

Article

# The curse of dependency: Examining structural change in African economies

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**Abstract:** This study investigates the effect of external dependency on structural change in 54 African countries between 1990 and 2021. The Two-Step System Generalized Method of Moments strategy is adopted to control for potential endogeneity problems. Findings reveal that structural change in Africa is strongly impaired by the level of external dependency. This is since all proxies of external dependency are negatively and statistically significant with all structural change proxies. For instance, under agricultural productivity, external debts stocks (EDS) give an eigen value ( $\beta$ ) of 0.879, standard coefficient (SC) = 0.162, and  $p = 0.000$ ; for external debt services (DSED),  $\beta = 0.240$ , SC =  $-0.040$ , and  $p = 0.972$ ; and for personal remittances received (PRR), we have  $\beta = 0.764$ , SC =  $-0.133$ , and  $p = 0.031$ . Depicting that, the more African countries rely on the external world for change, the less they realize this change. The results remain consistent after accounting for income differences by segmenting African countries into low- and middle-income groups. As suggestions to policymakers, for structural change to concretely take place in Africa, the rate of external dependence should be limited, and resources in Africa and local methods of growth should be used rather than copying from the Western world. Though the results are valid across income groups and Africa, the case of countries could be more significant.

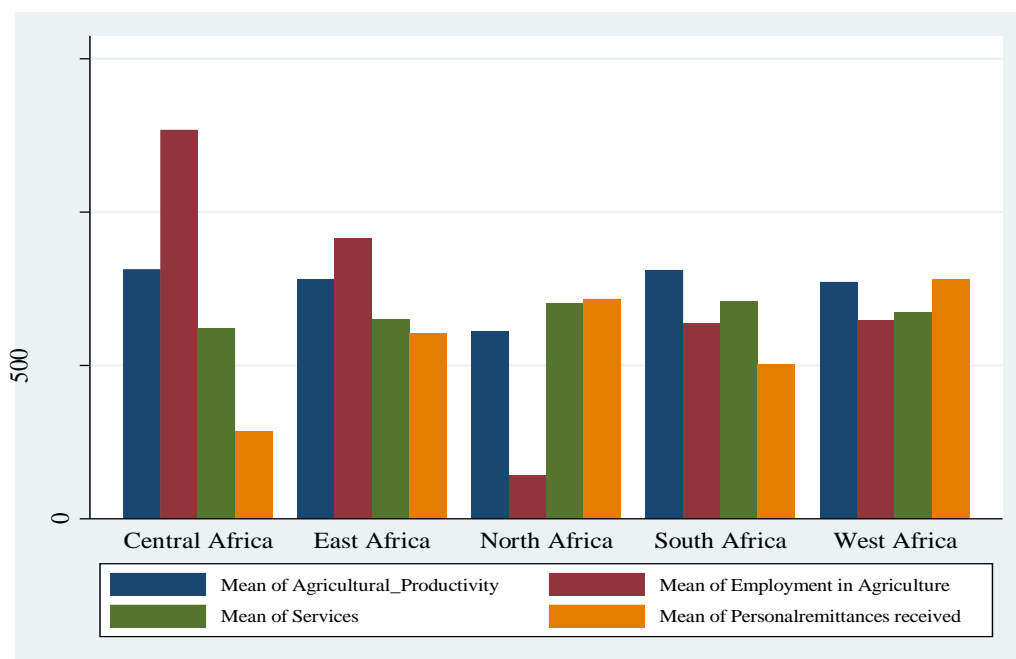
**Keywords:** structural transformation; agricultural productivity; service productivity; employment; external dependency; PLS-SEM; Africa

## 1. Introduction

A troubling upheaval in the world's economies and Africa in particular is that of structural change [1]. Though most African economies gained their independence (political per se) during the late 60 s and 70 s, it is evident that the economic part of Africa is still under the shadow of neocolonialism with much-felt ramifications from the reimposition of imperialism. Reason most African intellectuals and scholars are burdened with the fact that their contents and countries are the wealthiest in the world, but yet their people are the poorest [2]. Many have looked at the rich natural resources in their economies and countries to be a big "natural factor for structural change", but the case of Africa in the face of economic, political, agricultural, services, finance, productivity, and technology, among others, has yet to see change [1,3–6].

Indeed, the African continent is endowed with plenty of human and natural resources and a good and pleasing climate favorable to agricultural productivity, yet the importation rate of the African continent and the rate of dependency on the external world are feasible troubles (see **Figure 1**) that are worth dicking into—curbing this rate of dependency through structural transformation in terms of agricultural productivity, technological know-how, institutional quality, and others is credible. **Figure 1** depicts the rate of external debts and personal remittances received by African states between 1990 and 2021 and the effect of these debts on agricultural productivity, services, and labor employment in agricultural production in Africa. In addition, **Figure 1** shows that, as the rate of debts increases in Africa, the level of productivity falls. To Benoit et al. [7], this fall was mainly witnessed between the 2000s and feasible on the left side of the figure and cross-examined as an effect of the high increase in external debts between the said years (from 2000 to 2009) as seen on the right side.

Considered as a fundamental catalyst of economic development, structural transformation involves the movement/change from subsistence agricultural productivity to more productive sectors in an economy [8]. From the epistemology of structural transformation [6,9–11], we note that it equally involves the modification of certain axes of an economy in order to promote economic development and structural growth. Should we negate the fact that countries and economies are changing in diverse ways, then we must return to the antiquity society and re-implement the ways of life thereof by using the methods of production, communication, transport, trade, and infrastructure that were found in the antiquity society [12]. But if not, it means we all adhere to the fact that all economies are changing, but not in the same constituent [8,13]. Fereira and Cateia [12] have demonstrated how reforms and investments in infrastructure lead to structural transformation and poverty alleviation in Guinea-Bissau.



**Figure 1.** Cross-examining structural transformation in Africa, personal remittances received from other countries.

While occidental nations are transforming so fast, those of developing countries are relatively poorer and backward in terms of structural transformation [6,10] and other international issues like tourism [14]. With trade liberalization in the 90s, the economies of the world have become so interwoven that the rate of dependency on each other is alarming in the face of crisis—like the financial crisis of the 2000s, the financial bubbles of 2007–2009, and the recent health crisis of COVID-19 [3,12]. We align with Hollis Burnley Chenery, Robinson et al. [15] in defining structural transformation as a correlated process that is followed by economic development. In detail, structural transformation concerns the accumulation of human and physical capital as well as modifications in the demand compositions, trade, production, and employment. Nevertheless, Herrendorf et al. [8] break this definition down to be the reallocation of economic activity across the broad sectors of agriculture, manufacturing, and services. Hence, affirming today's slight move from producing goods into the production of services in most occidental economies [16,17].

With all due points raised, the rationale of this point of focus is paramount in the following. (i) Firstly, endowed with many human and natural resources, Africa is still importing most of its finished or semi-finished products. Causing her to be too dependent on her colonial and/or outside world. The feeding, productivity, value added, GDP, institutions, trade, and level of indebtedness of Africa need a drastic yet slow change. It is on this axis that we portray, to curb the dependency rate of Africa in terms of “agricultural productivity” not to be confused with improved agricultural productivity (IAP) as used by Cateia et al. [18], “trade in services”, “labor employment in agriculture”, and “external dependency-indebtedness”, to reboot it with “educational quality”, “domestic consumption”, “GDP”, among others; (ii) the institutional quality in Africa is so poor that leaders are more concerned about themselves and not about the good of the whole, with high levels of corruption and capital flight, giving way to poor developmental issues in the continent; (iii) current world situations like the Russian-Ukraine war and COVID-19 health crisis have demonstrated that depending on the outside world is a great disadvantage to developing economies, as these world issues have affected mostly developing countries. A fall in the GDP of these countries with economic recessions affecting the growth rate of these nations [19] and close to 80 billion US dollars lost in economic productivity in 2020 due to the COVID-19 health crisis [20]; yet (iv) Africa's scholars desire to identify the opportunities and constraints in Africa that can lead to the attainment of a more than 10% economic growth rate.

According to the African Bank of Development strategy (ABDs) for the period 2013–2022 [21], there is a need for inclusive and durable development in Africa. For this to happen, policymakers must note a certain number of things, such as the five principal means in which ABDs: (i) Infrastructural development as the ABDs estimate that the African continent invests only 4% of their GDP in infrastructural development compared to China with a 14% GDP [21]; (ii) regional economic development takes the stand that the 54 African countries should take advantage of the world market and participate in world activities to become more interconnected. Creating more vast markets in the continent and relating with caravan nations and pruning intra-African trade; (iii) developing the private sector of the continent that will contribute to development and research in Africa; (iv) governance and her

responsibilities; signifying that structural change can only be realized if the government is capable of handling all economic issues and lastly; (v) qualification and technological know-how of the continent. This is as well adhered to by the IMF [22], Donovan [23] and Avom and Nguenkeng [24] without keeping aside the work of Wung et al. [14].

Bad [21] highlights that unemployment is high among youths in all of Africa, and to ameliorate this situation, there should be an amelioration of working conditions and trainings offered by governments to youths according to needs in the labor market. Bad [21] gives three main domains that the African continent can base themselves in to realize this structural change: The fragile state should be given much attention, agriculture, and food security. Meanwhile, African debts on services greatly affect the productive capacity of the continent, as these debts are higher than any other structural change dimension. This means that trade in services in Africa is indeed low and needs scholarly and policymakers' attention for structural change to be feasible. The reason could be that much attention is given to other sectors while others, like that of services, are considered inferior [25]. On all the works carried out on structural transformation, this, to the best of our knowledge, is the very first covering the whole of Africa with varied and updated methods of analysis. Previous studies have tested structural change and agriculture alone [5,23,26], international exportation and change [27,28], population migration and structural change/transformation [29], industrial and manufacturing productivity [15,30].

This study contributes to the existing literature on structural transformation in several ways. First, three pillars of structural change, i.e., agricultural productivity, services, and labor employment in proactive activities, are the primary focus of this paper. Second, it encloses the whole of Africa rather than taking a particular segment of the continent. Several studies on structural transformation are limited to a single country or economy [31–33], while the current study makes use of 54 African countries—the whole continent—to better make generalizable recommendations. Besides, the current study segments Africa into two, both low- and middle-income countries, regarding the World Bank classification of countries to better understand structural change in function of low- and middle-income Africa. Lastly, most studies focus on the determinants of structural change in Africa and other contexts [32–35] in order to fight poverty [36], climate change, and agriculture [37], among other factors. But the narrative taken in this study is novel as we demonstrate the impact of African economies dependency on the outside world for structural change and the subsequent effects of their dependence. This is examined by using external dependency as an impacting proxy for structural change in the African continent.

We have a double causality effect in Africa where we produce and export more raw materials, cash crops, and human capital but import nearly everything for the local person's consumption. Exporting almost 80% of petroleum products but depending on the outside world for refined petroleum as cooking gas, fuel, among other things. Importing finished goods that tarnish the climate and soil fertility of the continent through CO<sub>2</sub> emissions. In this regard, we harness the query of finding out the impact of external dependence on Africa's structural change. What is the impact of external dependency on structural transformation (ST) in Africa? To better answer this question, we assume the following.

H<sub>1</sub>: The rate of external dependency does not promote agricultural productivity in Africa.

H<sub>2</sub>: The rate of service productivity in Africa is negatively affected by Africa's external dependence on other nations.

H<sub>3</sub>: There is a strong effect of Africa's external dependence on the level of labor employment in productive activities in Africa.

When we talk of agricultural productivity, we mean the gross output of all agricultural products produced in Africa. Basic products such as cocoa, minerals, and petroleum, in fact, all products extracted from the earth's surface [5,11,18]. Nonetheless, literature interrogates why resource-bound countries are instead the ones with high poverty rates and with low structural changes [11]. This gives rise to the intuition that it is due to high indebtedness and borrowing from the external world to produce that leads to low structural changes. For instance, out of Africa's agricultural productivity in terms of petroleum, 80% of it is being exported for refinery and later imported as fuel [21]. When we speak of industrial productivity, we refer to the gross output of finished or semi-finished products from the secondary sector. The occidental nations are slightly moving away from the production of goods into the production of services, even though the service industry has been for long neglected and inferred to as an inferior sector [16,38]. It is evident that the industrial sector is ahead of the service industry and remains a sector that needs much attention for structural change to take place [39].

## **2. Review of literature**

In view of amending existing works about structural transformation in Africa, we begin by giving a global in-depth point of focus on the theoretical background. Prolonging by exposing the state of structural change in Africa using four axes, i.e., the agricultural sector, the industrial sector, the service sector, and the manufacturing sector. This is in view of seeing the contribution of each sector to the GDP of African countries between the time being and with respect to policies that were amended to realize change.

### **2.1. Theoretical underpinning**

Looking at the essay on "economic development with unlimited supplies of labor" presented by Lewis [40], we realize that economic growth and development can take on the classical notion should we have just a little of labor supply with a good wage rate. However, productivity in the African sector of the economy seems to be completely financed by the external world and the IMF in particular; we note the millennium development goals (MDGs) of 2008 and structural development goals (SDGs) of 2015 in view of bringing change to African countries [38,41,42].

Structural transformation is an essential factor of growth in an economy, especially in the long run, a factor of reallocation of sectorial demand and toward the demand and consumption of natural resources [32,40,43–47]. According to Koo [48], it is impossible to realize any form of growth in real GDP in a country without a profound structural transformation. The opening of national boundaries in the name of trade liberalization and free trade has led to an increase in the world's output and

accelerated the growth of many economies [44,45,49]. Koo [48] highlights the case of Taiwan and reaffirms the notion of change in the economy of Taiwan and how various sectors have welcomed the idea of transformation and yet the country needs growth.

Chen et al. [30] provide an insightful literature review on the idea of industrial reforms and structural transformation in China. Looking at works from 2001 to 2011, Chen et al. [30] conclude that China's industrial sector has witnessed a profound and robust growth under persistent reforms since 1978, though the contribution to output has declined after 2001. To these authors, many factors are to be considered when analyzing and rethinking economic reforms and/or change in the economy in general; we intuitively do not look solely at the industrial sector as Chen et al. [30] but embroider it with four axes of change in the African continent.

A major issue in the theoretical literature is whether the TFP (total factor productivity) concept helps in the understanding of differences in the GDP of countries regarding their productivity, be it agricultural, labor, manufacturing, and/or services [7,8,13,30,50]. The essence here is not understanding the disparities in TFP across countries but seeing the effect or contribution of each of the four axes (agricultural productivity, service productivity, manufacturing, and industrialization) on the GDP in African countries. Following the footprints of Benoit et al. [7], who used a decomposition modelling approach to investigate the determinants of structural change in Africa, we do this in terms of structural change policies following a descriptive statistical model and the two-stage least squares generalized moment method (GMM). This is to see the contribution of each axis to the GDP stemming from a particular policy.

## **2.2. Structural transformation in Africa**

The literature on economic growth has largely relied on the so-called mono-sectorial neoclassical models. For instance, the Solow growth model [51], which relies on the aggregate homogeneous production function [39,52,53]. Yet with the high sectorial heterogeneity that characterizes developing economies and the fact that during development processes, people migrate from one sector to another, the adoption of dual economy models and structural change in the growth processes is necessitated [54]. However, the earliest literature on structural change dates to the 1950s and 1960s with the work of Chenery [55], Kuznets [56], and Chenery et al. [15], who presented important stylized facts about the relationship between a country's economic structure and its income level [39]. And showed how economic development occurs when it involves structural changes.

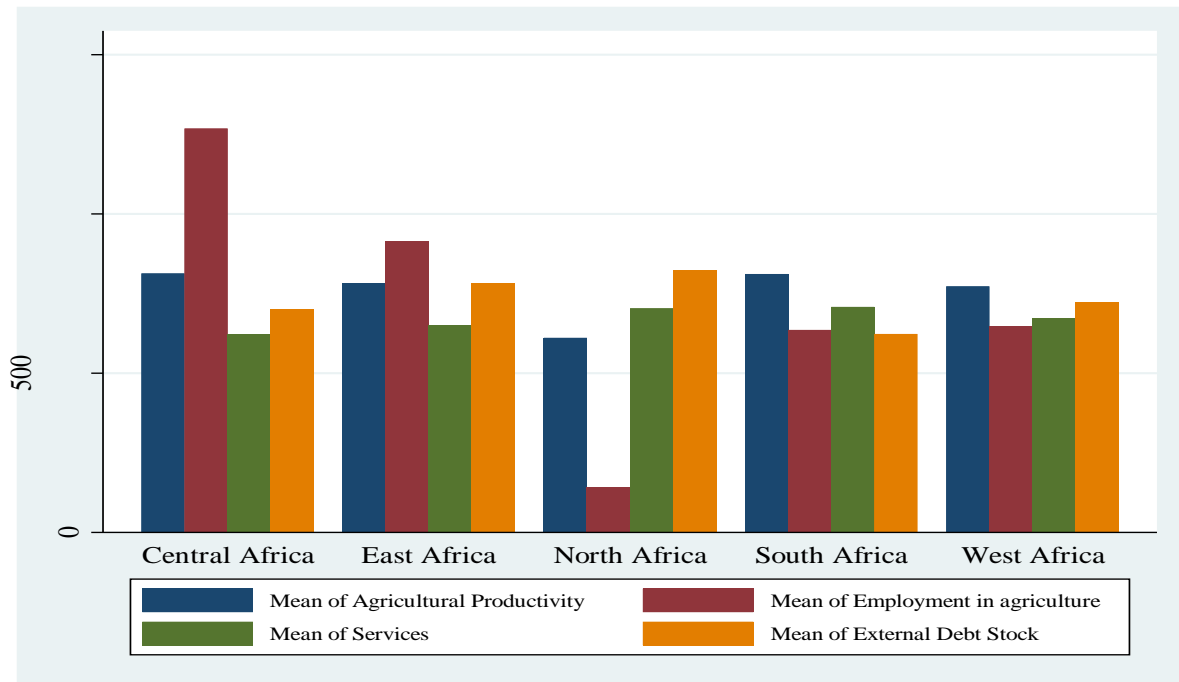
To this end, several studies and programs have highlighted the existence of a reciprocal relationship between the economic growth of a country and structural change [43,44,49,50,57]. Gbemenou et al. [57] examined the contribution of structural transformation to labor productivity growth and the determinants of structural transformation in Africa. They find that the contribution of structural transformation accounted for about one-third of productivity gains. And that the reallocation of labor to the service sector has been the main driver of structural transformation on the continent during the period 1991–2017 and that the pace of

structural transformation is strongly influenced by human and physical capital, population growth, and the initial level of agricultural employment. [32] examined the impact of structural transformation on the economy of India and recorded a significant improvement. Monga and Lin [58] examine structural transformation to be a mechanism to overcome the curse of destiny, and Zalk [33] examines structural transformation in the context of South Africa.

Similarly, on a dataset comprising 169 countries, 30 variables, and covering the period from 1991 to 2013, [39] comprehensively assesses structural change in the world economy and finds that structural change has played a key role in improving economic performance since the early 2000s. These results also concur with those of Triplett and Bosworth [6]; Caselli [59]; Duarte and Restuccia [60]; Chen et al. [30]; Herrendorf and Valentinyi [13]; McMillan and Headey [61]; Marouani and Mouelhi [62] who found that economic development is associated with a structural change in the economy, marked by a reallocation of labor from low productivity sectors to high productivity sectors, less dependent on natural resources to lead to strong economic growth in the long run. Likewise, Porzio et al. [63] have demonstrated the role of humans in structural transformation as a necessity. This means that transformation can't take place without adequate and realistic policies that can help in attaining both local, national, and international objectives.

However, some studies, such as those of McMillan and Headey [61], Zhao [64], Monga and Lin [58], and Barrett et al. [37], have shown that in countries where the share of natural resources in exports is relatively high, structural change has generally reduced growth. Li [28], note important disparities between countries and observe that in some countries, they have been able to diversify their productive structure without this having had any real impact on their economic development. In this regard, McMillan and Rodrik [65] also introduce the notion of "poor structural transformation" and speak of a "growth-reducing" or "productivity-reducing structural change", which aligns with [58] of a 'curse destiny'.

However, despite the extensive work done on structural transformation, the empirical identification of the key economic forces that shape structural transformation remains a matter of debate. As McMillan et al. [54] have pointed out, structural change, like economic growth itself, is not an automatic process [63]. They require appropriate direction. For authors such as Caselli [59] and Duarte and Restuccia [60], three characteristics differentiate poor countries from rich countries. First, labor productivity in agriculture appears to be much lower in poor countries than in rich countries [37,59,60,66,67]. Second, they also have lower labor productivity than rich countries in manufacturing and services, although the magnitude of these gaps is not as large as in agriculture. Finally, a larger share of the labor force in poor countries is concentrated in agriculture, the least productive sector. As seen in **Figure 2**, the effect of external debts stocks is stable on agricultural productivity, with North Africa having the most negative effect of structural change due to high external debts relating to the works of Andreoni et al. [34] in South Africa and beyond. Followed by Central Africa, with South and West Africa having equitable levels of change with external debts.



**Figure 2.** Cross-examining structural transformation in Africa in function of external debt stocks (that is, the mean of external debt stock).

Thus, to take into consideration the differences in productivity based on structural transformation, several studies have been carried out in this regard. In particular, the work carried out by McMillan et al. [54], who consider that countries that manage to escape poverty and become richer are those that can diversify away from agriculture and other traditional products. And identify that good policy, exchange rate, and labor market flexibility can stimulate structural change and contribute to overall productivity growth in resource-intensive countries.

This result thus agrees with Collier and Dercon [68], who suggest that for Africa’s economic development to be successful over the next 50 years, new institutional and policy frameworks are needed. And that African agriculture will have to change irreversibly, and production and labor productivity will have to increase massively, requiring a vast reduction in the proportion of the population engaged in agriculture and a significant rural-urban migration. Still, this challenge has also been advocated by Christiaensen and Todo [69], Conway [70], and the World Bank’s World Development Report, 2008, who believe that a variety of interventions, from technology to market development, are a stimulus to small farm growth. On the other hand, Bräutigam and Tang [71], Harrison, Lin, and Xu [72], Dorosh and Thurlow [26] instead highlight the role of China and public investments in promoting structural change in Africa.

In all, if it is commonly accepted by economists that industrialization is an important factor in the economic development process [73,74]. So oriented towards industrialization policies, studies conducted respectively by Nguimkeu and Zeufack [75], Hidalgo et al [76], McMillan and Rodrik [65], IMF [22], Lin [77], UNIDO [78] have shown that manufacturing, agriculture, and government play an important role in the structural transformation of Africa. Harrison et al. [72], on the other hand,



suggest that once African governments control infrastructure, access to finance, and policy competitiveness and attract private investment, African firms have a conditional advantage.

Avom and Nguenkeng [24], Lectard [79], Baldwin [80], Lederman and Maloney [81], Chen et al. [30] also show that diversification and sophistication of the productive structure in exports are the two main dimensions of structural change. And with the shift from trade in goods, known as “trade in goods”, to trade in tasks, known as “trade in tasks”. They have shown that as economies trade, more and more “tasks” are within the framework of global value chains (GVCs). Industrialization by insertion in value chains is found to be faster and easier and less successful in the process of structural transformation. Consequently, the progressive integration into GVCs contributes significantly to the structural transformation of the economies under consideration. The gap realized in the literature is that most works are mainly carried out on specific country issues and/or on the potentiality of single countries without looking at the constraints on structural transformation on a global and large scale like that used in this study

### **3. Materials and methods**

The methodology is presented in two phases: On one hand, the data source(s) and on the other, the empirical strategy used in measuring the retained variables.

#### **3.1. Nature and source of data**

All data used in these analyses is sourced from the WDI (World Development Indicator of the World Bank dataset). A panel of 54 African countries was considered for analysis, and regarding the objective of the paper, we ended up with 49 African countries in the analysis due to the absence of data on agricultural productivity and/or external debts within certain time periods. Due to imbalances in the data, such countries were ejected from the study. Data ranged from 1990 to 2021, giving a period of 31 years. The WDI measures agricultural productivity, external central government debts, and other controls as a percentage of the gross domestic product of the country (%GDP).

#### **3.2. The choice and justification of variables**

##### **3.2.1. Dependent variable(s)**

Since structural transformation is measured in the literature in two main strands: (i) First on productivity; and (ii) on labor employment in the economy. The first (productivity) has four facets of measuring structural change: Firstly, in terms of agricultural productivity, which measures the rate of agricultural production (output) in the country; the level of industrial productivity, which measures the rate of industrial output in the country; the level of manufacturing; and the level of service productivity [7,10,15,17,24,30,82]. This study examines the relationship between labor employment and economic growth, specifically analyzing how changes in employment levels impact the structure of the economy. Thus, the nature of the dependent variable is multidimensional, as we pick two variables from the first axis and part of labor employment in measuring structural change. Therefore, there are

three dependent variables of interest in this study, all as scores developed by the World Development Indicator (WDI) of the World-Bank. [83].

In measuring the part of labor in agricultural productivity with regard to structural change, the WDI [83] follows the pattern of the International Labor Organization (ILO) and depicts that the evolution of change in function of trade in services production and employment of labor in agricultural productivity is slowly stable within the time frame. Just for the fact that services productivity is evolving faster than the rate of labor employment and agricultural productivity (see **Figures 1 and 2**). We might as well conclude here that agricultural productivity is having a declining fracture while those of services and employment are stable. Affirming recent studies in structural transformation that countries are now deviating from the production of goods into the production of services [6,16,17,25].

### **3.2.2. Independent variable(s)**

The main independent variable is the central government external debt. It is a score developed by the WDI [83] on the GDP of each African country. This score is used in measuring the rate of external dependency of Africa. In the first place, dependency is true, measured in varied ways: The rate of debts, money borrowed from foreign countries for developmental issues in the country, money borrowed for agricultural purposes, among others. The number of countries made use of in the analysis is presented in Appendix **Table A1** in the form of the five African regions (Central, West, East, North and South Africa).

### **3.2.3. Other controls**

For controls, we made use of several controls such as the GDP growth per human capital (GDP-GPHC), the individuals using the internet (IUI), the international tourist receipts of Africa (ITR), gross fixed capital formation (GFCF), the kilotons (KT) of CO<sub>2</sub> emission in Africa (CO<sub>2</sub> emission), and the foreign direct investment level in Africa denoted as FDI-net flows. These variables are all sourced from the WDI recent version of the database updated by the World-Bank [83], ranging from 1990–2021. The justification for making use of such variables is due to the fact that they are most often missing in the structural change literature, as just a few variables are often made use of [5,24,30]. Thus, we think the use of these variables will enhance results. Regarding the nature of variables and their correlations, Appendix **Table A2** indicates their relations and proves that there are no problems of correlations.

**Table 1.** Symmetric analysis of ordinary least square (OLS).

VARIABLES	Proxy 1: Agricultural productivity			Proxy 2: Service production			Proxy 3: Employment Productivity		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	AP	AP	AP	Services	Services	Services	EP	EP	EP
PRR	-0.132 (0.042)***	-	-	-0.056(0.038)	-	-	-1.187 (0.289)***	-	-
DSED	-	-2.170 (6.821)***	-	-	3.300( 6.100)***	-	-	-3.431 (7.870)***	-
EDS	-		0.049 (0.042)	-	-	-0.019 (0.038)	-	-	-0.792 (0.506)
FDI	0.043 (0.042)	0.005 (0.042)	0.015 (0.042)	-0.103 (0.038)***	-0.083 (0.037)**	-0.107 (0.038)***	0.065 (0.38)	-0.470 (0.304)	-0.388 (0.594)
GDP-GPHC	-0.202 (0.039)***	-0.235 (0.039)***	-0.213 (0.039)***	-0.073 (0.035)**	-0.044 (0.036)	-0.073 (0.036)**	0.077 (0.331)	0.216 (0.301)	0.141 (0.626)
GFCF	0.099 (0.046)**	0.116 (0.045)**	0.121 (0.046)***	0.090 (0.042)**	0.105 (0.041)***	0.094 (0.041)**	-0.798 (0.410)	-0.436 (0.394)	0.147 (0.867)
IUI	-0.193 (0.060)***	-0.157 (0.061)**	-0.198 (0.059)***	0.077 (0.055)	-0.021 (0.055)	0.056 (0.054)	0.450 (0.344)	0.377 (0.326)	-0.222 (0.649)
ITR	0.001 (0.058)	-0.035 (0.058)	-0.044 (0.058)	-0.051 (0.053)	-0.091 (0.052)*	-0.069 (0.053)	1.369 (0.786)	0.704 (0.704)	0.153 (1.239)
CO <sub>2</sub> emissions	-0.089 (0.059)	-0.092 (0.057)	-0.090 (0.057)	0.056 (0.054)	0.055 (0.051)	0.048 (0.052)	-0.169 (0.486)	-0.431 (0.486)	1.243 (0.938)
DCPS	0.321 (0.695)	0.522 (0.700)	0.667 (0.704)	-0.121 (0.635)	0.037 (0.627)	-0.177 (0.639)	4757 (26.25)	31.17 (24.38)	20.92 (44.12)
Constant	1035 (74.84)***	1017 (70.55)***	951.2 (79.10)***	714.4 (68.38)***	657.4 (63.13)***	714.1 (71.82)***	1156 (465.7)*	821.2 (415.2)	619.9 (742.4)
Observations	679	651	652	679	651	652	14	14	14
R-squared	0.075	0.090	0.077	0.037	0.076	0.034	0.872	0.883	0.624
R2_adjusted	0.064	0.079	0.066	0.026	0.064	0.022	0.667	0.697	0.023

Notes: Standard errors in parentheses \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Acronyms in Appendix **Table A2**.

### 3.3. Empirical strategy

This study adopts the Two-Step System Generalized Method of Moments, which is an empirical strategy based on Roodman [84], an extension of Blundell and Bond [85], and Arellano and Bover [86]. This strategy is a robust standard corrected error strategy for finite samples [87]. The adoption of the system GMM strategy in this study is justified by the following arguments: Firstly, to adopt the GMM strategy, it should be a panel data analysis with several cross-sections and time dimensions. This condition of employing the GMM strategy, documented in GMM contemporary literature [88], is fulfilled in the present study. This strategy is better than other strategies as it produces robust findings in dynamic panel settings by accounting for cross-country variations as they are inherent in panel studies. Secondly, the number of countries cross-sections in the study should exceed the time series dimension. The present study is conducted in 54 African countries for 32 years. This condition is considered the main requirement in adopting the GMM strategy, which is fulfilled in the present study. Thirdly, the correlation between the dependent variables and their first lags should be greater than 0.800, considered the threshold or rule of thumb for assessing the persistence of macroeconomic variables [89]. This condition is verified and respected given that the correlation of agricultural productivity, service value added, and sectorial employment are 0.8103, 0.9863, and 0.8045, which exceeds the threshold of 0.80. The credibility of this strategy is that it accounts for potential endogeneity in cross-sectional analysis by controlling simultaneity bias through an instrumentation process.

The two-step system GMM technique adopted in this study is summarized with the equation in levels, Equation (1) and the first difference Equation (2) as follows:

$$ST_{it} = \beta_0 + \beta_1 ST_{i(t-\tau)} + \beta_2 Dep_{it} \sum_{h=1}^k \delta_h N_{hi(t-\tau)} + \eta_i + \gamma_t + u_{it} \quad (1)$$

The model can be summarized with the equation in first difference as follows:

$$ST_{it} - ST_{i(t-\tau)} = \beta_1 (ST_{i(t-\tau)} - ST_{i(t-2\tau)}) + \beta_2 (Dep_{it} - \beta_2 Dep_{i(t-\tau)}) + \sum_{h=1}^k \delta_h (N_{hi(t-\tau)} - N_{hi(t-2\tau)}) + (\gamma_t - \gamma_{(t-\tau)}) + (u_{it} - u_{i(t-\tau)}) \quad (2)$$

$ST$  signifies structural transformation,  $Dep$  stands for external dependency, and  $N$  represents the vector of control variables.  $\eta_i$  is the country-specific effect,  $\gamma_t$  is the time-specific constant,  $\tau$  is the lagging coefficient, and  $u_{it}$  is the error term.

## 4. Results and discussion

### 4.1. Baseline results and main results

We begin by acknowledging the inefficiency of the OLS strategy in not accounting for the problem of endogeneity and causality between variables. Though results from the OLS strategy indicate affirmative results regarding our hypothesis, we make use of the GMM as a regression model that better handles causality and issues of endogeneity due to potential feasibilities of endogeneity with the OLS

results. **Table 1** depicts such findings, and Equations (1)–(3) capture results of agricultural productivity, 4–6 results from service productivity, and 7–9 indicate labor employment in productive activities in Africa. The baseline results are developed with the help of the ordinary least square method. The GMM findings presented in **Tables 2–4** is well estimated, provided that the Hansen probability values are all greater than 10%, prompting the rejection of weak identification of variables. The nature of the Hansen probability and the second-order autoregression (AR2) validate the instruments used in the study.

Looking at **Table 2** on GMM results, we realize that the lag values of both agricultural productivity, services, and labor employment are positive and statistically significant at a 99% confidence interval. Meanwhile, the rate of external dependency (PRR and DSED) statistically and negatively affects agricultural and service productivity (that is, all equations on **Table 2**). But one of the dependency rate variables of interest (EDS-external debts stocks) positively affects the growth of the agricultural sector unless for services and labor employment. This negative effect of personal remittances received (PRR) and external debt services (DSED) on agricultural productivity and service production may be attributed to a few main reasons. First, resources received from international bodies may be poorly redistributed by African leaders/policy makers to satisfy a political need or due to incompetency. Second, resources received from outside may come with certain constraints, for instance, offering financial aid to a country to promote the growth and development of small and medium-sized enterprises (SEM) without a careful consideration of the entrepreneurial spirit within the country [90,91].

**Table 2.** Two-step system generalized method of moments regression analysis.

VARIABLES	Proxy 1: Agricultural productivity			Proxy 2: Service production			Proxy 3: Employment Productivity		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	AP	AP	AP	Services	Services	Services	EP	EP	EP
L.AP	0.540 (0.076)***	0.483 (0.0703)***	0.811 (0.035)***	-	-	-	-	-	-
L.Services	-	-	-	0.645 (0.030)***	0.606 (0.035)***	0.696 (0.0396)***	-	-	-
L.EP	-	-	-	-	-	-	0.970 (0.009)***	0.879 (0.008)***	0.840 (0.012)***
PRR	-0.120 (0.051)**	-	-	-0.054 (0.033)	-	-	-0.021 (0.007)***	-	-
DSED	-	-1.061 (4.711)**	-	-	-7.591 (4.181)*	-	-	-1.711 (2.171)***	-
EDS	-	-	0.005 (0.008)	-	-	-0.041 (0.023)*	-	-	-0.004 (0.004)
FDI	-0.002 (0.019)	-0.029 (0.022)	0.001 (0.006)	-0.047 (0.023)**	-0.043 (0.021)**	-0.044 (0.022)*	-0.003 (0.004)	-0.007 (0.002)***	-0.014 (0.004)***
GDP-GPHC	-0.057 (0.021)***	-0.038 (0.0237)	-0.032 (0.014)**	-0.107 (0.022)***	-0.111 (0.025)***	-0.092 (0.022)***	-0.002 (0.003)	0.001 (0.002)	-0.001 (0.004)
GFCF	-0.009 (0.0220)	0.023 (0.023)	-0.023 (0.009)**	0.010 (0.037)	-0.003 (0.041)	0.025 (0.043)	-0.002 (0.007)	-0.026 (0.004)***	-0.026 (0.011)**
IUI	-0.057 (0.047)	-0.171 (0.042)***	-0.068 (0.017)***	0.023 (0.028)	-0.028 (0.036)	-0.018 (0.030)	-0.013(0.006)**	-0.061 (0.005)***	-0.047 (0.011)***
ITR	-0.106 (0.030)***	-0.089 (0.029)***	-0.042 (0.019)**	-0.021 (0.056)	-0.015 (0.061)	-0.024 (0.055)	0.017 (0.008)*	0.037 (0.005)***	0.020 (0.015)
CO <sub>2</sub> emissions	0.049 (0.024)**	0.052 (0.025)**	0.001 (0.012)	0.031 (0.030)	0.063 (0.041)	-0.003 (0.032)	-0.004 (0.009)	-0.022 (0.006)***	0.011 (0.007)
DCPS	0.243 (0.268)	-0.047 (0.313)	0.318 (0.084)***	-0.359 (0.318)	-0.719 (0.363)*	-0.420 (0.374)	-0.066 (0.068)	-0.341 (0.044)***	-0.265 (0.082)***
Constant	507.8 (98.81)***	524.7 (79.00)***	225.0 (45.23)***	394.7 (67.16)***	402.6 (74.47)***	367.7 (75.15)***	33.83 (16.98)*	136.5 (9.081)***	144.6 (16.07)***
Observations	655	607	437	679	403	436	447	397	631
Prop > AR (1)	0.0408	0.00874	0.0932	0.037	0.005	0.003	0.078	0.078	0.073
Prop > AR (2)	0.863	0.320	0.650		0.201	0.127	0.585	0.238	0.297
Instruments	28	28	37		28	28	28	37	28
Prop > Hansen	0.839	0.704	0.670	0.026	0.124	0.239	0.922	0.214	0.675

Source: Authors' computation. Standard errors in parentheses \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ , acronyms in Appendix **Table A2** but L. Service is the lag of service productivity, L\_AP is the lag of agricultural productivity; L\_EA is the lag of labor employment in agriculture.

**Table 3.** Middle-income African countries segment.

VARIABLES	Proxy 1: Agricultural productivity			Proxy 2: Service production			Proxy 3: Employment Productivity		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	AP	AP	AP	Services	Services	Services	EP	EP	EP
L.AP	0.445 (0.089)***	0.425 (0.061)***	0.871 (0.073)***	-	-	-	-	-	-
L.Services	-	-	-	0.768 (0.027)***	0.750 (0.045)***	0.781 (0.039)***	-	-	-
L.EP	-	-	-	-	-	-	0.898 (0.011)***	0.745 (0.019)***	0.855 (0.012)***
PRR	-0.249 (0.053)***	-	-	-0.033 (0.024)	-	-	-0.044 (0.011)***	-	-
DSED	-	-2.451 (3.931)***	-	-	2.581 (3.761)	-	-	-4.111 (1.081)***	-
EDS	-	-	0.0337 (0.0348)	-	-	-0.074 (0.034)**	-	-	-0.016 (0.004)***
GFCF	-0.042 (0.030)	-0.033 (0.023)	0.004 (0.049)	-0.015 (0.039)	-0.029 (0.025)	0.123 (0.046)**	-0.024 (0.011)**	-0.050 (0.038)	-0.038 (0.019)*
IUI	-0.162 (0.062)**	-0.286 (0.055)***	-0.029 (0.038)	0.008 (0.021)	0.0157 (0.022)	-0.004 (0.024)	-0.023 (0.006)***	-0.079 (0.017)***	-0.055 (0.016)***
ITR	-0.034 (0.039)	-0.045 (0.029)	-0.035 (0.088)	-0.093 (0.060)	-0.049 (0.055)	-0.075 (0.072)	0.045 (0.009)***	0.034 (0.025)	0.061 (0.024)**
CO <sub>2</sub> emissions	0.057 (0.026)**	0.089 (0.032)**	0.001 (0.088)	-0.177 (0.031)***	-0.175 (0.036)***	-0.020 (0.037)	-0.006 (0.014)	0.040 (0.022)*	0.041 (0.016)**
DCPS	1.045 (1.945)	0.727 (0.649)	0.069 (2.185)	2.147 (1.562)	0.243 (0.727)	0.118 (1.570)	-0.381 (0.092)***	-0.915 (0.242)***	-0.363 (0.313)
Constant	663.5 (114.4)***	572.6 (94.80)***	73.77 (160.9)	361.8 (59.63)***	365.4 (51.19)***	222.3 (106.8)*	92.74 (26.50)***	202.2 (59.02)***	103.0 (21.01)***
Observations	383	352	241	264	228	241	257	221	350
Prop > AR (1)	0.058	0.0185	0.116	0.026	0.031	0.046	0.0782	0.0792	0.078
Prop > AR (2)	0.989	0.317	0.811	0.698	0.802	0.588	0	0.305	0.988
Instruments	28	28	37	28	28	28	28	37	28
Prop > Hansen	0.993	0.931	1.000	0.604	0.596	0.702	0.763	0.939	0.886

Source: Authors' computation. Standard errors in parentheses \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ , acronyms in Appendix **Table A2** but L. Service is the lag of service productivity, L\_AP is the lag of agricultural productivity; L\_EA is the lag of labor employment in agriculture.

**Table 4.** Low-income African countries segment.

VARIABLES	Proxy 1: Agricultural productivity			Proxy 2: Service production			Proxy 3: Employment Productivity		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	AP	AP	AP	Services	Services	Services	EP	EP	EP
L.AP	0.805 (0.062)***	0.891 (0.078)***	0.927 (0.054)***	-	-	-	-	-	-
L.Services	-	-	-	0.417 (0.062)***	0.381 (0.101)***	0.409 (0.074)***	-	-	-
L.EP	-	-	-	-	-	-	1.004 (0.009)***	1.000 (0.007)***	0.997 (0.007)***
PRR	-0.032 (0.037)	-	-	-0.095 (0.109)	-	-	0.0025 (0.005)	-	-
DSED	-	-0.341 (2.451)	-	-	-1.611 (8.251)*	-	-	1.331 (3.551)	-
EDS	-	-	0.004 (0.014)	-	-	0.055 (0.096)	-	-	0.003 (0.002)
GFCF	-0.031 (0.019)	-0.019 (0.012)	-0.015 (0.015)	0.021 (0.048)	0.037 (0.062)	0.106 (0.068)	-0.003 (0.002)	-0.007( 0.003)**	-0.005 (0.002)**
IUI	0.051 (0.024)*	0.003 (0.023)	-0.037 (0.020)*	-0.028 (0.120)	-0.084 (0.123)	-0.190 (0.113)	-0.011 (0.009)	-0.011 (0.006)	-0.014 (0.006)**
ITR	-0.031 (0.038)	-0.036 (0.058)	0.036 (0.058)	-0.045 (0.056)	-0.129 (0.118)	-0.099 (0.084)	-0.003 (0.013)	-0.026 (0.026)	0.010 (0.011)
CO <sub>2</sub> emissions	-0.014 (0.026)	0.008 (0.022)	0.028 (0.029)	0.210 (0.089)**	0.275 (0.110)**	0.423 (0.106)***	0.005 (0.006)	0.015 (0.015)	0.001 (0.005)
DCPS	1.042 (0.764)	-0.352 (0.557)	-0.188 (1.313)	2.410 (4.198)	-0.770 (3.424)	-6.776 (7.918)	-0.048 (0.200)	-0.026 (0.044)	0.242 (0.248)
Constant	159.5 (59.76)**	120.7 (129.7)	64.21 (64.84)	591.2 (145.4)***	651.8 (160.6)***	410.9 (184.6)**	-4.995 (20.56)	13.36 (13.51)	-1.106 (15.48)
Observations	272	255	196	189	175	195	190	176	196
Prop > AR (1)	0.019	0.016	0.00936	0.013	0.032	0.046	0.090	0.734	0.109
Prop > AR (2)	0.184	0.237	0.142	0.060	0.080	0.364	0.134	0.306	0.225
Instruments	28	28	37	28	28	28	28	37	28
Prop > Hansen	0.870	0.985	1.000	0.975	0.837	0.729	0.968	1.000	0.998

Note: Standard errors in parentheses \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ , acronyms in Appendix **Table A2** but L. Service is the lag of service productivity, L\_AP is the lag of agricultural productivity; L\_EA is the lag of labor employment in agriculture.



Thus, these factors themselves tend to act as a barrier to realizing a positive improvement in the intended agricultural and service productivity desired. Also, there is a recent rise in the world's service sector, and that of African economies is equally realizing growth [16]. Hence, explaining the negative influence of PRR and DSED on agricultural and service productivity. Inversely, the positively significant effect of external debts stocks on agricultural productivity is attributed to the fact that agriculture is the backbone of African economies. That is, the main sector for livelihood and sustainability in Africa is agriculture, as over 90% of the African population rely on agriculture and mainly produce and export cash crops/agricultural products such as cocoa, coffee, bananas, etc. [23,28,68]. As a result, most African economies are still struggling with strategies that boost structural change/transformation in agriculture [48,61], industrialization [75], health, and service production [16,29,57,61].

This aligns with existing works on the axes that we should pay attention to the service industry just as we do with other sectors of the economy [25,57]. This means that services (the service sector) are not an inferior sector of the economy but rather boosters of growth and development in an economy. This result shows that the more African countries rely on external bodies to help them grow their service sector and employment—through a fall in unemployment—the weaker they become in actively putting into play these growth policies. Thus, thinking of methods and means through which they can realize change in African communities with or without external aids will help in glomming the changes required [58,63]. We equally noticed from the results of **Table 3** that controls like the individuals using the internet (IUI), domestic credits to the private sector (DCPS), foreign direct investments net flows (FDI), CO<sub>2</sub> emissions, and gross fixed capital formation in Africa impair the rate of structural change through agriculture, service, and labor employments in Africa.

This is seen by their negative but statistically significant levels, plausibly at the 99% level of confidence intervals. On the side of IUI, we put forth the argument for the negatively significant relationship that the diffusion of internet usage in the methods of productivity, agricultural productivity, services, and labor employment is yet weak in the African continent, and as such, policies should be directed toward building and creating the awareness in agricultural practitioners and those of the service industry to exploit the internet in gaining new channels of productivity. These results aligned with those of Donovan [23], though this author made use of solely agricultural productivity in function of the intermediaries used in a cross-country income difference.

## **4.2. Sensitivity analysis**

According to the World Bank classification of countries, we deemed it efficient to carry out a sensitivity analysis of structural changes in Africa in function of middle- and low-income countries. Segmenting the 32-year strand of the panel (1990–2021), we realized results of **Tables 3** and **4**.

**Table 3** portrays middle-income African countries results. From these results, we find that middle-income African countries aligned with the GMM results as lags

remain positively significant at the 1% significance level. Variables of interest (external debts stocks, personal remittances received, and external debts services) are seen to be the same in terms of significance and signs as to the GMM results. Indicating that the middle-income African countries are negatively affected by their rate of dependency on the external world for structural change. Hence, developing their own frameworks and growth models will help in curbing the slow and low structural growth rate in Africa. However, we note here that domestic credit to the private sector (DCPS) does not reduce the rate of change in middle-income African countries—that is, in terms of agricultural productivity and trade in services, it reduces the level of labor employment in productive activities. This is seen by the significant negative sign in Equations (7)–(8) that measures labor employment. These negative relations could be attributed to the untapped natural resources in Africa, which, even when they are tapped, are exported to be refined in other occidental countries before being repurchased by Africans at exorbitant prices. This is in line with Djontu [27] and Avom and Nguekeng [24] in the case of SSA (Sub-Saharan African) economies.

**Table 5** depicts sensitivity results from the low-income African countries. These results reveal that low-income Africa is equally affected by the rate of external dependency in terms of personal remittances received, external debt stocks, and debts on services. However, this dependency rate is more grievous in this part of Africa compared to the middle-income countries, as seen by the non-significant positive relationship between labor employments in agricultural productivity in Equations (7)–(9) and weak significant levels recorded by other variables of interest. Arguments for such low and weak changes in this segment could be that (i) it is weak financially and often needs external help from other bodies to run structural change activities like agricultural output, employment, and building the service industry in order to trade and compete in the world’s market; (ii) this segment and Africa as a whole might not be completely directing funds meant for structural change to the right holes—high degrees of corruption and embezzlements; and (iii) low use of intermediaries in the agricultural sector, especially inputs such as fertilizers by local farmers—the case of Donovan [23] is enriched with such claims. We equally note that the rate of external dependency is in conformity with the main hypothesis of the study.

### **4.3. Robustness checks**

In order to account for explicit consistency in the GMM results and causality between variables, we made use of the partial least square structural equation modelling (PLS-SEM) approach accompanied by the necessary condition analysis (NCA) to logical adhere the hypothesis of the study [92–96]. A modelling method best fit for measuring varied items and variables of change, developed and well-grounded in the field of social sciences, psychology, sociology, anthropology, economics, and others [97–99].

From the results of this analysis, we realize that findings remain robust with those of the Two-Step System Generalized Method of Moments (GMM) as the rate of external dependence (measured in terms of external debt stocks, personal

remittances, and debts services) negatively and positively affects the rate of structural change in Africa. On **Table 5**, Model 1 depicts the relationship between one axis of structural change, agricultural productivity, and Africa’s external dependency.

**Table 5.** Structural equation simulation of agricultural productivity and external dependence.

<b>Model 1: The agriculture analysis</b>									
<b>Variables</b>	<i>Dependent variable is Agricultural productivity in Africa</i>								
	<b>SC/SE</b>	<b>T. V</b>	<b>VIF</b>	<b>Eigen value</b>	<b>CI</b>	<b>CE-FDH</b>	<b>P. V</b>	<b>CR-FDH</b>	<b>P. V</b>
GDP-GPHC	-0.404 (0.000)***	11.930	3474	0.058	9947	0.002	0.922	0.001	0.941
DCPS	-0.188 (0.016)***	7867	1724	0.102	7480	0.005	0.980	0.004	0.981
DSEDT	-0.040 (0.000)**	1760	1536	0.240	4877	0.000	0.972	0.000	0.973
IUI	-0.023 (0.024)	0.974	1742	0.261	4675	0.000	0.731	0.000	0.725
GFCF	-0.137 (0.031)***	7231	1088	0.362	3966	0.058	0.781	0.050	0.849
ITR	0.034 (0.023)**	1745	1128	0.532	3273	0.057	0.008	0.048	0.240
CO <sub>2</sub> emissions	-0.057 (0.248)**	1725	3354	0.689	2876	0.003	0.573	0.003	0.689
PRR	-0.133 (0.025)***	7206	1033	0.764	2731	0.005	0.031	0.004	0.065
EDS	0.162 (0.004)***	8660	1059	0.879	2546	0.107	0.000	0.145	0.001
FDI	0.023 (0.031)***	1236	1053	1413	2009	0.066	0.303	0.054	0.504
Intercept (β)	0.000 (0.827)***	37.891	-	5700	0.000	-	-	-	-
	Sum Square	df	Mean Square	F	P. V	-	-	-	-
Total	316,104,350	1729	0.000	0.000	0.000	-	-	-	-
Errors	179,056,219	1719	104,163	0.000	0.000	-	-	-	-
Regression	137,048,132	10	13,704,813	131,571	0.000	-	-	-	-
BPT	370,976	10	NN	NN	0.000	-	-	-	-
Hypothesis	H			H <sub>1</sub>		H <sub>2</sub>		H <sub>3</sub>	

This result shows that the more African countries rely on funds from other countries, the more their level of agricultural productivity and structural change dilapidates. This is indicated by the strong negative and statistically significant level of all independent variables and the conditional index of the eigenvalues that ranges from 1.00 to 9.947. Likewise, on the side of services, we affirm with literature that service production is neglected [17] and weak in Africa (see Model 2 of **Table 6** for details). We equally see that the level of labor employment in agricultural production in Africa is weak, depicting that most agricultural workers are mainly subsistent and less productive. This is shown by the negative and negatively significant relationship between variables in Model 3 of **Table 7** and both Models 1, 2 and 3 shows no

evidences of multi-collinearity problems as the VIF is all less than 5% rate of detection [99,100].

From the baseline results, the GMM and PLS-SEM results, we realize that the assumptions of the study are all validated. This can be seen in **Tables 1,2** and **5–7** through the negative but statistically significant levels of external dependency variables on those of structural change. We affirm this hypothesis as well in **Tables 3** and **4**; hence, a major drawback on transformation in Africa is that of external dependency.

**Table 6.** Structural equation simulation of service productivity and external dependence.

Variables	Model 2: The service production analysis								
	<i>Dependent variable is Service Production</i>								
	SC/SE	T.V	VIF	Eigen value	CIx	CE-FDH	P. V	CR-FDH	P. V
GDP-GPHC	0.003 (0.000)***	14.160	3.474	0.058	9.947	0.000	0.643	0.000	0.648
DCPS	0.075 (0.018)***	4.224	1.724	0.102	7.480	0.007	0.840	0.008	0.867
DSEDT	0.000 (0.000)***	2.807	1.53	0.240	4.877	0.000	0.967	0.000	0.969
IUI	-0.006 (0.026)	0.224	1.742	0.261	4.675	0.000	0.291	0.000	0.247
GFCF	0.092 (0.034)***	2.756	1.088	0.362	3.966	0.013	0.017	0.012	0.200
ITR	0.327 (0.025)***	13.114	1.128	0.532	3.273	0.003	0.030	0.005	0.050
CO2 emissions	-2.326 (0.272)***	8.568	3.354	0.689	2.876	0.000	0.405	0.000	0.431
PRR	0.302 (0.028)***	10.886	1.033	0.764	2.731	0.000	0.077	0.001	0.046
EDS	0.054 (0.004)***	12.518	1.059	0.879	2.546	0.009	0.001	0.023	0.001
FDI	0.386 (0.034)***	11.359	1.053	1.413	2.009	0.040	0.029	0.029	0.040
Intercept (β)	2.203 (0.904)***	2.437	-	5.700	1.000	-	-	-	-
	Sum Square	df	Mean Square	F	P.V	-	-	-	-
Total	347652,347	1729	0,000	0,000	0,000	-	-	-	-
Errors	214037,716	1719	124,513	0,000	0,000	-	-	-	-
Regression	133614,631	10	13361,463	107,310	0,000	-	-	-	-
BPT	2135,475	10	NN	NN	0,000	-	-	-	-
Hypothesis	✓ H		✓	H <sub>1</sub>	✓	H <sub>2</sub>		✓	H <sub>3</sub>

Note: BPT is the Breusch-Pagan Test; CI is the conditional index; PV is the probability value; T.V. is the student test; SC/SE is the standard coefficients and standard errors (standard errors in parenthesis); CE-FDH and CR-FDH are the ceiling envelopment-free disposal hull and the ceiling regression-free disposal hull (Statistics in parenthesis in model 3). While VIF measures the feasibilities of multicollinearities in the models, that is the variance inflation factor, -indicate results were not needed; F is the Fisher value that gives the global significance of the empirical model of the study.

**Table 7.** Structural equation simulation of employment and external dependence.

Variables	Model 3: Labor employment in Agricultural productivity					
	<i>Dependent variable is Employment</i>					
	SC/SE	VIF	Eigen value	CI	CE-FDH	CR-FDH
GDP-GPHC	-0.029 (9.000)	3.474	0.058	9.947	0.000 (0.989)	0.000 (0.990)
DCPS	-0.288 (0.025)***	1.724	0.102	7.480	0.007 (0.007)	0.008 (0.434)
DSEDT	0018 (0.000)	1.536	0.240	4.877	0.000 (0.233)	0.000 (0.837)
IUI	-0.134 (0.036)***	1.742	0.261	4.675	0.000 (0.821)	0.000 (0.821)
GFCF	-0.127 (0.047)***	1.088	0.362	3.966	0.013 (0.875)	0.012 (0.880)
ITR	-0.021 (0.035)	1.128	0.532	3.273	0.003 (0.044)	0.005 (0.759)
CO2 emissions	-0.348 (0.381)***	3.354	0.689	2.876	0.000 (0.745)	0.000 (0.968)
PRR	-0.055 (0,039)***	1.033	0.764	2.731	0.000 (0.000)	0.001 (0.032)
EDS	0.045 (0.006)***	1.059	0.879	2.546	0.009 (0.000)	0.023 (0.017)
FDI	0.001 (0.048)	1.053	1.413	2.009	0.040 (0.182)	0.029 (0.302)
Intercept ( $\beta$ )	0.000 (1.269)***	nn	5.700	1.000	nn	nn
	Sum Square	df	Mean square	F	P.V	nn
Total	738765,189	1729	0,000	0,000	0,000	nn
Errors	421849,654	1719	245,404	0,000	0,000	nn
Regression	316915,535	10	31691,554	129,140	0,000	nn
BPT	61,114	10	nn	nn	0,000	nn
Hypothesis	✓ H	H1	✓ H <sub>1</sub>	H <sub>2</sub>	✓	H <sub>3</sub>

Note: BPT is the Breusch-Pagan Test; CI is the conditional index; PV is the probability value; T.V. is the student test; SC/SE is the standard coefficients and standard errors (standard errors in parenthesis); CE-FDH and CR-FDH are the ceiling envelopment-free disposal hull and the ceiling regression-free disposal hull (Statistics in parenthesis in model 3). While VIF measures the feasibilities of multicollinearities in the models, that is the variance inflation factor, -indicate results were not needed; F is the Fisher value that gives the global significance of the empirical model of the study.

## 5. Conclusion, implication, caveats and policy recommendations

The study investigated the impact of external dependency in Africa on structural change. Making use of several dimensions of external dependency, personal remittances they receive from external bodies, the level of external debts stocks, and the debts on services are used as proxies for external dependency in Africa. Meanwhile, structural transformation is captured in the literature in two dimensions of the part of labor employed in agriculture and the productivity of each country. The second (productivity) is measured in four ways: Agricultural productivity, trade in services or service productivity, industrial productivity, and

manufacturing productivity. Due to data availability, we did not make use of the industrial and manufacturing axes of structural change.

Aiming at resolving potential endogeneity issues with analysis, we adopted the two-stage-system generalized method moment (GMM) on a panel of 54 African countries between 1990 and 2021. The findings of the study indicate that the continuous dependence of African countries on external and foreign bodies for structural change is farfetched. On all proxies of external dependency, we realize that structural transformation is negatively affected, though slightly stable in sensitivity analysis between low- and middle-income African countries. Accounting for differences in income levels, low-income African countries depict the highest level of dependency in Africa. This weak and low structural change in Africa is consistent with the literature on the fact that countries desiring and longing for short-, medium- and long-term structural changes should develop local means and developmental strategies within the country/economy without depending on foreign bodies. The reason for this we intuitively develop could be that completely depending on other countries for change may lead to developing countries struggling to follow occidental countries on development plans that do not fit into the African context. Results uncovered in this study are directly or indirectly supported by the works of Donovan [23], Avom and Nguenkeng [24], Benoit et al. [7], and IMF [22] who have argued that structural change in Africa and low-income countries is a problem and needs adequate attention. The result of this study adheres to this saying as indicated by negative significant levels of the external dependency on structural change on all tables of the analysis, be it OLS, GMM, and/or the partial least square structural equation modelling approach (PLS-SEM).

In the quest for enhancing structural growth in Africa, and gaining grounds from the results of this study, we loudly recommend African policymakers and their local communities; (i) develop means within their context that will lead to transformation such as building a framework of African intellectuals who will spearhead and take up the task of running developmental programs in Africa than borrowing funds from foreign bodies and using the same money to hire foreign engineers to carry on these projects. Equally, (ii) that African policymakers, especially those operating at the state level, should limit if otherwise seized depending on the external world for changes to take place within their context. This can be plausible if they make use of their own renewable and natural resources by growing modern technologies used in production and using the internet for diffusion of new methods of production. Results indicate that external dependency in Africa is indeed a major constraint to structural transformation in the African continent and should be given adequate attention should we want a 10% growth rate in the days ahead.

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JDT; visualization, EAW; supervision, EAW; project administration, EAW and JDT. All authors have read and agreed to the published version of the manuscript.

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## Appendix

**Table A1.** Countries per Africa regions used in the analysis.

Central	West	East	North	South
Burundi	Benin	Comoros	Algeria	Angola
Cameroon	Burkina Faso	Djibouti	Egypt	Botswana
Central Africa	Ivory Cost	Ethiopia	Libya	Lesotho
Congo Bissau	Gambia	Kenya	Mauritania	Malawi
DRC	Ghana	Madagascar	Morocco	Mozambique
Chad	Guinea Bissau	Somalia	Tunisia	Namibia
Equatorial Guinea	Liberia	Sudan	Mauritius	South Africa
Gabon	Mali	Tanzania		Zambia
Sao Tome	Niger	Uganda		Eswatini
Congo Kinshasa	Nigeria	Seychelles		Zimbabwe
	Togo	Eritrea		
	Sierra Leone	Rwanda		
	Cabo Verde	South Sudan		
	Guinea Conakry			

Source: Authors' computations from World Bank Classification 2022.

**Table A2.** Matrix of correlation.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) AP	1.000												
(2) EA	0.081	1.000											
(3) Services	0.082	-0.096	1.000										
(4) EDS	0.067	0.001	-0.039	1.000									
(5) DSED	-0.054	0.018	-0.117	0.025	1.000								
(6) PRR	-0.154	-0.228	-0.063	-0.063	-0.007	1.000							
(7) DCPS	0.035	0.039	-0.030	0.033	-0.025	-0.014	1.000						
(8) ITR	-0.014	0.092	-0.039	-0.130	0.054	0.056	0.042	1.000					
(9) IUI	-0.167	-0.284	0.034	-0.142	-0.034	0.133	-0.058	0.026	1.000				
(10) GFCF	0.060	-0.093	0.041	0.003	0.058	-0.071	-0.054	-0.117	0.090	1.000			
(11) GDP-GPHC	-0.096	0.124	-0.152	-0.055	0.038	0.077	-0.059	-0.029	-0.008	0.045	1.000		
(12) FDI	-0.061	0.006	-0.112	0.022	0.043	0.202	-0.054	0.052	0.228	0.224	0.209	1.000	
(13) CO <sub>2</sub> emissions	-0.030	-0.094	0.080	-0.005	-0.037	-0.056	0.046	0.052	0.033	0.008	-0.027	0.010	1.000

Authors' computations. Notes: AP is agricultural productivity, EA is employment in agriculture, and service is the service productivity/trade in Africa. EDS is external debts stocks; DSED is external debt services; PRR is personal remittances received; DCPS is the domestic credits to the private sector; ITR is the international tourism receipts; IUI is the individual using the internet; GFCF is the gross fixed capital formation; GGNP-GPHC is the gross domestic product per human capital. FDI is the foreign direct investment, and CO<sub>2</sub> emissions are the kilotons (KT) of emissions in Africa.