

2022

## IARIW-TNBS Conference on “Measuring Income, Wealth and Well-being in Africa”

Paper Prepared for the IARIW-TNBS Conference, Arusha, Tanzania, April 14-15, 2022

Productive efficiency, structural change, and catch-up within Africa

Emmanuel Buadi Mensah (GGDC, University of Groningen, Netherlands), Neil Foster Mcgregor (UNU-MERIT), Solomon Owusu (UNU-MERIT)

### 1. Introduction

Following endogenous and evolutionary growth models that underpin technology differences as important drivers of productivity growth, while arguing that technologically backward countries can catch-up to the world productivity frontier by exploiting technologies produced in technologically advanced countries, numerous studies have examined whether international productivity differentials exist in the long run. The evidence points to an increasing aggregate productivity gap between poor and rich countries (Landes, 1998; Islam, 2003; Jones, 2016). In contrast, there is evidence of convergence clubs where countries within a certain income range (Baumol, 1986; Kumar & Russel, 2002) or technology level (Castellacci, 2008) achieve aggregate productivity convergence. There is also evidence in support of sectoral (Rodrik, 2013) and regional (Sala-i-Martin, 1996) productivity convergence. Recent evidence further suggests the possibility of intra-continental productivity convergence (Rath & Akram, 2019). Particular attention has been given to productivity convergence in Europe (Fare, Grosskopf & Margaritis, 2006), North America (Easterly et al., 2003), and East Asia (Fakuda & Toya, 1995; Matsuki, 2019). However, little is known about productivity convergence within Africa.

In this paper, therefore, we study the dynamics of labor productivity convergence and technology catch-up within Africa, shedding light on three important and inter-related issues that are central to Africa’s growth: (i) convergence of relative productivity among African countries; (ii) underlying factors driving productivity change across and within African countries; and (iii) the underlying factors driving productivity change across and within sectors in Africa. The motivation for examining productivity convergence and technological catch-up to a local frontier is based on the conjecture that the peculiar nature of African development presents unique technological challenges. This often requires African-induced innovation or a combination of frontier and local technologies to solve problems unique to Africa. Several innovations, such as mPedigree, MPesa, etc., illustrate this point. These African induced innovations diffuse rapidly within Africa while technology from the global frontier diffuse slowly to Africa. An important

finding in the economics literature is that the slow diffusion of technology is responsible for the slow speed of productivity convergence (Barro & Sala-i-Martin, 1997; Mankiw, Romer, & Weil, 1992). Thus, the international diffusion of technology is geographically localized in the sense that knowledge gained from R&D decreases with geographic distance (Ertur & Koch, 2007) and relational distance (Basile, Capello, & Caragliu, 2011). However, most researchers study technological change in Africa in relation to a globally defined technology frontier (e.g., Harchaoui & Üngör, 2018).

Given that African countries are geographically and institutionally close to each other, this paper departs from existing literature and studies the relative contributions of technological change and technological catch-up to productivity convergence within Africa.

## 2. Methods

The paper begins with the investigation of labor productivity convergence within Africa using recursive trends analysis and nonparametric kernel density methods as in Fare & Grosskopf (2006). Second, data envelopment analysis (DEA) is used to construct the best practice production frontier for a sample of African countries, and compute Malmquist productivity indexes to decompose labor productivity in terms of technical change (shift of the production frontier) and technological catch-up (movement towards the frontier), allowing us to examine the underlying components of labor productivity growth within countries over time and across countries. The third contribution of the paper relates to the fact that convergence of countries to the productivity frontier through technological catch-up is strongly underpinned by structural shifts of resources (e.g., labor) across sectors. Fagerberg (2000) shows that structural change matters for overall growth and convergence and that countries that have managed to increase their presence in the technologically most progressive industries have experienced higher productivity growth. To understand further the importance of structural change to productivity convergence in Africa, we decompose technological catch-up using a structural shift-share model. This allows us to reflect on the role of structural change in the catch-up of the region. With this approach, we are able to examine if countries in the region are moving resources to sectors where the technology gap with the frontier is lower or decreasing over time.

Technological catch-up within the structural framework is a process in which a country eliminates the labor productivity gap with the frontier by moving workers into sectors with a lower technology gap to the frontier (i.e. a static effect) or a decreasing technology gap to the frontier (i.e., a dynamic effect). For this exercise, we use South Africa as the technological leader for two reasons: There is a prima facie evidence that South Africa has been on the best practice African production frontier since 1970 (Mensah et al, 2020). Second, South Africa leads the rest of Africa in terms of quality education, innovation, and intellectual property production. The novelty of this approach is that it traces the sources of productivity convergence to its sectoral origins.

### 3. Data

Data on value added and employment will be sourced from the Expanded Africa Sector Database (EASD), a novel dataset we constructed. We intend to update the EASD with GGDC/ UNU-WIDER Economic Transformation database (ETD). For robustness and to cover a larger sample of countries, we will also use output and employment data from the PWT (version 10.0). Capital stock data will be taken from PWT 10.0.

### 4. Conclusion

The paper examines labor productivity convergence within Africa, its underlying components, and their sectoral origins. Our analysis contributes to the broader literature on convergence and highlights the special role of structural change in catch-up. Particularly, it shows that countries can climb up the income ladder at a faster rate through a two-pronged transformation – i.e., structural change and technological catch-up within sectors.

Successful catch-up to the technology level of the local frontier has huge implications for (transitory) growth and development in Africa, implying a movement from the current average GDP per capita of \$1500 to a GDP per capita of about \$10000.