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Structural Change in East Africa: Patterns and Drivers

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Abstract
This study analyzes structural change patterns and derivers in nine East African countries for the years between 1990 and 2018. The task presented value-added, employment share, and productivity for twelve sectors using the Economic Transformation database of Groningen University. From the output side, the study result found a reduced agricultural share in GDP compared to that of service and industrial sectors. From the employment perspective, a reduction of employment was also observed in the agricultural sector. The sector released labour to other sectors and has also room to make additional releases as the productivity gap between the agriculture and other sectors is high. The study also found positive labour productivity growth during the period. The productivity growth was sourced from within, between and dynamic effect in combination; though, the lion share was sourced from between (structural change) sources. Sect orally, the manufacturing industry was punching below its weight. In sampled countries on average, only 4 per cent contribution was done by the manufacturing sector for overall structural change. Further, the result from the empirical task demonstrated that, the structural change observed in the region was potentially affected by initial agricultural employment share in the economy, investment, and population size.
Keywords: productivity, productivity growth, structural change, value-added, employment share, East Africa.
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1. Introduction

Multi-directional sectoral interactions are necessary through dynamic processes to successfully take the economy from traditional less productive to modern more productive sectors (Bruce & Albert). The outcome of this process is named structural transformation[1]; due to the fact that, the structure of the economy is changed in the way. The process is mainly observed in output and employment; the shift of output and employment share in GDP and total employment respectively from agriculture to the manufacturing industry and modern service. In the study, though the discussion was made about output side structural change, paramount emphasis was given to the employment side. A move of the factor of production, labour, from the low and sluggish productive sector to high productive sector; especially the move from primarily agricultural to manufacturing industry and service sectors (El Haddad, 2015; Kuznets, 1971; Lewis, 1954; McMillan & Rodrik, 2011).

The historical development of developed countries also reflects a similar path. The primary factors of production, labour, move from low productive sector to high productive sector open up the economy to move somewhere necessary for further development and poverty reduction. The process is also theoretically supported. The dual-sector model of Arthur Lewis and the Stages of Economic Growth by W.W. Rostow suggests the involvement of the economic transformation from the low stage to higher and better productive stages through reallocation of factors of production (Lewis, 1954; Chenery 1986). The process is very important especially at the early stage of development, (Richard, 2015); as it is a means to make adjustment in the economy that enhances growth.

But, because of the low stage of the economy, structural change is not much observed in Sub-Saharan African and many other developing countries. Still the countries are moving like Turtle to achieve the required amount of labour productivity growth and structural change compared to other regions. The case of Africa is naked truth; labour productivity growth and structural change activities are low in the continent compared against other low-income countries (Page, 2012). Also, the registered structural change is in favour of urban informal service (the labour shift is from low productive agriculture to low productive informal service) (UNCTAD, 2020). Moreover, the recent trend reflects that; the observed structural change faced a challenge, deindustrialization, which put additional pressure on the way to industrialize the continent (Richard, 2015).

Eastern African countries have also similar trends. Productivity growth and structural change are at an early stage in the region, and the flow has been mostly from low productive agriculture to low productive sectors of traditional services. Between 1991 and 2011, in countries such as Uganda, Tanzania and Kenya high structural change were observed in the service sector of trade, restaurants, hotels, transport, storage and communication than manufacturing industry (UN-Habitat). Thus, policy directions are necessary to move in the right direction to

[1] In the study the term structural transformation and structural change used interchangeable to refer the same meaning.

industrialization and attain sustainable development since the successful accomplishment of industrialization and sustainable development is much possible with productivity growth in the economy.

In this regard, this study was undertaken to further evaluate the trend of structural transformation and its determinants in nine East African countries[1]. In addition, the previous studies undertaken on structural transformation were based on ten sector classifications, this study will further move to detail by determining structural change and productivity growth among twelve sectors. Further, analysis has been done on a shift-share contribution by each sector which will help the policymakers to have detailed information for policy action in solidification of right-way to structural change. Moreover, this study adds to the existing literature, by presenting empirical regression analysis to examine the factors that affect structural change by including variables with a potential effect on structural change.

The methodology used while undertaking the study was, computing output & employment shares and sectoral productivity, productivity growth decomposition, and shift-share analysis at twelve sectors level. Sect oral labour productivity was computed by dividing each sector's value addition by the corresponding sectoral employment level at a respective year. Productivity growth in the economy was done by dividing into three components: within-sectors productivity growth, labour reallocation between sectors (structural change effect) and dynamic component (which involves both the reallocation of labour among sectors and improvement of the production system in the sectors). Further econometric analysis was done to determine which factors affect the structural change. In this document, section two presents the literature review. Section 3 will show the facts on the structure of the economy and labour productivity in nine countries. Section 4 will demonstrate the econometric results and the final section deliver the conclusions and policy directions.

2. Literature review

The 2020 report of the United Nations Conference for Trade and Development (UNCTAD) classified all countries under our studies as least developed countries (UNCTAD, 2020). But, signs of progress were demonstrated in the economies over course of time. By 2017, the economic growth of the region was 5.9 per cent and the trend has been continued through 2018 and 2019. With agriculture-led growth, the performance of the economies was robust in most countries. But, the performance was not accompanied by significant poverty reduction (African Development Bank Group, 2019).

The reliance on agriculture is the main factor behind for high poverty in the region. The sector is characterized by low production and productivity. Thus, policies focused more on materializing structural change through creating a wide range of employment opportunities for the growing population and improving productivity are recommended frequently (African Development Bank Group, 2019). The process follows the move of surplus labour from low productivity agriculture to other sectors that demonstrate relatively high productivity. Lewis first presented the case in a dual economy model in mid of the 1950s. The model explains growth is possible and sustainable through the transfer of surplus labour whose marginal productivity is negligible or negative in one sector/s to another sector/s where the transferred labour will be more productive (Todaro & Smith, 2012).

The process is termed structural change, as the production and employment pattern of the economic structure is changing. At the low-income level, the process follows the transfer of primary factors of production; labour, between low and high productive sectors. Developing countries are mostly presented such a trend in their recent course of growth (UNCTAD, 2020). The trend was similar in East Africa too. Since 2000, the countries in the region are releasing the surplus-labour surrounding the primary sectors of the economy to the industry and service sectors. This is to the fact that improvement in productivity growth within agriculture is the main reason behind (McMillan and Harttgen, 2014).

However, the path of structural change in the region is not as it was in Asia and Latin America. The revealed structural change followed the path of low productive agriculture to low productive and informal service activities (Rodrik 2013; Timmer et al. 2015). The other issue in the process of structural change is the source. As mentioned above in many developing countries the source is merely due to labour shift, but this is not sustainable. More sustainable structural change that enhances growth requires reallocation of labour that results from improvement of productivity within labour releasing sectors (Andriansyah, et al., 2020). To this end, acting on policy reforms that affect the enhancement of productivity growth and structural change is paramount. Dabla-Norris et al. (2013) identified areas where reforms are necessary such as trade openness, improving human and physical capital as well as finance access. In addition to these, initial agricultural labour share in the economy, Undervaluation Index, labour rigidity, and patent rights are also among factors (McMillan, et al., 2014). Thus, acting on these and other related variables help to generate growth-enhancing structural change.

The study used the Economic Transformation Database (ETD) of Groningen Growth and Development Center (GGDC) for calculating employment and value-added share of the sectors, and productivity of each sector. Also, economy-wide labour productivity growth and decomposition of overall productivity growth

[1] The countries include Ethiopia, Kenya, Malawi, Mauritius, Mozambique, Rwanda, Uganda, Tanzania, and Zambia.

among within, between (structural change), and dynamic changes were formed using the same database. For international comparison purposes the GDP obtained from GGDC, which was placed in local currency form for each country, was converted to USD form. The processes followed were, developing the sectoral value-added share from the economy using GGDC data. Then value added of each sector was generated by multiplying sectors share in the economy obtained from GGDC database with GDP figure from World Penn table (PWT) version 10.0. The study also used the World Development Indicator of the World Bank as an additional data source.

3. Structure of the economy and labour productivity in the region

3.1. Structure of the economy (sectoral value-added and employment share)

The trend on employment and value-added share among sectors display a picture of the structure of the economy (Mouelhi & Ghazali, 2021). East Africa's economy has been changing; and the structure of the economy also showed transition (African Development Bank Group, 2020). Though, the transition is from agriculture to service, the other industries, except the manufacturing industry, also showed progress. The share of agriculture in GDP presented about a 12.6 percentage point reduction. The reduction of the sector's share has been partly compensated by the increase in the industry, especially mining and construction related industrial groups. In the region, industry value-added share in GDP increased from 18.9 per cent to 22.8 per cent between the years 1990 and 2018. But the major of the agricultural share reduction, about 8.7 percentage points, was reflected with the increase of service share in GDP.

Periodically, the first ten years seems lost period for the region. No significant structural movement was observed. By the year 1990, the share of agricultural, industry and service in GDP was 35.9, 18.9, and 45.2 per cent respectively. After ten years, by 2000, the agricultural sector showed a 2.5 percentage point reduction only. The whole industry as well as part of the sub-sectors of it; the manufacturing and mining sectors showed a reduction in their share in GDP. Output side structural change was so sluggish during the period. A significant change was observed between the years 2000 and 2010. The agriculture sector falls by about 6 percentage points and other industries except for manufacturing and the services sector receipts part of 2.7 and 3.3 percentage points respectively.

As presented in the table below, regionally, the service sector share shifted from 45.2 per cent to 54.0 per cent in 29 years; this was about an 8.8 percentage point increase. In the industry sector, the main actor was construction, which showed about a 97.5 per cent increase during the period. On the other hand, the manufacturing industry sector with a better base at the beginning of the period exhibited a reduction (see the below table).

Table 1. Sector value added share in GDP (Regional Level, Average of 9 countries)

Year/Sector	Agriculture	Mining	Manufacturing	Utilities	Construction	Trade services	Transport services	Business services	Financial services	Real estate	Government services	Other services[1]	Agriculture	Industry	Manufacturing	Service
1990	35.9	2.4	9.9	2.4	4.1	13.0	3.9	4.4	3.4	6.9	11.2	2.3	35.9	18.9	9.9	45.2
1995	35.1	1.7	9.4	2.3	3.9	13.2	4.5	4.7	4.1	7.2	11.7	2.3	35.1	17.2	9.4	47.7
2000	33.4	1.7	9.7	2.6	4.3	13.4	4.8	5.1	4.2	7.1	11.2	2.4	33.4	18.3	9.7	48.3
2005	30.9	2.6	9.7	2.3	5.3	14.1	5.0	5.4	4.1	6.5	11.4	2.6	30.9	19.9	9.7	49.2
2010	27.5	3.2	9.5	2.2	6.1	15.1	5.7	6.0	4.7	6.4	11.0	2.7	27.5	20.9	9.5	51.6
2015	24.6	3.3	9.1	2.2	7.2	16.2	5.4	6.3	5.4	5.8	11.7	2.8	24.6	21.8	9.1	53.6
2018	23.3	3.6	8.8	2.2	8.1	15.9	5.7	6.4	5.4	6.1	11.7	2.8	23.3	22.8	8.8	54.0

Source: - Own computation based on Groningen University ETD (2021) & PWT Version 10.0.

From a sectoral perspective, much progress was observed in the service sector. Except for real estate, the remaining sub-sectors reflected increments in their share in GDP. The trade service sub-sector takes the lion share compared to others. From the total service sector increment in GDP during the period, about 2.9 percentage points were absorbed by the trade service. The financial, business and transport service sectors showed percentage points of 2.0, 2.0, and 1.8 increments respectively. Compared against the modern tradable and traditional non-tradable[2] services, the increase in overall service sector value-added share in GDP was more

[1] Other sectors include Arts, entertainment and recreation; Other service activities; Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use; Activities of extraterritorial organizations and bodies

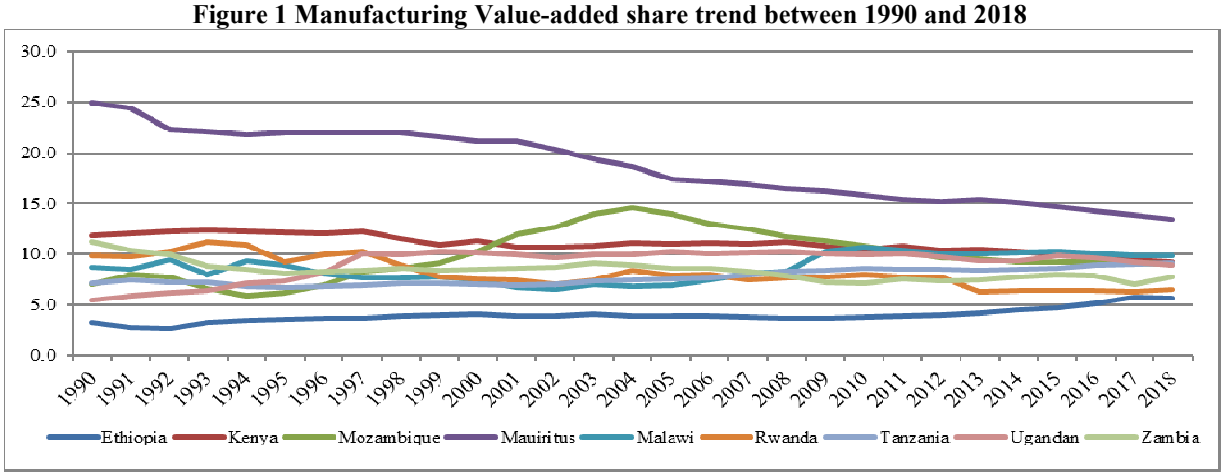
[2] Modern services include such as finance & insurance, transport, communication & storage; and traditional services are trade & personal services

induced by the increase of modern tradable services during the period.

At a country level, agricultural value addition share in GDP declined in all countries during the period. A huge reduction was observed in countries of Ethiopia (34.5%), Uganda (21.0%), Mozambique (20.1%), and Rwanda (16.1%). From the industry side, a reduction in industrial share in GDP was observed in the countries of Mauritius, Kenya, Rwanda and Zambia. The reduction of industry share in GDP was the highest in Mauritius, whose economy is dominated by the service sector. The remaining countries showed an increase in the share of the industry sector in GDP. From a service perspective, except for Malawi and Tanzania, the share in GDP demonstrated increasing trends. On average the sector showed about a 25.2 per cent increase between 1990 and 2018 in sampled countries.

Manufacturing, which is assumed to play the leading role in industrialization, showed minor progress. Regionally, the average manufacturing industry share in GDP was 9.9 per cent in 1990 and reduced to 8.8 per cent by 2018. This reflects the way to industrialization has been fully utilized by other industries rather than the manufacturing sector. Though, the share in GDP is very low compared to other sample countries, a strict increase of manufacturing share in GDP has been observed in Ethiopia. Also, signs of progress were witnessed in countries such as Mozambique, Malawi, Tanzania and Uganda. But, the share of the sector in GDP is below 10 per cent in all countries except for Mauritius. Even, the case of Mauritius was also special, the trend of the economy is more inclined to be service-oriented and the manufacturing share in GDP reduced from 25.0 per cent to 13.4 per cent between 1990 and 2018.

Figure 1 Manufacturing Value-added share trend between 1990 and 2018



Source: - Own computation based on Groningen University ETD (2021) & PWT Version 10.0.

From an employment perspective, the surplus-labour holder, agriculture, is losing its share in the economy. In 1990 the economy of the region was predominately agrarian. The labour share in the agricultural sector was about 83 per cent, service holds 13 per cent share and the industry represents about 5 per cent. By 2018 the region showed some progress in shifting employment between the sectors. The move favours more to the service side. The agricultural sector showed about a 20 per cent reduction in employment share and the service and industry sectors showed increment. The employment share of the agriculture sector reduced from 83 per cent to 63.0 per cent between 1990 and 2018.

Table 2 Sect oral Employment Shares (East Africa Level, Average of nine countries)

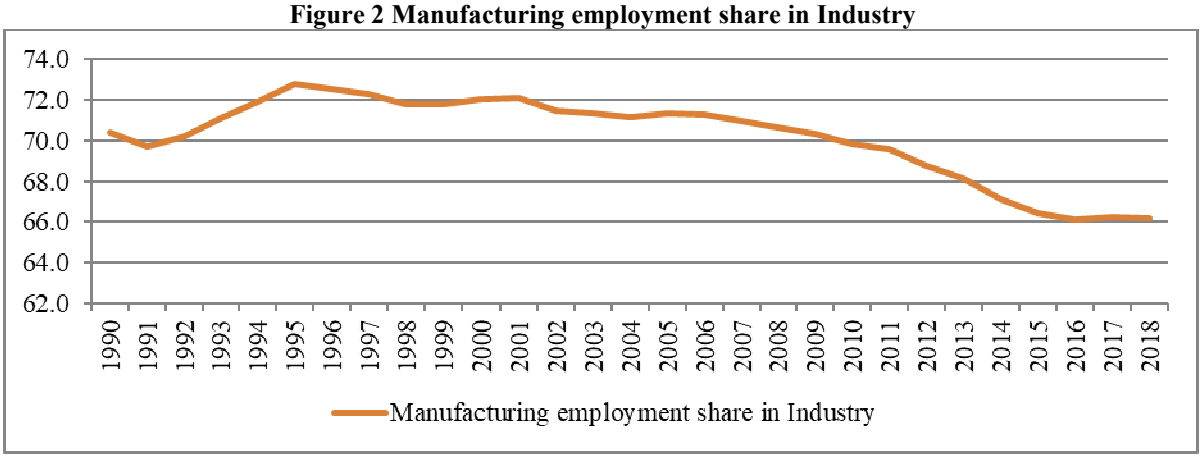
Sectors/Year	1990	2000	2010	2018
Agriculture	**82.6**	**76.9**	**68.8**	**63.0**
Industry	**4.7**	**6.5**	**9.3**	**11.3**
Manufacturing	3.3	4.7	6.5	7.5
Service	**12.7**	**16.7**	**22.0**	**25.6**
Trade Service	5.8	7.6	10.8	11.2
Transport Service	0.7	0.9	1.2	1.6
Business Service	0.5	0.9	1.1	1.1
Financial services	0.1	0.2	0.3	0.4
Real Estate Service	0.0	0.0	0.0	0.1
Government Service	3.0	4.0	4.0	4.6
Personal Service	2.6	3.1	4.6	6.7

Source: - Own computation based on Groningen University ETD (2021) & PWT Version 10.0.

The majority of the outflow of labour is inclined to the service sector. The share of the sector increased from 12.7 per cent in 1990 to 25.6 per cent in 2018. Trade service holds the lion share among the service sectors. Even though the modern service showed better performance in increasing value addition but the employment

share of the sector demonstrated insignificant changes. By 1990 the modern services hold 2.2 per cent in total employment and the figure moved to just 3.1 per cent after 29 years. Overall, the employment movement is more to traditional services, which are less productive, compared against the modern ones. The employment share of the industry sector also presented an increment of about 7 percentage points; mostly due to the expansion of employment in manufacturing and construction industries. Though the manufacturing sector showed improvement in employment share, the employment share it held from the industry sector exhibited continuous reduction. In 1990 manufacturing employment share from industry holds 70.2 per cent but in 2018 the share reduced to 66.4 per cent (see figure 2 below). This may reflect the employment deindustrialization in the region.

Figure 2 Manufacturing employment share in Industry



Source: - Own computation based on Groningen University ETD (2021) & PWT Version 10.0.

Excluding Mauritius, agriculture is still the dominant sector of the economy which employed on average over 62 per cent of the labour force in the region. But the trend through time demonstrated reduction. All countries are losing labour from the agricultural sector. Employment in the sector showed on average a 17.5 per cent reduction during the period. Huge agricultural labour share release was observed in countries of Rwanda, Kenya, Ethiopia and Malawi. In addition to agriculture, in the countries of Mozambique, Mauritius, Uganda and Zambia employment share reduction was observed in the sector of manufacturing and utilities. The service sector demonstrated a positive absorption figure for all countries. From the industry side, it is only in Kenya, Ethiopia, and Rwanda higher labour absorption by the industry sector was observed. The remaining countries industrial sector showed negligible figures in absorbing the withdrawal labour from the surplus sector (see table 2).

Table 3 Labour Releasing and Absorbing Sectors

Country/sector	Agriculture	Mining	Manufacturing	Utilities	Construction	Trade services	Transport services	Business services	Financial services	Real estate	Government services	Other services	Sum	Releasing Sector	Absorbing Sectors
Ethiopia	-23.8	0.4	7.5	0.5	2.5	3.0	0.6	0.6	0.3	0.0	1.0	7.4	0.0	Agri	Except Agri
Kenya	-27.3	0.7	8.9	0.0	2.1	9.6	1.6	0.1	0.2	0.0	1.4	2.8	0.0	Agri	Except Agri
Mozambique	-12.7	0.2	-0.5	-0.1	0.4	3.0	0.0	0.7	0.0	0.0	5.3	3.6	0.0	Agri, Manu, & Utilities	Except Agri, Manu., & Utlit
Mauritius	-10.4	0.1	-15.6	-1.1	-0.7	11.9	1.4	4.5	1.5	0.4	3.8	4.2	0.0	Agri, Manu., Utlit & Construction	Except Agri, Manu., Utlit & Construction
Malawi	-22.0	0.1	1.1	0.2	1.1	14.2	1.3	0.7	0.3	0.4	0.8	1.7	0.0	Agri	Except Agri
Rwanda	-29.1	1.1	2.6	0.2	5.7	9.5	2.5	1.6	0.5	0.1	3.8	1.5	0.0	Agri	Except Agri
Tanzania	-14.9	0.0	1.2	0.0	0.9	8.1	1.1	0.6	0.2	0.0	0.8	1.8	0.0	Agri	Except Agri
Uganda	-7.1	0.8	-0.8	0.0	1.5	0.4	1.1	0.6	0.1	0.0	2.1	1.1	0.0	Agri, & Manu	Except Agri, & Manu
Zambia	-10.4	-0.98	-2.48	0.10	2.05	7.79	0.71	-0.49	0.12	0.19	2.71	0.73	0.0	Agri, Mining, Manu., & B.S	Except Agri, Mining, Manu., & B.S

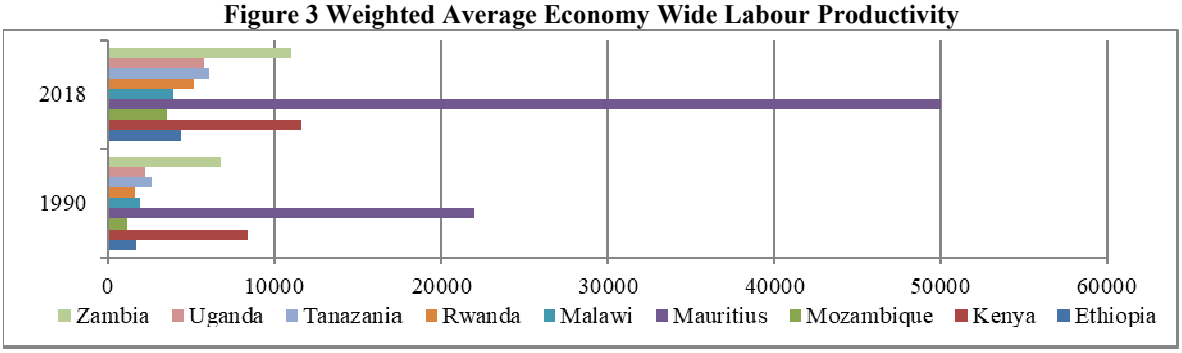
Source: - own computation based on Groningen University ETD (2021) & PWT Version 10.0.

3.2. Sectoral labour productivity

This part presents the simple and relative labour productivity at the sectoral as well as country level. Simple labour productivity represents the ratio between value-added and the number of employees engaged in the production process in the respective sector. The ratio is low in the sectors where over and above labour is engaged in the production process. The reverse is true for a lower amount of labour employment that is relatively lower than the amount of output. On the other hand, the relative labour productivity demonstrates the ratio between labour productivity of each sector and the Weighted Average Economy-Wide Labour Productivity (WAEWLP) in the economy.

Sect orally, though, the agricultural sector is low productivity sector compared against other sectors, but the labour productivity of the sector has been increasing during the period in the region. This is mainly due to the reduction of employment and technical improvement observed in the sector, as we will see in section 4.1.

Figure 3 Weighted Average Economy Wide Labour Productivity



Source: - Own computation based on Groningen University ETD (2021) & PWT Version 10.0.

The industry sector also showed improvement in the productivity for all sampled countries on average, while the service sector productivity failed (see appendix 4). As we can see from table 4 below, the WAEWLP demonstrated increment in all countries. Relatively highest WAEWLP was observed in countries of Mauritius (50,036.0), Kenya (11,632.5) and Zambia (11,023.8).

From the relative labour productivity perspective, agriculture demonstrated the lowest relative productivity as compared against other sectors. The majority of the countries showed an agricultural productivity rate of over 50 per cent lower than overall economy-wide labour productivity in 2018. The case was worsening in the countries of Zambia, Mozambique, Uganda, and Tanzania. In 2018, these countries registered relative productivity of 0.1, 0.4, 0.4 and 0.4 respectively for the agricultural sector. Sectors such as "other" services, personal and trade services are also demonstrated low relative productivity. It is the real estate sector that reflects higher value for relative labour productivity. For the sector, in the countries such as Rwanda and Ethiopia, the figure goes up to 12,482.9 and 1,389.9 per cent higher than overall economy-wide labour productivity. Service sectors of financial & business and construction industry sectors are also among the most productive sectors, though they demonstrated decreasing trend over course of time in many countries.

Table 4 Sectoral relative Labor Productivity, WAEWLP, & CV

Sector/Country/Year	Ethiopia		Kenya		Mozambique		Mauritius		Malawi		Rwanda		Tanzania		Uganda		Zambia	
	1990	2018	1990	2018	1990	2018	1990	2018	1990	2018	1990	2018	1990	2018	1990	2018	1990	2018
Agriculture	0.8	0.5	0.5	0.7	0.5	0.4	0.5	0.5	0.3	0.5	0.5	0.5	0.5	0.4	0.6	0.4	0.2	0.1
Mining	2.8	0.4	6.6	1.2	2.7	14.5	7.8	1.0	2.4	3.0	11.5	2.2	2.2	5.6	0.7	0.9	5.6	8.3
Manufacturing	1.6	0.6	2.2	0.6	2.8	4.5	0.8	0.8	2.9	2.4	7.4	1.6	3.6	2.8	1.0	1.8	1.6	1.6
Utilities	10.5	1.0	8.6	9.1	3.0	56.8	1.5	2.3	8.2	3.2	67.1	6.1	10.8	10.2	15.9	65.8	10.7	6.6
Construction	14.6	5.7	2.6	1.6	0.6	1.2	0.6	0.5	1.6	1.2	6.9	1.2	5.2	7.9	2.6	3.4	6.5	3.2
Trade services	3.3	3.0	0.8	0.5	2.4	1.5	1.5	0.8	5.5	1.1	4.9	1.0	2.5	0.8	1.1	1.4	2.3	1.6
Transport services	7.6	4.9	9.8	3.9	4.8	9.2	0.8	0.9	6.1	1.8	5.6	1.7	8.2	4.0	1.7	1.3	2.0	2.0
Business services	5.9	2.5	3.1	2.5	13.0	5.9	1.1	1.2	9.7	3.6	49.9	5.7	22.5	6.1	8.8	9.8	0.6	1.6
Financial services	42.7	11.8	15.2	13.2	21.0	50.6	4.5	4.5	61.8	15.1	16.5	5.6	42.5	16.2	6.1	13.4	16.6	5.4
Real estate	1389.9	264.9	213.9	267.9	511.4	101.6	62.0	12.9	686.2	17.4	12482.9	116.7	888.2	145.4	287.9	90.6	11.0	23.9
Government services	1.2	2.6	1.9	1.7	5.8	2.1	1.3	0.9	2.2	2.0	24.6	2.4	2.4	2.5	5.4	2.2	4.2	2.2
Other services	1.0	0.2	0.3	0.2	0.7	0.2	1.0	0.7	4.2	1.9	0.2	1.0	2.1	0.4	0.9	0.7	0.6	0.1
WAEWLP	1715.5	4382.6	8393.1	11632.5	1191.7	3525.5	21941.6	50036.0	1975.1	3908.3	1640.4	5211.7	2620.2	6117.7	2242.2	5771.3	6820.7	11023.8
CV	0.22	0.20	0.17	0.19	0.22	0.21	0.13	0.09	0.21	0.11	0.27	0.15	0.20	0.16	0.20	0.18	0.14	0.16

Source: - Own computation based on Groningen University ETD (2021) & PWT Version 10.0.

The variable termed CV in table 4 of the last row belongs to the Coefficient of Variation, which shows the productivity gap among sectors. In the region, the CV reflected negligible changes during the period. Except for Kenya and Zambia, the value has been declining over time for the remaining countries. This demonstrates the productivity gap among high productive and low productive sectors has been falling; implying that the room for labour reallocation between sectors is reducing. But, compared to high-income countries, the CV is still high for the countries under consideration and which reflects the allocative inefficiencies within the economies (McMillan & Rodrik, 2011; McMillan, M., Rodrik, D., & Verduzco-Gallo, Í., 2014).

4. The pattern of labour Productivity growth

4.1. Economy-wide Labor productivity growth

Value addition and level of labour employed in the sector are the two important variables to determine the labour productivity level in a given time for a given sector. In the formula below Y_{it} represent value-added for the sector "i" at a time "t" and L_{it} represent the number of labour employed at sector "i" at a time "t". Though the number

of hours engaged in a given production period is more appropriate for measuring productivity but due to the absence of required data in developing countries number of labours employed in the sector has been used for productivity determination. y_{it} belongs to labour productivity for the sector "i" at a time "t".

$$y_{it} = {}^{Y_{it}}/_{L_{it}}$$

Then overall productivity in the economy would be computed by using weighted average economy-wide labour productivity. The weighted average economy-wide labour productivity calculated by summing the product of labour productivity and employment share of the sector "i" at a time "t"; "i" runs from 1 to n. Here the basic logic is, weighting each sectors labour productivity by its employment share to show the overall economy-wide labour productivity.

$$Y_t = \sum_{i=1}^{n} y_{it} * Qit$$

Where Y_t is the weighted average economy-wide labour productivity at year t, y_{it} is labour productivity for the sector "i" at "t" and Q_{it} employment share for the sector "i" at a time "t". In this study "i" runs from 1 to 12. We have twelve sectors in our case and the summation follow the summing of twelve sectors to get weighted average economy-wide labour productivity.

Using the above formula, it is possible to measure economic growth over time; as the increase in factors productivity is linked with an increase in economic output. In connection to this, one can make decomposition of this form of growth between growth that resulted from technological advancement and that of change in factors of production (allocative efficiency). The technological change and allocative efficiency factors are further divided into three growth components, with-in sector (intra-sect oral productivity growth), between sector (inter-sectoral productivity growth) and dynamic component. The first component represents, change in productivity due to the adoption of new practices, and or realign plants, and or adoption of new technologies, without reallocating the labour.

The second component of labour productivity growth is resulting from labour reallocation between sectors. Labour, which is over and above the required amount in one sector results in a reduction of productivity in that sector compared against a sector with less labour. Thus, releasing the excess labour from less productive to high productive sector improve the overall productivity of the economy. The third component, the dynamic component of overall labour productivity growth, represents productivity growth resulting from both within sector production improvement and labour reallocation. It is also termed the interaction effect.

Academically, there are two discourses on the dynamic (interaction effect). Those from McMillan side argue that the inclusion of dynamic effect is not necessary. They support their argument: first, in developing countries labour move is mostly from the surplus agricultural sector to service and industry sectors. In this case, the difference between the end year and the beginning year agricultural labour share become negative, therefore, even if positive labour productivity is observed in the sector, but the resultant dynamic effect will be growth reducing, negative, McMillan et al (20 14). Second, even if there is a reduction in both labour share and productivity in the sector, the dynamic effect term could be positive. Thus, these cases led to ambiguity to make an explanation about the result. The third argument placed with this category is that, the process of structural change is itself dynamic and inclusion of such a third component is not necessary.

On other hand, Fagerberg and others favour the inclusion of dynamic effect together with within and structural change effects. Their argument is supported by the fact that for testing Baumol's hypothesis of structural bonus or burden. The movement of labour will become a structural bonus or burden. If the movement is from the more productive sector to the less productive sector, it becomes a structural burden and the opposite is true (Baumol's, 1967). As clearly presented by Lilis, et al, "If the dynamic-shift effect has a negative value, it indicates a structural burden which means that the economic sector with high labour productivity growth is unable to manage the labour share in total employment causing a decline in labour share." (Lilis, et al, 2019).

Thus, in this study, the paper follows the second argument of productivity determination approach; the method used by Fagerberg (2000), to see the full picture of productivity growth. Fagerberg used the following formula while determining total labour productivity growth.

$$\Delta Y = \frac{Y_t - Y_0}{Y_0} = \frac{\sum_{i=1}^{n} y_{io}\,(Q_{it} - Q_{io}) + \sum_{i=1}^{n} Q_{io}\,(y_{it} - y_{io}) + \sum_{i=1}^{n} (Q_{it} - Q_{io})(y_{it} - y_{io})}{\sum_{i=}^{n} y_{io}}$$

Where y_{i0} is labour productivity for the sector "i" at a time "0" or beginning of the year; Q_{i0} represents employment share for the sector "i" at a time "0"; and Q_{it} belongs to employment share for the sector "i" at a time "t". The first term is structural change, the second term is termed with-in sector component of productivity growth and the third term is named dynamic component.

Following the above formula decomposition of overall productivity growth was undertaken for nine countries under consideration of this study. The result demonstrated that positive overall labour productivity growth was observed in all countries. Regionally, in the period, between the years 1990 and 2018, the total labour productivity growth level is about 136 per cent. Periodically, better total labour productivity growth was

observed in the region between the years 2000 and 2018. Country-wise such as Rwanda, Mozambique, Uganda, and Ethiopia exhibited high percentage point overall labour productivity growth between 1990 and 2018. The remaining countries also showed positive productivity growth.

Table 5 Total labour productivity between the years 1990 & 2018

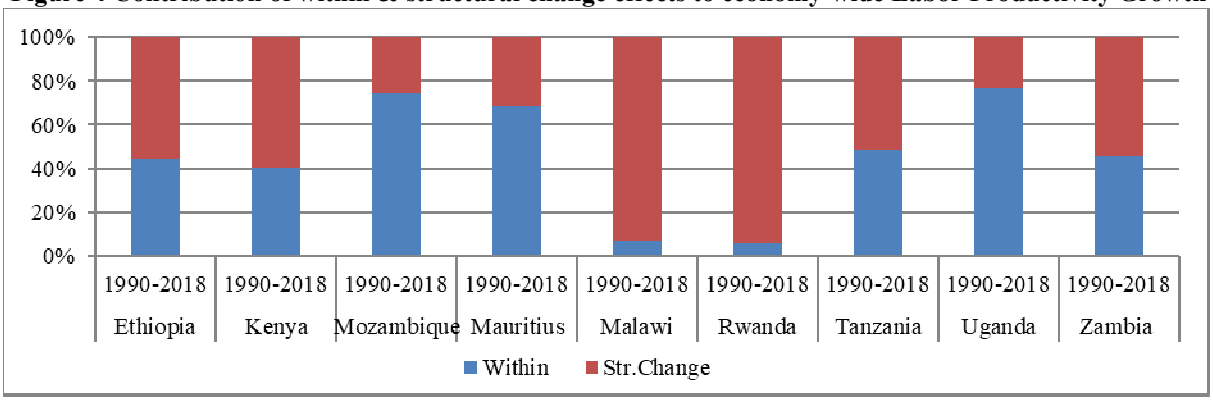
Country	Ethiopia	Kenya	Mozambique	Mauritius	Malawi	Rwanda	Tanzania	Uganda	Zambia
Total labour Productivity growth	1.55	0.39	1.96	1.28	0.98	2.18	1.33	1.57	0.62
Weighted Average labour Productivity growth for East Africa									
Period	Total		Within effect		Structural change effect			Dynamic effect	
1990-2018	1.36		0.73		1.27			-0.64	
1990-1999	0.09		0.00		0.48			-0.40	
2000-2009	0.39		0.29		0.22			-0.11	
2010-2018	0.39		0.27		0.19			-0.07	

Source: - Own computation based on Groningen University ETD (2021) & PWT Version 10.0.

Coming to the decomposition, both within and structural change effect contributes positively for the overall labour productivity growth region. But the dynamic part showed a negative effect. This is to the fact that, the labour movement at the regional as well as the country level is from the low productive agricultural sector to the service sector, particularly relative less productive services of trade and personal service. This also reflects that, sectors that showed high productivity are not absorbing the withdrawal labour from the agricultural sector. Thus, this is a structural burden for the economy (see table 5 and appendix 5).

In the countries of Mozambique, Mauritius, and Uganda within sectoral productivity effect contribution for overall labour productivity growth dominate both the structural change and dynamic effects. In these countries, within sector contribution for overall labour productivity growth is on average about 115 per cent for the period. This represents labour productivity level in sectors is positive due to changes in the production process and or application of technology in the production process. For the remaining countries, structural change holds the highest share for overall economy-wide labour productivity growth. In the countries of Rwanda and Malawi, the percentage share of structural change in overall labour productivity growth holds over 90 per cent.

Figure 4 Contribution of within & structural change effects to economy-wide Labor Productivity Growth



Source: - Own computation based on Groningen University ETD (2021) & PWT Version 10.0.

4.2. Periodical Decomposing, (1990 to 1999 & 2000 to 2018)

As Mcmillan, et al., well noted, an increase in commodity export price and fruits from past economic reforms and improved governance results in a rise of Africa's economy since 2000 (Mcmillan, et al., 2014). In relation to this, regionally, pre-2000 result for overall labour productivity growth reveals lower figure compared to post 2000 period. In the region, high labour productivity growth was observed since 2000 and both within and structural change effect showed an increasing trend in most countries. All countries are demonstrated high total labour productivity growth compared to the period of 1990 to 1999. In addition, a similar result was found by Mcmillan, et al. using ten sector data (Mcmillan, et al., 2014). The productivity growth was generated from both within and structural change contribution; but, in the period on average 71 per cent contribution for overall labour productivity growth was obtained from structural change effect.

Table 6 Total labour productivity growth, within and structural change effect between 1990 and 1999 and 2000-2018

Countries	Period	Total labour productivity growth	Within	Str. Change	Str. Change share in total	within share in total
Ethiopia	1990-1999	-0.01	-0.09	0.09		
	2000-2018	1.53	0.90	0.75	48.99	58.89
Kenya	1990-1999	-0.19	-0.32	0.39		
	2000-2018	0.77	0.94	-0.01	-1.47	122.08
Mozambique	1990-1999	0.36	0.24	0.11		
	2000-2018	1.16	0.99	0.35	29.88	85.57
Mauritius	1990-1999	0.33	0.24	0.11		
	2000-2018	0.59	0.41	0.25	43.22	70.03
Malawi	1990-1999	0.11	-0.02	0.27		
	2000-2018	0.78	0.26	1.70	218.50	33.80
Rwanda	1990-1999	0.34	-0.01	8.57		
	2000-2018	1.32	0.60	1.56	118.62	45.88
Tanzania	1990-1999	0.24	0.21	0.12		
	2000-2018	0.82	0.37	0.49	59.94	44.62
Uganda	1990-1999	0.50	0.41	0.06		
	2000-2018	0.70	0.53	0.18	26.16	75.84
Zambia	1990-1999	-0.03	0.12	-0.12		
	2000-2018	0.66	0.05	0.63	95.68	7.62

Source: - Own computation based on Groningen University ETD (2021) & PWT Version 10.0.

During the period, 2000 to 2018, for countries of Malawi, Rwanda, Tanzania, and Zambia structural change contribution for productivity growth is higher than within effect. Especially for Malawi and Zambia almost overall labour productivity growth was sourced from structural change. Kenya is the only exception with a negative contribution of structural change effect for labour productivity growth in the region during the same period.

4.3. Sectoral shift-share contribution for structural change

The structural change observed in the region between 1990 and 2018 was service lead. Almost 97 per cent contribution for the shift-share was obtained from the service sector and the remaining was born from the industrial and agricultural sectors; of course, the contribution of agriculture was negative during the period. The top three sectors which contributed the highest share for structural change were service-related activities in all countries, except for Kenya and Ethiopia, where industry sector contribution for structural change was competitive with that of service. But in these countries also the contribution of manufacturing industry was low. The real estate and trade service are the dominant actors in the process of structural change. The countries of Mozambique, Mauritius, and Uganda were total service-oriented countries.

Table 7 Sectoral contribution for structural change between the years 1990 and 2018

Country	Agricul ture	Mining	Manufa cturing	Utilities	Constr uction	Trade services	Transport services	Business services	Financial services	Real estate	Government services	Other services	Str. Change
Ethiopia	-0.18	0.01	0.12	0.06	0.36	0.1	0.04	0.04	0.13	0.18	0.01	0.07	0.93
Kenya	-0.15	0.05	0.2	0	0.05	0.08	0.16	0	0.02	0	0.03	0.01	0.45
Mozambique	-0.07	0.01	-0.01	0	0	0.07	0	0.09	0.01	0.07	0.31	0.03	0.49
Mauritius	-0.05	0.01	-0.12	-0.02	0	0.18	0.01	0.05	0.07	0.25	0.05	0.04	0.45
Malawi	-0.06	0	0.03	0.01	0.02	0.78	0.08	0.07	0.19	3.06	0.02	0.07	4.28
Rwanda	-0.14	0.13	0.19	0.12	0.39	0.47	0.14	0.81	0.09	8.88	0.94	0	12.01
Tanzania	-0.07	0	0.04	0	0.05	0.2	0.09	0.14	0.07	0.14	0.02	0.04	0.73
Uganda	-0.04	0.01	-0.01	0	0.04	0	0.02	0.06	0.01	0.12	0.12	0.01	0.32
Zambia	-0.02	-0.06	-0.04	0.01	0.13	0.18	0.01	0	0.02	0.02	0.12	0	0.38

Share of major sectors in their contribution for the observed structural change

Country	Agricu lture	Industry	Service	overall
Ethiopia	-19.57	58.7	60.9	100
Kenya	-32.89	66.3	66.6	100
Mozambique	-13.87	-1.5	115.4	100
Mauritius	-12.03	-30.5	142.5	100
Malawi	-1.31	1.6	99.7	100
Rwanda	-1.19	6.9	94.3	100
Tanzania	-9.41	13.1	96.3	100
Uganda	-13.69	10.7	103	100
Zambia	-4.36	12.9	91.5	100

Source: - own computation based on Groningen University ETD (2021) & PWT Version 10.0.

Note: - The colours stand for the top three sectors whose contribution to structural change were highest. The green is for the highest contributing sector, the Yellow is for the second-highest contributor and the red is for the third-highest contributor.

The manufacturing industry was punching below its weight. In sampled countries on average, only 4 per cent contribution was done by the manufacturing sector for structural change. Only in Kenya, better performance of the sector was observed compared to other sectors. The sector showed even negative contribution for structural change in the countries of Mozambique, Mauritius, Uganda and Zambia during the period.

5. The determinate of structural change

Structural change is a long-term process and various factors determine its successful accomplishment. Thus, in addition to a simple descriptive presentation, it is better to undertake some econometrics analysis to see what factors contribute to structural change observed during the period in the region. The study included various determining variables which potentially affect the witnessed structural change. But, while undertaking the regression analysis Rwanda[1] was excluded from the sample due to the unusual trend observed in the five years structural change figures of the country. The regression result generated for variables with the inclusion of Rwanda was insignificant and also against theoretical and stylized facts (see appendix 6). Thus, the analysis was undertaken in eight countries. In the analysis, variable identification was done based on previous empirical literatures. In the equation below, structural change contribution for economy-wide labour productivity growth is the dependent variable. i.e, structural change for country "i" at period "t" is represented by $\sum_i^n y_{it}\Delta Q_{it}$. In the analysis, one period means five years; between the beginning and the end. As presented above, the study time scope is from 1990 to 2018 and totally of 29 years and which are periodically divided into six periods. The first five periods each contains 5 years and the final (sixth) period contains four years.

$$\sum_{i=1}^{n} y_{it}\Delta Q_{it} = \delta + \beta \sum_{i=1}^{n} X_{it} + \epsilon_{it}, t = 1, \dots T,$$

Where δ is the constant term, β is a parameter to be estimated and ϵ is the error term which is exogenous and doesn't have a relationship with explanatory variables included in the study. The included explanatory variables are classified into five broad categories. The categories are globalization and trade openness, economic structure, quality of human capital, labour regulation & institutional barriers, and R&D & innovation activities. But for this study case, due to data limitation in the final two categories, the first three categories were used for analysis. Share of export of goods and non-factor services in GDP used as a proxy for globalization and trade openness; the share of agriculture employment at the beginning of the period and investment share in GDP was used as an indicator for showing how economic structure determines structural change; Human capital index, based on years of schooling and returns to education as a proxy indicator for the human capital of the economies. The study also included an additional variable named Technological Choice Index[2], for looking at the type of development policies followed by the countries; that is, to see whether "growth patterns reflect whether a country's institutional and policy environment favours technological upgrading in sectors which are compatible with the country's comparative advantage, given its initial endowment structure" (Randolph, et al, 2015). Further, the study included the population variable as an additional regressor.

In the table below, the result in the final column is our interest for analysis, as the model under the column has the advantage in variable inclusion including time and country effects over the other three models presented.

VARIABLES	Structural Change	Structural Change	Structural Change	Structural Change
Agricultural employment share (in %)	0.043**	0.054*	0.071*	0.568*
	(0.021)	(0.029)	(0.041)	(0.297)
Share of investment in GDP (in %)	0.018	0.020	0.021	0.044**
	(0.020)	(0.021)	(0.022)	(0.017)
Share of export in GDP (in %)	0.037	0.031	0.034	0.045
	(0.026)	(0.030)	(0.025)	(0.063)
Human Capital Index		0.008	0.003	0.224
		(0.067)	(0.059)	(0.253)
Population size		-0.010	-0.016	-0.916**
		(0.016)	(0.019)	(0.376)
Technological Choice Index			-0.017	-0.058
			(0.027)	(0.050)
Constant	-0.021	-0.050	-0.083	1.318*
	(0.055)	(0.120)	(0.142)	(0.740)
	0.043**	0.054*	0.071*	0.568*
Country	No	No	No	Yes
Time	No	No	No	Yes
Number of country	8	8	8	8

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Agricultural employment share in total employment is expected to have a positive relation with structural change. Initial agricultural employment share during the beginning of the period was used as an indicator here.

[1] Due to political unrest during 1990s and its potential impact through the period, the economy of the country has been seriously affected and that creates some unusual trends until the country's economy regain its normal growth trajectory.

[2] Technological Choice Index is constructed following the proposition of Lin, 2012, by dividing productivity of manufacturing sector to overall economy productivity. That is, the ratio of manufacturing value added to manufacturing sector labour to total value added of the economy to total labour of the economy ($\frac{\frac{VAN}{L_m}}{\frac{GDP}{L}}$).

As a high agricultural labour share at a base year represents a wide gap to be tapped for future growth-promoting structural change, as the surplus-labour in the sector requires less cost and simple effort to move to a relatively more productive sector(s) (UNCTAD, 2020; McMillan, et al., 2014), thus the expected regression result would be positive. The result of this study also arrived at the same conclusion. A 1 per cent increase in the share of agricultural labour led to a 0.6 per cent increase in growth-promoting structural change. Our second variable is investment; inter into the model as a share in GDP. Countries at early stages of development were characterized by investment in labour-intensive manufacturing, human capital development, and infrastructure-related issues which induce labour shift between sectors and enhance production and productivity (Steven, 1992; Oshima 1987, as cited by Kaoru Sugihara, (2019)). Thus, investment activities are expected to have the potential to take away labour force from low productivity sector(s) and will promote growth-enhancing structural change. This study result also reflects such a stylized fact.

Population size reflects inverse relation with structural change. This is to the fact that developing countries with a low industrial base can't absorb the growing labour force. Thus, the additional labour from fertility will remain at primary sectors and reduce productivity level at the sector as well as in the overall economy. The result shows a negative relationship between population figures and structural change. The result for Technological Choice Index is negative. Higher Technological Choice Index belongs to comparative advantage defying development strategy and therefore development is low in such countries (Lin, 2012). As Randolph, et al. pointed "Over-investing in an excessive capital or forcing productivity through costly R&D when a country is below the sufficient level of development will entail a distorted strategy that will not be sustainable in the long run" (Randolph, et al., 2015). This study also found a similar result of growth reducing effect of a technological choice index on productivity-enhancing structural change.

The result for variables of export and human capital development are positive as per expectation. But, they are statistically not significant. Developing countries export effect on structural change was based on the export items; when the export is more attached to manufacturing products, the effect on structural change is significant (Jaime & Sherman, 1992). But, the fact of developing countries is, export is more concentrated to primary products and the structural change which is sourced from such type of export base is found negative (Mouelhi & Ghazali, 202; McMillan, et al., 2014). However, this study result demonstrated positivity relationship between export and structural change. This may be to the fact that, the relative improvement of production and productivity in the agricultural sector during the period. Even though the sector contribution for structural change is very low, but it showed an increasing trend in all countries. Thus, this may infer improvement of the sector due to boosted export earing that promote the demand for other sectors output and that further helps the expansion of the economy; through this process, structural change will flourish (McMillan and Harttgen, 2014). From the human capital side, we have a positive but insignificant relationship. This is maybe due to the mismatch between educational systems and the industrial policies the countries followed.

6. Conclusion and policy remarks

The economy of developing countries is characterized by surplus labour in the low productive agricultural sector. In relation to this, many recent studies recommend, rapid and sustained growth realization is possible with reallocation of labour from less productivity sector/s to more productive sector/s. In this regard, the East African region is among the poorest region in the globe and the majority of the population has been in subsistence agriculture. By 2018, on average, about 63.0 per cent of employment was generated from the agriculture sector in our sampled countries. In the same year, 25.6 per cent of employment share was supplied by the service sector. The sector, industry, expected to push the structural transformation through absorption of surplus labour from the agriculture sector was punching below its weight. Between 1990 and 2018, a reduction in agricultural labour was observed but the large share was moved to the service sector. By 2018, on average, only 11.4 percentage employment opportunity was generated from the industry sector.

The sectoral value-added share in GDP and productivity was also following a similar trend as the employment. The decline of agricultural value-added share was compensated by the increase of the service sector. The industry sector demonstrated only a 4.1 percentage point increase in share during the period; the manufacturing share reduced by 1.1 percentage points. While the service sector demonstrated the highest growth of output share in GDP.

The study also found that, regionally, positive labour productivity growth was observed. The source of growth was both structural change and within sector labour productivity growth effect. The result also indicates that the region has structural bonus resulted from static effect and structural burden resulting from dynamic effect. Periodically, the years between 2000 and 2018 were shining for the region. During the period high structural change effect was observed. From sectoral crosswise, the service sector contribution for structural change effect was dominant. But, the contribution of the agricultural sector has been improving compared to the industry and service sectors.

The observed structural change was determined by initial agricultural employment share in total

employment, share of investment in GDP, share of export in GDP, human development index, population size and Technological Choice Index. Except for population size and the Technological Choice Index, the remaining variables robustly made positive contributions to structural change. Developing human capital through education and training, which produce labour with the skill to facilitate easy transfer to modern more productive sectors, contribute positively to structural change but the result is not statistically significant. The export result is also statistical not significant.

Thus, despite the labour reallocation between sectors, within sector technical change and improvement in the production method also resulted in a reduction of productivity gap among sectors in the countries under this study. In this regard, policies tools such as expanding labour-intensive manufacturing industry through deploying various incentives for both domestics and foreign investors, improving export by encouraging export-oriented industries, and searching new export destinations are recommended for making the structural change to be growth-enhancing. Also, policies such as modernizing the method of technology, improving the skill of the technical experts at local industries and linking local industries with educational institutions to improve the within structural change effect are necessary. Moreover, prioritizing investment areas and reducing over investment on capital intensive investment is recommended. Further, undertaking a detailed study is necessary to test structural change determinates by including additional potential variables.

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Appendices

Appendix 1. Sectors and sub-sectors under Economic Transformation Database

Economic Transformation Database Sector name	**ISIC Rev. 4 description**
Agriculture	Agriculture, forestry, fishing
Mining	Mining and quarrying
Manufacturing	Manufacturing
Utilities	Electricity, gas, steam and air conditioning supply; Water supply; sewerage, waste management and remediation activities
Construction	Construction
Trade services	Wholesale and retail trade; repair of motor vehicles and motorcycles; Accommodation and food service activities
Transport services	Transportation and storage
Business services	Information and communication; Professional, scientific and technical activities; Administrative and support service activities
Financial services	Financial and insurance activities
Real estate	Real estate activities
Government services	Public administration and defence; compulsory social security; Education; Human health and social work activities
Other services	Arts, entertainment and recreation; Other service activities; Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use; Activities of extraterritorial organizations and bodies

Source: - Groningen University ETD (2021).

Appendix 2. Value-added share (between the year 1990 & 2018)

Year	Country	Agri culture	Mining	Manu facturing	Utilities	Const ruction	Trade services	Transport services	Business services	Financial services	Real estate	Govern't services	Other services
1990	Ethiopia	68.3	0.3	3.2	0.9	3.7	12.1	2.3	1.1	1.6	1.9	2.6	2.0
2018		33.8	0.2	5.7	0.6	15.6	19.9	4.1	2.1	4.0	3.7	8.1	2.1
1990	Kenya	38.1	0.5	11.8	2.7	3.6	7.1	7.6	3.8	5.9	7.0	10.4	1.4
2018		31.4	0.9	9.3	2.5	5.7	9.2	9.3	3.3	7.2	8.3	11.7	1.3
1990	Mozambique	46.2	1.0	7.0	0.3	0.7	12.5	3.9	4.8	1.3	8.2	13.1	1.0
2018		26.1	8.6	9.0	3.0	1.9	12.7	7.4	6.1	5.6	3.0	15.8	0.8
1990	Mauritius	8.8	1.3	25.0	3.0	5.7	16.3	4.5	6.7	6.2	4.0	15.5	3.3
2018		3.3	0.2	13.4	2.3	4.7	18.9	6.3	12.4	12.7	6.0	14.5	5.3
1990	Malawi	21.9	0.4	8.7	1.8	2.5	18.6	2.1	7.3	5.0	19.8	7.4	4.6
2018		29.3	0.9	9.8	1.3	3.0	19.4	3.0	5.3	5.8	8.3	8.4	5.5
1990	Rwanda	44.9	1.4	9.9	6.6	3.8	5.4	1.1	6.6	0.7	9.7	9.0	1.0
2018		28.8	2.7	6.5	1.7	7.5	10.6	4.7	9.9	3.1	8.4	10.1	6.0
1990	Tanzania	38.9	1.8	7.2	1.0	5.0	15.2	8.0	5.1	2.7	5.6	6.7	2.8
2018		27.9	4.4	9.1	1.3	14.7	11.4	8.3	5.1	3.9	3.2	9.3	1.4
1990	Ugandan	45.5	0.1	5.5	1.2	2.5	13.2	2.4	2.8	0.9	4.0	19.8	2.1
2018		24.5	0.9	8.9	3.9	8.5	17.2	3.4	9.4	3.5	5.0	12.5	2.3
1990	Zambia	10.8	15.0	11.2	4.5	9.4	16.8	3.4	1.7	6.2	2.0	16.7	2.2
2018		4.2	13.9	7.8	3.5	11.4	23.7	4.9	3.7	2.6	8.9	14.9	0.6

Source: - own computation based on Groningen University ETD (2021) & PWT Version 10.0.

Appendix 3. Employment share (between the year 1990 & 2018)

Year	Country	Agriculture	Mining	Manufacturing	Utilities	Construction	Trade services	Transport services	Business services	Financial services	Real estate	Government services	Other services
1990	Ethiopia	89.2	0.1	2.0	0.1	0.3	3.6	0.3	0.2	0.0	0.0	2.1	2.1
2018		65.4	0.5	9.5	0.6	2.7	6.6	0.8	0.8	0.3	0.0	3.1	9.5
1990	Kenya	71.21	0.07	5.34	0.32	1.42	8.44	0.77	1.24	0.39	0.03	5.38	5.38
2018		43.88	0.79	14.26	0.27	3.54	18.06	2.38	1.32	0.55	0.03	6.77	8.15
1990	Mozambique	85.67	0.36	2.52	0.11	1.17	5.32	0.82	0.37	0.06	0.02	2.27	1.32
2018		72.95	0.59	2.01	0.05	1.52	8.33	0.81	1.05	0.11	0.03	7.58	4.96
1990	Mauritius	16.72	0.16	31.49	2.09	10.03	11.04	5.51	6.00	1.37	0.06	12.16	3.37
2018		6.37	0.24	15.88	1.02	9.34	22.91	6.88	10.54	2.85	0.47	16.00	7.52
1990	Malawi	86.10	0.15	2.98	0.22	1.54	3.39	0.35	0.75	0.08	0.03	3.32	1.09
2018		64.10	0.30	4.10	0.40	2.60	17.56	1.62	1.46	0.39	0.48	4.16	2.83
1990	Rwanda	91.50	0.12	1.34	0.10	0.55	1.10	0.20	0.13	0.04	0.00	0.37	4.55
2018		62.38	1.21	3.98	0.27	6.24	10.59	2.72	1.76	0.56	0.07	4.18	6.04
1990	Tanzania	84.57	0.79	2.02	0.10	0.96	6.11	0.98	0.23	0.06	0.01	2.85	1.34
2018		69.70	0.79	3.25	0.13	1.87	14.24	2.07	0.84	0.24	0.02	3.69	3.16
1990	Ugandan	73.10	0.19	5.67	0.07	0.96	12.10	1.44	0.32	0.15	0.01	3.64	2.34
2018		66.03	0.98	4.90	0.06	2.47	12.52	2.58	0.96	0.26	0.06	5.77	3.41
1990	Zambia	68.03	2.66	7.23	0.42	1.46	7.43	1.73	2.76	0.37	0.18	3.94	3.77
2018		57.59	1.68	4.75	0.52	3.51	15.22	2.44	2.27	0.49	0.37	6.66	4.50

Source: - own computation based on Groningen University ETD (2021) & PWT Version 10.0.

Appendix 4. Sectoral Labor Productivity, Value-Added Per Person

Year	Country	Agriculture	Mining	Manufacturing	Utilities	Construction	Trade services	Transport services	Business services	Financial services	Real estate	Government services	Other services
1990	Ethiopia	1314.8	4866.4	2695.1	18094.8	25092.4	5677.9	13091.5	10097.6	73213.6	2384410.5	2123.3	1659.6
2018		2265.5	1953.5	2611.6	4553.5	25028.7	13156.6	21280.4	10748.0	51880.0	1160962.8	11505.7	987.2
1990	Kenya	4495.3	55675.0	18549.6	71791.0	21516.9	7047.3	82501.3	25937.2	127661.0	1795670.4	16227.2	2258.4
2018		8331.9	13845.2	7551.4	105676.6	18747.4	5895.3	45469.4	28826.8	153029.7	3116393.5	20114.6	1785.5
1990	Mozambique	642.5	3169.0	3328.1	3558.8	726.5	2806.7	5721.6	15448.6	25013.5	609389.4	6859.5	883.4
2018		1260.5	50960.0	15829.2	200198.0	4396.3	5368.7	32501.4	20674.7	178483.5	358222.7	7348.9	593.6
1990	Mauritius	11483.4	171172.8	17399.4	31941.9	12368.4	32400.5	17820.5	24375.9	98965.6	1359621.2	27894.1	21208.5
2018		25701.3	47918.7	42173.8	112845.4	25059.7	41353.6	45629.0	58834.0	223229.8	647854.2	45381.7	35194.0
1990	Malawi	502.8	4782.3	5749.0	16134.0	3185.7	10839.3	12031.3	19094.7	122140.2	1355350.4	4387.5	8310.1
2018		1787.3	11820.3	9347.2	12586.1	4583.1	4311.2	7195.5	14182.1	58948.1	67918.0	7896.1	7542.2
1990	Rwanda	804.7	18918.1	12068.2	110105.4	11327.2	8040.1	9130.6	81799.7	27117.4	20476495.5	40308.9	376.6
2018		2407.3	11507.8	8459.0	31537.2	6263.3	5236.6	8997.9	29539.4	29263.7	608325.7	12550.1	5188.3
1990	Tanzania	1204.8	5871.5	9319.4	28332.6	13628.7	6526.5	21473.9	58850.4	111467.6	2327193.3	6169.1	5550.0
2018		2449.5	34061.3	17170.9	62327.0	48077.6	4882.6	24511.7	37399.1	99217.2	889533.5	15427.8	2658.3
1990	Uganda	1396.3	1544.2	2172.8	35578.3	5746.0	2454.1	3725.3	19647.2	13714.1	645506.8	12176.8	1970.6
2018		2145.6	5056.3	10459.9	379513.2	19858.2	7927.0	7524.0	56579.4	77097.1	523111.0	12524.8	3949.6
1990	Zambia	1078.7	38428.0	10582.1	72761.1	44052.8	15387.4	13615.4	4318.3	113305.3	74913.5	28966.6	3938.3
2018		807.5	91084.0	18069.6	73220.8	35636.8	17158.7	22047.6	18146.1	59381.3	263915.5	24607.3	1586.6

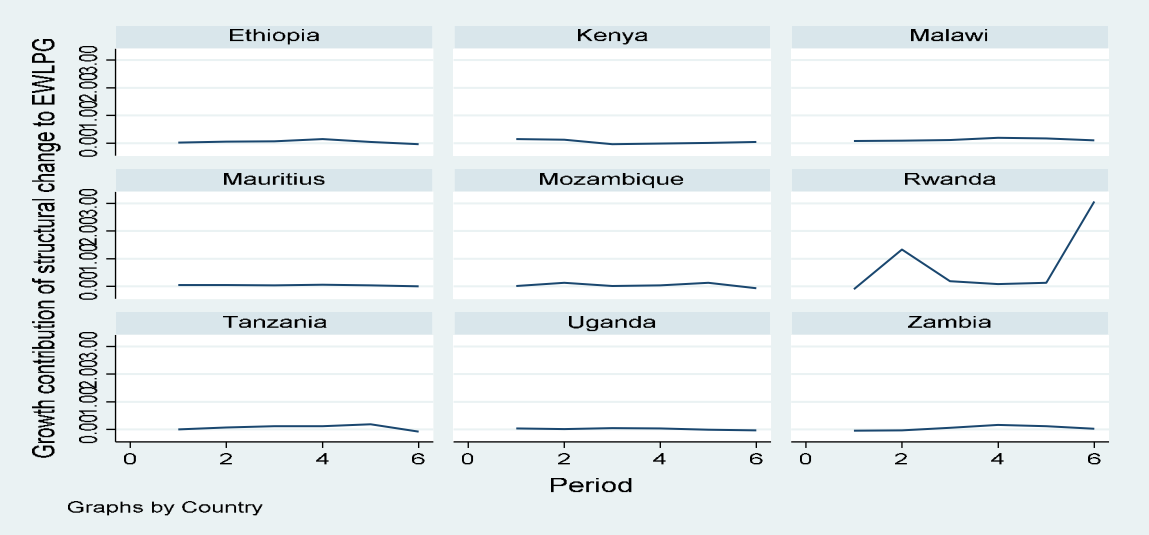
Source: - own computation based on Groningen University ETD (2021) & PWT Version 10.0.
Note: the shade in the table is to represent sectors in which labour productivity showed a reduction between the year 1990 and 2018.

Appendix 5. Contribution to Growth in Economy-wide Labor Productivity

Country	Period	Within	Structural Change	Dynamic	Total labour Productivity growth
Ethiopia	1990-2018	0.75	0.93	-0.13	1.55
Kenya	1990-2018	0.30	0.45	-0.36	0.39
Mozambique	1990-2018	1.43	0.49	0.03	1.96
Mauritius	1990-2018	0.97	0.45	-0.14	1.28
Malawi	1990-2018	0.33	4.28	-3.63	0.98
Rwanda	1990-2018	0.71	12.01	-10.54	2.18
Tanzania	1990-2018	0.69	0.73	-0.08	1.33
Uganda	1990-2018	1.06	0.32	0.19	1.57
Zambia	1990-2018	0.32	0.38	-0.08	0.62

Source: - own computation based on Groningen University ETD (2021) & PWT Version 10.0.

Appendix 6. Structural change contribution to economy-wide labour productivity



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