} s^{US}_{j,\tau}}_{LRC_{\varsigma'-\tau}}$$
$$+ \underbrace{\sum_{j=1}^{J} \overline{\left(\frac{y^{i}_{j,\tau}}{y^{US}_{\tau}}\right)} \Delta_{\varsigma-\varsigma'} s^{i}_{j,\varsigma'} - \sum_{j=1}^{J} \overline{\left(\frac{y^{US}_{j,\tau}}{y^{US}_{\tau}}\right)} \Delta_{\varsigma-\varsigma'} s^{US}_{j,\varsigma'}}_{LRC_{\varsigma-\varsigma'}},$$

where $\overline{\left(\frac{y^{i}_{j,\tau}}{y^{US}_{\tau}}\right)} = \frac{1}{2}\left(\frac{y^{i}_{j,\tau}}{y^{US}_{\tau}} + \frac{y^{i}_{j,\varsigma}}{y^{US}_{\varsigma}}\right)$. Finally, between-sector convergence during ς and τ ($BSC_{\varsigma-\tau}$) is decomposed as

$$BSC_{\varsigma-\tau} = \underbrace{\sum_{j=1}^{J} \left(\bar{s}^{i}_{j,\tau} - \bar{s}^{US}_{j,\tau}\right) \Delta_{\varsigma'-\tau}\left(\frac{y^{US}_{j,\tau}}{y^{US}_{\tau}}\right)}_{BSC_{\varsigma'-\tau}}$$
$$+ \underbrace{\sum_{j=1}^{J} \left(\bar{s}^{i}_{j,\tau} - \bar{s}^{US}_{j,\tau}\right) \Delta_{\varsigma-\varsigma'}\left(\frac{y^{US}_{j,\varsigma'}}{y^{US}_{\varsigma'}}\right)}_{BSC_{\varsigma-\varsigma'}}.$$

3. The source data

3.1 Preamble

The implementation of our framework requires several source data. The natural source data for the top-down approach are represented by the Penn World Tables (PWT), a rich panel dataset of a wide range of countries over a long time span typically designed to facilitate cross comparisons of living standards and their proximate sources. The latest vintage

of the PWT (PWT 9.0) features several upgrades in terms of concepts, methods and data sources.[5] Feenstra *et al.* (2015) describe the latest developments in the PWT, while Inklaar and Rao (2017) construct a set of bias-adjusted relative prices for ICP 2005 that exploited methods of ICP 2011. This adjustment has been applied to the PWT 9.0 to maintain historical coherence.

While the PWT 9.0 represents a major leap forward both in terms of enhanced reliability of macroeconomic data and coverage of many of the 48 countries that officially constitute the SSA, its equivalent at the sectoral level remains scant.[6] For example, the World Bank's World Development Indicators (WDI), which covers most of the 48 SSA countries, offers value added in current and constant U.S. dollars for agriculture, industry and services for some years. However, these series are not offered in international PPPs nor does this source data provide the corresponding long and continuous employment time-series that are necessary to compute coherent labour productivity trends and levels. Longer series for labour productivity are deemed important for the delineation of broad patterns of economic growth and development.

The recently developed Africa Sectoral Database (ASD)[7] fills an important gap. This panel dataset provides information on valued added (in current and constant 2005 prices expressed in national currencies) and employment for 10 main sectors of 11 SSA economies.[8] This sample covers two landlocked, resource-scarce economies (Ethiopia and Malawi), five coastal, resource-scarce economies (Ghana, Kenya, Mauritius, Senegal and Tanzania) and four resource-rich countries (Botswana, Nigeria, South Africa and Zambia). The ASD offers several attractive features over some other existing third-party data. First, compared to the economy-wide dataset such as the WDI, it includes sector-specific PPPs for the 2005 benchmark year that facilitate the construction of reliable sectoral measures of productivity levels. Second, it is consistent, both in terms of sectoral delineation and concepts, with the 10-Sector Database. This feature facilitates data integration represented by the use of information on the U.S. economy which represents the benchmark.[9]

Compared to sector-specific datasets such as the ones available for agriculture and the industry compiled by the Food and Agriculture Organization (FAO)[10] and the United Nations Industrial Development Organization,[11] respectively, the ASD is too broad-brush to capture the finer industry details offered by these competing datasets. However, a compensating factor is that the ASD facilitates the general equilibrium effects of reallocation that these sector-specific datasets cannot do. The other attractive feature of the ASD is its

5 http://www.rug.nl/ggdc/productivity/pwt/

6 The set of countries are reported in Appendix A.

7 http://www.rug.nl/ggdc/productivity/10-sector/other-releases/africa-sector-database

8 The sectoral breakdown based on the International Standard Industrial Classification, Revision 3.1 comprises: (1) agriculture, (2) mining, (3) manufacturing, (4) utilities, (5) construction, (6) trade services, (7) transport services, (8) business services, (9) government services and (10) personal services. Data for dwellings are presented separately for the purpose of productivity analysis since this imputed production does not have an employment equivalent. We exclude it for the purpose of sectoral productivity comparisons.

9 http://www.rug.nl/ggdc/productivity/10-sector/

10 http://www.fao.org/statistics/en/

11 http://www.unido.org/resources/statistics/statistical-databases.html

reliance on the System of National Accounts (SNA), an integrated framework that facilitates the compilation of coherent data on output and labour. Under the architecture of the SNA, data on outputs and inputs become integrated and facilitate the construction of reliable productivity series.[12]

While the PWT and ASD have contributed to accurately advance our knowledge of SSA economy growth path over the 1970–2010 period, they certainly suffer from a lack of timeliness which makes it difficult to contrast the setbacks following the 1970s' oil booms with those ascribed to the recent collapse of the commodity super cycle.

3.2 Coverage and data series

3.2.1 Sample

The need to employ these two source data in an integrated fashion comes, however, at the cost of a reduced sample of economies. Combining the PWT with the ASD necessarily leads to a reduction in the sample of economies to its lowest common denominator represented by the 11 economies that form the ASD. Despite this smaller coverage in terms of countries, the resulting sample remains representative both in terms of relative size which is close to 70% of GDP of the entire set of SSA economies reported in the WDI and in terms of the breadth of countries that fall under the World Bank country classification (World Bank, 2016).[13]

While these 11 countries have consistently been covered by the PWT 9.0 since 1960 onwards, for many countries in the ASD—including Botswana, Kenya, Malawi, Mauritius and Senegal—the coverage starts at a later stage. As a result, we truncate the time period from 1960–2010 to 1970–2010 while still covering the most interesting episodes of the SSA economies such as the lost decades and the recent growth spurt periods. We believe that the earlier 1960–1970 is primarily a transition period following the independence of the majority of the countries covered and thus is the least interesting episode from the perspective of the development path of the SSA economy.[14] While we cover the 1970–2010 period, we contrast the lost decades that spanned much of the 1970–1990 sub-period with the 1990–2010 sub-period of economic resurgence.

3.2.2 Aggregate variables

With a sample of countries and time periods consistently maintained across the two source data, we consider the following set of variables for the implementation of our framework.

12 Differences with respect to sources and methods make a definitive reconciliation between the ASD and some of these alternate source data impossible. For example, the ASD is based on a double deflation approach of the real value added series while the FAO output series are constructed using a wide range of commodity detail and their corresponding volume and price series. Nonetheless, the cross-country coefficient of correlation of the employment shares and labour productivity series between the two datasets are high, hovering around 96%.

13 This classification, based on the GNI per capita in US$ (the World Bank Atlas method) of the year 2010, offers the following brackets: low-income economies $\leq$\$1,005 (Ethiopia, Kenya, Malawi, and Tanzania); \$1,006 $\leq$ lower middle-income economies $\leq$\$3,975 (Ghana, Nigeria, Senegal and Zambia); and \$3,976 $\leq$ upper middle-income economies $\leq$\$12,275 (Botswana, Mauritius and South Africa) (databank.worldbank.org/data/download/site-content/OGHIST.xls).

14 Bates *et al.* (2007) refer to this episode as "the post-imperial 'lost decades'". Kenya, Malawi, Botswana and Mauritius became independent in 1963, 1964, 1966 and 1968, respectively.

From the PWT 9.0, we retain the variables for GDP, physical capital, human capital and population. Specifically, we use the variable *cgdpo* (output-side real GDP at current PPPs (in millions of 2011 US$)) for GDP. This provides a more accurate measure of the productive capacity of an economy than previous real GDP measures in PWT by accounting for differences in the terms of trade.[15]

The human capital index, the variable *hc*, is constructed from the combination of returns to schooling and years of schooling using the procedures developed by Hall and Jones (1999) and Caselli (2005).[16] In their comprehensive survey of the literature, Hanushek and Woessmann (2008) stressed that this measure of human capital tracks the time spent at school and not how much students are gaining in terms of learning and skills.[17] We use the SSA's test score of cognitive skills based on the work of Altinok *et al.* (2014) to ascertain the robustness of the measure of human capital.[18]

Physical capital input, represented by capital stock *ck*, is measured in terms of current PPPs (in millions of 2011 US$). The measurement of capital rests on a breakdown of total investment into a wide range of assets (with their geometric depreciation rates). This includes structures (residential and non-residential), transport equipment, computers, communication equipment, software, and other machinery and assets. Population, the variable *pop*, is given in millions of people. The employment series available from the PWT were superseded by those of the ASD. According to de Vries *et al.* (2015), employment series from the ASD are based on the population census, admittedly an adequate vehicle to track informal activities. This contrasts with the series from the PWT 9.0 which are taken from labour force surveys, making them prone to under coverage due to inadequate frames.

The ASD employment series reflect the big slump experienced by the SSA from the mid-1980s until the early 1990s and the important recovery that emerged during the following period. Similarly, they report a lack of convergence to the U.S. level for most of the historical period until the recent surge period. This contrasts markedly with the PWT 9.0 employment series which wiped out the slump period and report an unlikely steady movement of convergence to the U.S. level (see Figure A1 in the Online Appendix). The information required for the compilation of the employment rate for those in the 15–64 age group was obtained from the WDI. Finally, we follow Bernanke and Gürkaynak (2001), Gollin (2002), and Caselli (2005) and set a common value of $\alpha = 1/3$ for the SSA and the U.S.

15 Detailed discussions are available at: www.rug.nl/ggdc/docs/what_is_new_in_pwt_81.pdf

16 Human capital for the SSA region is calculated as the employment weighted human capital for each country.

17 In a set of studies that culminated with Hanushek and Woessmann (2015), they argued that internationally comparable measures of cognitive skills correlate highly with economic growth, and cognitive skills can explain away large differences in growth rates between world regions, i.e., conditional on initial income levels, regional growth over the last four decades can be described by differences in cognitive skills. Countries that do well on the achievement tests systematically have higher growth rates than countries with poor educational achievement.

18 Altinok *et al.* (2014) provide data on all of the SSA countries we are interested in except Ethiopia. Based on their work, the average score for the SSA over the 1965–2010 period for the SSA is 367.0 compared to 576.0 for the U.S. See also Altinok and Murseli (2007) and Altinok and Aydemir (2016) for related data discussions.

3.2.3 Sectoral variables

The ASD has been subject to two changes. First, sectors of government services and personal services had to be collapsed into one sector as the employment series for Zambia do not offer this breakdown while owner-occupied dwellings have been dropped due to the absence of employment data. Second, the constant-price value added series expressed in national currencies have been converted to dollars using the 2005 PPPs supplied as part of the ASD. A complete series on real value added in international prices has been extrapolated forward and backward using the growth rates of real value added by sector. We follow this approach for each sector and country over the 1970–2010 period.

Aggregate employment and PPP-adjusted value added series are derived from the straight sum of annual levels across sectors for each SSA country. These national series are, in turn, aggregated across all 11 countries to arrive at the SSA group. The same procedure is implemented for the U.S. Our aggregation procedure is thus different from the one used by McMillan *et al.* (2014) and de Vries *et al.* (2015) who do not resort to sectoral or national weights. While our approach tends to give more weight to larger sectors within a given economy and to larger economies across the SSA sample, it remains a well-established practice in the area of economic measurement (OECD, 2001). Another important reason in favour of using weighted aggregates is motivated by the need to reduce the impact of volatility that may arise from small economies or from those that experienced a rapid growth from a low level. Our sample of SSA economies comprises many poor countries that feature a high degree of specialisation in a few highly volatile sectors. Moreover, the lack of diversification of these economies makes them prone to severe macroeconomic shocks which reinforce idiosyncratic shocks (Koren and Tenreyro, 2007). Our approach, therefore, has the merit to place the emphasis on long-terms paths free from any significant volatility that the sample of SSA economies is generally subjected to. With these considerations in mind, labour productivity in each sector of the SSA and U.S. economies is computed as the ratio of each sector's PPP-adjusted (real) value added by the corresponding level of sectoral employment.

4. Aggregate analysis

4.1 GDP per capita and its components

Plotted on a log scale for the 1970–2010 period, the most striking fact displayed in Figure 1 is the steady increase of U.S. real GDP per capita. While the growth rate slowed during the 1990–2010 period compared to the 1970–1990 period (1.5% vs. 2.3%), the overall period experienced a 1.9% annual advance, a rate sufficient to double the standard of living every 37 years. In the SSA, the average growth rate between 1970 and 2010 is a lacklustre 0.5% annual growth, reflecting an erratic advance compared to the U.S. (−2.1% during the early two decades compared to 3.1% during the subsequent two decades). The SSA fell steadily behind the U.S. through the late 1980s then suffered downward dislocations associated with the period of structural adjustment that started in the mid-1980s and continued until the early 1990s. These periods, which were at the core of SSA's lost decades, were followed by a reversal that is not propelled forward by the fundamentals (more on that below).

Figure 2 depicts the equivalent record for labour productivity. Labour productivity growth in the U.S. is not as steady as output per capita growth and displays its strongest

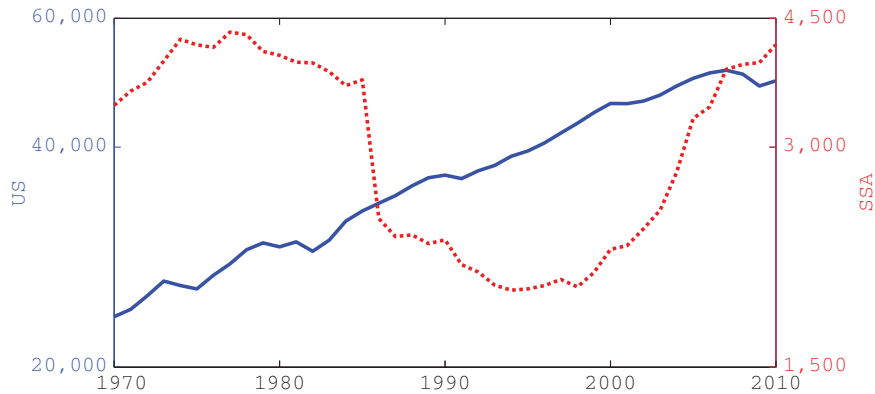

Figure 1: GDP Per Capita (Log Scale).

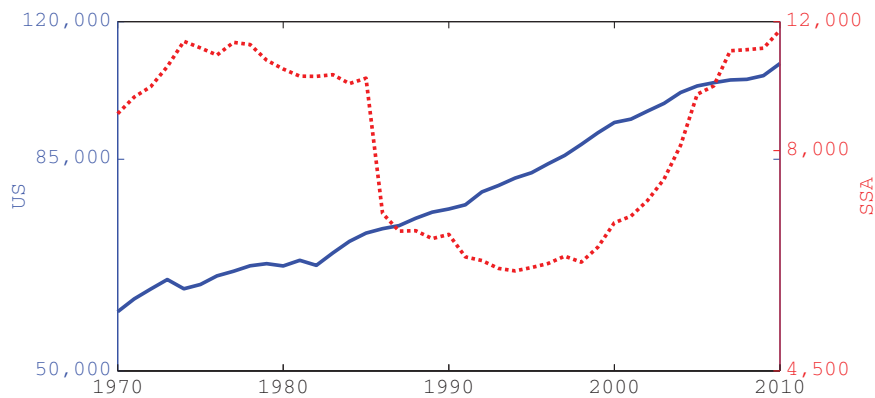

Figure 2: Labour Productivity (Log Scale).

performance during the 1990–2010 period (1.8% compared to 1.3% during 1970–1990). The SSA record on labour productivity in Figure 2 closely mirrors that for output per capita in Figure 1. The SSA starts out considerably below the U.S. in 1970, experiences a 1.9% average decline in its labour productivity performance during the 1970–1990 period but then, with a sharp 3.3% spurt during 1990–2010, recovers all of the lost ground during the 1980s.[19]

The data in Figures 1 and 2 can be combined as in Figure 3, which plots the ratios of the SSA to the U.S. levels of output per capita and the factors that underlie its change-labour productivity, employment rate, and demographic dividend. Figure 3 dramatises

19 To put these numbers into perspective, it is insightful to note that China's labour productivity increased 1.8% during 1970–1990, compared to 6.9% during 1990–2010. In the meantime, China's labour productivity relative to that of the U.S. barely increased from 5.1% to 5.7% from 1970 to 1990 before reaching 15.0% in 2010. This suggests that convergence to the U.S. level requires a growth rate that is almost a 4-fold faster that of the U.S.

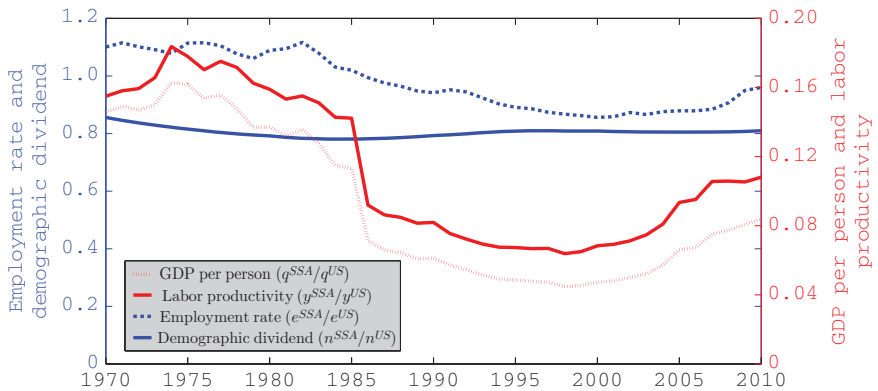

Figure 3: GDP Per Person and its Sources in the SSA (Relative to the U.S.).

several themes that are less obvious in Figures 1 and 2. The SSA-U.S. ratio of GDP per capita declined steadily from 14.6% in 1970 to 6.1% in 1990 with sharp structural adjustment-related jolts taking the ratio down to its minimum of 4.5% in 1998. The upsurge from 2000 to 2010 brought the ratio to 8.4% in 2010, above the pre-structural adjustment level, but never recovered the one attained in 1970.

Three facts stand out behind the patterns offered by SSA relative GDP per person. First, the SSA economy produced about one sixth of the output per worker of the U.S. during the early 1970s then dwindled precipitously to one twentieth around the mid-1990s. The growth spurt that occurred during the first decade of the new millennium caused the level of SSA labour productivity to reach only one-tenth of the output per worker of the U.S. Second, the labour productivity gap represents the primary source behind differences in GDP per capita, hovering around slightly more than 90% during the 1970–2010 period with little variation across sub-periods. Third, except for the demographic dividend which remained steady, all of the underlying sources of relative GDP per capita experienced a precipitous decline from the early 1970s to 1998, followed by a reasonably rapid pick up which nonetheless recovered less than half of the loss encountered prior 1998.

4.2 The sources of labour productivity gap

From the last section, we have established that SSA relative labour productivity is the primary source of its GDP per capita. We now quantify the apportionment of the relative gap in labour productivity between a broad notion of capital intensity (physical capital per worker combined with human capital per worker) and TFP.

In 1970, the SSA's relative capital-labour ratio was only 6.0%, reflecting the state of an economy at the initial stage of economic development with a modest endowment of capital (Figure 4). During most of the 1970s, the ratio advanced more rapidly relative to its U.S. counterpart, reaching a historical peak in 1985 at 8.5% before entering a long period of deterioration that halted in 2002 when the ratio reached a 4.5% trough. The 3.4 percentage points gained during the subsequent period recovered more than four-fifths of the 4.05 percentage points lost between 1985 and 2002. Despite this remarkable turnaround, the SSA relative capital-labour ratio remains considerably low. Of the numerous economic

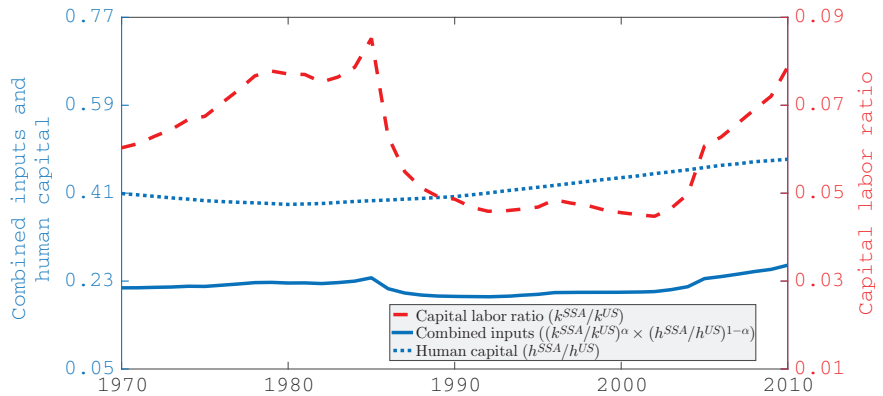

Figure 4: Human and Physical Capital in the SSA (Relative to the U.S.).

indicators presented so far, human capital measured in terms of education attainment is the only one that suggests a more optimistic perspective for the SSA economy. In 2010, the SSA's human capital represents 47.9% that of the U.S. compared to 40.9% in 1970, and much of this gain has taken place since 1990 (Figure 4).

How much capital intensity and TFP account for the relative labour productivity gap? Over the 1970–2010 period, the SSA's relative capital intensity contributed for 70% of its relative labour productivity, leaving just 30% to TFP. Although these proportions vary from one sub-period to the other (almost three-quarters for capital intensity during the 1970–1998, compared to 60% in the subsequent period), the main story stands and contrasts markedly with the common wisdom which argues that TFP represents the primary source of cross-country relative labour productivity gap (Figure 5) (Hsieh and Klenow, 2010; Jones and Romer, 2010).

The real question is whether capital intensity remains the primary source of the SSA's relative labour productivity gap under an alternate measure of human capital based on cognitive skills. We propose the following simple adjustment for measuring cross-country differences in human capital:[20]

$$\underbrace{\frac{h_t^{SSA*}}{h_t^{US*}}}_{\substack{\text{Considering the joint effects} \\ \text{of years of schooling and cognitive skills}}} = \underbrace{\frac{h_t^{SSA}}{h_t^{US}}}_{\substack{\text{Considering only} \\ \text{years of schooling}}} \times \underbrace{\frac{T^{SSA}}{T^{US}}}_{\substack{\text{Cognitive} \\ \text{skills}}}. \tag{7}$$

20 Our adjustment can be thought of as a special case to the one made by Islam *et al.* (2014) in the sense that we only include test scores as the adjustment variable. In addition to the test scores, Islam *et al.* (2014) measure quality of human capital by some other schooling input and output variables. Our approach is also a variant of the adjustment proposed by Hanushek and Woessmann (2012, 2015) who used a micro estimate of the return to educational achievement on the labour market. They find that differences in human capital (incorporating cognitive skills) are significant enough to account for major part of the differences in income per capita around the world (see also Gundlach *et al.*, 2002).

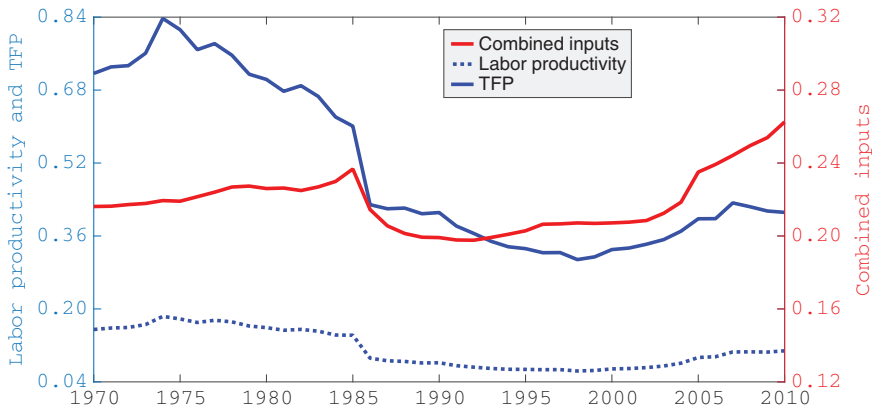

Figure 5: Sources of Labour Productivity Gap in the SSA (Relative to the U.S.).

Using the education achievement ratio (i.e., $\frac{T^{SSA}}{T^{US}} = \frac{367.0}{576.0} = 0.64$), the results led to a downgrade of human capital from 0.42 down to 0.27, on average, over the 1970–2010 period.[21] This means that the SSA's relative human capital gap is worse than what the standard figures seem to suggest. The upshot of this result is an increase in the contribution of factor endowment gaps (physical capital-labour ratio and cognitive skills-adjusted human capital per worker) to the SSA's relative labour productivity gaps.

The results reported in Figure 6 show that, under the alternate measure of human capital, combined inputs contribute for 81.1% of labour productivity over the 1970–2010, compared to 67.7% under the baseline measure. Although the main story stands—a factor endowments gap is the primary source of the SSA's relative productivity gap—the way human capital is measured matters in a meaningful way, accounting for a full 13.4 percentage points. A key question for future research is what accounts for such a large difference in the intensity in the relative factor endowments of the SSA economy.

Given that our top-down analysis suggests that a factor endowments gap (physical capital-labour ratio and human capital deepening) is the story behind a relative labour productivity gap, it is important to identify whether this holds at the sectoral level. This question is taken up by the next section which tries to sort out the quantitative importance of within-, reallocation- and between-effects in the labour productivity convergence.

21 Cubas *et al.* (2016) look at PISA scores and use direct observations of the achievements of individuals prior to their entry into the labour force as an exogenous input to a theory of labour quality. They develop a theoretical framework in which countries differ in two key dimensions (talent and TFP) and in which individuals endogenously become unskilled or skilled workers. They calibrate the distribution of talent using PISA data, assuming a gamma distribution of PISA scores. They choose the two gamma distribution parameters to reproduce the observed U.S. mean and coefficient of variation in the PISA mathematics test score. They assume that the PISA score is mapped into their theoretical notion of talent with parametric assumptions. In our approach, we choose to provide a simple modification of human capital in a (relatively) parameter free environment so that we can illustrate the role of cognitive skills in explaining income per worker differences between the SSA and the US.

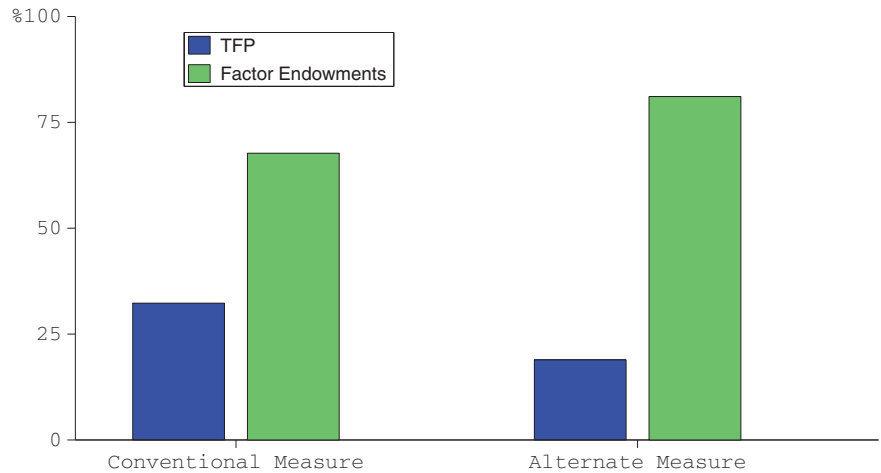

Figure 6: Convergence Accounting, 1970–2010 Average.

5. Sectoral analysis

5.1 Broad patterns

We now move to the bottom-up part of our quantitative analysis to examine whether there are any indications of sectoral convergence (see Equation (6)). Our analysis reiterates some important regularities highlighted by Harchaoui and Üngör (2016) but also emphasise some novel results. Table 1 shows that the employment share in agriculture in the U.S. was less than 2% in 2010. With 58.3% of the workforce in 2010, down from 71.6% in 1970, this sector was still the primary employer in the SSA economy. These 13 percentage points decline over a four-decade period pale, however, when compared to Asia which achieved this performance for almost each of the decades that spanned the 1970–2010 period.[22] During the period of economic slump, 1970–1990, the agricultural employment share declined moderately for the majority of SSA countries and increased for others, like Nigeria and Zambia (see also Harchaoui and Üngör, 2016). The 1990–2010 period that featured the revival of SSA economic growth coincided with a hefty decline in the employment share in agriculture from 70.3 to 58.3% (Table 1). Placed in the SSA historical context, this 12 percentage points decline look remarkable but lag considerably behind the 23.4 percentage points reported by China over the same period (from 60.1% to 36.7%).[23]

Market services represent the primary destination sectors of the deployed labour of the SSA economy. Manufacturing, which under typical circumstances has much greater potential to absorb the 'surplus' labour deployed away from agriculture, has experienced a premature relative decline along this process of structural transformation.[24] The SSA's pattern

22 Asia covers China, India, Japan, South Korea, Taiwan and Thailand. The estimates are constructed from the 10-Sector Database (Timmer *et al.*, 2015).

23 Data for China are from Timmer *et al.* (2015).

24 Rodrik (2016, p. 1) refers to this phenomenon as "premature deindustrialization", a situation where developing economies are "running out of industrialization opportunities sooner and at much lower levels of income compared to the experience of early industrializers."

Table 1: Sectoral Data, SSA vs. U.S., 1970–2010

Country	Agriculture	Mining	Manufacturing	Utilities	Construction	Trade	Transport	Business	Non-market	Whole Economy
Panel A. Employment shares (%)										
SSA										
1970	70.6	1.4	8.3	0.2	1.5	9.4	1.3	0.5	6.6	100.0
1990	70.3	1.3	7.4	0.3	1.4	9.3	1.4	1.0	7.6	100.0
2010	58.3	0.6	6.6	0.3	2.7	15.7	2.5	2.4	11.0	100.0
US										
1970	3.2	0.7	22.2	0.7	5.3	21.0	6.0	9.2	31.7	100.0
1990	2.0	0.6	15.2	0.6	5.6	24.1	4.6	15.5	31.8	100.0
2010	1.5	0.5	8.7	0.4	5.1	24.1	4.0	18.1	37.6	100.0
Panel B. Labour productivity (*in PPPs*) (*in thousands*)										
SSA										
1970	0.6	42.1	4.3	17.2	17.0	3.7	9.8	134.4	9.7	3.5
1990	0.5	42.4	5.8	22.2	13.1	4.1	11.0	104.4	11.1	4.0
2010	0.7	68.5	6.3	22.9	11.5	3.7	10.9	70.0	9.1	5.2
US										
1970	15.5	334.9	30.5	172.6	106.0	26.1	36.0	145.6	60.1	56.6
1990	29.4	301.2	53.7	251.6	79.5	32.7	63.1	130.9	60.3	66.7
2010	68.3	372.7	108.3	360.1	54.3	54.9	113.0	166.3	57.3	85.9
Panel C. Labour productivity, relative to the U.S. (%)										
SSA										
1970	3.7	12.6	14.0	10.0	16.0	14.1	27.1	92.3	16.1	6.1
1990	1.6	14.1	10.7	8.8	16.4	12.6	17.5	79.8	18.3	6.0
2010	1.0	18.4	5.8	6.4	21.2	6.8	9.7	42.1	16.0	6.0

Note: Aggregate labour productivity of country i at time t constitutes a weighted sum of the sectoral productivity levels, $y_t^i = \sum_{j=1}^{J} s_{j,t}^i y_{j,t}^i$, with $s_{j,t}^i$ representing the share of employment of sector j in the overall economy.

thus stands in a sharp contrast with that of Asia where manufacturing hosted almost one-fifth of the 30 percentage points of employment deployed away from agriculture during this period.[25]

Another feature of the SSA's structural transformation is the large intersectoral productivity gaps, indicative of advances in allocative inefficiencies that reduce overall labour productivity. In 2010, the most efficient SSA sector shows a level of productivity 98 times higher than the least efficient one, compared to only about 7 times for the U.S. While this represents a significant advance compared to the 236 times order of magnitude difference reported in 1970 by the SSA economy (21.6 for the U.S.), the SSA still fits, to a large extent, the dual economy model à la Arthur Lewis (Lewis, 1954; Gollin, 2014).[26]

5.2 Sectoral sources of convergence

We now cast these rich and contrasting sectoral considerations into a unifying framework which quantifies the sources of the aggregate productivity convergence. Figure 7 quantifies how much of the convergence in the aggregate productivity is attributable to the within-, reallocation- and between-effects during the 1970–2010 period and its two sub-periods 1970–1990 and 1990–2010.

The lack of convergence of the SSA economy to the U.S. level documented earlier results from two conflicting effects: The within- and, to a lesser extent, the reallocation-effects pulled the performance of the SSA economy away from the world frontier. With a −38 percentage points contribution, the within-effects suggest that both capital deepening and/or TFP contributed to the shortfall in the SSA convergence. The effects of structural transformation, albeit small, are negative suggesting a deployment of labour towards sectors reporting a productivity gap, an indication that SSA's structural transformation works backward—away from and towards low-productivity sectors. The positive contribution of the between-effect reflects the advance made by the SSA in resolving some of the allocative inefficiency issues. Out of the three effects considered, it represents the only good news which contributed to wipe out all of the negative impacts of within- and reallocation-effects. Considered together, these results suggest the absence of bold fundamentals behind the SSA's growth spurt.[27]

The analysis performed over a four-decade time span can legitimately be regarded as being unfair to the efforts deployed by the SSA prior the turn of the 21st century which reduced armed conflicts, enhanced macroeconomic conditions and initiated economic reforms meant to energise markets. These efforts, combined with favourable global

25 Shifa (2015) notes that the kind of low-skill manufacturing growth experienced by the East Asian countries did not happen in the SSA despite the availability of a vast and cheap labour force.

26 These aggregate patterns mask, however, the existence of some good practices best represented by Mauritius and Botswana (Edwards *et al.*, 2016).

27 Despite the long history of these sorts of decomposition formulas, a consensus on a single standard approach has not emerged. For example, in the context of the SSA economy, McMillan *et al.* (2014) do not explicitly account for the between-effects while they are regarded as being analytically important by de Vries *et al.* (2015). Whatever these differences, our decomposition highlights the weak economic fundamentals behind the wakening pulse of the SSA economy. Indeed, if we assume, as McMillan *et al.* (2014) do, that between-effects are included in the within-effects, the results still convey the absence of convergence as these two effects cancel out.

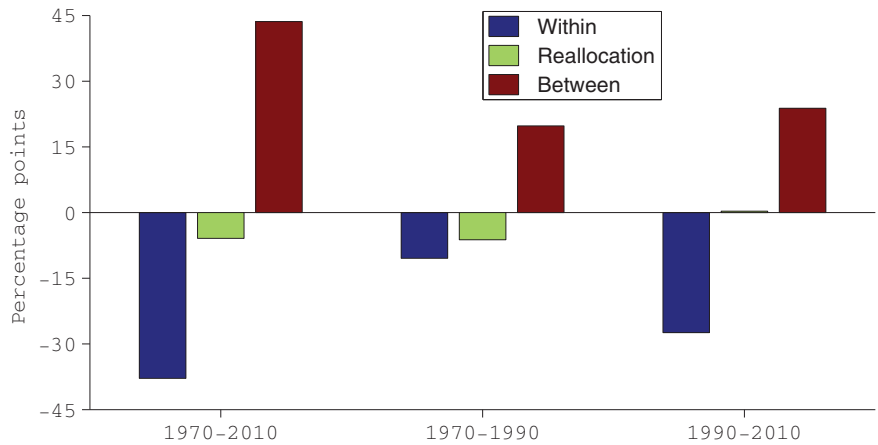

Figure 7: Sources of Convergence of the SSA to the U.S. Labour Productivity Level.

tailwinds ascribed primarily to the emergence of China, are generally regarded as the primary source in the wakening pulse of the SSA economy over the last two decades or so. To investigate whether the effects of these reforms altered the broad trends that were reported earlier, we look at the decomposition formula across the sub-periods 1970–1990 and 1990–2010 as laid out by Equation (6).

The results reported in Figure 7 refer to each of the sources underlying labour productivity convergence. The story related to the within-effect remains unaltered in the sense that it contributed to dampening labour productivity convergence but even more so during the 1990–2010 than during the 1970–1990 period (−27 percentage points compared to −10 percentage points). Much of the negative reallocation effect disappeared from 1990 to 2010, a period that has experienced a deployment of labour away from and towards lagging sectors. The between-effect has made a consistent positive contribution to the convergence, though slightly larger during the 1990–2010 period compared to the earlier period.

What do these results suggest? They point to large and persistent relative sectoral gaps of the SSA economy resulting primarily from within-effects. This suggests the presence of a combination set of factors such as distortions that prevent factor input endowments and technological advancement to lift sectoral labour productivity to the U.S. level. At the same time, weak relative sector productivity impeded the process of structural transformation in the SSA. Thus, the SSA economy offers a striking parallel with the south of the U.S. during the 19th century as studied by Caselli and Coleman (2001)—a massive workforce trapped in the agriculture sector in the South leading to low relative productivity performance compared to the North, hypothetically regarded as the frontier. However, there are several differences, one of which is the elimination of any impediment to intersectoral mobility in the U.S. (decline in the cost of education in rural areas) while they seem to remain important in the SSA. For example, Restuccia *et al.* (2008) emphasise the presence of distortions that prevent the use of modern technology (e.g., fertilisers and pesticides) and labour mobility from agriculture to non-agriculture (presence of wedges in the payment of labour). Unless these impediments are removed, the SSA will not be in a position to take advantage of the proven source of economic growth that arises from structural transformation.

6. Conclusions

The resurgence of the SSA's economic growth from the early 1990s through 2015 has outrun all but the most optimistic expectations. This development, which has been the focus of an active line of research, still remains controversial. The starting point for the economic debate is the argument that the 1990s are a mirror image of the 1970s when a series of favourable shocks propelled economic growth. The competing perspective is that the current episode is the reflection of fundamental changes in the SSA economy leading to permanent improvement in growth prospects. While this debate has contributed to advancing our knowledge, it somewhat neglected the important question of whether the growth spurt translated into a gradual convergence to the U.S. level. This aspect is less well understood and has important implications for our understanding of the SSA's development path now and in the future.

To address this question, we employ well-tested and familiar methods in the economic development literature to analyse important new information made available by the vintage 9.0 of the PWT and its complement at the sectoral level represented by the ASD. The results are in two categories. At the aggregate level, our study highlights three findings. First, the SSA's GDP per capita income and labour productivity levels relative to the U.S. are well below those reported during the 1970–1985 period. The SSA's relative productivity level exhibited the same downward slide at about the same rate from approximately 15.5% during the 1970s and early 1980s to a 6.4% in 1998 before advancing to 10.8% in 2010. Second, over the entire 1970–2010 period, labour productivity remained slightly above that of GDP per person. This is a reflection of two effects: (i) the SSA had a level of employment per capita close to that of the U.S., and (ii) the SSA had a relatively more favourable demographic dividend. However, these two effects were not large enough to compensate for the startling labour productivity gap. Third, we emphasise that the relative capital intensity endowments constitutes the primary source of the relative labour productivity gap, and this result remains robust to a shift in the measure of human capital from education attainment to the more reliable one based on cognitive skills.

The sectoral evidence suggests that the lacklustre and persistently low aggregate relative labour productivity is primarily the joint result of weak relative intensity in capital endowments and TFP across all sectors of the SSA economy. The result also shows that a slow and atypical process of structural transformation has moderately contributed to this lack of convergence. While relative intersectoral labour productivity gaps have been reduced, sources of allocative inefficiency remain large and contribute to holding back aggregate relative labour productivity.

In 2016, the SSA economy reported a reversal in the growth of its GDP per capita and labour productivity, following an uninterrupted advance since 2000. This turnaround coincided with the prolonged decline in the commodity prices that followed the mid-2014 burst of the commodity super cycle. This suggests that SSA remains heavily dependent on commodity exports which make its economy prone to adverse global shocks. The absence of a typical process of structural transformation that leads to a diversified economy, combined with the specialisation in a handful set of low-hanging fruit primary activities—even when it spurs growth—tends not to represent a genuine recipe for development. At best, this represents another form of the natural resource curse.

Supplementary material

Supplementary material is available at *Journal of African Economies* online.

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