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**Working Paper**

## Structural transformation as determinant of growth in the best performing sub-Saharan African states

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**Structural transformation as determinant of growth  
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## **Structural transformation as determinant of growth in the best performing sub-Saharan African states**

**JEL Classification:** *O1; O3; O4*

**Keywords:** *economic development; sub-Saharan Africa; technology development; new structural economics;*

### **Abstract**

**Research background:** Economic development in sub-Saharan Africa is of paramount importance, yet it escapes most of the attempts to understand it better in the economic discourse and it remains a sensitive issue in politics, contradicting stake holders on national and international levels. The region still lags behind others in terms of technological advancement and economic development. It grew significantly in the precedent decade, but the extent of growth has not sufficiently translated to its development. Determining strategies for sub-Saharan Africa is a scientific challenge, which requires more attention. In the globalized, interconnected reality, solving problems of the South is in the best interest of the North.

**Purpose of the article:** The aim of this research is to analyse structural changes as factors of economic development in the best performing sub-Saharan African countries on the grounds of new structural economics in order to provide policy implications.

**Methodology/methods:** Namibia, Botswana, South Africa and Gabon were selected as best performing economies in the region. Based on the literature review and the analysis of descriptive statistics, profiles of sample countries were set. This in turn allowed to determine potential explanatory variables for OLS model of economic development. In the model, factors relating to labour productivity, technology and structural change were included. The data was sourced from WDI database, Gretl software was used for computations.

**Findings & Value added:** This paper contributes to the literature by attempting to explain structural changes in the process of economic development in the sub-Saharan region on the sample of best performing states. New structural economics concept was applied to understand the problem of. Based on the results, policy implica-

tions were proposed with respect to technology promotion, natural resources management, and quality of institutions. The research was limited by data availability and reliability.

## **Introduction**

Forgetting to address the problems of developing economies comes with the consequences. The income gap across the World does not seem to close. The differences of wealth between nations raise negative consequences for international stability (Devarajan & Kanbur 2007; Harman, & Williams, 2014, pp. 935-940). This is aggravated by income disparities inside middle and low income economies, which remain the source of instability for decades (Kuznets, 1972:198; WDI, 2017). Therefore development studies, particularly these focused on sub-Saharan Africa - the poorest region in the globalized World, require an in-depth analysis.

The purpose of this paper was to analyse structural changes' impact on the economic growth in the best performing sub-Saharan African countries in order to determine directions for successful strategies and provide some policy implications. This paper explores whether new structural economics as defined by Lin (2012, 2015) add to our understanding of economic development in sub-Saharan Africa on the example of Botswana, Gabon, Namibia, and South Africa after 1980. Descriptive statistic methods and linear regression modelling methods were used in data analysis. Comparative and systemic analysis were applied in the interpretation of the results of empirical study. Paper is organized in 4 sections. After research methodology is explained, literature review section focused on development and sub-Saharan Africa studies follows. Next, the results of data analysis are presented and discussed. Final section summarizes the main conclusions of the research.

## **Research Methodology**

In this three phases research, first the literature on the new economic structuralism ideas and sub-Saharan region was analysed in order to set foundations for further empirical analysis. Next, comparative analysis of the data within the group, with regional aggregate, and with laggard economies (Niger, Central African Republic, and Eritrea - countries with lowest HDI index based on 2014 data) was conducted. Finally, regression models were estimated in order to detect crucial structural change factors of development. Field study and qualitative research experience from sub-Saharan African countries (9) supported the process of results interpretation.

In order to approximate the successful development policy, GDP per capita was chosen as dependent variable representing economic development (Calderón, 2009). Next, in a number of trials on data for sample countries, indicators related to structural change were selected (Table 2). The methodology suggested by Lin in 2004 and explored by Bruno et al. (2015: 133) using Technology Choice Index was not explored due to lack of data for the selected countries. Since Buera and Kaboski (2008) and Herrendorf et al. (2013) include sectoral reallocations of economic activity across three broad sectors (agriculture, manufacturing, and services) that accompanies the process of modern economic growth as a trend of structural change, based on available data, dependent variables address these factors and industry.

Individual correlation matrix for studied countries allowed to summarize dependent variables related to economic structure influential for GDP per capita in 1980-2015. Next, individual OLS regression models were estimated for 1997-2015. Variance inflation factors were checked for every model in order to avoid collinearity problem, while Durbin-Watson test was performed against autocorrelation in the models. Because of data problem, the model results, and the model for Namibia. All computations were performed in Gretl software. The most important limitation of this research was data availability. A number of explanatory variables was excluded because it was missing either for required period of time or for all observations.

## **New structural economics in sub-Saharan context**

New structural economics (NSE) are a voice in the market/state role debate, which provides a certain view on the role of the governments to promote development and enable required technology transfer in the most efficient way, based mostly on the experience of Asian countries (Vučković, 2014; Devarajan & Kanbur, 2013). NSE attempts to integrate structuralism with more traditional neoclassical thinking (Berglof, 2015: 116; Fine & Van Waeyenberge, 2013: 361, *passim*). Industrialization in this theory is a central agenda in development economics (Sato, 2013: 326; Bruno, et al., 2015: 150). While “old” structuralism blamed market failure for distorting structural transformation, “new” structuralism recognizes market as driving force of transformation. However, since the differences between more and less advanced economies lie in different comparative advantages arising from their respective endowment structures, appropriate industrial policy is required to guide these forces towards the “right” sectors, in which the country has its comparative advantage (Lin, 2012). NSE proposes a demand-side theory on the appropriate financial and endowment structure for an economy (Lin et al., 2013: 109-119)

Recommendations of NSE contradict the mantra to stabilize, privatize, and liberalize, as it is considered potentially disadvantageous for emerging economies in the context of global trade (Stiglitz, 2011). The idea of new structural economics as advertised by Lin (2013, 2015), is to go beyond neo-classical structural and neo-liberal approaches to development and acknowledge that the benevolent, informed and competent state has a significant role to play as a leader of change and as a cushion to any market dys-functionalities. At the same time the market is fundamental to resource allocation, innovation and industrial diversity (Lin, 2012). State is supposed to shape the strategy of growth and correct any market failures. It directs the economy to the latent comparative advantage, which is the neoclassical comparative advantage, but not exploited (Sejkora & Buryan, 2015: 1).

The endowment structure - labour, natural resources and capital – both human and physical – are dynamic in time and represent the total available budget that the country can allocate to primary, secondary, and tertiary industries to produce goods and services (Lin & Treichel, 2012: 6). Convergence is possible once the industry/technology is aligned with the economy's comparative advantage (Lin, 2012: 307). The role of the government, which is aware of the economy's comparative advantage, is to provide soft and hard infrastructure in order to reduce transaction costs, compensate pioneer firms for externalities (such as information externalities) and temporarily protect infant industries. Access to information and conscientious distribution of information amongst chosen agents is crucial element of the theory (Lin, 2015: 161).

Therefore in Lin's NSE theory, it is assumed that the state has a certain capacity and motivation to act in a general interest of the economy as a system. Therein lies the dilemma. In Africa institutions bear a systematic and significant relationship to economic performance (Devarajan et. al., 2001; 12 Bates et. al., 2012: 519). The region is generally condemned by quality of democracy and institution and corruption indexes, which put a number of countries it in the fragile states catalogue (Kekic, 2007: 3-5; FFP, 2017). So from one stand point, can we indeed assume, that the state can assume the role of manager of change, suggested by Lin, while from the other – one may ask how? Structural adjustment experiences have shown that the liberalization check list – market will do the rest, did not work out (Stiglitz, 2011). It was largely because of exogenous rivalry interests and endogenous mismanagement, lack of social responsibility and cohesion (Williamson, 2000). Experiences of successful reformers in sub-Saharan Africa depict, that the introduction of reforms requires consultative processes that results in a broad consensus for reform (Devarajan, et. al. 2001:11). Berglof (2015:122) sug-

gests that interventionist policies may be necessary for economic development today, so it is more about how to intervene then, if to intervene, and how to ensure that such interventions are not captured by particular interests.

## Economic development by African leaders

The rationale of choosing Botswana, Gabon and South Africa, and Namibia as best performing economies involved various aspects. These countries score highest in the Human Development Index ranking (Table 1), as compared with the other countries in the region<sup>1</sup>. The complexity of HDI as indicator allows to reflect the qualitative dimension in the growth processes, which is crucial in the economic development (Fukuyama, 1992; Acemoglu & Robinson, 2015).

African best performing group is ahead of the sub-Saharan region when it comes to the human capital quality reflected by the access to education and research activity<sup>2</sup>. This may indicate that these states recognize and support the process of industrialization by supporting the quality of labour force, which in turn may allow its mobility (Gollin & Parente, 2002; Gollin & Rogerson, 2010; Lin, 2012: 166). Not only the average literacy rate among adults and youth in the leading group is exceeding regional performance, but also the differences between them are not high (Table 3). It allows a plausible conclusion, that the access to basic education is common in the best performing group.

However, in order to climb the value added ladder, also secondary and tertiary education must be developed. Definitely leaders are more advanced than the region<sup>3</sup>, however more effort is needed. Also, considered the value of GINI index (Table 1), there is a risk, that income disparities in these societies favour some groups when it comes to the access to technical and higher education. Gabon is exceptional, with relatively lower GINI index value, so the disparities in this country seem lesser.

**Table 1.** Rationale for choosing best performing economies sample group for the research (2014 data, unless otherwise stated).

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<sup>1</sup> It was decided to not include Cabo Verde in the group (0.646 HDI 2014), because of limited data availability and its geographical characteristics (island country).

<sup>2</sup> Lack of data availability did not allow to include these factors into the model, however, static data analysis allows to draw some opening remarks of this section.

<sup>3</sup> The regional mean as shown in Table 3, is probably higher than in reality. It was based on available data, whereas a number of countries does not provide such information. In these countries access to tertiary education in generally lower and if would be included, probably would further decrease the regional outcome.

Country:	SA	Gabon	Botswana	Namibia	Regional*
HDI index 2014	0.666	0.684	0.698	0.628	n.a.
GDP per capita <sup>a</sup>	7593	10 752	7080	6000	1660
GINI index <sup>b</sup>	63,38	42,18	60,46	60,97	43,98 <sup>f</sup>
Growth rate <sup>c</sup>	1.10	0.92	2.70	3.01	2.00
Agri. % emp. <sup>d</sup>	4.6	24.2	26.4	31.4	49.41
Agri. va % GDP <sup>e</sup>	2.37	4.69	2.41	6.69	17.50
GCI rank 2015	85	103	71	49	-

\* Regional average - based on WDI data for sub-Saharan region aggregate;

<sup>a</sup> – 2015 data; <sup>b</sup>-data respectively for: 2011, 2005, 2009, 2009; <sup>c</sup> – mean per capita growth rate (annual %) in 2006-2015; <sup>d</sup> - data respectively for 2014, 2005, 2010, 201, aggregate data was computed as a mean of any available latest data from 2005 (28 observations were found); <sup>e</sup> - Agriculture, value added (% of GDP);

Source: own elaboration based on GCI (2016) and WDI (2017).

When it comes to the scientific journals indicator (including per capita values)<sup>4</sup>, we can see that best performing group is outstanding the regional performance. Showing the overall productivity of researchers it reflects the capacity to transfer, diffuse, and develop technology. It varies across the region (standard deviation 1469), but also in the best performing group (4149), as a consequence of strong South African output (9679). This suggests, that the technological capacity and readiness is far more advanced in sample group than in the region on average.

Compared to the laggard group and the regional average, also the value added per agricultural worker is significantly highest in the best performing group. This may indicate the potential ability of the workforce to shift from this sector to others (Gollin & Parente, 2002). Agriculture value added per worker indicates the growing productivity of the sector, which is also a consequence of human capital quality. The studied group performance in this aspect suggests that the intangible assets of these countries are more advanced than the regional average, which may be interpreted as a potential source of their better performance. High per worker value added in agriculture seems to confirm the conclusions based on scientific articles values.

**Table 3.** Human capital indicators in best performing vs. regional and laggard group countries performance in sub-Saharan Africa in 2015.

Country group:	Best performing	Sub-Saharan	Laggard group*
HDI 2014 index	0.669	0.518	0.370

<sup>4</sup> Scientific and technical journal articles refer to the number of scientific and engineering articles published in the following fields: physics, biology, chemistry, mathematics, clinical medicine, biomedical research, engineering and technology, and earth and space sciences.



Adult literacy**mean	89%	67%	42%
- stand. dev.	4	20	20
Youth literacy***	95%	76%	52%
- stand. dev.	3	19	25
Secondary edu.*a	78%	54%	Na
Tertiary educ.*b	14%	10%	Na
Scientific journals <sup>c</sup>	2494	424	16
Scientific journ. pc	$8,05 \times 10^{-5}$	$2,11 \times 10^{-5}$	$2,28 \times 10^{-6}$
Agri_va	4338	1222	1041 <sup>d</sup>

\*Lowest HDI performance countries: Niger, Central African Republic, Eritrea, Chad.

\*\* Adult literacy rate, population 15+ years, both sexes (%), 2015 data.

\*\*\* Youth literacy rate, population 15-24 years, both sexes (%), 2015 data.

Agriculture value added per worker is a measure of agricultural productivity. Value added in agriculture measures the output of the agricultural sector (ISIC divisions 1-5) less the value of intermediate inputs. Agriculture comprises value added from forestry, hunting, and fishing as well as cultivation of crops and livestock production. Data are in constant 2010 U.S. dollars.

<sup>a</sup> - secondary education enrolment, gross %; <sup>b</sup> - tertiary education enrolment, gross %; <sup>c</sup> - data for 2013, latest available; <sup>d</sup> - data not available for Eritrea.

Source: own elaboration of WDI data (04.01.2017)

However, there are some differences between the sample countries. GDP value of Botswana, Gabon and Namibia accounted for 12% of South African GDP value in 2015. Considerably less people are employed in agriculture sector in South Africa than in Botswana, Gabon, and Namibia. South African agricultural employment has fallen after the minimum wage legislation was introduced in the beginning of 2000 (Bhorat et al., 2014: 1416). As mentioned before, the size of South African economy far surpasses the other economies in the sample. South Africa is also more advanced in structural transformation and replacing industry with services in the GDP composition. In South Africa and Namibia, the share of services in GDP overpassed industry. In Botswana this happened only in the turn of the century. However, while in South Africa and Botswana the process amplifies, in Namibia it advances at slower pace.

In Gabon on the other hand, a moderate increase of industry is observable in 2001-2015, while the services importance does not rise. Gabon depends on raw material exports, especially on fuels. A steady decrease of agriculture share in GDP is observable. It may not necessarily be a positive trend, especially, that agriculture was contributing to the overall growth when oil prices were dropping in Gabon. Bearing in mind that the decrease of agriculture importance, despite its growing value added is not followed by the increase of the manufacturing, we may assume either flow of labour to services (which could be positive) or to industry (which can be positive, but also negative if leads to more dependence on oil extraction).

The regression analysis for the sample countries (see Appendix 1) revealed that there is no common way of economic development, even in similar economic environment of the region. Depending on individual endowment structures and the level of attained industrialization, different policies are required. While more advanced South African economy already profits from the increasing value added of manufacturing, in Botswana and Namibia the positive increase of services has been revealed. Despite the fact, that Botswana, Namibia and South Africa's value added of industry to GDP is comparable, in Botswana the growth of industry sector is positive, while in South Africa decreasing industry contribution to annual growth has a positive impact on development. It means that decreasing dependence on industry is better for South African development. South Africa and Gabon seem to depend on natural resources rents in GDP too much, which in case of Gabon is additionally reflected in positive impact of increased contribution of services to annual growth. Plausibly, while decreasing raw material prices influence the natural resources rents contribution to GDP, it is thanks to services, that the growth persists. Botswana seems to be managing natural resources rents in a most efficient way; increasing technology which enables the transformation of raw materials makes Botswana less dependent of global prices and demand.

## **Conclusions**

Berglof (2015) found that the emphasis of economic structure change without enough emphasis on institutional change is not desirable for African development. Learning from European transition experience, he suggests that the long-term stability of economic reforms can only be ensured when accompanied by political reforms. In the new structural economics, this has not been put as a primary concern, which in turn makes it questionable, if these can indeed be applied for the sub-Saharan region. It may be concluded, that the assumptions of NSE provide a framework for the analysis of development processes and that development indeed follows structural change while a presence of a stable state enables the process. However, NSE does not go beyond the endogenous and neo-classical theories of growth, in a way which would provide a break in the development policy implications for the region burdened with the responsible leadership problems.

Sub-Saharan African states are depending on their endowment structures rather than managing them. Countries rich in natural resources, profit from raw material exports and do not diversify their economies enough despite the fact, that the dependence on industrial, service and agriculture sectors as GDP components varies across the region. The experiences of best performing economies analysed in this study shows, that there is no uniform way to

develop. As Birdsall et al. (2005) claim, the most successful development stories have been based on innovative policies, often heterodox. African best performers experiences inscribe in this thinking.

In this research four best performing sub-Saharan countries performance was analysed. Relative advantage in human capital of the best performing countries as compared to regional average, implies that successful growth strategies require inputs on education, which in turn increases labour productivity and mobility towards higher value added sectors of economy. However, despite relative homogeneity of the leaders towards the region, which marks out their potential of development, absolute heterogeneity was found within the group. In Gabon, the distribution of income favour social inclusion, Botswana seem to undergo most intensive technological change, and South African economy is outstanding due to the size, attained level of structural transformation and industrialisation. Each of the leaders is in a different stage of structural transformation and the process proceeds at individual pace.

Since three out of four best performing countries are found in the southern corner of Africa, a positive impact of the largest South African economy on bordering Namibia and Botswana's development paths can be assumed. In the sub-Saharan context, chances to ensure sustainable growth are better, once sound domestic policies and institutions are established (Devarajan, et.al. 2001: pp. 4-40; Kose & Prasad, 2012). On the other hand, as Chauvet claims, failing states inflict very large costs on their neighbours (Chauvet et al., 2010: 976-977). Therefore, we can conclude, that countries in the sub-Saharan region may profit from the proximity of large and relatively stable economies.

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## Appendix 1

**Table. 1** Explanation of data used for OLS regression models.

Variable	Long definition
Agri_va_per_worker	Agriculture value added per worker (constant 2010 US\$)
Agri_va_of_GDP	Agriculture, value added (% of GDP)
Agri_va_% growth	Agriculture, value added (% of GDP)
Agri_va	Agriculture, value added (constant 2010 US\$)
Industry_va_of_GDP	Industry value added (% of GDP)
Industry_va_% growth	Industry value added (constant 2010 US\$)
Industry_va	Industry, value added (constant 2010 US\$)
Services_va_of_GDP	Services, etc., value added (% of GDP)
Services_va_% growth	Services, etc., value added (annual % growth)
Services_va	Services, etc., value added (constant 2010 US\$)
Manufact_va_of_GDP	Manufacturing, value added (% of GDP)
Manufact_va_% growth	Manufacturing, value added (annual % growth)
Manufact_va	Manufacturing, value added (constant 2010 US\$)
Natural resources of GDP	Total natural resources rents (% of GDP)
Trade of GDP	Trade (% of GDP)
Trade in services of GDP	Trade in services (% of GDP)
Scientific articles pc	Scientific and technical journal articles per capita

Source: Regional average - based on WDI data for sub-Saharan region aggregate;

**Table 2.** Correlation of depended variables with GDP per capita (constant 2010 USD) based on individual best performing sub-Saharan countries models.

Country:	BWA <sup>a</sup>	GAB <sup>b</sup>	NAM <sup>c*</sup>	SA <sup>d</sup>
Agriperworkerconstant2010US	0,21	-0,71	0,13	0,70
Agri_va_of_GDP	-0,83	na	-0,61	-0,35
Agri_va_annual % growth	0,08	0,11	-0,38	0,08
Agri_va	0,87	-0,70	0,43	0,58
Industry_va_of_GDP	-0,73	na	0,67	-0,19
Industry_va_annual % growth	-0,46	0,26	0,14	0,15
Industry_va	0,96	0,13	0,99	0,78
Services_va_of_GDP	0,87	na	-0,47	0,21
Services_va_annual % growth	-0,27	0,09	0,41	0,28
Services_va	0,97	-0,52	0,98	0,70
Manufac_va_of_GDP	0,25	na	0,45	-0,64

Manufact_va_annual % growth	-0,09	0,36	-0,14	0,09
Manufact,va	0,97	-0,59	0,95	0,73
Natural resources of GDP	0,36	-0,18	0,21	0,81
Trade of GDP	-0,46	0,53	0,55	0,82
Trade in services of GDP	-0,67	na	-0,63	0,60
Scientific articles pc	0.89	-0.34	0.78	0.87

a - observations 1980 – 2014 5% critical value (two-tailed) = 0.3338 for n = 35;

b - using the observations 1981 – 2014 5% critical value (two-tailed) = 0.3388 for n = 34;

c- using the observations 1990 – 2014 5% critical value (two-tailed) = 0.3961 for n = 25;

d - using the observations 1980 – 2014 5% critical value (two-tailed) = 0.3338 for n = 35;

Source: own elaboration.

**Table 3.** OLS regression model of GDP per capita in South Africa in 2000-2013.

Variable	Coefficient	Std. Error	t-ratio	p-value	VIF
const	1943.17	166.178	11.6933	<0.0001	..
Manufact_va	1.3522e-07	4.99226e-09	27.0859	<0.0001	2.326
Industry_va_% growth	-26.7582	5.75053	-4.6532	0.0009	1.025
Trade of GDP	-20.1896	3.98968	-5.0605	0.0005	2.352

OLS using observations 2000-2013 (T = 14); R-squared value 0,99.

Source: own elaboration.

**Table 4.** OLS regression model of GDP per capita in Botswana 2000-2014.

Variable	Coefficient	Std. Error	t-ratio	p-value	VIF
Const	920.007	234.69	3.9201	0.0015	..
Agri_va_per_worker	0.954824	0.222742	4.2867	0.0008	1.643
Services_va	6.10943e-08	2.29508e-09	26.6196	<0.0001	2.240
Industry_va	9.84287e-08	6.55578e-09	15.0140	<0.0001	1.570

OLS, using observations 1997-2014 (T = 18) R-squared value 0,99.

Source: own elaboration.

**Table 5.** OLS regression model of GDP per capita in Botswana 2000-2014.

Variable	Coefficient	Std. Error	t-ratio	p-value	VIF
Const	15129.1	4496.12	3.3649	0.0063	..
Scient_log	1163.21	452.146	2.5726	0.0259	1.591
Services_va	3.29e-07	4.33e-08	7.5930	<0.0001	1.591

OLS, using observations 1997-2014 (T = 18)

Source: own elaboration.

**Table 6.** OLS regression model of GDP per capita in Gabon 2001-2014.

Variable	Coefficient	Std. Error	t-ratio	p-value	VIF
Const	7654.67	844.749	9.0615	<0.0001	..
Services_va_% growth	71.2914	15.424	4.6221	0.0009	1.690
Natural resources	-50.8327	11.4566	-4.4370	0.0013	1.809
Industry va	2.40599e-09	3.4254e-010	7.0240	<0.0001	1.093

OLS, using observations 2001-2014 (T = 14) R-squared value 0,91.

Source: own elaboration.

**Table 9.** OLS regression model of GDP per capita in Namibia in 1997-2013.

Variable	Coefficient	Std. Error	t-ratio	p-value	VIF
const	1517.15	294.793	5.1465	0.0002	..
Natural resources	91.6273	20.1571	4.5457	0.0005	1.566
Services_va	6.34e-08	3.07e-09	20.6848	<0.0001	1.636
Agri_va_per_worker	0.12559	0.06818	1.8420	0.0884	1.127

OLS, using observations 1997-2013 (T = 17) R-squared value 0,99.

Source: own elaboration.