

T.C.
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SOSYAL BİLİMLER ENSTİTÜSÜ
İKTİSAT (İNG.) ANABİLİM DALI
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**STRUCTURAL CHANGE, TOTAL FACTOR PRODUCTIVITY
AND ECONOMIC GROWTH IN DEVELOPING COUNTRIES**

Ph.D. Dissertation

WONDWOSEN GETANEH EJIGU

Istanbul, 2020

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Istanbul, 2020

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ABSTRACT

Structural change usually happens with economic development and its trend is different for different groups of countries mainly due to their level of economic development. While developed countries successfully transform their economies to highly productive manufacturing and then to service sector dominant economies both in terms of employment and sectoral contribution to GDP, developing countries are recognized to have a diverse and infrequent type of structural change trend. Therefore, it is vital to identify the main drivers of structural change for different groups of countries and define its effect on different economic aggregates. As a result, GDP per capita, the share of agricultural employment, and dependency on raw material export produce a positive structural change in developing countries while they have an opposite effect on the structural change of developed countries. On the contrary, sectoral wedges, within sector technological advancement and institutional quality affect structural change term in developing countries negatively.

On the other hand, structural change has far-reaching effects on economic aggregates. This study also found out that structural change has contributed positively to the growth of the TFP of a sample of African countries. But, against the odds, relocation of labor between sectors does not result in a significant change of sector-specific labor productivity. Furthermore, I also analyzed the effect of structural change on the GDP growth rate of Ethiopian economy. Following wide-ranging policy reforms adopted since 1991, a considerable change in the structure of production is perceived. Change in the structure of the economy boosts GDP growth rate both in the short run and long run

through the relocation of labor mainly from the agriculture and manufacturing sectors to the service sector. Hence, developing countries should promote the relocation of labor from the agriculture sector to the modern sectors to increase TFP growth and GDP growth.



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ÖZ

Yapısal değişim genellikle ekonomik kalkınma ile olur ve eğilimi, esas olarak ekonomik kalkınma düzeylerinden dolayı farklı ülke grupları için farklıdır. Gelişmiş ülkeler başarılı bir şekilde hem istihdam hem de GSYH'ye sektörel katkı açısından önce yüksek verimli üretime ve daha sonra hizmet sektörünün baskın olduğu ekonomilere dönüşürken, gelişmekte olan ülkelerin farklılaşmış ve her zaman tekrarlamayan türde yapısal değişim eğilimi gösterdikleri kabul edilmektedir. Bu nedenle, farklı ülke grupları için yapısal değişimin ana belirleyicilerini belirlemek ve bunların değişik makro düzeydeki ekonomik göstergeler üzerindeki etkisini belirlemek çok önemlidir. Sonuç olarak, kişi başına düşen GSYH, tarımsal istihdamın payı ve hammadde ihracatına bağımlılık, gelişmekte olan ülkelerde olumlu bir yapısal değişime yol açarken, gelişmiş ülkelerin yapısal değişimlerine zıt bir etki yaratmaktadır. Öte yandan, sektör içindeki teknolojik gelişme ve kurumsal kalite içindeki sektörel katılıklar gelişmekte olan ülkelerde yapısal değişim sürecini olumsuz etkilemektedir.

Yapısal değişimin ekonominin bütünü üzerinde geniş kapsamlı etkileri vardır. Bu çalışma, yapısal değişikliğin seçilmiş bir Afrika ülkeleri grubunda TFV'sinin büyümesine olumlu katkıda bulunduğunu ortaya koymuştur. Ancak, beklenebileceğine ters olarak, sektörler arasında emeğin yer değiştirmesi, sektör içi emek verimliliğinde önemli bir değişikliğe yol açmamaktadır. Ayrıca, yapısal değişikliğin Etiyopya ekonomisinde GSYH büyüme oranı üzerindeki etkisini de inceledim. 1991'den beri Etiyopya ekonomisi tarafından benimsenen geniş kapsamlı politika reformlarının ardından, üretim yapısında önemli bir değişiklik görülmektedir. Hem kısa dönemde hem

de uzun dönemde, ekonominin yapısındaki deęişim, işgücünün ağırlıklı olarak tarım ve imalat sektörlerinden hizmet sektörüne taşınması yoluyla GSYH büyüme oranını artırmaktadır. Bu nedenle, gelişmekte olan ülkeler TFV ve GSYİH büyüme oranını artırmak için emeğin tarım sektöründen modern sektörlere kaymasını teşvik etmelidir.



PREFACE

This thesis is written when I was a Ph.D. student at Marmara University, department of economics (English). I would like to thank Turkey government (YTB) for providing me the opportunity to study my Ph.D. in Economics at Marmara University, Turkey.

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TABLE OF CONTENTS

<i>PREFACE</i>	<i>v</i>
<i>LIST OF TABLES</i>	<i>viii</i>
<i>LIST OF FIGURES</i>	<i>x</i>
<i>ABBREVIATIONS</i>	<i>xi</i>
<i>CHAPTER ONE</i>	<i>1</i>
1. <i>INTRODUCTION</i>	<i>1</i>
<i>CHAPTER TWO</i>	<i>6</i>
2. <i>STRUCTURAL CHANGE TRENDS IN DEVELOPED AND DEVELOPING COUNTRIES: A COMPARATIVE ANALYSIS</i>	<i>6</i>
2.1 <i>Introduction</i>	<i>6</i>
2.2 <i>Literature Review</i>	<i>8</i>
2.2.1 <i>Theoretical Discussion: Drivers of Structural Change</i>	<i>8</i>
2.2.2 <i>Empirical Literature Review</i>	<i>10</i>
2.2.3 <i>Conceptual Framework: Deriving Factors of Structural Change</i>	<i>12</i>
2.3 <i>Methodology</i>	<i>15</i>
2.4 <i>Data Sources</i>	<i>18</i>
2.5 <i>Analysis and Discussion</i>	<i>19</i>
2.5.1 <i>Trends in Sectoral Share of GDP</i>	<i>19</i>
2.5.2 <i>Structural Change Term: Shift-Share Analysis</i>	<i>26</i>
2.5.3 <i>Factors Affecting Structural Change Term</i>	<i>29</i>
2.6 <i>Conclusion</i>	<i>35</i>
<i>CHAPTER THREE</i>	<i>37</i>
3. <i>STRUCTURAL CHANGE, TOTAL FACTOR PRODUCTIVITY AND SECTORAL LABOR PRODUCTIVITY IN SELECTED AFRICAN COUNTRIES</i>	<i>38</i>
3.1 <i>Introduction</i>	<i>38</i>

3.2	<i>Conceptual Framework</i>	40
3.3	<i>Overall Characteristics of Sample Countries</i>	41
3.3.1	<i>GDP, GDP Per Capita and Rate of Unemployment</i>	41
3.3.2	<i>Population Structure</i>	42
3.4	<i>Data and Stylized Facts</i>	43
3.4.1	<i>Total Factor Productivity Growth</i>	43
3.4.2	<i>Sectoral Labor Productivity</i>	44
3.4.3	<i>Structural Change Term and Within Sector Labor Productivity Growth Rate</i>	48
3.5	<i>Methodology and Empirical Findings</i>	54
3.5.1	<i>Model Estimation Technique</i>	54
3.5.2	<i>Estimation Results and Discussion</i>	58
3.6	<i>Conclusion</i>	64
CHAPTER FOUR		65
4.	<i>STRUCTURAL CHANGE AND ECONOMIC GROWTH IN ETHIOPIA</i>	65
4.1	<i>Introduction</i>	65
4.2	<i>A Brief Overview of Economic Reforms in Ethiopia</i>	67
4.3	<i>Structural Change and Economic Growth: Theoretical Framework</i>	69
4.4	<i>Methodology</i>	71
4.5	<i>Results and Discussion</i>	73
4.5.1	<i>Descriptive Statistics</i>	73
4.5.2	<i>Trends in Sectoral Share of GDP</i>	77
4.5.3	<i>ARDL Model Regression Results</i>	79
4.6	<i>Conclusion</i>	91
CHAPTER 5		93
5.	<i>CONCLUSION</i>	93
6.	<i>REFERENCES</i>	97

LIST OF TABLES

Table 2. 1: List of sample countries considered	19
Table 2. 2: Trends of the three main sectors for the changes in GDP per capita, by group of countries	22
Table 2. 3: Descriptive statistics by groups of countries, 1991-2017.....	28
Table 2. 4: Panel GLS estimation results for different groups of countries	29
Table 2. 5: Factors that derives the difference in structural change term between developed and developing countries, 1991 to 2017.....	34
Table 3. 1: Summary of sectoral average labor productivities of selected african countries over 1991-2017	45
Table 3. 2: Summary statistics of structural change and within sector labor productivity growth rate	50
Table 3. 3: Disaggregated components of the total average productivity growth rate of sample countries for 1991-2017, by taking 5-year average.....	52
Table 3. 4: Decomposition of aggregate labor productivities into structural change component and within labor productivity component, from 1991—2017, by country	53
Table 3. 5: Variables, sources of data and expected sign	55
Table 3. 6: Fixed effects panel data estimation of structural change on the growth rate of TFP based on driscoll-kraay standard errors	58
Table 3. 7: Fixed effects panel data estimation of structural change term on sectoral labor productivity based on driscoll-kraay standard error	60
Table 4. 1: Typology of growth patterns and outcomes	71
Table 4. 2: Dependent and explanatory variables for our model.....	72
Table 4. 3: Descriptive statistics of major variables involved in the analysis.....	73
Table 4. 4: Decomposition of average growth of labor productivity in ethiopia from 1991 to 2017	75
Table 4. 5: Correlation coefficient between sectoral share of GDP with GDP growth rate.....	95
Table 4.6: Unit root test based on dickey-fuller	80

Table 4. 7: Var lag order selection criteria	81
Table 4. 8: ARDL model estimation for short-run scenario	82
Table 4. 9: Diagnostic tests for the ardl model estimated above	84
Table 4. 10: ARDL regression for long-run scenario	85
Table 4. 11: Pesaran/ Shin/ Smith (2001) ARDL bounds test.....	86



LIST OF FIGURES

Figure 2. 1: The share of the agricultural sector value-added for developed countries, 1991-2017	20
Figure 2. 2: The share of the agricultural sector value-added for low-income developing countries, 1991-2017	21
Figure 2. 3: Trends of sectoral value-added shares for low-income developing countries, 1991-2017	24
Figure 2. 4: The value-added share of the manufacturing sector in developed countries, 1991 to 2017	25
Figure 2. 5: Value-added share of the service sector in developed countries, 1991 to 2017	25
Figure 2. 6: Structural change term in developed countries, 1991 to 2017	27
Figure 2. 7: Structural change term in low-income developing countries, 1991 to 2017	27
Figure 3. 1: TFP growth of a sample of african countries over 1991-2017.....	44
Figure 3. 2: Sectoral labor productivity of selected african countries	46
Figure 3. 3: A five-year average growth rate of sectoral labor productivities for a sample of african countries	47
Figure 3. 4: Structural change term and within productivity change in a sample of African countries.....	51
Figure 4. 1: The contribution of sectors to the country's GDP from 1981 to 1990	68
Figure 4. 2: Sectoral labor productivities in Ethiopia.....	74
Figure 4. 3: Structural change at the sectoral level.....	76
Figure 4. 4: Sector specific within sector labor productivity change in Ethiopia.....	76
Figure 4. 5: Trend of sectoral share of GDP of the country as GDP increases	78
Figure 4. 6: Scatter plot of GDP growth rate with structural change term	79
Figure 4. 7: A plot of the cumulative sum of recursive residuals	87
Figure 4. 8: A plot of the cumulative sum of square of recursive residuals	88

ABBREVIATIONS

<i>ADLI</i>	Agricultural Development Led Industrialization
<i>AIC</i>	Akaike Information Criteria
<i>ARDL</i>	Auto Regressive Distributive Lag
<i>FDI</i>	Foreign Direct Investment
<i>BRIC</i>	Brazil, Russia, India And China
<i>FPE</i>	Final Prediction Error
<i>GDP</i>	Gross Domestic Product
<i>GLS</i>	Generalized Least Square
<i>GTP I</i>	Growth and Transformation Plan I
<i>GTP II</i>	Growth and Transformation Plan II
<i>HQIC</i>	Hannan-Quinn Information Criterion
<i>MDG</i>	Millennium Development Goals
<i>OLS</i>	Ordinary Least Square
<i>SBIC</i>	Schwarz Bayesian Information Criteria
<i>TFP</i>	Total Factor Productivity
<i>UNCTAD</i>	United Nations Conference on Trade and Development
<i>VAR</i>	Vector Auto Regressive
<i>WDI</i>	World Development Indicators

CHAPTER ONE

1. INTRODUCTION

As economies develop, sectoral composition of employment and Gross Domestic Product (GDP) changes. The change in the employment and production structure of the economy usually follows a well-documented pattern: the agricultural share declines, the share of the service sector increases, and the share of manufacturing sector follows an inverted U-shape. According to Kuznets (1971), all developed countries followed the same process of structural change. He distinguished the two phases of structural change for these countries. In the first phase, resources are reallocated from agriculture into industry and service sectors. But in the second phase, resources are allocated from both agriculture and industry towards the service sector.

However, in developing countries, structural change trend deviates from what developed countries followed. While developed countries transform their economies to high productive modern sector dominant economies, developing countries have shown a structural change that demonstrates a departure from the usual trend (Bah, 2008; Rodrik et al., 2016; Świącki, 2017). Similarly, Bah (2011) and Nuhu (2017) claim that even in developing countries alone, structural change trends vary among themselves. For example, Bah (2008) stated that Africa, Asia and Latin American countries are following different structural change trends. African countries are having an increased share of the service sector at a very low level of GDP per capita. Latin American countries, on the other hand, managed to transform towards the second stage but at the very low level of GDP per capita. But Asian countries have relatively higher manufacturing output share. Therefore, there is a need for studies that identify structural change trends of different groups of countries. It is also important to find out factors that cause the difference in structural change terms across countries.

The other important subject that is needed to be addressed is whether structural change affects total factor productivity (TFP) growth and sectoral labor productivities. Vries et al. (2012) claim that structural change, measured through the change in labor productivity as a result of relocation of labor among sectors, increases aggregate

productivity growth in China, India and Russia but not in Brazil. Similar study by Chen et al. (2011) also claimed that structural change contributed to TFP and output growth in China substantially, but it has been declining overtime. However, the effect of structural change on TFP growth and sectoral labor productivities in low income developing countries is not well studied.

Furthermore, developing countries have undertaken economic reforms with the objective of transforming their economy. For example, Ethiopia undertook far-reaching economic reforms since 1991. Following these reforms, the relative importance of sectors has changed. In 2017, the service sector becomes the dominant contributor of GDP. Several studies on structural change in Ethiopia agreed that the country is realizing a slow change in the production structure of the economy since 1991. But there is no agreement on whether the change in the structure of the economy brings economic growth.

Therefore, the dissertation has the following three independent but interrelated major objectives. These are:

- ⇒ Determining the structural change trends in developed and developing countries and identify factors that result in a dissimilarity in structural change terms.
- ⇒ Determining the effect of structural change on total factor productivity and sectoral labor productivities in selected African countries and
- ⇒ Establishing the short run and long run effects of structural change on GDP growth rate of Ethiopian economy.

Hence, this dissertation consists of three independent chapters, in correspondence with the above objectives, and one concluding chapter. All the chapters are related to structural change in developing countries. The second chapter is a comparative analysis of structural change trends in developed and developing countries. Various empirical literature asserted that structural change trends are different for developed and developing countries. Therefore, the major objective of this chapter is to identify factors that are responsible for the variation in the structural change terms and trends of developed and developing countries. The third chapter deals with the effect of structural change on total factor productivity and sectoral labor productivity in selected

African countries. The fourth chapter discusses the effect of structural change on the growth rate of the Ethiopian economy. The third and fourth chapters pointed at deciding whether the structural change in African countries is growth-promoting. I present a summary of the chapters as follows.

Chapter 2: *Structural Change Trends in Developed and Developing Countries: A Comparative Analysis*. Developed countries transform their economies into highly productive manufacturing and service sector-dominant economies after getting through the conventional two stages of structural change. During the first stage, they transform their economies towards the manufacturing sector dominant economies and in the second stage, they became service sector dominant economies. On the contrary, developing countries are transforming their economies to the service-dominant economies without going through the first stage of transformation which involves the growth of the manufacturing sector in terms of both its value-added contribution and share of employment first. Therefore, the major objective of this chapter is to identify factors that results in a difference in the structural change trends in developed and developing countries. To this end, I provide a two-stage analysis. In the first stage, I compared structural change trends of the two groups of countries. The value-added share of different sectors shows different patterns for developed and developing countries as they grow rich. I also used a shift-share analysis to decompose labor productivity growth into structural change term and within labor productivity change. As a result, I manage to demonstrate a difference in structural change trends and magnitudes between developed and developing countries. But at the second stage of the analysis, I have identified common determining factors of structural change based on literature and conducted a generalized least square estimation. As a result, agriculture sector employment, GDP per capita (it can also serve as a proxy for non-homothetic preferences) and dependency on raw material exports trigger a positive structural change in developing countries while dependency on raw material export and the share of agricultural employment has a negative and significant impact on structural change of developed countries. On the other hand, sectoral wedges, within sector technological advancement and institutional quality affect structural change term in developing countries negatively. Hence, developing countries shall work to improve the performance of the manufacturing sector both in

terms of its contribution to GDP and employment so that they can raise labor productivity growth as a result of labor relocation.

Chapter 3: *Structural change, total factor productivity, and sectoral labor productivity in selected African countries*: In this chapter, I analyzed the effect of structural change on TFP and sectoral labor productivity for a sample of African countries which includes Burkina Faso, Ethiopia, Madagascar, Mozambique, Tanzania, and Uganda. The sample is chosen based on the availability of data. Like in the first chapter, I followed a two-stage analysis. In the first stage, I have estimated the effect of structural change term on TFP by using a Fixed-effect panel data model with Driscoll-Kraay standard error. Hence, structural change term significantly affects the growth rate of total factor productivity. However, in the second stage, I have estimated the effect of structural change term on sectoral labor productivity and I found that structural change term doesn't affect sectoral labor productivity due to one or more of the following reasons. These are: relocating labor to and from the agriculture sector is insignificant in increasing labor productivity in the sector due to the availability of large number of labor employed in the sector. Besides, relocation is a long-term and costly decision and it follows a slightly slow process. On the other hand, the underdeveloped service sector in urban areas where most of the relocation is completed provides a new area of employment, therefore, labor productivity becomes non-responsive for the changes in the structure of the economy. As a result, I recommend these countries to promote the relocation of labor towards more productive sectors to raise total factor productivity.

Chapter 4: *Structural Change and Economic Growth in Ethiopia, 1991-2017*: In this chapter, I have estimated the effect of structural change term on the GDP growth rate of the Ethiopian economy for 1991 - 2017. I adopted a growth model by applying a unified framework of the neoclassical growth model of Solow (1956) and the structural change theory of Lewis (1954). Therefore, adding a structural change variable into the neoclassical growth model helps to better predict the growth rate of GDP. ARDL model is employed to estimate the effect of structural change term on the GDP growth rate of Ethiopian economy both in the short run and in the long run. As a result, the country shall promote structural change through the relocation of labor from the agriculture and

manufacturing sector to service sector to increase labor productivity and economic growth in Ethiopia.

Chapter 5: *Conclusion*: this chapter concludes the results and provides recommendations for future studies on structural change.



CHAPTER TWO

2. STRUCTURAL CHANGE TRENDS IN DEVELOPED AND DEVELOPING COUNTRIES: A COMPARATIVE ANALYSIS

2.1 Introduction

Structural change is a transformation of an economy from low productive and labor-intensive to high-productive and skill-intensive economic activity (Oyelaran - Oyeyinka et al., 2016; Markus and Francis, 2013; Neuss, 2019). It is conceptualized as a change in the aggregate components of the economy (Thakur, 2011). It happens when some sectors of the economy grow faster than the others which leads to a shift in the share of these sectors to the total aggregates (Kruger, 2008) that is basically due to the increase in productivity of modern sector which is mainly dominated by manufacturing and service sectors.

One of the main characteristics of structural change is a shift in productivity and movement of labor from the traditional sector to the modern sectors (Bah, 2008). According to Oyelaran-Oyeyinka et al. (2016), labor might move to a new sector if they are properly trained. This proposition links structural change with an increase in labor productivity. On the contrary, Timmer et al. (2013) showed that structural change is not always related to the increase in productivity, but it can also be achieved even when labor productivity is stagnant. Hence, the main challenge for many economies related to structural change is on how to move resources from less productive agriculture to high productive manufacturing and service sectors.

Different empirical studies show that structural change trends are mainly different for developed and developing countries. Bah (2008) and Świącki (2017) asserted that while developed countries successfully transform their economies to highly productive manufacturing and then service sector dominant economies, developing countries' structural change shows a departure from this usual trend. On top of that, Bah (2011) and Nuhu (2017) argue that even in developing countries alone, structural change trends differ greatly from each other. Traditionally, countries are supposed to experience two stages of structural change. In the first stage, they reallocate their resources from the

agriculture sector to the manufacturing sector. And in the second stage, resources again will be reallocated to the service sector from both the agriculture and manufacturing sectors. Most developed countries passed through these stages. But, according to Rodrik et al. (2016), apart from what developing countries experienced during the first decade of the 21st century, the structural change in developing countries is not following the pattern that we are familiar with. On top of that, the process of structural change and its contribution to labor productivity and economic growth of developing countries have slowed down since 2010. Recent growth experiences of developing countries in Africa and Latin America are not achieved through rapid industrialization. For example, Diao et al. (2017) claimed that structural change in developing countries is the result of the increase in the demand for goods and services produced in the modern sector, not through a change in the supply side of the economy.

In developed countries, the productivity growth of factors is important for structural change to happen, but this may not hold for developing countries (Timmer et al., 2013). For example, in Africa, there has been a relocation of labor from agriculture to manufacturing and service sectors, but labor productivity remains stagnant (Diao et al., 2017). They argued that positive structural change in Africa is achieved whilst labor productivity in the modern sectors is declining. The positive structural change is the result of forces that originate from the demand side, either through external transfers or an increase in agricultural income.

Besides, for a hand full of countries – including Ethiopia, the structure of output has changed from the agriculture sector directly to the service sector domination. Economists called it premature deindustrialization though it doesn't show such kind of behavior. The change in the share of manufacturing sector contribution to GDP is non-existent in the first place. Besides, factor productivity in the manufacturing sector is very low to attract factors from other sectors. For example, according to McMillan and Rodrick (2011), though Ghana and Ethiopia have demonstrated growth-enhancing structural change, labor productivity in manufacturing sector in both countries remains notably low.

The above cross-country difference in structural change is due to the nature of goods and services produced (Badibanga et al., 2013), Globalization in a sense of

openness (McMillan and Rodrik, 2011), and sector-biased technical advancement (Świącki, 2017). However, there is no agreement on the factors that caused the difference in structural change trends in developed and developing countries which poses a need for new studies that identify factors that are responsible for the difference in structural change trends.

Therefore, this chapter identified the basic determinants of structural change in developed and developing countries. Dependency on raw material export, regulatory quality index, the relative importance of sectors in terms of their contribution to GDP, within sector labor productivity, agriculture sector employment, and their level of income cause the difference in structural change trends between developed and developing countries.

The rest of this chapter is divided into four further sections, the first section presents the literature review and the theoretical framework. The second section discusses the methodologies and the third section offers a detailed analysis of structural change and its deriving factors in both developed and developing countries and the fourth section concludes.

2.2 Literature Review

2.2.1 Theoretical Discussion: Derivers of Structural Change

The comprehensive study of structural change theories resulted in two divergent theories. While the first structural change theory, which is developed by Kongsamut et al. (2001), is based on consumer non-homothetic preferences, the second theory is contributed by Baumol (1967) and it is based on the existence of sector-biased technical change.

Kongsamut et al. (2001) presented a simple model that is consistent with Kaldor's facts of economic growth. Kaldor's facts explain that the growth rates of output, real interest rate, capital-output ratio, and labor-income shares are roughly constant over time. However, it dis-regarded the relocation of labor between sectors. So, what the authors did was adding non-homothetic preference assumption to Kaldor's facts (balanced growth hypothesis) by introducing sectoral relocation of factors. But, according to Guillo

et al. (2011), their theory completely relies on the assumption of preference specification with inelastic, unitary elastic and highly elastic demand for agricultural goods, manufacturing goods, and services respectively.

The alternative structural change theory is developed by Baumol (1967). This theory is a formal framework that relies on the response of number of labor hours to the biased distribution of technological change between sectors. This theory is formalized by Ngai and Pissarides (2007) by taking two sectors, one of them with a high level of TFP growth, as a result, hours of work increases in the stagnant sector if the two goods are complementary that triggers relocation of labor to the sector with a low level of TFP. But if the final products of these sectors are substitutes to each other, the relocation of labor will be towards the sector with high TFP.

Neuss (2019) and Świącki (2017), on the other hand, identified four main deriving factors of structural change. These are: changes in income, changes in input-output linkages, changes in relative prices, and changes in comparative advantage in international trade. The income effect of structural change is due to the incorporation of non-homothetic tastes into the multi-sector economy. Structural change happens due to a change in the structure of demand following the change in income. The shift in the structure of demand results in a change in the marginal rate of substitution for the products from different sectors which further triggers relocation of economic activity. Similarly, a relative price change due to a change in production technology results in a structural change. Usually, the difference in production technology across sectors in an economy results in a difference in productivity (TFP), factor intensity, and elasticity of substitution of inputs.

Moreover, differences in the input-output linkage between sectors also determine the relocation of factors. Neuss (2019) linked the accumulation of intermediate products across different sectors as a reason for the relocation of economic activities. In developed countries, the accumulation of intermediate products is as high as half of the total final products of the manufacturing sector while it is the lowest in the service sector which triggers relocation of factors to service sectors.

The other deriving factor is the change in the comparative advantage in international trade. The specialization pattern of an economy following the change in comparative advantage initiates a shift in factors from one sector to the other. But this process has also an implication for sectoral factor productivity. If the country is specializing in one sector of the economy, it is highly likely that TFP will be higher in that specific sector which leads to the relocation of factors.

In general, it is empirically supported that structural change usually happens with economic development. As a result, the structural change trend is different for countries with different levels of economic development. Therefore, it is vital to identify the main drivers of structural change to understand what causes cross-country differences in structural change trends.

2.2.2 Empirical Literature Review

Empirically, it is not easy to characterize structural change trends like it is explained theoretically. According to Bah (2008), understanding the development process of developed and developing countries helps to identify factors that cause the cross-country differences in income and compare structural transformation trends. He affirmed that developing countries follow a distinct structural-change trend. Besides, he also revealed the presence of a great deal of heterogeneity on structural change trends of developing countries alone.

Asian countries follow the path that is fairly similar to developed countries while African countries followed a trend that has resulted in high service and low agricultural value-added shares at low GDP per capita. On the other hand, Latin American countries are known to enter into the second stage at low GDP per capita with low industrial output.

This conclusion agrees with McMillan and Rodrik (2011) which asserted that structural change in Africa and Latin America has been growth-declining since the 1990s. Timmer et al. (2013) also showed that during post-independence Africa, workers relocated to market service industries which are characterized by having above-average productivity levels but its growth rate is low and falling behind the world frontier. They also asserted that though labor productivity in the service sector is higher than agriculture,

it is not technologically dynamic. Therefore, the relocation of labor towards the service sector in developing countries couldn't bring a positive structural change in the long run.

In deciding on the determinants of structural change trends, Świącki (2017) analyzed the significance of the four determinants of structural change by using counterfactual simulations. The four forces identified are: (i) sector-biased technological progress, (ii) international trade, (iii) non-homothetic tastes, and (iv) changing wedges between sectors. Therefore, sector biased technological change is found to be the most important factor for the relocation of labor from manufacturing to the service sector in developed countries while non-homothetic preference is for developing countries.

On the contrary to what is explained above, Badibanga et al. (2013) preferred to take the nature of products as a determinant of structural change. Structural change is relatively higher when an economy produces specific capital and consumer durables that can result in the production of high valued products. For example, China's transformation is due to the proximity of its products to capital and consumer durables and Malaysia's structural change accounts for its production of industrial products which help the country to keep its gaps with China. But the structural change in Ghana has been stagnant for a long time because its production concentrates on primary products. As a result, countries that produce capital and consumer durable goods manage to achieve a higher rate of structural change than others.

McMillan and Rodrik (2011) have taken globalization in a sense of openness as one of the major deriving factors for structural change in developing countries. This factor was not supposed to explain large cross-country differences in structural change. Rather its effect is dependent on the local conditions, choices made by domestic policymakers, and domestic growth strategies. For example, with different degrees of openness, while Argentina experienced a growth-reducing structural change, Ethiopia, Ghana, and Malawi are among the countries that have experienced growth-promoting structural change.

Therefore, the aforementioned studies are consistent in explaining cross-country differences in structural change trends. However, they fall short of determining the its deriving factors in different groups of countries.

2.2.3 Conceptual Framework: Deriving Factors of Structural Change

Assuming homogenous labor is the only factor of production and can be employed either of the three main sectors, Świącki (2017) affirmed that non-homotheticity of preferences, sector-biased technological advancement, international trade, and changing sectoral wedges are the major deriving factors of structural change. Similarly, Kuznets (1973) wrote that “rapid changes in production structure are inevitable — given the differential impact of technological innovations on the several production sectors, the differing income elasticity of domestic demand for various consumer goods, and the changing comparative advantage in foreign trade”. To show how the hypothesized variables affect structural change term in a three-sector economy, I employed Świącki (2017)’s model as follows.

A. Consumer preference: *Non-homotheticity of preferences*

According to Świącki (2017), one of the factors that determine the sectoral re-allocation of labor is the existence of non-homothetic preference. This implies that as countries get richer, labor will be relocated from low-income elasticity sectors towards high-income elasticity sectors. To demonstrate this proposition, a model of an indirect utility function of consumers is developed. The maximum level of utility a consumer can get is represented by “V”, and it can be written as a function of the consumption of aggregate output from each sector (C_A , C_M , and C_S) and budget constraint (P_A , P_M , P_S , and m) as follows:

$$V(P_A, P_M, P_S, \text{and } m) = \sum_{s \in [A, M, S]} \gamma_s \frac{\left(\frac{m - \sum P_{s'} \bar{C}_{s'}}{P_s} \right)^{\alpha_s - 1}}{\alpha_s} \quad \text{Eq. 1}$$

Where $\bar{C}_s$ is subsistence level of consumption, P_a, P_m , and P_s are the prices of products from agriculture, manufacturing and service sectors and the parameters satisfy the following conditions

$$\gamma_s > 0, \quad \sum_s \gamma_s = 1, \quad \alpha_s \geq -1, \quad \bar{C}_s \geq 0.$$

The equation augments the constant difference of elasticity of substitution (CDES) because it introduced the subsistence level of consumption. Świącki (2017) argued that the indirect utility function mentioned above satisfies regulatory conditions imposed by the consumer theory and it will stay non-homothetic regardless of income level.

Assuming $\tilde{m} = m - \sum P_{s'} \bar{C}_{s'}$ be a discretionary expenditure, then the Marshallian demand function for goods from sector s is given by:

$$C_s = \bar{C}_s + \frac{\gamma_s \left(\frac{\tilde{m}}{P_s} \right)^{\alpha_s + 1}}{\sum_{s'} \gamma_{s'} \left(\frac{\tilde{m}}{P_{s'}} \right)^{\alpha_{s'}}} \quad \text{Eq. 2}$$

for high income, the ratio of expenditure on sector s and s' is $\frac{\gamma_s \left(\frac{m}{P_s} \right)^{\alpha_s}}{\gamma_{s'} \left(\frac{m}{P_{s'}} \right)^{\alpha_{s'}}}$

The demand function incorporates non-homotheticity as long as $\alpha_s \neq \alpha_{s'}$. Neuss (2019) agreed with the above asserting that consumption expenditure is dependent on income and prices of products in the sector which further results in 'preference-driven structural change'. Therefore, the rise in income changes the marginal rate of substitution among different goods from different sectors which induce the relocation of economic activities towards the sectors that can produce goods and services to satisfy higher hierarchical needs. Consequently, the rise in aggregate income results in a positive structural change towards modern¹ sectors.

¹ Modern sectors, in this thesis, refer to both manufacturing and service sectors

B. Production and trade: *Technology and comparative advantage*

Sector biased technological advancement and international trade may cause structural change. Technological advancement in one of the main sectors increases labor productivity which further attracts labor towards the sector. Similarly, labor is relocated towards the sector from where the country's comparative advantage lays on. In general, sector-specific costs which are determined by productivity and transportation cost for tradable products are affected by sector biased technological advancement and international trade, which in turn, results in the relocation of resources towards the sector that produces goods with low cost of production and to the sector that produces goods that the country has a comparative advantage in the international trade. Therefore, to represent these factors, I have included two independent variables in the regression analysis: dependency on raw material export and openness, to account for international trade and relative comparative advantage the country enjoys in the international trade. I have also included the within sector labor productivity change to accommodate the difference in rate of technological advancement.

C. Intersectoral wedges: *the difference in relative input prices*

Wage differentials across sectors need to be taken into consideration to account for differences in value-added and sectoral employment shares. Świącki (2017) summarized the wage differential as a wedge between agriculture or services and manufacturing wages.

$$\xi_{Ai} \equiv \frac{W_{Ai}}{W_{Mi}}; \text{ and } \xi_{si} \equiv \frac{W_{si}}{W_{Mi}} \quad \text{Eq. 3}$$

Where W_{Ai} , W_{si} and W_{Mi} are wages in agriculture, service and manufacturing sectors; and ξ_{Ai} and ξ_{si} are wedge in agriculture and wedge in services, respectively. The wedge for manufacturing will be equal to 1. I.e. a change in price of inputs in one of the sectors will result in a change in labor costs which in turn affects the share of labor employed and their value-added contribution to GDP across sectors assuming labor is homogenous. Therefore, sectors are intertwined with each other. To accompany this proposition, I have included the ratio of the agricultural share of GDP and to

manufacturing share of GDP so that I can account for a difference in productivity and relative costs.

Therefore, a difference in one of the factors across countries may lead to a difference in both the rate and trend of structural change.

2.3 Methodology

McMillan and Rodrik (2011) and Rodrik (2013) came up with a mechanism to define the contribution of structural change towards labor productivity. According to the authors, growth of labor productivity can be sourced in two ways: an increase in productivity within a sector through capital accumulation, technological change and reduction of miss-allocation of labor, and a movement of labor from low productive to high productive sectors. This will be done by using shift-share analysis that decomposes overall labor productivity growth by its sources. Accordingly, the definition of structural change effect that measures the change in labor productivity due to relocation of labor across sectors is calculated as follows based on Nguyen (2018).

Given overall labor productivity, Y_t as the ratio of total value-added and employment of a country or the sum of the share of employment of each sector multiplied with the corresponding labor productivity.

Therefore,

$$Y_t = \frac{GDP_t}{L_t} = \sum_{i=n} \theta_{i,t} \frac{GDP_{i,t}}{L_{it}} \quad Eq. 4$$

Then the change in labor productivity between consecutive years is represented by

$$Y_t - Y_{t-1} = \sum_{i=n} (y_t^i - y_{t-1}^i) \overline{\theta_{i,t}} + \sum_{i=n} (\theta_t^i - \theta_{t-1}^i) \overline{y_{i,t}} \quad Eq. 5$$

To explain it in growth rate mode, I can divide both sides by previous period labor productivity so that I can come up with the following expression

$$\frac{Y_t - Y_{t-1}}{Y_{t-1}} = \sum_{i=n} \frac{(y_t^i - y_{t-1}^i)\overline{\theta_{i,t}}}{Y_{t-1}} + \sum_{i=n} \frac{(\theta_t^i - \theta_{t-1}^i)\overline{y_{i,t}}}{Y_{t-1}} \quad Eq. 6$$

While the first expression of the above equation represents the *with-in* sector labor productivity change, the second one shows the structural change effect. Hence, it can be written as:

$$\sum_{i=n} \frac{(\theta_t^i - \theta_{t-1}^i)\overline{y_{i,t}}}{Y_{t-1}} = \frac{Y_t - Y_{t-1}}{Y_{t-1}} - \sum_{i=n} \frac{(y_t^i - y_{t-1}^i)\overline{\theta_{i,t}}}{Y_{t-1}} \quad Eq. 7$$

In this case, the left-hand side of the equation is known as a structural change effect which is defined as the difference of overall labor productivity change and within sector labor productivity change due to internal factors (also known as "intra-effect"). Based on the structural change term equation, when the relocation of labor is towards a more productive sector, structural change will be positive and help to increase economy-wide productivity growth.

Therefore, after defining the structural change effect based on the above-mentioned procedure, structural change trends of both developed and developing countries from 1991 to 2017 are compared. To this end, the estimation technique used by Bah (2011) is adopted. He came up with the mechanism that the trend of structural change for different countries can be captured by the relative importance of each sectoral output for GDP. He took the following features as common characteristics. (1) As the GDP of a country increases, the output share of agriculture declines, (2) The share of manufacturing increases and then quickly declines, and (3) The share of service increases steadily.

Considering the above, he compared the trend of structural change by using the following fixed-effects model.

$$y_{it} = \alpha_i + \beta_1 x_{it} + \beta_2 x_{it}^2 + \dots + \varepsilon_{it} \quad Eq. 8$$

While y_{it} is a sectoral output share, x_{it} log of GDP per capita for a country i at time t . However, I applied the generalized least square (GLS) estimation technique to eliminate the problems of heteroskedasticity and autocorrelation.

In the second stage of the analysis, I have identified factors that affect structural change for different groups of countries. In this respect, the share of agricultural employment, dependency on raw material export, trade openness, foreign direct investment, and institutional quality as it is proxied by the regulatory quality index of the public offices to explain the structural change term. Considering the ratio of the value-added shares of the service sector to the manufacturing sector helps to see the relative contribution of each sector towards structural change. Definition and hypothesized effects of variables on the structural change term is given as follows.

- A. Raw-material export: based on WDI, it is defined as a percentage of agricultural raw materials (excluding crude oil and coal) as a percentage of the total export of goods and services. It shows how much the country is dependent on agricultural raw material exports. Its effect on the structural change term is dependent on the development level of the country. For developing countries that are highly dependent on agricultural raw material export, more labor will stay in the agriculture sector, structural change will be very low. However, in developed countries, dependency on agricultural raw material export may motivate labor to relocate towards the agriculture sector which results in a negative structural change.
- B. Foreign direct investment: it is measured as a net inflow of investment as a percentage of GDP. And its effect on the structural change is dependent on the sector where FDI has targeted. If FDI is concentrated on the non-agricultural sectors, it is likely to motivate relocation of labor towards these sectors so that it results in a positive effect on structural change.
- C. Regulation quality index: This index measures the perceptions of the ability of the government to formulate and implement sound policies and regulations to promote private sector development. When the ability of the government to regulate the economy is perceived good, resources will be relocated towards the more productive sector. Therefore, the regulatory quality index will have a positive and significant effect on structural change.
- D. Openness index: this index measures country's total trade in terms of GDP. Its effect on structural change is dependent on the extent of openness and comparative

advantage. Hence, including this variable in the regression helps to show the effect of international trade on structural change term.

- E. The ratio of value-added contributions of service to manufacturing sectors: This ratio is included in the analysis to indicate the relative importance of sectors to affect structural change term. The higher the ratio, the higher the structural change in developing countries will be. Labor productivity in the service sector is disproportionately higher than in the manufacturing sector.
- F. Within sector labor productivity change: it is a measure of a change in labor productivity due to technical advancement, capital accumulation, or reduction of labor misallocation in each sector. It is included as a determinant factor to measure the effect of technological advancement on structural change term. Hence, the effect will be dependent on the sector at which more technical advancement is witnessed. If the within sector labor productivity change is in the high productive sector, it will have an increasing effect on the structural change term.
- G. The share of agricultural employment: This factor may determine the nature and direction of labor relocation. Countries with the highest share of agricultural employment are likely to achieve a higher structural change term than others.
- H. GDP per capita: it is a measure of the development level of countries. Besides, its effect on the structural change term in developing and developed countries is supposed to be different. GDP per capita is expected to have a positive effect on structural change in developing countries. With the increase in income, the demand will shift towards income elastic products, therefore, it is inevitable to have a relocation of labor from agriculture to the non-agricultural sector.

2.4 Data Sources

Data is collected from World Bank's WDI and the structural change term is calculated by using McMillan and Rodrik (2011)'s labor productivity decomposition technique, also known as shift-share analysis. I have considered a total of 22 countries. 8 of them are developed and 14 are developing countries out of which 7 are low-income and the other 7 are lower-middle-income countries. These countries are chosen mainly based on the availability of data. Table 2.1 shows the sample countries involved in the analysis.

Table 2. 1
List of sample countries

Developed countries	Developing countries	
	Low-income countries	Lower middle income
Australia	Benin	Bangladesh
France	Burkina Faso	Bolivia
Germany	Ethiopia	Indonesia
Italy	Madagascar	Nicaragua
Japan	Mozambique	Philippines
Sweden	Tanzania	Ukraine
United Kingdom	Uganda	Vietnam
United States		

2.5 Analysis and Discussion

2.5.1 Trends in Sectoral Share of GDP

The structural change is highly intertwined with the relative importance of each sector in the economy. The share of agriculture as a percentage of GDP determines the intensity and direction of relocation of labor from one sector to the other. For example, according to Świącki (2017), in countries with small share of agriculture to their GDP, there will not be enough labor to be relocated towards both manufacturing and service sectors. Hence, the relocation of labor will be mainly from manufacturing to service sector. This marks the second stage of structural change developed countries have experienced for decades.

However, in developing countries, especially in low-income countries, relocation is dominated by the movement of labor from agriculture to the non-agriculture sector due to the prevalence of higher level of labor productivity in the modern sectors.

Therefore, structural change is mostly achieved through the relocation of labor from the agriculture sector to the manufacturing and service sectors than from manufacturing to the service sector. Fig. 2.1 and fig. 2.2 show that the share of agriculture to the overall GDP is rapidly declining for developing countries from 1991 to 2017 while it was a very small change for developed countries. This is because the share of agriculture to the overall GDP was very small in developed countries.

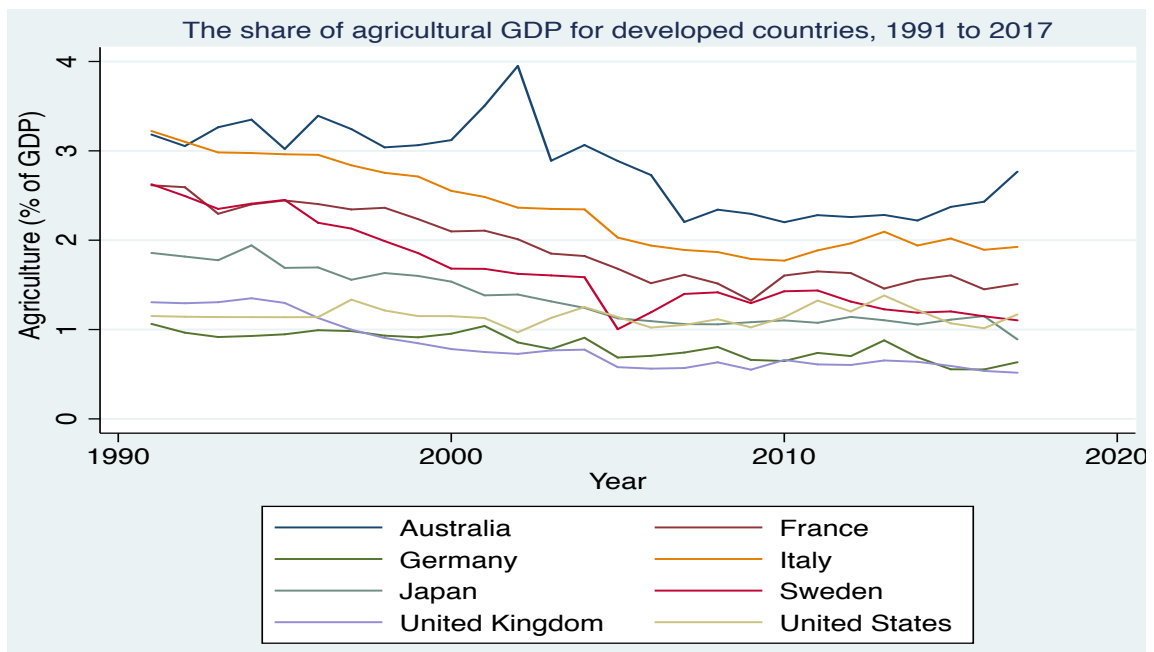


Figure 2. 1: The share of the agricultural sector value-added for developed countries, 1991-2017

Source: Author's computation based on WDI

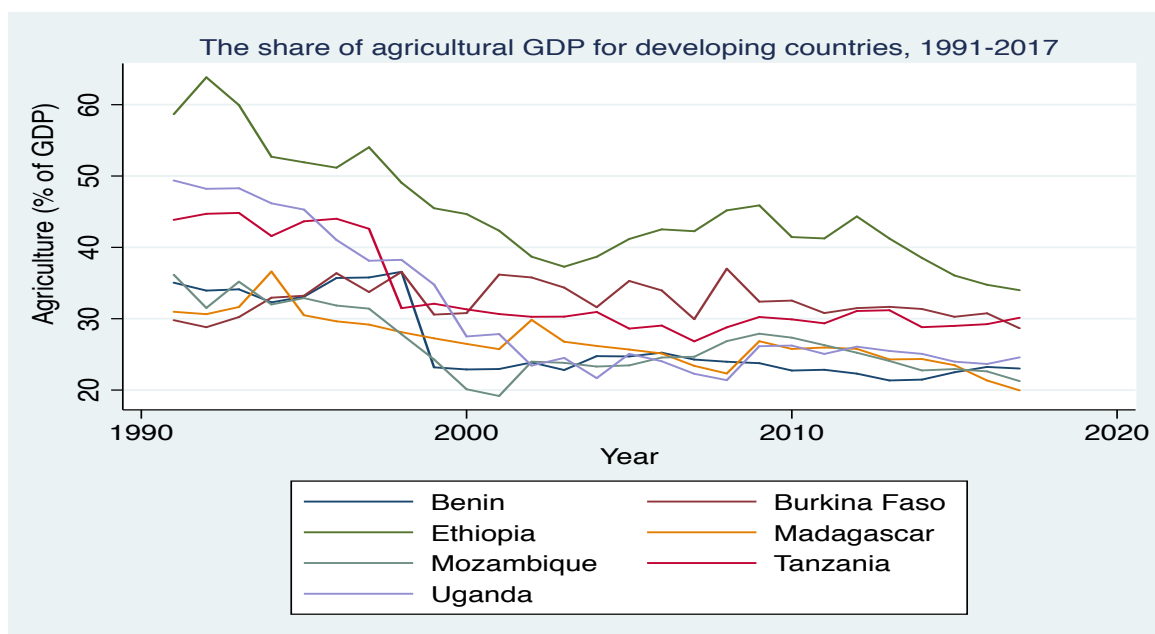


Figure 2. 2: The share of the agricultural sector value-added for low-income developing countries, 1991-2017

Source: Author's computation based on WDI

The share of value-added contribution of agriculture sector for developed countries ranges from 1.5% to 8.5% with a mean of 3.22% which is a lot smaller than the share of agricultural GDP of low-income countries. In low-income countries, the average share of the agriculture sector to real GDP is 25.6%. However, it is persistently declining for both groups of countries despite the existence of a huge difference in the declining rate. The share of agricultural GDP is declining faster in developing countries than in developed countries.

To better quantify the impact of GDP per capita on sectoral output shares in developed and developing countries, I estimated the following regression as it is used by Bah (2011). The General least square estimation technique is used because of its advantage in avoiding autocorrelation and heteroskedasticity problems and the polynomial degree (number of regressors) is chosen based on the significance of regressors and model goodness of fit.

Table 2. 2:
Trends of the three main sectors for the changes in GDP per capita, by income group

VARIABLES	Lower middle income			Low-income countries			Developed countries		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Sergdp	Manugdp	Agrigdp	Sergdp	Manugdp	Agrigdp	Sergdp	Manugdp	Agrigdp
Log of GDP per capita	-0.805 (0.804)	2.905*** (0.691)	-42.43*** (9.845)	60.76** (24.19)	1.534** (0.679)	-69.67** (29.72)	8.008*** (1.971)	561.4** (218.4)	-94.26** (38.52)
Log of GDP per capita square			2.458*** (0.688)	-4.809** (2.029)		4.913** (2.493)		-26.75*** (10.28)	4.395** (1.812)
Constant	52.59*** (5.906)	-3.401 (5.073)	194.5*** (35.04)	-147.3** (71.85)	0.273 (4.145)	273.0*** (88.27)	-18.91 (20.94)	-2,929** (1,161)	506.9** (204.7)
Observations	189	189	189	189	189	189	216	216	216
Number of countries	7	7	7	7	7	7	8	8	8

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2.2 shows that the share of agriculture to GDP has a non-linear relationship with GDP per capita of all the three groups of countries. In other words, the effect of GDP per capita on the share of agriculture is dependent on the level of GDP per capita itself. However, the marginal effect of log of GDP per capita on the GDP share of agriculture is relatively higher for developing countries than other groups of countries. This implies that the rate of decline in the share of agriculture in all groups of countries declines as the country grows rich. For all groups of countries, the increase in GDP per capita will decrease agriculture's share of GDP at a relatively faster rate at the beginning. Hence, the share of agricultural GDP is declining at a declining rate as GDP per capita increases which confirms Bah (2011).

On the other hand, the value-added share of the manufacturing sector is found to have a positive and linear relationship with the log of GDP per capita for low and lower-middle-income countries. The share of the manufacturing sector on GDP increases as the countries grow richer and the marginal effects are equivalent to the coefficient estimates mentioned in table 2.2 on regressions (2) and (5). However, the story is different for developed countries. GDP per capita has a non-linear but declining effect on the GDP share of the manufacturing sector. The marginal effect of log of GDP per capita on the share of the manufacturing sector of developed countries is dependent on their GDP per capita itself. The higher the GDP per capita, the lower its effect on the value-added share of the manufacturing sector will be. However, it will continue to be positive until the log of GDP per capita reaches around 10.5. If it is above 10.5, it will be negative. This marks the second stage of structural transformation that developed countries have passed through where the share of the manufacturing sector is declining while the share of the service sector is increasing.

The above regression for low-income countries can be complemented by the following graphical illustration.

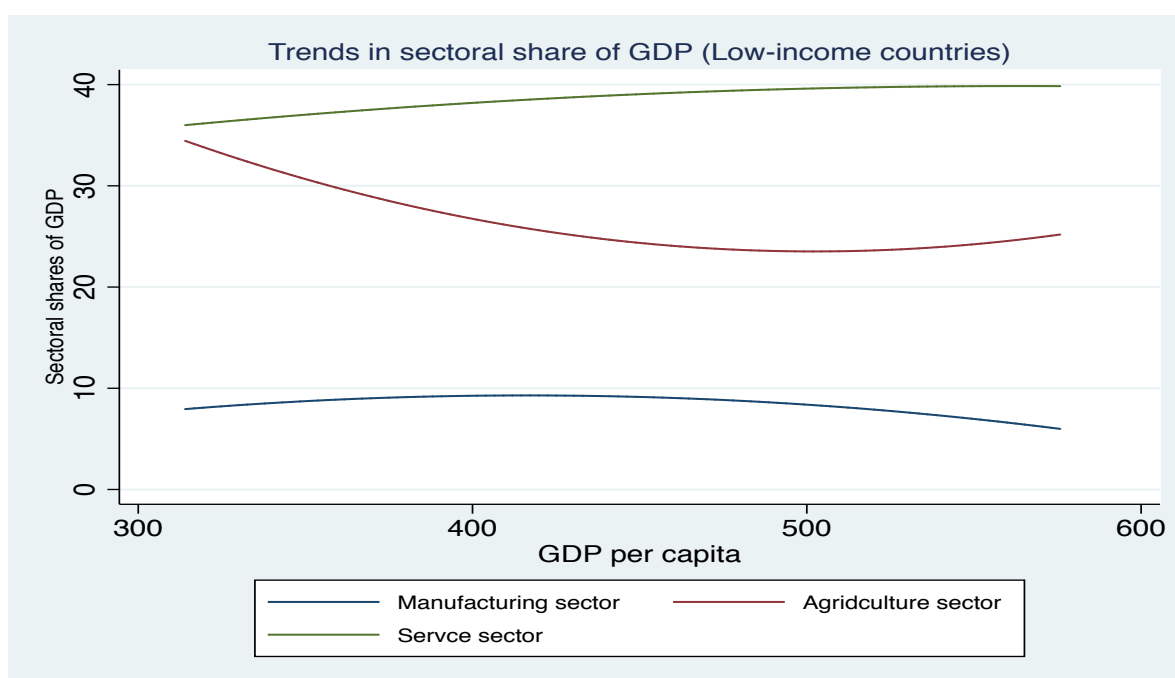


Figure 2. 3: Trends of sectoral value-added shares for low-income developing countries, 1991-2017

Source: Author's computation based on WDI

For low-income countries, as figure 2.3 shows, the share of the manufacturing sector to GDP first increased and then declined continuously as their economy grows. This phenomenon is called "premature de-industrialization" (McMillan and Rodrik, 2011). Low-income economies are shifting towards the service sector even before achieving the state of maturity in the manufacturing sector. On the other hand, the share of the service sector has been increasing continuously for most of the low-income countries considered in this study since 1991. In other words, the service value-added share of GDP increases as the country gets richer.

Similar but straight forward interpretation can be given regarding the share of the service sector in developed countries. GDP per capita is positively and significantly affecting the share of the service sector to GDP for these countries. Figures 2.4 and 2.5 show the intertemporal shift in the share of the manufacturing and service sectors in developed countries. While the share of the manufacturing sector to GDP is declining since 1991, the share of the service sector to overall GDP increases linearly.

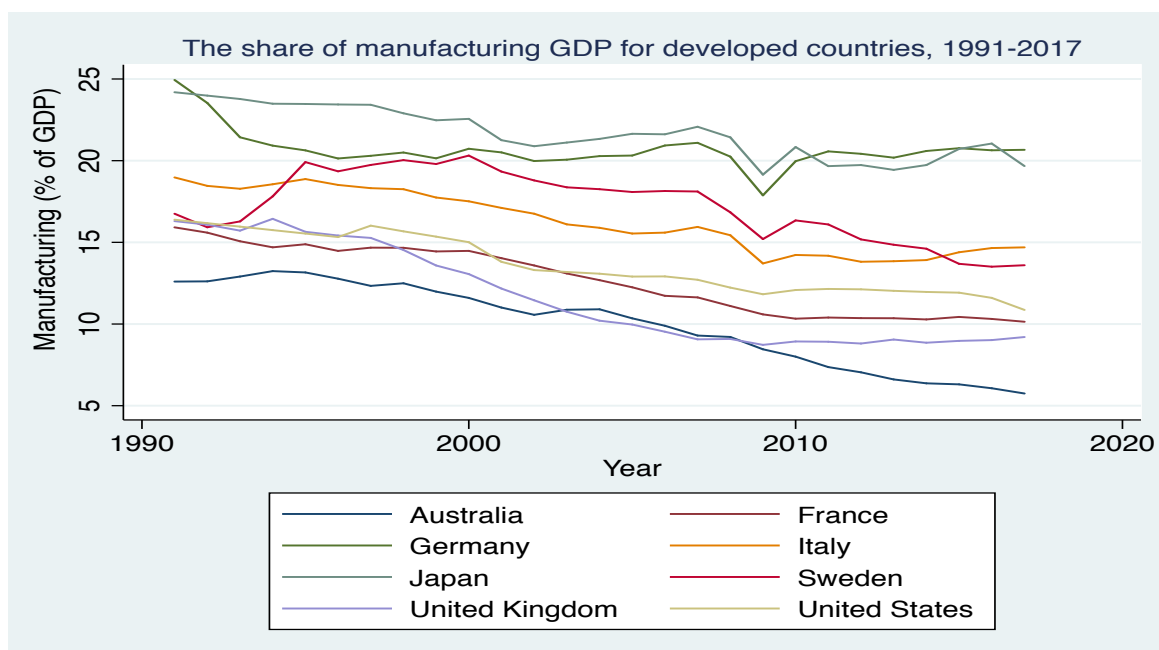


Figure 2. 4: The value-added share of the manufacturing sector in developed countries, 1991 to 2017

Source: Author's computation based on WDI

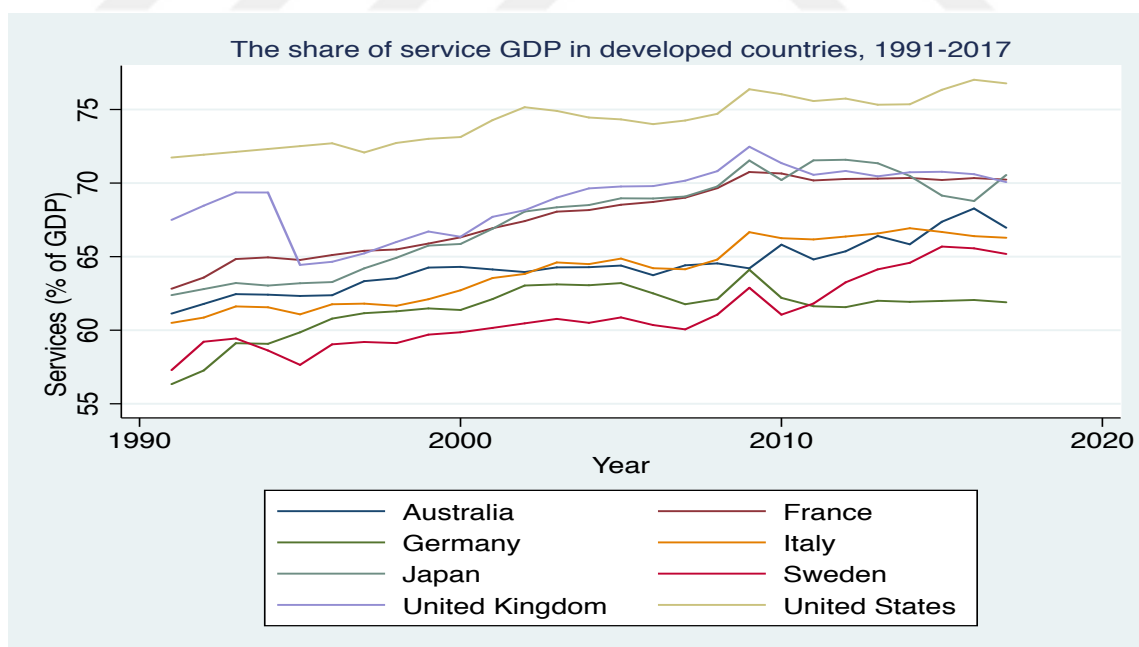


Figure 2. 5: Value-added share of the service sector in developed countries, 1991 to 2017

Source: Author's computation based on WDI

2.5.2 Structural Change Term: Shift-Share Analysis

Structural change term is a measure of labor productivity growth due to a relocation of labor from one sector to the other. To quantify the structural change term, I used a methodology called *the Shift-share decomposition techniques*. This method helps to decompose the overall labor productivity into two sources: within-sector labor productivity improvement (*within-effect*) and between-sector labor productivity (*between effect or structural change effect*) as it is explained above in the methodology section.

Countries have shown varied structural change trends due to changing productivity growth as a result of the relocation of labor from one sector to the other. On average, developing countries have shown a high level of structural change term when it is compared with developed countries. On the other hand, developed countries seem to have an interdependency in their structural change dynamics. The labor productivity gains due to the relocation of labor by one of the developed countries may have a similar effect over the other. Perhaps, this may show the existence of a high level of interdependence and the spill-over effect of policies among developed countries. For example, as it is demonstrated in figure 2.6, a raise in the structural change term of one of the countries is likely to be followed by a similar trend by other countries. Therefore, it is likely that the structural change dynamics of developed countries might be highly interlinked and perhaps followed a causal linkage.

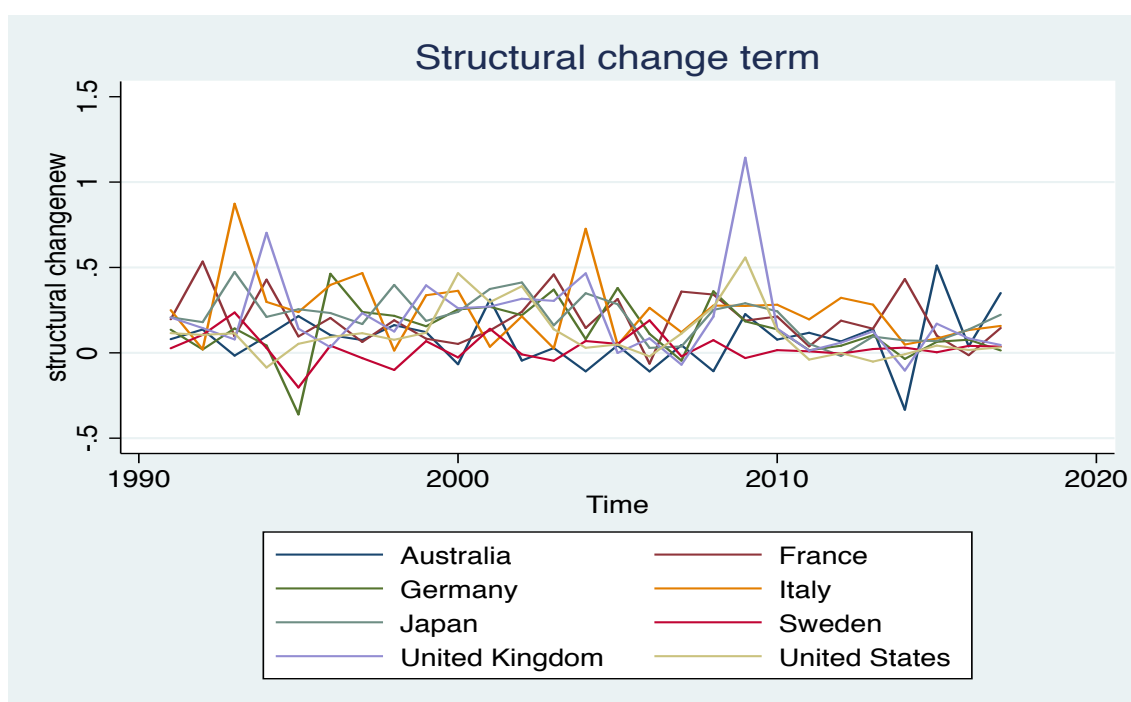


Figure 2. 6: Structural change term in developed countries, 1991 to 2017

Source: Author's computation based on WDI

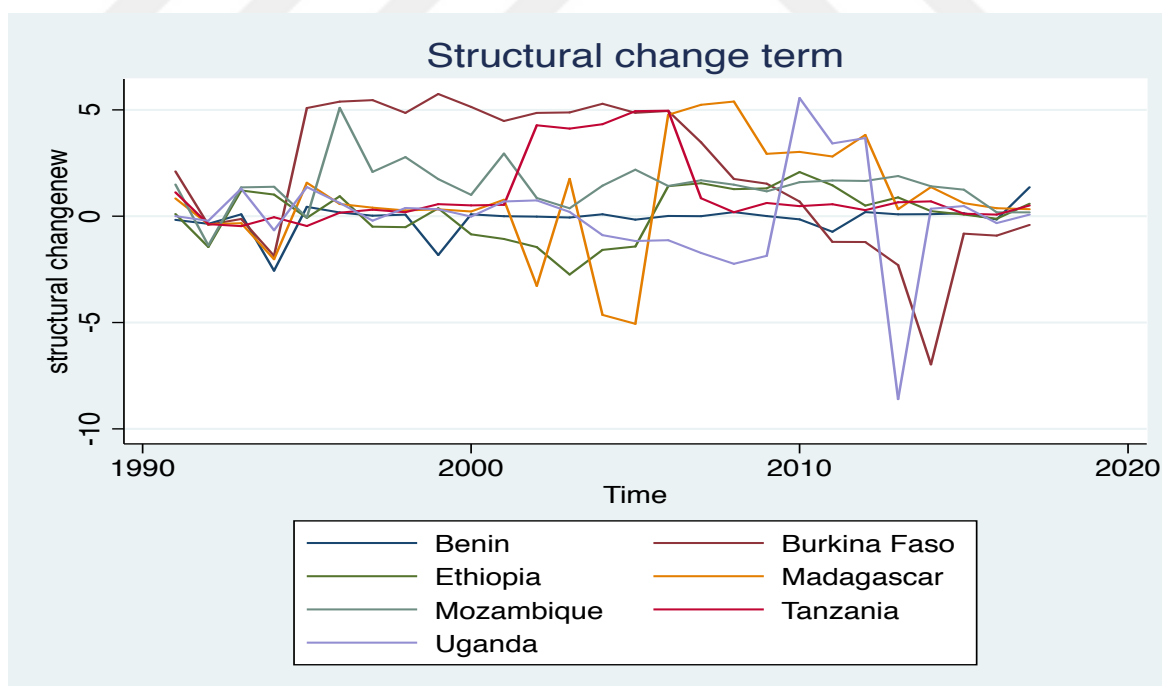


Figure 2. 7: Structural change term in low-income developing countries, 1991 to 2017

Source: Author's computation based on WDI

Figures 2.6 and 2.7 demonstrated that the structural change term of developing countries has a relatively higher level of variability than their developed countries counterparts with a standard deviation of 2.16. Structural change term shows a relatively smooth transition for developed countries except for the quick rise and decline of labor productivity gain by the UK in 2009. Fittingly, the average standard deviation of the sample that incorporates both developed and developing countries is 1.43 while its mean is 0.48. However, when it is measured independently, the standard deviation is 0.18 for developed and 2.16 for low-income developing countries. Table 2.3 presents a descriptive statistic for different groups of countries: baseline, developed, and low-income developing countries.

Table 2. 3
Descriptive statistics by groups of countries, 1991-2017

Variables	Baseline		Developed countries		Low-income developing countries	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Structural change term	.4865878	1.431808	.1522599	.1810407	.7679664	2.159581
Share of agricultural employment	36.56949	30.48577	3.223245	1.510473	71.78869	13.92124
Log of GDP per capita	8.130673	1.98893	10.62202	.1548443	6.093663	.4164081
Raw material export	9.10199	17.07971	2.011219	2.020501	23.69861	24.38951

FDI as a percentage of GDP	2.930799	4.07593	2.177159	2.642156	3.661081	5.949469
Regulation quality index	.2118476	.9561284	1.398679	.3484647	-.447245	.3158093
Openness	.5614042	.3024731	.4712517	.2015045	.5019925	.2262632

Source: Author's computation based on WDI

2.5.3 Factors Affecting Structural Change Term

Since countries with different levels of income are supposed to have different sectoral composition and employment dynamics, it is expected of them to have different marginal effects of factors on the structural change term. To this end, generalized least squares (GLS) estimation technique is utilized because, according to Musau et al. (2015), GLS estimation technique it has an advantage of addressing autocorrelation and heteroskedasticity problems by relaxing the homogeneity and non-correlation properties of the error term.

Therefore, the estimation result for different groups of countries is given as follows in table 2.4.

Table 2. 4

Panel GLS estimation results for different groups of countries

VARIABLES	(1)	(2)	(3)	(4)
	Dependent variable: Structural change term			
	Baseline	Developed	Developing	Low Income Developing
Dependency on raw material export	0.00302	-0.0309***	0.0114**	0.0226***

	(0.00372)	(0.00793)	(0.00482)	(0.00704)
Foreign direct investment	0.0116 (0.0165)	0.00527 (0.00482)	0.0204 (0.0222)	0.0311 (0.0337)
Regulation quality index	0.307*** (0.115)	0.0408 (0.0525)	-0.757** (0.301)	-0.194 (0.552)
Openness index	-0.181 (0.238)	-0.110 (0.0702)	-0.0283 (0.343)	0.356 (0.920)
The ratio of service GDP to manufacturing GDP	-0.147*** (0.0328)	0.000103 (0.00801)	-0.205*** (0.0553)	-0.132 (0.0906)
Within sector labor productivity growth	-0.0408** (0.0169)	-0.00133 (0.00821)	-0.0395* (0.0213)	-0.0321 (0.0411)
Agricultural sector employment	0.0201*** (0.00370)		0.0490*** (0.0101)	0.0897*** (0.0176)
Log of GDP per capita		-0.211** (0.0869)	0.996*** (0.286)	1.614*** (0.577)
The ratio of agricultural employment to manufacturing employment		0.598* (0.363)	0.0236 (0.0158)	0.0264 (0.0221)
Constant	0.386 (0.249)	2.361*** (0.917)	-8.614*** (2.493)	-16.08*** (4.585)
Observations	572	208	364	182
Number of countries	22	8	14	7
Log-likelihood	-987.3355	76.32799	-694.8419	-374.2982
Wald chi2(7)	81.71	41.30	73.20	61.72
Prob > chi2	0.0000	0.0000	0.0000	0.0000

Standard errors are in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Note: All explanatory variables are in their lag 1 form to accommodate the time lag available in affecting the structural change term

Four different estimations are conducted. The first one is a baseline regression that considers all sample countries in the analysis. In this case, data is pooled and used regardless of the income level of the country. Other estimations are done for each respective group of countries. While the second estimation is for developed countries, the third is for developing countries that consider both low and lower-middle-income countries. Finally, the fourth estimation is conducted for low-income countries to accommodate their unique attributes.

Accordingly, the share of agricultural employment in the economy is found to have a positive and significant effect on the structural change term for the baseline, developing, and low-income developing countries. But it was missing for developed countries because it was highly correlated with GDP per capita to cause a near-perfect multicollinearity problem. This implies that developing countries with a high proportion of employment in less productive sectors, like agriculture, are likely to achieve a higher level of structural change than other group of countries. Agricultural share of employment in a country will determine the productivity of labor in the agricultural sector. Hence, having a larger share of agricultural employment, like in most low-income developing countries, gives more windows for structural change due to both "labor push" and "labor pull" channels (Alvarez-Cuadrado and Oschke, 2011).

On the other hand, an improvement in the production technology of the manufacturing sector has a "labor pull" effect by raising labor productivity in the modern sector. For low-income countries, average labor productivity in the service sector from 1991 to 2017 is higher than the agriculture sector. Consequently, labor in the agriculture sector has an incentive to relocate towards the service sector. The relocation will continue as long as labor productivity in the modern sector is greater than that of agriculture even if productivity in agriculture continues to rise. A similar conclusion is reached by Cao

and Birchenall (2013). They claimed that agricultural labor has reduced by 5% annually even when the TFP of agriculture as a sector grew by 6.5% in China. Similarly, Nguyen (2018) asserted, based on empirical evidence, that developing countries are likely to be benefited more from structural transformation by enhancing an aggregate labor productivity. Consequently, for developing countries in general and low-income countries in particular, labor can be relocated towards the more productive sector easily. Therefore, it can be justified that countries with a higher share of labor in agriculture are likely to achieve a higher level of structural change.

Similarly, GDP per capita affects structural change term positively and significantly in developing countries. A high level of GDP per capita creates a window for labor to easily relocate towards a more productive sector. Here also, the application of "pull and push factors" comes to play. The rise in GDP per capita pushes labor from the labor-intensive sector to more productive modern sectors. According to Laitner (2000), with the rise in income, the share of total expenditure on agricultural goods will be reduced so does the importance of the sector in the economy. This triggers a positive structural change by relocating labor and other resources into the more productive sector. However, GDP per capita has a negative and significant effect on the structural change term of developed countries.

On the other hand, the regulation quality of the country, which is included in the analysis as a proxy variable for institutional quality, has a declining effect on the structural change of the economy in developing countries. Since these countries are characterized by having low institutional qualities, it triggers a negative structural change. But, it has a positive and significant effect on the structural change of the baseline group.

Another unique attribute identified in this analysis is that the effect of dependency on the export of raw materials on structural change term. It is found to contribute to the positive structural change in developing countries. The relocation of labor towards commercial agriculture in developing countries helps to increase the gain in labor productivity due to relocation. However, it has a negative and significant impact on the structural change of developed countries. Dependency on raw material export

requires the relocation of labor from the modern sector to the traditional primary sector that results in negative structural change.

To represent the wedges between sectors, I have included two variables in the analysis. The first one is the ratio of the value-added contribution of service to the manufacturing sector. Accordingly, the ratio of value-added contributions of the service sector to the manufacturing sector is insignificant for developed countries in explaining the structural change term. However, it has a negative and significant effect on the structural change of developing countries. In other words, the rise in the share of service over the manufacturing sector has a negative and significant effect on the gain in labor productivity due to labor relocation. This implies that, in developing countries, the value-added contribution of the manufacturing sector contributes better for structural change than the service sector. On the other hand, the ratio of the share of agriculture employment over the manufacturing employment has an insignificant effect on structural change.

The increase in labor productivity due to technological advancement within each sector, keeping the share of employment across sectors constant, doesn't affect structural change term at 5% level of significance for all groups of countries except the baseline group. However, at a 10% significance level, labor productivity increment results in a negative effect on the gain in labor productivity due to the relocation of labor. In other words, in developing countries, technical change in each sector may trigger the relocation of labor towards the less productive sector. The gain in labor productivity due to technical advancement in the low productive sector may initiate the relocation of labor towards these sectors.

Finally, openness and FDI are found to be insignificant for all groups of countries. According to Świącki (2017), for the effect of openness on structural change term to be better quantified, there has to be a trade imbalance both at the sectoral and aggregate levels. Moreover, openness may result in technological advancement in one of the sectors so that labor productivity in that specific sector increases. Empirically, Nguyen (2018) concluded that an opening up of the economy fosters positive structural change in east Asian countries which contradicts the result I have found. Similarly, FDI was supposed to have a positive and significant impact on structural change term because

they are supposed to bring modern production technology and create employment in the modern sectors for all groups of countries, but this contradicts the estimation output. FDI has no effect on the change in labor productivity due to relocation of labor.

Table 2. 5
Factors that derives the difference in structural change term between developed and developing countries, 1991 to 2017

Factors	Structural change of developed countries	Structural change of developing countries
Dependency on raw material export	—	+
Regulation quality index	0	—
The ratio of service GDP to manufacturing GDP	0	—
Within sector labor productivity growth	0	—
Agricultural sector employment		+
Log of GDP per capita	—	+

The ratio of agricultural
employment to manufacturing
employment

In general, non-homothetic preferences and international trade in terms of raw material exports trigger a positive structural change in developing countries, sectoral wedges (the ratio of service to manufacturing share of GDP), and regulation quality index serve the opposite. On the other hand, non-homothetic preferences and international trade affect structural change negatively and significantly in developed countries.

2.6 Conclusion

There are two divergent structural change theories known to literature. The first theory is developed by Kongsamut et al. (2001) and it is based on introducing consumer non-homothetic preferences on Kaldor's balanced growth theory, and the second one is contributed by Baumol (1967) and it is based on sector biased technical change. Hence, Non-homothetic preferences and biased technical change are the main drivers of structural change.

Historically, Structural change trends for developed and developing countries are dissimilar. While developed countries successfully transform their economies into highly productive manufacturing and then service sector dominant economies after passing through the two stages of transformation, developing countries followed a trend that departs from the one developed countries have passed through. However, a little is known on what derives the difference in the structural change trend of developed and developing countries. Therefore, the major objective of this chapter is to identify factors that caused the difference in the structural change terms of developed and developing countries.

The share of value addition in agriculture ranges from 1.5% to 8.5% with a mean value of 3.22% for developed countries which is a lot smaller than in developing countries. For example, for low-income countries average share of agriculture to real GDP from 1991 to 2017 is approximately 25.6%. However, it has been continuously

declining for both groups of countries despite there is a difference in the rate of decline. It is faster for developing countries. By using a regression analysis, I have proved that the marginal effect on the share of agriculture due to a unit change on log of GDP per capita is relatively higher for developing countries than other groups of countries.

On the other hand, the GDP share of the manufacturing sector is found to have a positive and linear relationship with GDP per capita for low and lower-middle-income countries. However, the story is different for developed countries. GDP per capita has a non-linear and declining effect on the share of the manufacturing sector. But it has a positive and significant effect on the value-added share of the service sector for both high and low-income countries.

To identify factors that determine the structural change in different groups of countries, I have conducted a generalized least square (panel GLS estimation technique) due to its advantage over heteroskedasticity and autocorrelation. Hence, the share of agricultural employment in the economy is found to have a positive and significant effect on the structural change term for the baseline, developing, and low-income developing countries. However, it is dropped for developed countries because it created a near-perfect multicollinearity problem.

Similarly, GDP per capita affects structural change term positively and significantly for developing countries. A high level of GDP per capita creates a window for labor to easily relocate towards the more productive sector. But in developed countries, it worked for the opposite. It affects structural change negatively and significantly. It might be because they are characterized by service-dominant economies. Relocating more labor from manufacturing to the service sector may have negative consequences on structural change term. On the other hand, the regulation quality of the country, which is included in the analysis as a proxy variable for the institutional quality, has a declining effect on the structural change term of developing countries.

Another unique attribute identified in this analysis are the effect of dependency on the export of raw materials and the ratio of the share of service to the manufacturing sector on the structural change term. While the share of raw materials exports to total

export found to contribute to a positive structural change of the economy of developing countries, the ratio of the share of service to manufacturing works for the opposite. Finally, openness was not significant in determining structural change for all groups of countries.



CHAPTER THREE

3. STRUCTURAL CHANGE, TOTAL FACTOR PRODUCTIVITY AND SECTORAL LABOR PRODUCTIVITY IN SELECTED AFRICAN COUNTRIES

3.1 Introduction

Structural change is a transformation of an economy from low productive and labor intensive to high productive and skill intensive economic activity (Oyelaran-Oyeyinka et al., 2016; Markus and Francis, 2013). It is conceptualized as a change in the aggregate component of the economy (Thakur, 2011). When one or more sectors of the economy grow faster than others, structural change is likely to happen. The difference in productivity among sectors will be followed by a relocation of resources towards more productive sectors.

Structural change has a far-reaching effect on economic performance. According to Kruger (2008), its effect can be witnessed at different levels of aggregations. It results in a change in the characteristics of the three important sectors of the economy as well as the industrial composition within the sector and among firms in the industry. As labor moves from agriculture to modern sectors, productivity rises and incomes expand (Vries et al., 2012). However, it is not always followed by an increase in total factor productivity. Not only the nature and speed with which structural change takes place but also the direction of movement of factors of production determine the effect of structural change on total factor productivity (TFP) and sectoral-labor productivities.

Developing countries have shown a structural change trend that deviates from the structural change developed countries have experienced. This trend causes a departure from the established relationship between structural change and other macroeconomic performance indicators. Most of these countries have shown positive structural change without having a rise in labor productivity which is unlikely to happen in developed countries (McMillan and Rodrik, 2011). Besides, the experience of African countries is full of heterogeneity. For example, Nigeria and Zambia have achieved a structural change

that reduces overall productivity while Ghana and Ethiopia have exhibited a structural change that can be characterized as growth-enhancing. On the other hand, Mauritius followed a structural change pattern that is similar to developed countries (Neuss, 2019). Despite the above disparities on the nature of structural change in developing countries, they have demonstrated similar pattern on sectoral share of employment. The share of employment in agriculture has been declining due to relocation of labor towards modern sectors. However, the relocation of labor towards the manufacturing sector may not result in a positive structural change due to its low level of sectoral labor productivity.

Furthermore, the effect of structural change on total factor productivity (TFP) growth in developing countries is not well studied. The limited number of empirical studies linking structural change to TFP growth is inconclusive (Isaksson, 2007). Likewise, the response of sector-specific labor productivities to structural change in these countries is not defined yet. Hence, it appears that it is difficult to make any formal conclusion about the relationship between structural change and productivity in Africa. Thus, in this chapter, I investigated (1) whether a shift in structural change leads to a change in TFP growth of the overall economy (2) the effect of the shift in structural change at disaggregated sectoral level labor productivity². Estimating the effect of structural change on the TFP and sector-specific labor productivities for a sample of African countries has paramount importance in understanding the effect of labor relocation on economic performance of these countries.

Using a fixed-effects model with Driscoll-Kraay standard error estimation technique, I find a significant positive effect of structural change on the growth rate of TFP. This implies that relocation of labor towards more productive sectors increases total factor productivity through creating a better combination of factors that increases growth rate of TFP. This result contradicts Bah and Brada (2009) which examined the effect of inter-sectoral movements of labor on aggregate TFP growth and capital accumulation for the new EU member countries and they came up with a result that structural change does have little or no effect on TFP growth.

² The disaggregated sectoral level TFP lacks the capital data, thus our sector analysis is restricted to labor productivity.

On the contrary, I also find that structural change doesn't have any effect on sector-specific labor productivities. This result corresponds with Moussir and Chatri (2019) and with Mallick (2015) somehow. Mallick (2015) estimated the effect of structural change on labor productivity for BRIC countries and found a significant relationship only in China and India. But for Brazil and Russia, structural change is not significant in affecting sectoral labor productivity. Similarly, Moussir and Chatri (2019) found that the intra-sectoral (within) component would account for much of labor productivity growth rather than the structural change.

The rest of this chapter is organized as follows. In section 3.2, I have presented a simple conceptual framework. Section 3.3 discusses the overall characteristics of the sample countries. Data and stylized facts are presented in section 3.4. Section 3.5 presents the method of estimation and empirical findings. Finally, section 3.6 concludes.

3.2 Conceptual Framework

TFP is a measure of output that is not explained by the volume of inputs utilized in the production process. It shows how efficiently the inputs are used in the production process. Traditionally, it is measured by Solow residual which can be estimated by using the growth accounting process through econometric estimation of production functions³.

Solow residual estimates TFP correctly if we assume a neoclassical production function and perfect competitive market. It is one of the basic indicators that constitute cross-country differences in growth and GDP. Therefore, based on the neoclassical growth model, the following theoretical framework is developed.

Let the overall production function of a country i at time t , Y_{it} , is determined by the available resources like labor force (L_{it}), capital stock (K_{it}) and other exogenous factors (Z_{it}). It is also affected by other factors that cannot be labeled under labor, capital or other exogenous factors. These factors are usually given by the parameter A_{it} which

³Assuming a Cobb-Douglas production function, the Solow residual is calculated as: Solow residual = $g_y - \alpha g_k - (1 - \alpha)g_l$ Where, g_y is the growth rate of aggregate output, g_k is the growth rate of aggregate capital and g_l is the growth rate of aggregate labor and α is the share of capital.

usually represents TFP in the neoclassical growth models. Therefore, the overall production function of an economy can be given as

$$Y_{it} = F(A_{it}, L_{it}, K_{it}, Z_{it}) \quad \text{Eq. 9}$$

It can also be rewritten as

$$Y_{it} = A_{it}(Z_{it})F(L_{it}, K_{it}, Z_{it}) \quad \text{Eq. 10}$$

Where A_{it} is also affected by external factors (Mastromarco and Zago, 2012) like structural change, technological advancement, and technical efficiency. The change in technical advancement, structural change and technical efficiency at country levels can only be captured by a change in TFP. This implies that TFP is affected by the change in one or more of these factors.

Therefore, this study estimates the effect of structural change on TFP by using the above simple framework. Eshete and Kumuyu (2016) supported this framework by claiming that a shift in the relative contribution of sectors to GDP is supposed to bring higher total factor productivity, higher earning and profit. But it is not direct forward, rather the effect of structural change on the TFP is dependent on which sector is dominating the economy. Traditionally, manufacturing sector dominant economies are known to have higher total factor productivity than other countries with agriculture and service-dominant economies. Therefore, it is likely to respond fast to structural change.

3.3 Overall Characteristics of Sample Countries

For this analysis, six African countries are chosen based on the availability of data. These are Burkina Faso, Ethiopia, Madagascar, Mozambique, Tanzania, and Uganda. In this section, the basic economic and demographic characteristics are discussed.

3.3.1 GDP, GDP Per Capita and Rate of Unemployment

These countries are categorized as low-income countries. None of them have a real per capita GDP of greater than 1000 dollars by 2017 based on 2010 US dollar valuation. Tanzania has the highest per capita GDP of 937.3 while Madagascar scored the lowest with 481.4 dollars. But on average, their GDP per capita has been increasing

continuously but slowly. The average GDP per capita growth rate for these countries over 1991-2017 was 2.54% which is small for low-income countries. They have achieved a positive average growth rate of per capita GDP for all years except 1991, 1992 and 1994. During these years, all of these countries except Uganda have been achieving a negative GDP per capita growth rate. However, in a nutshell, these countries have a positive growth rate of GDP per capita between 1991 and 2017. But the state of unemployment is relatively small and surprising. By the year 2017, the average unemployment rate⁴ was 2.72% based on the data from WDI. This figure is way below the average unemployment rate of Sub-Saharan African countries which happens to be 6.121%.

3.3.2 Population Structure

Based on the data from WDI, these countries have one of the highest population growth rates in the world. The average population growth rate over 1991 - 2017 is 2.96% with no sign of intertemporal change. When it comes to the gender composition of the population, 50.5% of the total population is female by 2017.

The other important aspect that I need to discuss is a rapid rural-urban migration with a rise in the percentage of people living in urban areas. In 1991, the average percentage of the population living in urban areas was 17.45% with the highest percentage of 25.5% in Mozambique and the lowest percentage of 12.9% in Ethiopia. However, by the year 2017, the average percentage of people living in urban areas has raised to 29.54%. Ethiopia had the lowest percentage of the population living in urban areas with 20.31% while Madagascar had the highest with 36.522%. In general, these countries have one of the highest growth rates of urban population in the world with an average annual growth rate of 5% from 1991 to 2017. By the year 2017, Uganda is the country with the highest growth rate of urban population among sample countries with 6.25% while Mozambique has the lowest with 4.4%.

⁴ It is measured as total unemployment as a parentage of total labor force (Modeled ILO estimate) and the data is adopted from WDI (2019).

3.4 Data⁵ and Stylized Facts

In this section, the characteristics of countries involved in this study will be explained in terms of the main variables to give a context before presenting the result.

3.4.1 Total Factor Productivity Growth

The average total factor productivity growth (TFP) of sample countries is approximately 3.368%, with large variation across countries. As figure 1 shows that the average growth rate of TFP has been showing fluctuations over the years. TFP growth has been relatively small and sometimes negative for countries like Ethiopia and Madagascar during the first half of the 1990s. But after the mid-2000s, countries showed a similar trend of increasing, reached a maximum and then declining TFP growth. This makes sense when we compare this performance with their respective economic growth. Developing countries especially sub-Saharan African countries have achieved a rapid economic growth of 5% since 2000 until they face a sluggish economic growth after 2014. Therefore, it is not unexpected to have a positive TFP growth for most of the years since the beginning of the century. This fact is supported by Bah (2014) that countries with a relatively higher rate of economic growth are known to have a higher level of TFP growth. Specifically, he asserted that countries or sectors with the lowest growth performance mostly suffered from very low or negative TFP growth.

⁵ The nature and source of data is summarized in table 3.5

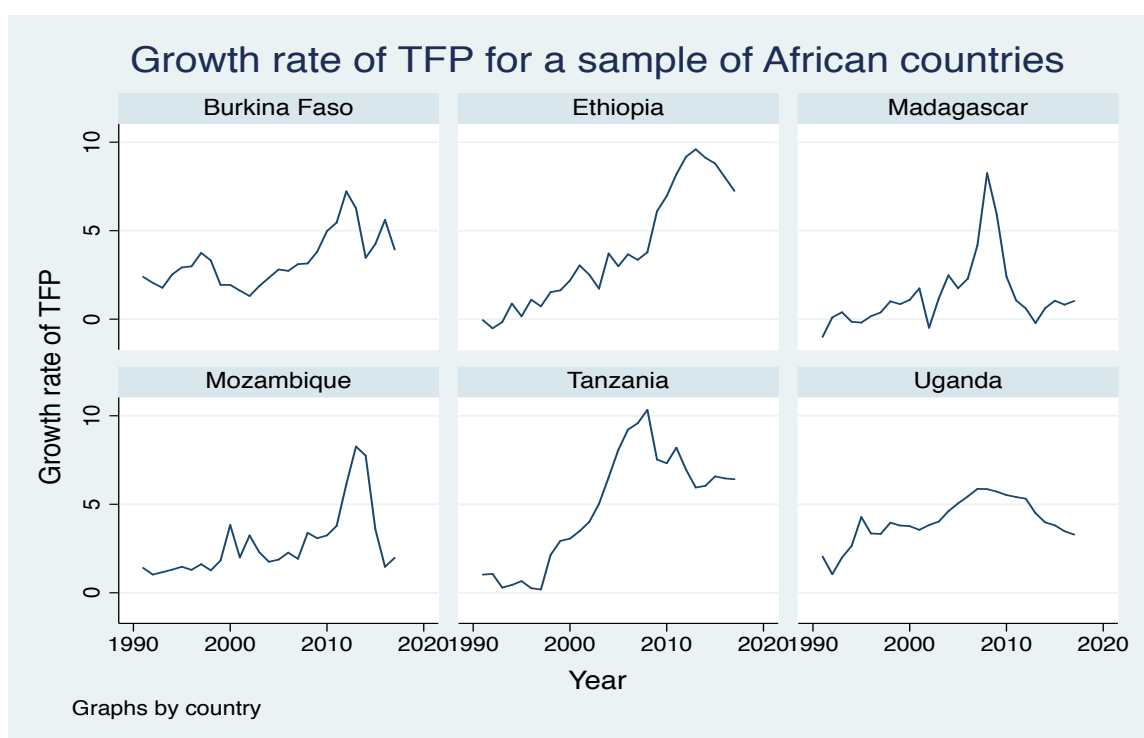


Figure 3. 1: TFP growth of a sample of African countries over 1991-2017

Source: The Conference Board Total Economy Database™, (Adjusted version), April 2019

3.4.2 Sectoral Labor Productivity

The existence of a sizable gap in labor productivity between sectors is a fundamental reality of developing countries (McMillan and Rodrik, 2011; Lewis, 1954). This reality holds for our sample too. Labor productivity in the service sector is higher than in both the agricultural and manufacturing sectors. On average, the labor in the service sector is 5 times more productive than labor in the agricultural sector. Similarly, labor in the manufacturing sector is 3.4 times more productive than labor in the agricultural sector. These figures are much higher than what McMillan and Rodrik (2011) have estimated for African countries. They have calculated that the average manufacturing to agriculture sector labor productivity ratio is 3.9 in Asia, 2.8 in Latin America and 2.3 in Africa which reveals that our sample countries experience a much higher labor productivity gap than an average African country. On hierarchical basis, labor productivity in the service sector is higher than that of both in the manufacturing and agricultural sectors. This explains why there is a rapid rise in both the share of employment and GDP contribution of the service sector since 1991. Therefore, the

positive structural change that I have illustrated in tables 3.2, 3.3 and 3.4 is the result of the gain in labor productivity due to the fact that the relocation of labor from agriculture to manufacturing and service sectors, and from manufacturing to service sectors outweighs the loss in labor productivity from the labor mobility of reverse direction.

Table 3. 1

Summary of sectoral average labor productivities of selected African countries over 1991-2017

Sectoral Labor Productivities	Mean	Standard Deviations	Minimum	Maximum
Labor productivity in agriculture	499.897	327.159	142.257	2164.14
Labor productivity in manufacturing	1733.619	989.2235	247.039	3809.19
Labor productivity in service	2610.814	938.49	767.863	5294.54

Source: Author's calculation based on the data from WDI

Equally, the following graph shows the historical trends of sectoral labor productivities. Figure 3.2 demonstrates that labor productivity trends of different sectors have been changing across periods for each country. Labor productivity in the service sector has been increasing continuously since 1991 for Ethiopia, Mozambique, and Uganda. But it is unusually declining for Burkina Faso and Madagascar. This is too early for countries with a larger proportion of their population is employed in the traditional sector.

On the other hand, labor productivity in the agriculture sector is found to be small and stagnant. Only Burkina Faso managed to increase agricultural labor productivity since 2011. This might be due to the relocation of labor from agriculture to non-agricultural sectors without a significant change in production volume. Similarly,

labor productivity in the manufacturing sector has been declining for all countries except Uganda. Uganda's labor productivity growth in both the manufacturing and service sectors are impressive. But for all countries, the productivity of labor in the service sector is higher than in any other sector by 2017.

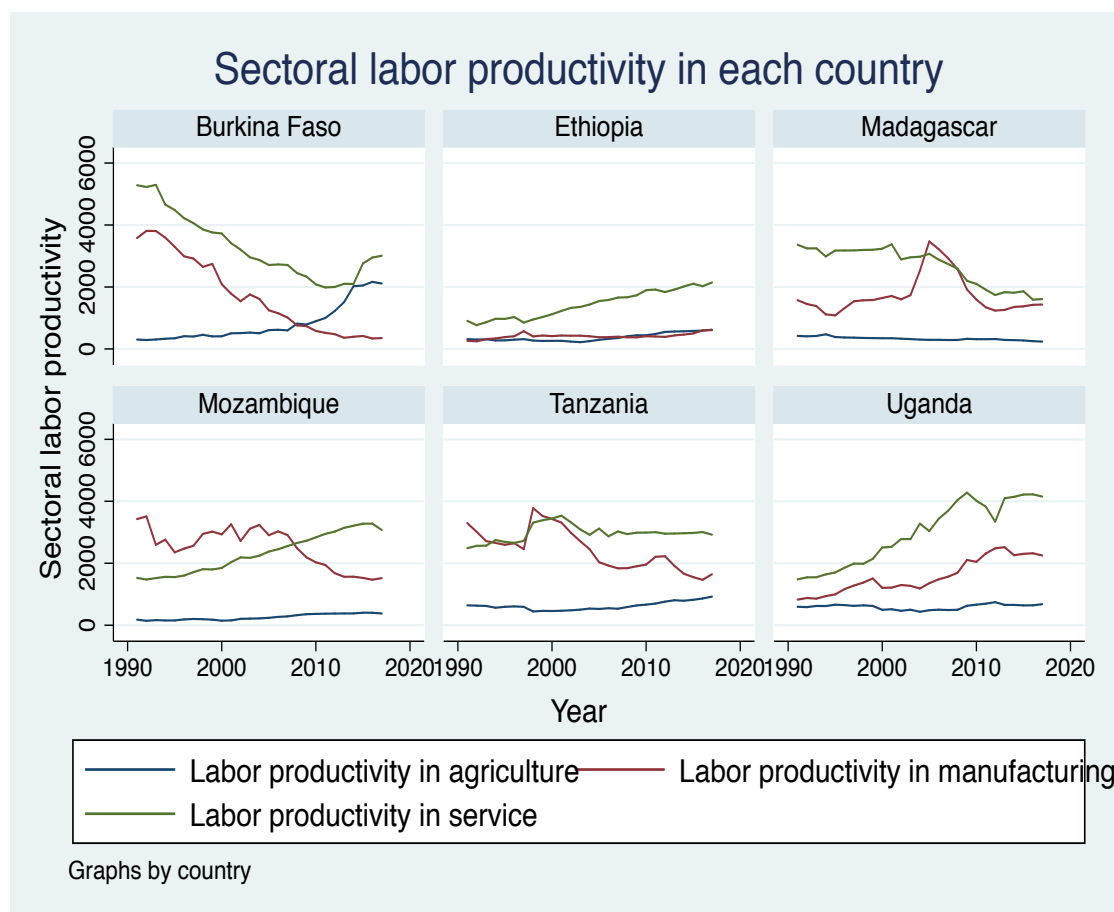


Figure 3. 2: Sectoral labor productivity of selected African countries

Source: Author's calculation based on the data from WDI

Alternatively, a five-year average growth rate of labor productivity in each sector is provided graphically as follows.

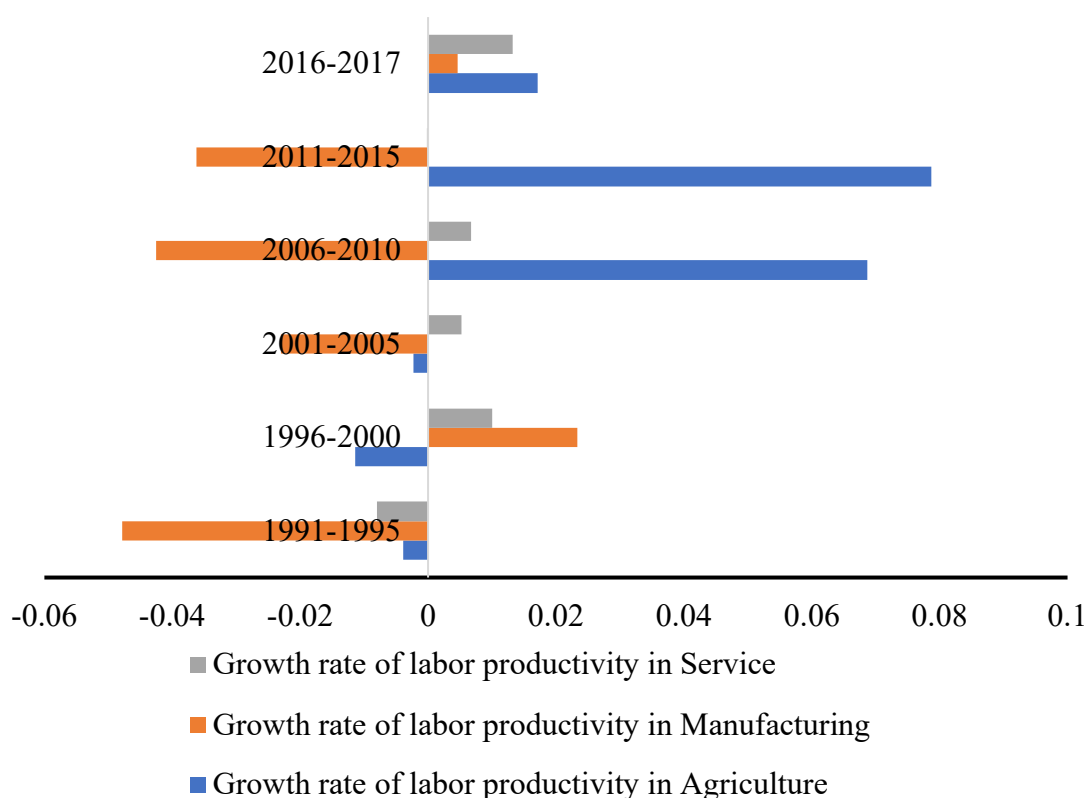


Figure 3. 3: A five-year average growth rate of sectoral labor productivities for a sample of African countries

Source: Author's calculation based on the data from WDI

Based on figure 3.3, the five-year average labor productivity growth rate for all sectors was negative between 1991 and 1995. During these years, the population grows much faster than what the economy did which results in a decrease in labor productivity for all sectors. On top of that, sample countries except Uganda achieved a negative GDP growth rate that exacerbated the situation. But for the next five years (1996-2000), the growth rate of labor productivity in the service and manufacturing sectors became positive. Basically, since the mid-1990s, labor productivity in the service sector has been consistently positive.

However, the five-year average labor productivity growth in the manufacturing sector revealed that it has been negative for all years except between 1996 and 2000 and after 2016. But on average, the growth rate of labor productivity in the manufacturing

sector has been negative since 1991. This claim is supported by McMillan and Rodrik (2011). They asserted that labor productivity in the manufacturing sector in developing countries is found to be stagnant and sometimes declining.

The five-year average growth rate of labor productivity in the agriculture sector has been positive since 2005. Both the rapid mobility of labor towards non-agricultural sectors and technical advancement within the sector contributed for the positive labor productivity growth rate in the sector.

The labor productivity gap between agricultural and modern sectors has also shown a specific trend. Starting from the early 1990s, it has been increasing until the early 2000s. However, after the 2000s, the gap has begun to narrow because of a decline in labor productivity in manufacturing and an increase in labor productivity in the agriculture sector. This can be cross-checked by estimating the ratio of labor productivity in non-agricultural sectors to the agricultural sector. Hence, the ratio first increased and reached a maximum and began to fall. This implies that the labor productivity gap between sectors has changed with time. McMillan and Rodrik (2011) also came up with similar trend that the labor productivity gap between agriculture and the non-agricultural sector first increases and then declines which means the ratio of agricultural to non-agricultural labor productivity exhibits a U-shaped pattern with time.

There is an important economic logic behind the U-shaped curve of the agriculture-modern sector labor productivity ratio. Since most developing countries have few modern sectors, the productivity gap will increase as the economy began to grow (McMillan and Rodrik, 2011). Usually, the source of growth in these countries is public and private investments in the non-agricultural sector and urban areas. However, as the economy grows, labor starts to move to the modern sector so that labor productivity began to converge. This scenario also proves the dual economy theory of Lewis (1954).

3.4.3 Structural Change Term and Within Sector Labor Productivity Growth Rate

In addition to the labor productivity of each sector, I explained sectoral productivity performance in terms of structural change and within sector labor

productivity growth. McMillan and Rodrik (2011) proposed a shift-share mechanism to decompose total labor productivity into structural change and within labor productivity. While structural change term⁶ is a valid indicator of structural change that measures the change in labor productivity due to relocation of labor between sectors, within sector labor productivity growth is a measure of the gain in labor productivity due to technological advancement in each sector.

Based on our estimation of structural change, the countries have been gaining an average of 0.915% increase in labor productivity annually since 1991 due to the relocation of labor between sectors. The result coincides with the theory which affirms that for developing countries with a relatively large proportion of their population is employed in the low productive agricultural sector, structural change is likely to be positive and that is what has happened. While the gain in labor productivity for these countries ranges from -8.6% to 5.7% between 1991 to 2017, the standard deviation is estimated to be 2.28 which is relatively low. Therefore, there exists a minimum level of cross-country differences when it comes to the average level of structural change they have achieved.

⁶ Structural change term measures the change in labor productivity due to relocation of labor between sectors. Based on the shift-share analysis, structural change term is calculated as follows:

Let overall labor productivity at time t and $t - 1$ are given as Y_t and Y_{t-1} respectively and corresponding sectoral labor productivity are given as y_t^i and y_{t-1}^i with index i referring to different sectors. Given θ_t^i is the share of employment of each sector i at time t , the structural change term is calculated by using the following equation.

$$\sum_{i=n} \frac{(\theta_t^i - \theta_{t-1}^i) \bar{y}_{t,t}}{Y_{t-1}}$$

Table 3. 2**Summary statistics of structural change and within sector labor productivity growth rate, 1991-2017**

Variables	Mean	Standard deviation	Minimum	Maximum
Structural change term	0.915238	2.28373	-8.6021	5.747
Within sector productivity growth ⁷	0.933	3.814428	-9.01882	13.5384

Source: Author's calculation based on WDI

Similarly, the average within-sector labor productivity growth rate due to technical change in each sector is 0.93% which ranges from -9.02% to 13.54%. When it is compared with structural change term, countries have gained a higher labor productivity due to technological advancement than due to relocation of labor. However, a t-test revealed that the gains in labor productivity from the two sources are systematically the same. These countries have been gaining labor productivity equally from both sources. I was unable to reject the null hypothesis of no difference in the mean values of structural change term and within sector labor productivity growth.

However, based on table 3.2 and figure 3.4, within sector labor productivity growth inclines to be more volatile than the structural change term. The standard deviation of the within sector productivity growth is 1.67 times higher than that of structural change term. This is because, according to Rodrik, McMillan and Sepulveda (2016), labor mobility is costly and a long-term decision while technological change

⁷ Within sector labor productivity is calculated based on the following formula:

$$\sum_{i=n} \frac{(y_t^i - y_{t-1}^i) \bar{\theta}_{t,t}}{Y_{t-1}}$$

where y_t^i and y_{t-1}^i are sectoral labor productivity with index i referring to different sectors, θ_t^i is the share of employment of each sector i at time t and Y_{t-1} is the base year level of aggregate labor productivity in the economy.

happens unexpectedly and frequently. Therefore, within sector labor productivity growth rate changes more frequently for the changes in technological advancement than structural change term.

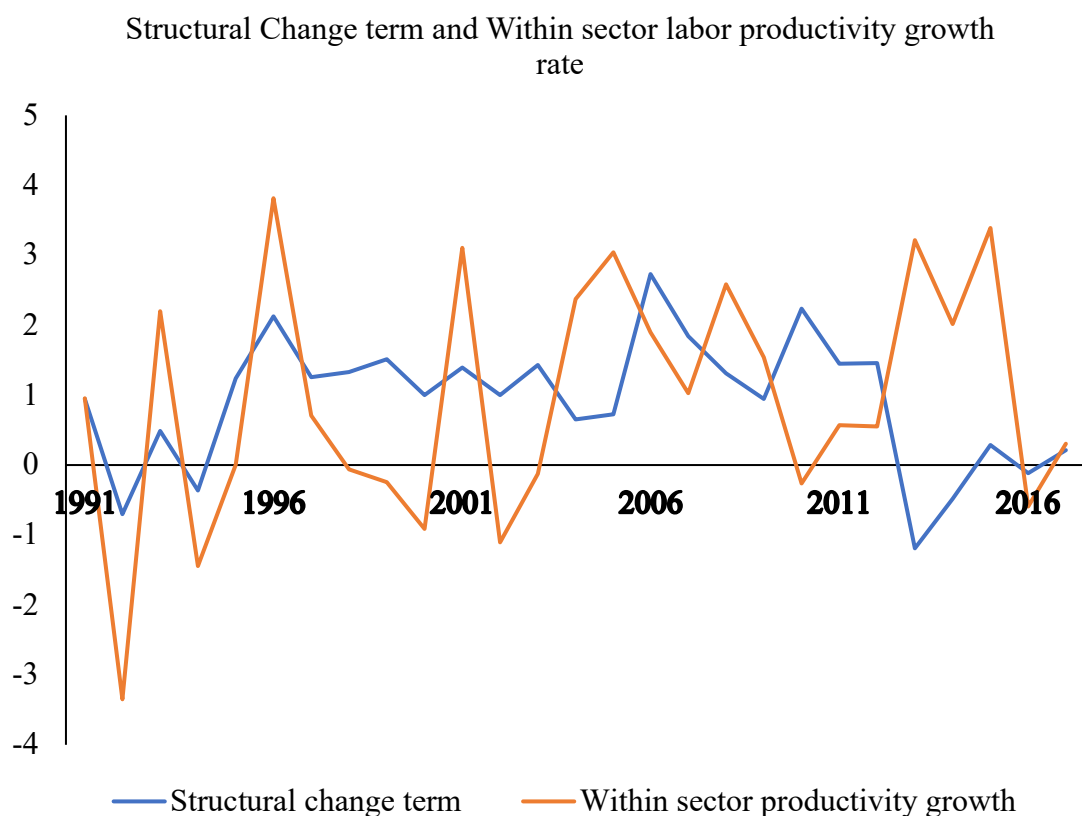


Figure 3. 4: Structural change term and within productivity change in a sample of African countries

Source: Author's calculation based on the data from WDI

Disaggregating the total average productivity change into structural change and within productivity change helps to show the relative strength of the change in labor productivity at different periods. For example, from the years 1991 to 1995, while labor productivity has shown a 0.3211% growth rate due to structural change, the within labor productivity was declining by 0.3262% which minimizes the overall growth rate of labor productivity to -0.0051%. Similarly, labor productivity change due to relocation contributes more to the total labor productivity change for almost all years considered in this study. But for 2016-2017, the contribution of within labor productivity change

outweighs the structural change term. In general, for the last 25 years, structural change contributes more to the growth of aggregate labor productivity than within sector productivity.

Table 3. 3: Disaggregated components of the total average productivity growth rate of sample countries for 1991-2017, by taking a 5-year average

Years	Structural Change	Within productivity	Total average labor productivity Change
1991-1995	0.32113843	-0.3262458	-0.0051073
1996-2000	0.55876193	0.24523567	0.8039976
2001-2005	1.29820433	0.5180952	1.81629953
2006-2010	1.30770737	1.21490137	2.52260873
2011-2015	1.55823353	1.09264007	2.6508736
2016-2017	0.13136867	1.885793	2.01716167

Source: Author's calculation based on the data from WDI

Country specific decomposition of aggregate labor productivity growth is indicated in table 3.4.

Table 3. 4: Decomposition of aggregate labor productivities into structural change component and within labor productivity component, from 1991—2017, by country

Country	Structural change term	Within labor productivity growth rate	Aggregate labor productivity growth
Burkina Faso	2.01094372	0.76628122	2.77722494
Ethiopia	0.11915479	2.5390648	2.65821959
Madagascar	0.8153982	-1.9043103	-1.0889121
Mozambique	1.44086392	1.78580441	3.22666833
Tanzania	1.09935723	0.31613287	1.41549011
Uganda	0.0057107	2.09677596	2.10248666

Source: Author's calculation based on the data from WDI

Mozambique and Burkina Faso achieved the highest aggregate labor productivity growth rate which is originated from different sources. While Mozambique generated most of its aggregate labor productivity growth from within sector labor productivity, Burkina Faso gets more than 72% of its growth rate of labor productivity from structural change. In the case of Burkina Faso, sectoral labor productivity has been changing dramatically for the last 26 years. Labor productivity in agriculture has been increasing continuously when it was declining for the manufacturing and service sectors. Based on our sectoral labor productivity estimation, in 1991, labor productivity in agriculture, manufacturing and service sectors was 303.024, 3582.6 and 5282.6 respectively. However, by 2017, labor productivity in agriculture, manufacturing and service sectors became 2113.4, 350.58 and 3007.94 respectively which confirms a radical change in sectoral labor productivity due to a relocation of labor. From the above dynamics, we can understand that labor has been relocated towards the manufacturing and service sectors.

3.5 Methodology and Empirical Findings

The main objective of the chapter is to determine whether- and to what extent- structural change is influencing TFP in a sample of African countries. I used fixed effects with Driscoll-Kraay standard error panel data estimation technique, an important method to eliminate the incidences of heteroskedasticity, autocorrelation and cross-sectional dependency (Hoechle, 2007).

Theoretically, a change in TFP due to a change in employment structure occurs with one or more lags. This is because for the productivity to shift due to structural change, there shall be a reallocation of labor from one sector to the other. Therefore, keeping this in mind, the following empirical estimation strategies are developed.

3.5.1 Model Estimation Technique

Mallick (2015) examined structural change and its effect on productivity growth for BRIC countries. He estimated total factor productivity (TFP) as a function of FDI, trade volume, fixed investment, industrial output, education sector expenditure, and the female labor force. Similarly, Mastromarco and Zaglo (2012) used regional banking inefficiency, human capital, and technological investments and spillovers as determining factors to affect TFP growth while Cardarelli and Lusinyan (2015) modeled TFP growth rate as a function of schooling, log schooling, tertiary education attainment, business, and total R&D expenditures and time trend.

In this study, TFP is modeled in terms of within sector labor productivity change (served as a proxy for sector-specific technological advancement), structural change term, openness index, regulation quality of the country, foreign direct investment, dependency on raw material export, human capital index and finally labor productivity in the agriculture sector.

Table 3. 5

Variables, sources of data and expected correlation sign

Explanatory variable	Sources of data	Dependent variables			
		TFP	Sectoral labor productivity		
			Agriculture	Manufacturing	Service
Structural change term	Own computation based on WDI	+	+	±	—
Within productivity growth(t-1)	Own computation based on WDI	+	+	+	+
Structural change term (t-1)	Own computation based on WDI	+	+	±	—
Openness	WDI	±	+	+	±
Regulatory quality index	World governance index	+	+	+	+
Foreign direct investment	WDI	+	+	+	+
Raw material export	WDI	+	+	0	—

Agricultural Labor productivity (natural log)	Own computation based on WDI	+	0	–	–
Human capital Index	Penn world table 9.0	+	+	+	+

***Note:** while the + sign hypothesizes positive relationship between variables, –predicts the opposite. ± shows the possibility of either positive or negative relationships depending on the circumstances but 0 shows no relationship.*

Theoretically, technological change, which is represented by the within sector labor productivity growth in the regression, is the main component of TFP. TFP in the neoclassical growth theory is treated as a technical component of the production function. Therefore, sectoral technical change constitutes technological advancement and knowledge transfer and by implication TFP. Empirically, different works of literature (For example, Plastina and Lence, 2018; Jajri, 2007; Mariyono, 2018; Mastromarco and Zaglo, 2012) have concluded that technological advancement is the largest contributor for the change in TFP and TFP growth rate.

On the other hand, growth-supporting structural change is supposed to increase TFP growth rate. The relocation of labor towards a more productive sector increases the overall productivity growth of the country. This happens when the sector that labor is joining is already enriched with labor augmenting technology. Therefore, theoretically, structural change term increases aggregate TFP growth rate of a country, but it might have different signs for sectoral TFPS depending on the proportion of labor employed and the nature of technological advancement that resides in the sector.

Openness is included in the model to control the role of international trade on TFP and sectoral labor productivity. More open economies have high level of technology transfer which by implication helps to advance TFP of the economy (Abizadeh

and Pandey, 2009). Similarly, regulation quality of the country helps the resource mobility towards the more productive sectors. Therefore, openness and regulatory quality indexes are expected to have a positive and significant effect on TFP growth rate of developing countries.

Similarly, human capital and productivity of labor in the agricultural sector are supposed to have a positive effect on TFP while dependency on raw material export might have a negative effect. The latter relationship is dependent on the development level of the country. Dependency on the export of raw materials in international trade can help developing countries in boosting their TFP by compelling them to use modern technologies to keep up with the competition. However, for high-income countries with the dominant modern sector, dependency on raw materials export will have a decremental effect on the TFP of agriculture. As a result, dependency on raw material export which is measured as a percentage of total export in our analysis is expected to have a positive sign.

Hence, to empirically examine the above theoretical predictions, the panel data estimation technique is employed. However, due to the existence of heteroskedasticity, autocorrelation and cross-sectional dependency among the panel elements, I was unable to use pooled OLS, random effects and fixed effects estimation techniques but fixed-effects regression with Driscoll-Kraay standard error. Dynamic panel data estimation techniques are not useful in this context because they are more useful for models with “N greater than T” structure that are usually found in microeconomic studies.

According to Hoechle (2007), a fixed-effects model with Driscoll and Kraay standard errors estimation technique is realized in two steps.

First, all variables in the model $z_{it} \in \{y_{it}, x_{it}\}$ are within-transformed in the following fashion:

$$\tilde{z}_{it} = z_{it} - \bar{z}_i + \bar{\bar{z}} \quad \text{where} \quad \bar{z}_i = T_i^{-1} \sum_{t=t_{i1}}^{T_i} z_{it} \quad \text{and} \quad \bar{\bar{z}} = (\sum T_i)^{-1} \sum_i \sum_t z_{it}$$

Considering the above estimator as the OLS estimator of

$$\widehat{y}_{it} = \widehat{x}_{it}'\theta + \widehat{\varepsilon}_{it} \quad \text{Eq. 11}$$

Then, secondly, the transformed regression model $\widehat{y}_{it} = \widehat{x}_{it}'\theta + \widehat{\varepsilon}_{it}$ is estimated by using pooled OLS estimation with Driscoll-Kraay standard errors. This estimation technique can also handle missing values and unbalanced panels.

3.5.2 Estimation Results and Discussion

Four different models are estimated to determine the effect of structural change on the growth rate of TFP and sectoral labor productivity of each major sector. The estimation results are presented in two separate tables. While table 3.6 presents the estimation result where aggregate TFP growth rate is regressed against structural change and other control variables, table 3.7 presents three regression results that estimate the effect of structural change on the productivity of labor in each sector.

A. The effect of structural change on aggregate TFP growth rate

Table 3. 6

Fixed effects panel data estimation of structural change on the growth rate of TFP based on Driscoll-Kraay standard errors

Explanatory Variables	Dependent Variable: TFP growth
Within productivity growth	0.125***(0.0227)
Structural change term	0.152***(0.0475)
Within productivity growth (with 1 lag)	0.0694***(0.0179)
Structural change term (with 1 lag)	0.245***(0.0601)
Openness	0.252(1.258)
Regulatory quality index	3.382***(0.904)
Foreign direct investment	0.120***(0.0350)
Raw material export (%ge to the total)	-0.0616(0.0531)
Agricultural labor productivity	0.352(1.143)

Human capital index	7.141***(1.491)
Constant	-7.305(7.450)
Number of observations	162
Number of countries	6
Prob > F	0.0000
within R-squared	0.5165
Standard errors in parentheses	

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's estimation using STATA 14

According to Table 3.6, the structural change term affects the growth rate of TFP positively and significantly at a 1% significance level. This supports the idea that relocation of labor towards more productive sectors affects the growth rate of TFP. Based on the coefficient estimates, if labor productivity gains due to the relocation of labor increases by 1%, TFP growth rate will increase by an average of 0.152%. At the same time, a one-year lag value of structural change term affects TFP growth positively. This implies that TFP growth responds to the changes in structural change term twice. In other words, a change in structural change at time t increases TFP growth at t and $t + 1$. Therefore, these countries shall work to advance the relocation of labor from the low productive sectors to the high productive sectors so that they can increase total factor productivity growth of their economy. This result contradicts the result the result by Bah and Brada (2009) which concluded that the movements of labor between sectors do not help to increase growth of aggregate TFP and capital accumulation in the newly joined EU member countries.

Furthermore, the growth rate of aggregate TFP is positively and significantly affected by the regulatory quality index, foreign direct investment, within sector labor productivity growth and human capital index. This result is supported by economic theory as it is explained by table 3.5. Regulation quality index increases TFP growth by reducing

inefficiency in resource allocation. Similarly, FDI and within sector labor productivity have an incremental and significant effect on TFP growth through their technological component. While FDI brings new technology to the country, within sector labor productivity change is evolved from technological advancement in the first place. On the other hand, openness index, percentage share of raw material export and agricultural labor productivity are found to be insignificant in affecting the growth rate of TFP in these countries.

B. The effect of structural change on sectoral labor productivities

In this section, structural change is regressed against the natural log of labor productivities of main sectors: agriculture, manufacturing and service. And the estimation output is presented in table 3.7 as follows.

Table 3. 7

Fixed effects panel data estimation of structural change term on sectoral labor productivity based on Driscoll-Kraay standard error

	Model I	Model II	Model III
Explanatory Variables	Labor productivity in agriculture	Labor productivity in manufacturing	Labor productivity in service
Within productivity growth	0.0126** (0.00576)	0.00399 (0.00523)	0.0128* (0.00664)
Structural change term	-0.00442 (0.00808)	0.0154 (0.0147)	0.00558 (0.0109)
Within productivity growth (with 1 lag)	0.0156*** (0.00455)	0.0154** (0.00639)	0.0163** (0.00707)
Structural change term (with 1 lag)	0.00569	-0.000426	-0.00632

	(0.00601)	(0.0135)	(0.00912)
Openness	0.252*	-0.448**	-0.177
	(0.141)	(0.184)	(0.140)
Regulatory quality index	0.116	0.290**	0.332
	(0.123)	(0.137)	(0.238)
Foreign direct investment	0.00932***	0.00716	0.0177***
	(0.00309)	(0.00699)	(0.00607)
Raw material export (%ge to the total)	-0.0303***	0.0166*	0.0165**
	(0.00551)	(0.00814)	(0.00686)
Agricultural labor productivity		-0.763***	-0.0126
		(0.130)	(0.123)
Human capital index	0.0366	1.423***	1.252***
	(0.182)	(0.248)	(0.182)
Constant	6.428***	9.866***	5.958***
	(0.372)	(1.089)	(0.819)
Number of observations	162	162	162
Number of countries	6	6	6
Prob > F	0.0000	0.0000	0.0000
within R-squared	0.6046	0.6243	0.3599
Standard errors in parentheses			

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Author's estimation using STATA 14

Thus, structural change but within sector productivity change is not helping to boost sectoral labor productivities. The result corresponds with Moussir and Chatri (2019) and with Mallick (2015) partially. Moussir and Chatri (2019) found that the intra-sectoral (within) component would account for much of labor productivity growth rather than the structural change. Similarly, Mallick (2015) estimated the effect of structural change on labor productivity for BRIC countries and found a significant relationship only in China and India. But for the rest, structural change was not significant in affecting sectoral labor productivity.

In general, structural change is insignificant in determining sectoral labor productivities in selected African countries due to one or more of the following reasons:

- A large proportion of the population in these countries is employed in agriculture. At the same time, a considerable number of labors is entering to the sector. Therefore, the change in productivity of labor in the agriculture sector due to relocation of labor is insignificant.
- Relocation of labor is a long-term and costly decision and it follows a relatively slow process. Therefore, even if there is a high level of sectoral labor productivity gap between modern and traditional sectors, it takes time to fill the gap through a slow process of relocation of labor. As a result, the modern sector may not be matured for a while to cause a change in labor productivity as a consequence of labor mobility.
- The underdeveloped and informal service sector that resides in urban areas provides an opportunity as a new area of employment and business startups for the relocated labor which keeps its effect on labor productivity non-existent.

Hence, the above forces may hinder rapid significant change in sectoral labor productivity as a result of a structural change.

On the other hand, intra-sectoral (within) labor productivity component is contributing to the growth of labor productivities in agriculture and service sectors.

However, it takes a year to increase labor productivity in the manufacturing sector. In other words, the increase in labor productivity due to technological advancement in each sector is found to increase labor productivity in the service sector twice in two consecutive periods. Technological advancement in agriculture and service sectors results in an increase in labor productivities in their respective sectors.

While openness index has a positive effect on labor productivity in the agriculture sector, it has decreasing effect on the manufacturing and service sectors. This makes sense for developing countries. These countries are known to have a comparative advantage in the export of agricultural products. On the other hand, since they are net importers of manufactured and service products, domestic manufacturers and service providers will not be able to keep up with the international competition. Therefore, the more open the economy becomes, the higher labor productivity in agriculture and the lower in the manufacturing and service sectors will be.

But the regulation quality index is found to affect labor productivity in the manufacturing sector positively and significantly at 5% significance level. The higher the regulation quality index, the better the resource allocation will be. Therefore, labor will be located in a way to increase its productivity. For example, Medreseh et al. (2018) agreed that the proper and logical use of abilities and talents helps to improve labor productivities in the manufacturing sector. But foreign direct investment is significant in increasing labor productivity both in the agriculture and service sectors. However, it has no effect on labor productivity in the manufacturing sector. This conclusion agrees on the idea that most FDI in these countries is done in either agricultural or service sectors.

Human capital index, on the other hand, has an increasing effect on labor productivity in the manufacturing and service sectors. But it doesn't have any effect on labor productivity in agriculture sector. This result partially agrees with Huffman (2000) as he asserted that the effect of educational attainment in agriculture is rather dependent on conditions like the use of communication, information technology, the existence of options for off-farm work and migration. If these conditions exist, education in particular and human capital index in general, affects labor productivity in agriculture positively and significantly. But with the absence of communication and information technology,

which is among the common characteristics of African countries, human capital may not have a significant effect on labor productivity in the agriculture sector.

3.6 Conclusion

This chapter shows empirically how the structural change in selected African countries affects aggregate TFP growth rate as well as labor productivity of major sectors. To this end, I used a dataset that covers from 1991 to 2017. Using a fixed-effects model with Driscoll-Kraay standard error estimation technique, the study concludes the following:

- On average, the labor in the service sector is 5 times and labor in the manufacturing sector is 3.4 times more productive than labor in the agricultural sector which indicates the prevalence of substantial gap in labor productivity between sectors.
- Following this gap in labor productivity, there is a relocation of labor mainly from agriculture to modern sectors which results in a positive structural change.
- Labor productivity in the agriculture sectors is very low and sometimes declining, therefore, reallocation of labor to the manufacturing and service sectors will help to increase aggregate labor productivity in the short run.
- The ratio of labor productivity in agriculture and non-agriculture sectors exhibits a U-shaped pattern which indicates the change of pattern in the gap of labor productivity between sectors.
- TFP has increased until 2012 and started to decline in correspondence with the GDP growth rate of most of the sample countries.
- The structural change affects the growth rate of TFP positively. However, it is insignificant in affecting sectoral labor productivity. The “unlimited” supply of labor in the traditional sector, unmet labor needs along with underdeveloped informal sector in urban areas and the slow and costly process of structural change may hinder sectoral labor productivity to react to the change in the structure of the economy.

Therefore, these countries can facilitate structural change to increase the growth rate of TFP. However, sector-specific labor productivity doesn't respond to the structural change but technical advancement in each sector.

CHAPTER FOUR

4. STRUCTURAL CHANGE AND ECONOMIC GROWTH IN ETHIOPIA

4.1 Introduction

Since 2004, Ethiopian economy has been growing 11.2% on average which is above the Sub-Saharan African average growth rate of 5.23%, based on WDI. Besides, there was a shift in the relative importance of major sectors in terms of their contribution to GDP and total employment. The service sector has been growing faster than the agriculture and manufacturing sectors in both accounts. For example, for the year 2014, the service sector accounted for 46% of GDP (Eshete and Kumuyu, 2016; Martin, 2014) that makes it a dominant sector in the economy. The share of the manufacturing sector to the total GDP is very low (Oyelaran-Oyeyinka and Lal, 2016). Based on WDI, the average share of the sector to overall GDP for 1991-2017 is 4.73%. However, it has shown a plodding improvement in its contribution to GDP with an average growth rate of 2.986%. This may not qualify the economy for the so called “pre-mature deindustrialization” scenario most developing countries went through. Moreover, labor productivity in this sector is not significantly higher than the agriculture sector. Hence, according to Nuhu (2017), slow transformation towards the manufacturing sector didn’t result in an improved economy-wide productivity.

The economic growth performance of the country is not triggered by structural change surplus (Eshete and Kumuyu, 2016). Relative productivity of agriculture has been increasing but at a very low, 2.6% according to Timmer et al. (2013), level of economy-wide labor productivity growth. Besides, after 2006, labor productivity in the agriculture sector is higher than labor productivity in the manufacturing sector. Consequently, unlike the result by Cao and Birchenall (2013) for the post reform China, relocation of labor from agriculture to the non-agriculture sector may not increase aggregate labor productivity and by implication economic growth in Ethiopia. But Diao et al. (2017) disagreed. They claim that Ethiopia has experienced growth-promoting structural change.

In general, several studies on the structural change in Ethiopia agreed that the country is realizing a slow change in the structure of the economy even with low level of TFP in non-agricultural sector. But there is no agreement on whether structural change helps to achieve high level of GDP growth rate. Martin (2014) gives more recognition to demographic changes in motivating higher level of growth rate than structural change. Hence, these discussions call for new studies that emphasize on the effect of structural change on GDP growth rate of the economy both in the short-run and long-run.

Therefore, this study determines the effect of structural change on the GDP growth rate of the Ethiopian economy over 1991-2017 by taking both investment fundamentals and structural change constituents as the two major sources of economic growth. The analysis follows two steps. In the beginning, the change in aggregate labor productivity is decomposed into structural change term and within labor productivity change by applying the shift-share method (McMillan and Rodrik, 2011). And the result displays that the country has gained labor productivity from both structural change and within sector productivity but in a different magnitude.

The second step can be considered as the centerpiece of the study. At this step, autoregressive distributive lag (ARDL) model is estimated to determine whether structural change is contributing to the GDP growth rate. Accordingly, structural change is found to have a positive and significant effect on the GDP growth rate of the country both in the short run and long run. This implies that a change in labor productivity as a result of relocation of labor towards more productive sectors, the service sector in this specific case, has an increasing effect on the growth rate of GDP in Ethiopia. This result disproves Moro (2015) which claims that an increase in the share of service sector to GDP reduces both TFP and GDP growth rates.

This chapter is divided in to five further sections. The first section describes a brief overview of overall economic reforms in Ethiopia since 1991. In this section, main economic reforms and overall economic performance of the country are summarized. The second section presents the nexus between structural change and economic growth theoretically so that it can be used as a foundation for our analysis. The third section discusses the methodologies while the fourth section offers a detailed analysis of

structural change and within sector productivity of labor and their interaction with economic growth, and the fifth section concludes.

4.2 A Brief Overview of Economic Reforms in Ethiopia

Structural change and achieving a high level of economic growth rate have been the main concerns of several economic policies in Ethiopia by different regimes.

Before 1991, the country had a command economic system which allows a limited role for private sectors in the economy. During the Derg regime (1974-1991), the nationalization of private enterprises and the introduction of different restrictions on private sectors regarding investment caps and price controls discouraged entrepreneurship and active participation of the private sector in the economy which further affected economic growth and structural change. According to Manyazewal and Shiferaw (2019), even though state-owned manufacturing firms were established during this regime, their performance was poor due to maladministration. Furthermore, frequent droughts and the civil war in the northern part of the country exacerbated the economic problems of the country.

As a result, it was difficult for the country to achieve structural change with the existing poor level of economic growth. Especially, during the end of the 1980s and beginning of the 1990s, the economy was characterized by the combination of having a slow or negative GDP growth rates with a very slow rate of structural change. As figure 1 illustrates, the GDP contribution of sectors didn't show any significant change for ten years between 1981 and 1990. For most of the 1980s, based on WDI, the average contribution of agriculture sector to the overall GDP was 53%. Similarly, the average contribution of the manufacturing sector to the overall GDP was only 4.5%. Therefore, during this period, the country achieved a very slow economic growth with a low level of structural change.

Sectoral contribution of sectors to GDP

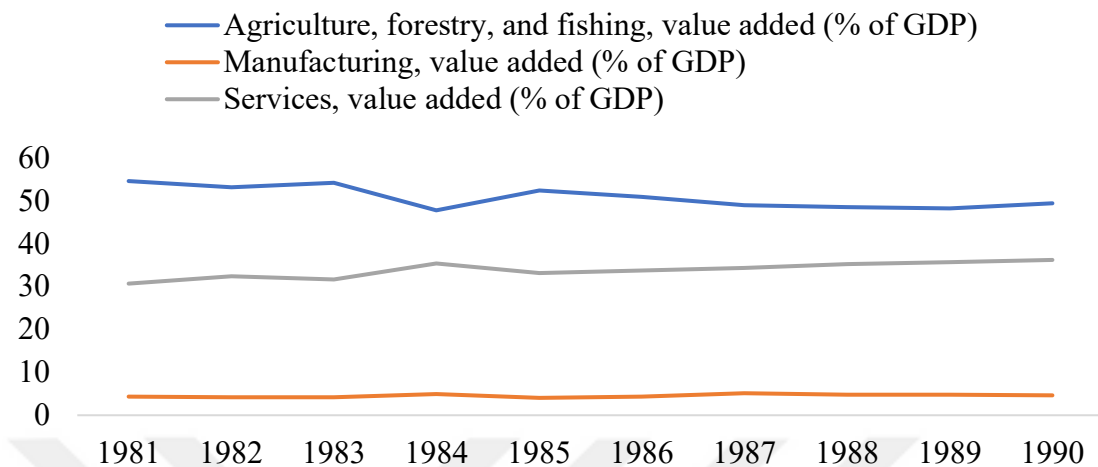


Figure 4. 1: The contribution of sectors to the country's GDP from 1981 to 1990

Source: World development indicators (WDI)

However, after 1991, the transitional government of Ethiopia implemented a series of economic policies in collaboration with international development agencies to achieve macroeconomic objectives: macroeconomic stability, rehabilitation of damaged infrastructures and boosting private sector participation. The initial policy reforms that the government started to implement include lifting different restrictions on the private sector, reinstalling market forces, reducing international trade restrictions especially tariffs on imported products and finally devaluation. But the first and most comprehensive economic policy since 1993 is Agricultural Development Led Industrialization (ADLI). This policy aimed at enhancing productivity growth at smallholder agriculture through the provision of modern agricultural inputs, extension services and road networking with the objective of industrialization (Manyazewal and Shiferaw, 2019). Hence, it is safe to say that ADLI was a policy of structural change. The foundation behind this policy is raising agricultural productivity at small-scale farms which is believed to trigger the establishment of agro-processing firms and increase the demand for industrial consumer goods, therefore, the structure of the economy changes.

Following the implementation of ADLI, the growth rate of agricultural GDP has increased from 1.9% per annum during the 1980s to 2.5% per annum by the year 1990s

(Manyazewal and Shiferaw, 2019). But it is difficult to establish whether it is due to the implementation of ADLI. The fastest growth rate in agricultural GDP is achieved between 2000 and 2014. During this time, agricultural GDP was increasing with an average growth rate of 13.45%, based on the WDI. However, it is not clear whether the increase in the growth rate of agricultural GDP led to the expansion of manufacturing sector as it was predicted by ADLI. Meaningful structural change was not achieved until the early 2000s. But after 2000, the GDP contribution of agriculture and its share of employment have been declining while the contribution of the service sector in both accounts was increasing. The data from WDI confirms that the share of agriculture to the overall GDP has been declining since 1991. The contribution of the agriculture sector to GDP by 1991 was 58.7% but it has declined to 33.8% by 2017. Similarly, the share of agricultural employment has also declined from 90.1% by the year 1991 to 68.22% in 2017. However, there is no empirical evidence that claims the structural change is a result of a rise in the productivity of agriculture.

As it is concluded by Eshete and Kumuyu (2016), the prediction of ADLI regarding the causal link between productivity in agriculture and structural transformation couldn't be established. That is why the government preferred to try other options and proposed a series of growth and transformation plans (GTP-I and GTP-II) intending to join middle income countries by 2025. Specifically, with GTP I, the objective was maintaining an average growth rate of GDP at 11% so that Millennium development goals (MDGs) can be attained between 2010/11 and 2014/15. But it was too ambitious to achieve all the objectives. Therefore, GTP II is introduced to keep the momentum of achievements and lessons to increase the share of manufacturing to GDP to 10% between the years 2015 and 2020. And now the present government is introducing a “home-grown” economic reform with the objective of creating an industrialized lower-middle-income country by 2030.

4.3 Structural Change and Economic Growth: *Theoretical Framework*

Lewis (1954) showed how economic growth can be achieved through the relocation of labor in a dual economy. Based on this approach, the availability of labor in

urban areas for the manufacturing sector at a constant wage is dependent on the existence of family farming in rural areas which are believed to have an unlimited supply of labor at least at the early stage of development. Hence, only the rise in wages in the manufacturing sector can draw labor out of agriculture. With this process, labor will be relocated to the modern sector to increase labor productivity and by implication economic growth. In other words, according to Lewis (1954), the overall productivity in a country increases when labor from the less productive traditional agricultural sector is relocated towards the more productive manufacturing sector. A similar theory is proposed by Chenery and Syrquin (1980) by focusing on establishing the link between the "rise in industry and level of per capita income". Kuznets (1979) also states that "it is impossible to attain high rates of growth of per capita or per-worker product without commensurate substantial shift in the shares of various sectors". The central idea here is that countries that manage to transform their productive resources towards the manufacturing sector have achieved a high level of per capita income.

On the other hand, Solow (1956) developed a neoclassical growth model that shows how economic fundamentals determine the growth rate of an economy. According to this model, economic growth is the result of changes in the saving rate, population growth rate and rate of technological advancement. In other words, two countries with the same population growth rate, saving rate and rate of technological progress will have an equal level of GDP growth rate.

Taking the above into consideration, Rodrik (2013) came up with a unified framework of the above two traditions in the economics of growth. The dual economy approach of Lewis (1954) is combined with the neoclassical growth theory of Solow (1956) to explain economic growth. In this approach, economic growth is determined not only by the relocation of resources from the traditional agriculture sector to modern and highly productive non-agricultural sectors but also through the incentives to save, accumulated physical and human capital, and innovation of new products and production systems.

Therefore, Rodrik (2013) and Rodrik et al. (2016) considered these traditions as the two basic challenges of economic growth: structural change and 'fundamentals'

challenges in growth. While the former deals with the relocation of resources, the latter is focusing on developing broad capabilities. Hence, the nature of growth a country can achieve is dependent on the relative success that countries are removing structural transformation and fundamental challenges. A country is expected to achieve rapid, sustained growth if it manages to achieve a rapid structural change with a high level of investment in fundamentals. Rodrik (2013) summarized the hypothesis as follows:

Table 4. 1
Typology of growth patterns and outcomes

		Structural transformation	
		Slow	Rapid
Investment in fundamentals	Low	No growth	Episodic growth
	High	Slow growth	Rapid, sustained growth

Source: Rodrik (2013)

The important message here is that growth can be modeled by a unified framework of the neoclassical growth model with structural change. Therefore, adding a structural change variable into the neoclassical growth model helps to better predict the growth rate of GDP.

4.4 Methodology

By definition, structural change term is an index that measures the gain in labor productivity due to relocation of labor between sectors. A shift-share decomposition technique is employed to calculate structural change term as it is indicated in chapter 2 section 2.3 and chapter 3 section 3.4.3. As a rule of thumb, when the relocation of labor is towards a more productive sector, structural change term will be positive and helps to increase aggregate productivity growth.

Following the estimation of structural change, econometrics model is employed to determine the effect of structural change on economic growth in Ethiopia by taking

additional control variables into account. To start with the classical growth model, Markus and Francis (2013) employed the following to predict GDP growth rate:

$$\ln y_t = \beta_0 + \beta_1 \ln l_t + \beta_2 \ln k_t + \beta_3 \ln H_t + \varepsilon_t \quad \text{Eq. 12}$$

Where y is GDP, l is labor, k is capital and H is human capital. However, this model cannot only accommodate the main objective of the study but also abandoned the duality nature of the structure of the economy. Therefore, the level value of the structural change parameter which is estimated from the shift-share analysis is incorporated into the model. With a slight adjustment, the following explanatory and dependent variables are chosen, and the model is estimated by using ARDL technique.

Table 4. 2
Dependent and explanatory variables for our model

VARIABLES	
Dependent variable	Explanatory variables
GDP growth rate	Rate of employment
	Structural change term
	Human capital index
	Openness index
	Total factor productivity index

4.5 Results and Discussion

4.5.1 Descriptive Statistics

Table 4.3 shows the descriptive statistics of the major variables involved in this study so that, along with the above explanation, it provides a clearer understanding of the kind of economy we are dealing with.

Table 4. 3

Descriptive statistics of major variables involved in the analysis

S. No	Variable	Mean	Standard deviation	Minimum	Maximum
1	GDP growth rate	6.90	6.16	-8.67	13.57
2	The growth rate of employment	0.03	0.002	0.03	0.04
3	Structural change term	0.12	1.20	-2.74	2.08
4	Within labor productivity	2.54	4.05	-7.31	9.13
5	Openness	0.39	0.25	0.13	1.02
6	TFP growth rate	0.49	3.71	-8.50	6.5

Source: Author's calculation based on WDI

As it is indicated in table 4.3, Ethiopia has achieved an average GDP growth rate of 7% for 1991 - 2017. Especially after the year 2000, the average growth rate of GDP has increased to 9.02%. The highest GDP growth rate is achieved in 2014 with 13.57%. This puts the country as one of the fastest-growing economies in Africa for three consecutive years starting from 2011.

On the contrary, structural change trend has been slow with an average growth rate of 0.12%. This is way below the sample of developing countries' average which was 0.8%. This conclusion is supported by McMillan and Rodrik (2011). They have revealed that in countries like Ethiopia, the growth rate of labor productivity in the non-agricultural

sectors is very low, therefore, relocation may not increase aggregate labor productivity. Particularly, the average growth rate of labor productivity in the manufacturing sector has been 0.033% and it was stagnant for a long period of time. Especially between 2006 to 2017, sectoral labor productivity in the manufacturing sector was even lower than that of agriculture sector.

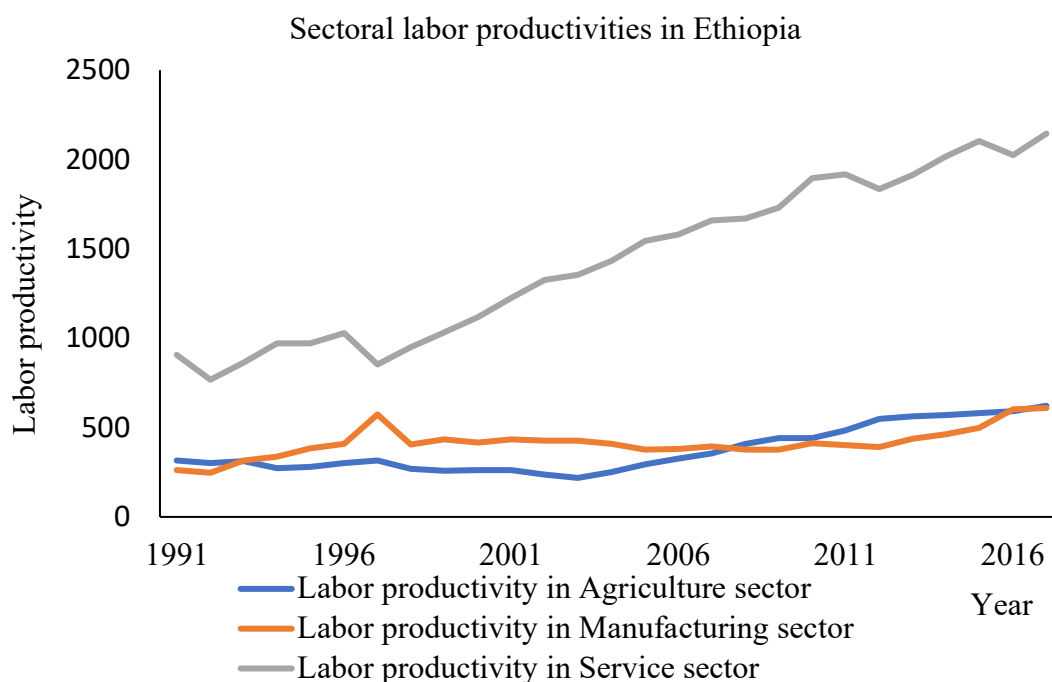


Figure 4. 2: Sectoral labor productivities in Ethiopia

Source: Author's calculation based on WDI

Similarly, the within sector labor productivity growth also contributes to the growth of aggregate labor productivity. Its contribution is greater than structural change term for almost all years considered in this study. To be more specific, the average annual growth rate of the gain in labor productivity due to technological advancement from the three sectors is 2.54% as it is demonstrated in table 4.4.

Table 4. 4

Decomposition of average growth of labor productivity in Ethiopia from 1991 to 2017

S. No	Measurement	Agriculture	Manufacturing	Service	Total
1	Structural change term	-0.46395	0.122935	0.56065	0.1196
2	Within sector labor productivity change	1.07533	0.14290	1.32082	2.5390
Total		0.61138	0.265835	1.88147	2.6586

Source: Author's computation based on WDI

When it comes to structural change at sectoral level, it has been negative for the agricultural sector which contradicts the theory given that the share of employment in this sector is declining. The number of labor force joining the sector is higher than that of leaving the sector which results a negative structural change. However, the average growth rate of the aggregate labor productivity in the sector has increased because the within labor productivity growth rate has been positive and compensates for the decline in the structural change term. Except for the agricultural sector, aggregate labor productivity change is generated from both structural change and the change in within sector labor productivity.

On an average basis, while 68.2% increase in aggregate labor productivities is from service sector, 22.2% is from agriculture sector. And the remaining 9.6% is contributed by the manufacturing sector. This implies that the service sector contributes more to the growth of aggregate labor productivity than other sectors through both structural change and within sector labor productivity growth (figure 4.2 and table 4.4). This advantaged the country to have a steadily increasing aggregate labor productivity since 1991. Figure 4.3 and figure 4.4 show structural change and within labor productivity change at sectoral level.

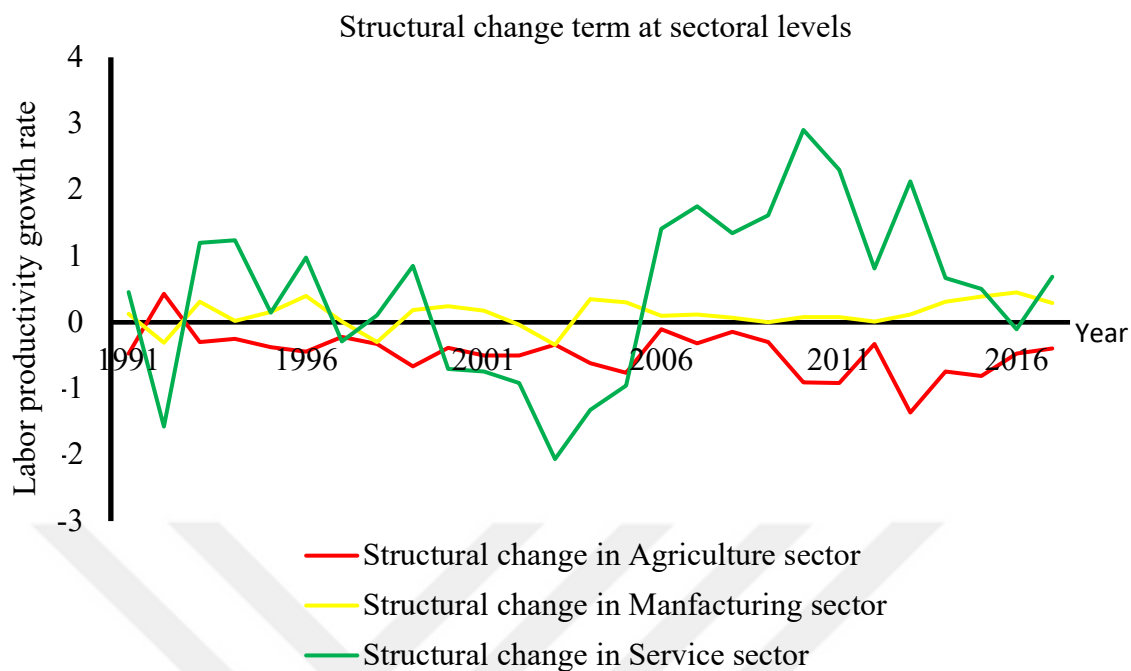


Figure 4. 3: Structural change at the sectoral level

Source: Author's computation based on WDI

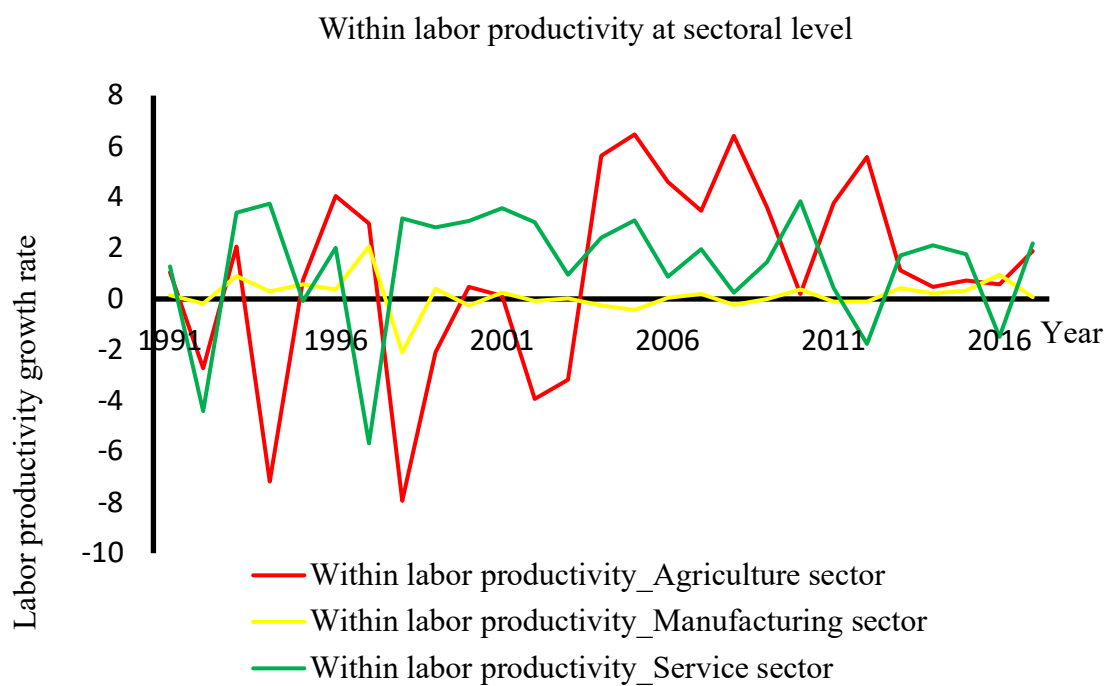


Figure 4. 4: Sector specific within sector labor productivity change in Ethiopia

Source: Author's computation based on WDI

The within sector labor productivity growth rate in the manufacturing sector doesn't show an increasing or decreasing trend rather it is stable with an average growth rate of 0.143%. The growth rate of labor productivity due to technological efficiency is very low. The combination of low levels of structural change term and within sector labor productivity growth underestimates the contribution of manufacturing sector for aggregate labor productivity growth. However, figure 4.4 displays the fact that within labor productivity growth in agriculture and service sectors has been positive for almost all years after 2000. But, along with the structural change term, the service sector is the single most contributor (68.2%) to the increase in the aggregate labor productivity growth of the economy.

4.5.2 Trends in Sectoral Share of GDP

As it is explained in the above sections, Ethiopia is one of the countries that have shown far-reaching transformation in the production structure of their economy. While the share of agriculture sector declines with GDP growth rate, the share of service sector increases. A simple correlation analysis suggests that, regardless of its statistical significance, agricultural and manufacturing GDP are negatively correlated with GDP growth rate. In other words, as the country grows richer, the share of agriculture and manufacturing sectors to GDP decline.

Table 4. 5

Correlation coefficient between sectoral share of GDP with GDP growth rate

	Agrgdp	Manugdp	Sergdp	GDPgr
Agrgdp	1.0000			
Manugdp	-0.2854	1.0000		
Sergdp	-0.8687	0.0049	1.0000	
GDPgr	-0.4788	-0.0053	0.4758	1.0000

Source: Author's computation based on WDI

Similarly, the following graph demonstrates the simple fact that the relative importance of sectors has changed with GDP.

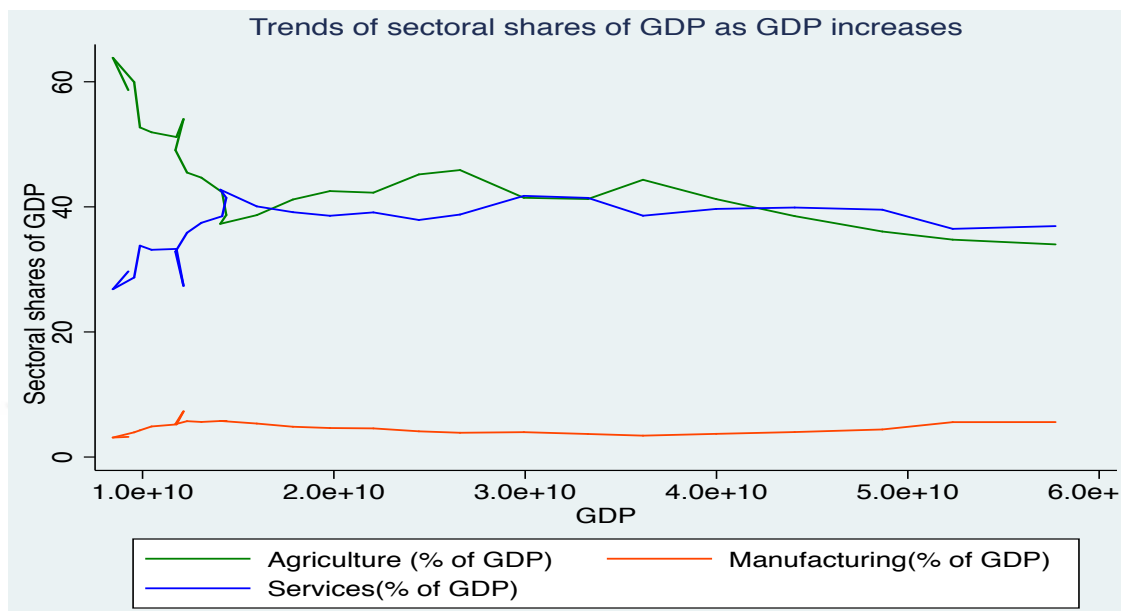


Figure 4. 5: Trend of sectoral share of GDP of the country as GDP increases

Source: Author's computation based on WDI

As it is shown by figure 4.5, with the increase in GDP, the share of service sector to GDP has increased and become the dominant sector while the share of agriculture sector to GDP has declined continuously. The share of manufacturing sector seems non-responsive for the changes in GDP.

Therefore, there are three facts regarding sectoral share of GDP, GDP and GDP growth rate for Ethiopian economy over 1991 - 2017.

Fact 1: On average, the share of service sector in GDP, GDP and GDP growth rate are positively correlated.

Fact 2: The share of agriculture sector in GDP is negatively correlated with GDP and GDP growth rate. And,

Fact 3: The share of manufacturing sector in GDP may not be correlated with both GDP and GDP growth rate.

4.5.3 ARDL Model Regression Results

A scatter plot is used to decide on the mathematical specification of the model that shows the relationship between structural change and economic growth.

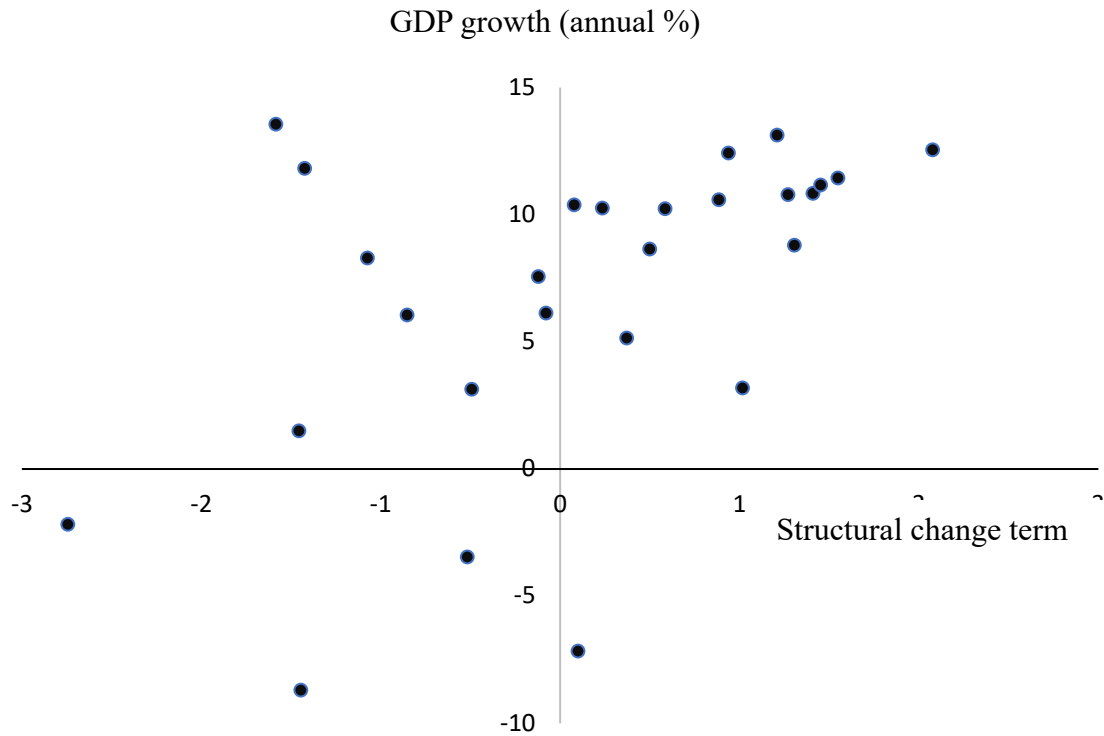


Figure 4. 6: Scatter plot of GDP growth rate with structural change term

Based on fig. 4.6, the model can have either a linear positive relationship or a U-shaped-quadratic mathematical form. But the quadratic form of structural change term is tested, and it is found to be insignificant at 5% significance level. Therefore, the mathematical specification of the model is destined to be linear.

I. Stationary tests

Checking the stationarity of variables is the first step to choose a method of analysis from timeseries models. These models that are used to estimate stationary variables cannot be used for non-stationary variables. According to Shrestha and Bhatta (2018), ordinary least square (OLS) and vector autoregressive (VAR) models result in unbiased estimates only when all variables are stationary. On the other hand, Johansen

cointegration test and ARDL can be used if all variables are non-stationary, while ARDL is the only estimation technique available for a model with a mixture of stationary and non-stationary variables (I(1)).

As a result, keeping this in mind, the Dickey-Fuller unit root test is used to check the stationarity of variables. And four of the variables mentioned on the following table with no sign of “D” are found to be stationary at level form. But those variables with “D” are non-stationary at level but at first difference I(1).

Table 4. 6
Unit root test based on Dickey-Fuller

Dickey-Fuller test for unit root		Number of obs = 26			
	Test Statistic	1% critical value	5% critical value	10% critical value	P-value
TFPGR	-3.425	-3.743	-2.997	-2.629	0.0101
Openness (D.)	-4.196	-3.750	-3.000	-2.630	0.0007
Structural Change (D.)	-6.597	-3.750	-3.000	-2.630	0.0000
Employment rate	-2.963	-3.750	-3.000	-2.630	0.0385
GDP growth rate	-4.081	-3.743	-2.997	-2.629	0.0010
Structural change in the manufacturing sector	-7.370	-3.750	-3.000	-2.630	0.000

Source: Author’s computation using STATA 14

Hence, the variables listed in table 4.6 are a mixture of stationary and non-stationary variables. Therefore, our choice of time series model is narrowed down towards the ARDL model. This model is an ordinary least square (OLS) based model that is most widely used for the time series with mixed order integration (Nkoro and Uko,

2016). According to the authors, ARDL model has many important advantages that makes it suitable for our analysis. These are:

- a. *Since all variables are assumed to be endogenous and free of residual correlation, endogeneity problem is less likely to happen.*
- b. *ARDL model presents a reduced form of equation that shows the long run relationship of the identified dependent and independent variables*
- c. *Helps to identify cointegrating vectors and finally*
- d. *It can be used to derive the error correction model from ARDL by using a simple transformation.* (Nkoro and Uko, 2016)

But the main reasons for me to choose this model are because it can handle a mixture of variables that are stationary at level and first difference, and it also provides the short-run and long-run coefficients so that I can easily interpret the results accordingly. Moreover, since we have 26 data points which is an annual data with a short lag (which is 2), and since the residuals also fulfill the required properties, ARDL model is appropriate to use.

II. Choice of appropriate lag length

In choosing the optimal lag length by using VAR lag order selection criteria, the number of explanatory variables will be decided.

Table 4. 7
VAR lag order selection criteria

Selection-order criteria					Number of observations = 24			
Sample: 1994-2017								
Lag	LL	LR	df	P	FPE	AIC	HQIC	SBIC
0	18.748				8.9e-10	-.9790	-.8879	-.6354
1	194.31	351.12	49	0.000	2.8e-14	-11.53	-10.79	-8.7769
2	292.27	195.93*	49	0.000	1.8e-15*	-15.6*	-14.2*	-10.45*

Endogenous: GDPgr, employment rate, structural change, human capital index, openness, TFPGR
Exogenous: _Cons

Source: Author's computation using STATA 14

Based on table 4.7, the optimal lag length is 2 which is determined based on most of the criteria mentioned in table 4.7 (FPE, AIC, HQIC and SBIC).

III. The Model

One of the major econometric advantages of using ARDL model is the estimation of short run and long run coefficients simultaneously. Hence, given the optimal lag length is 2, ARDL estimation for short run and long run coefficients along with the post estimation diagnosis tests are given in the following sections.

Table 4. 8

ARDL model estimation for short-run scenario

ARDL regression: selected based on the above criteria

Explanatory variables	Dependent Variables
	GDP growth rate
L. GDP growth rate	-0.737*** (0.172)
L2. GDP growth rate	-0.697*** (0.124)
Rate of employment	1,915*** (239.5)
L. growth rate of employment	2,438*** (278.7)
L2. Growth rate of employment	558.9* (260.4)
Structural change term	5.202*** (0.411)

L. Structural change term	3.254**(0.889)
L2. Structural change term	0.831(0.473)
Human capital index	-1,012*** (159.1)
L. Human capital index	751.9**(282.4)
L2. Human capital index	392.2*(196.0)
Openness index	6.836*(2.971)
L. Openness index	9.706**(2.880)
L2. Openness index	-14.21*** (2.390)
Total factor productivity index	0.614*** (0.139)
L. Total factor productivity index	0.592**(0.212)
L2. Total factor productivity index	0.640*** (0.132)
Constant	-297.7*** (34.41)

Observations	24
R-squared	0.990
Sample	1994 – 2017
F (17, 6)	33.61
Prob > F	0.000
Adj R-squared	0.9602
Root MSE	0.9175

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's estimation by using STATA 14

Table 4. 9

Diagnostic tests for the ARDL model estimated in table 4.8

Test	Null hypothesis	chi2(1)	Prob>chi2
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity	Constant variance	1.43	0.2324
Breusch-Godfrey LM test for autocorrelation	No serial correlation	0.684	0.7103
Skewness/Kurtosis tests for Normality	Normally distributed	4.09	0.1294
Ramsey RESET test using powers of the fitted values of GDP growth rate	The model has no omitted variables	F (3, 17) = 1.01	0.4123

Source: Author's estimation by using STATA 14

The post estimation diagnostic tests which are presented in table 4.9 shows that there are no problems of heteroskedasticity and serial correlation. Also, the Ramsey RESET test proved the appropriateness of the mathematical model while normality test based on Skewness/Kurtosis proved the normality of the distribution of the error term. Furthermore, since each of the underlining variables are considered as stand as a single equation, endogeneity problem is no more our concern (Nkoro and Uko, 2016). Therefore, the estimated ARDL model can be used for interpretation.

Similarly, the long run coefficient that determine the effect of structural change is given as follows.

Table 4. 10**ARDL regression for long-run scenario**

Explanatory variables	Dependent Variable: GDP growth rate	
	ADJ	Long run
L.GDP growth rate	-2.434***(0.259)	
Rate of employment		2,018***(129.2)
Human capital Index		54.23***(2.271)
Openness index		0.957(0.866)
Structural change term		3.817***(0.252)
TFP growth rate		0.759***(0.107)
Observations	24	24
R-squared	0.993	0.993
Adj R-squared		0.9729
Log-likelihood		-15.351311
Root MSE		0.9175

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's estimation by using STATA 14

As can be seen from table 4.10, taking R-square and F-test as a measure of goodness of fit, the model explains the relationship very well. 99.3% of the variation in the dependent variable is explained by the variations in the independent variables. The cointegration coefficient is negative and significant which formalizes the long-run model.

Also, post-estimation diagnosis tests presented in Table 4.9 confirmed that all the assumptions are met, and the problem of endogeneity is less of our concern due to the nature of the ARDL model. The error terms in this model are assumed to be correlation free.

IV. ARDL Bound test

The ARDL bound test is conducted to check whether the variables are cointegrated in the long run therefore the long-run coefficients can be used for interpretation.

Table 4. 11
Pesaran/ Shin/ Smith (2001) ARDL bounds test

Pesaran/ Shin/ Smith (2001) ARDL bounds test: H0: No levels relationship				
F-statistics	15.552			
t-statistics				
Optima lag length	2			
Asymptotic critical values	Lower bound, I (0)		Upper bound, I (1)	
	F-test	t-test	F-test	t-test
1%	3.41	-3.43	4.68	-4.79
2.5%	2.96	-3.13	4.18	-4.46
5%	2.62	-2.86	3.79	-4.19
10%	2.26	-2.57	3.35	-3.86

Source: Author's estimation by using STATA 14

As it is indicated in table 4.11, the F-statistics for the bounds test is 15.552 which is higher than the critical values indicated on the table. As a result, the null hypothesis of no levels relationship is rejected and proved the existence of long run relationships between variables. In addition, the t-statistics is given by -9.488 which is also way smaller than the critical values. Therefore, the long-run model estimation which is presented in table 4.10 is legitimized once again.

V. Stability test

Once the long run coefficients are estimated, their stability can be checked by using recursive cumulative estimation of CUSUM and CUSUM square tests. The test results are illustrated by the following figures.

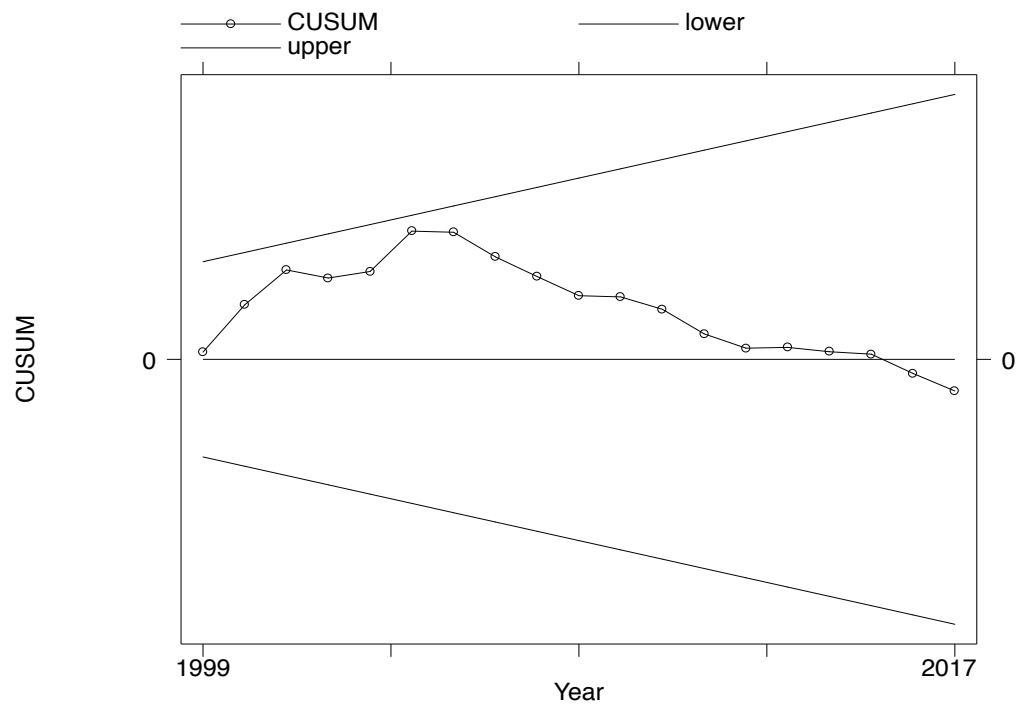


Figure 4. 7: A plot of the cumulative sum of recursive residuals

Source: Author's computation based on STATA 14

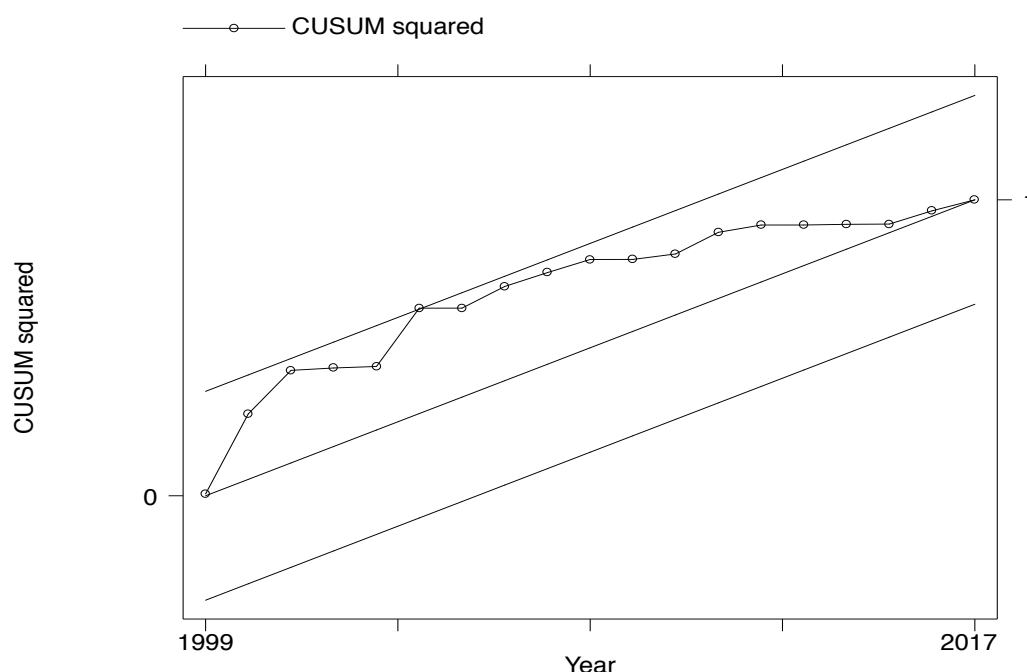


Figure 4. 8: A plot of the cumulative sum of square of recursive residuals

Source: Author's computation based on STATA 14

Fig 4.8 and fig 4.9 shows that CUSUM and CUSUM squared graphs lay between the 95% confidence bands for the period mentioned on the graph which guarantees the stability of the parameter estimates. The coefficients of our ARDL estimates are stable and can be used over time for policy formulation. As a result, there is no structural break in the residual and both the short-run and long-run estimates are used for interpretation as follows.

A. The effect of structural change on GDP growth rate in the short run

Based on Table 4.8, the gain in labor productivity due to relocation of labor affects the growth rate of GDP of the country positively. A 1% increase in labor productivity due to relocation of labor between sectors increases the GDP growth rate of the country by 5.2% for the same year and 3.3% for the next year. Hence, the effect of structural change in terms of labor relocation between sectors cause the growth rate of the economy in two consecutive years. This is because the relocation of labor in Ethiopia has been mainly from low productive agricultural and manufacturing sectors to high

productive service sector. Therefore, it is likely to boost aggregate labor productivity and by implication GDP growth rate.

This result confirms the long-time consensus by economists noting the positive correlation between the intensity of structural (sectoral) shifts and economic growth (Mironov and Konovalova, 2019). It also agrees with Lin (2011) and McMillan and Rodrik (2011). These studies claim that the nature and speed of structural change determine its role in achieving and sustaining economic growth. The structural change in Ethiopia is mainly characterized by the movement of labor from both the agriculture and manufacturing sectors to the service sector. The average labor productivity in the service sector is almost four times higher than labor productivity in agriculture and 3.5 times higher than labor productivities in the manufacturing sector for 1991 - 2017. Therefore, the movement of labor towards the service sector happens to be the main channel that can result high level of labor productivity and economic growth. The relocation of labor from agriculture to the manufacturing sector didn't result in an increased labor productivity and growth rate of GDP. Even if the share of employment in the manufacturing sector has increased from 6% to 11.4%, the relocation of labor towards the manufacturing sector has reduced aggregate labor productivity for 2008 - 2016.

Furthermore, openness, total factor productivity and growth rate of employment have a positive and significant effect on the growth rate of GDP at 5% significance level. On the other hand, the level value of the human capital index and lagged values of GDP growth rate are affecting GDP growth rate negatively in the short run.

Many literatures agree on the idea that opening up the economy helps to increase GDP growth rate. Unlike Rodriguez (2007), most literatures (for example, Harrison, 1996; Andersen and Babula, 2008; Romalis, 2007; Idris et al., 2019; Keho, 2017) support the positive linkage between openness and GDP growth rate in developing countries. Idris et al. (2019) studied the linkage between trade openness and economic growth for 86 developing and OECD countries and they claim that openness promotes economic growth for both groups of countries. Keho (2017) came up with similar result for Cote d'Ivoire which has, more or less, similar economic structure with Ethiopia. Theoretically, especially in the long run, trade openness enhances economic growth through increasing

allocation efficiency, providing access to goods and services, easy access to technologies through technological diffusion and knowledge transfer. Hence, Ethiopia might have benefited from international trade in terms of access to markets for its exports, knowledge and technical transfer and import of productive capabilities.

Similarly, TFP is one of growth promoting factors in Ethiopian economy. It is expected to be positively and significantly affecting GDP because it is the share of output of an economy that cannot be explained by the amount of capital, labor and other factors used in the production process. Usually, it is considered as a proxy variable for technological efficiency. Therefore, average annual growth rate of TFP in the country for the period 1991 to 2017 is 0.5%. This has contributed for the positive GDP growth rate of the country. Based on the above estimation result, a 1% increase in TFP growth increases the growth rate of GDP by 0.6% for three consecutive years.

On the other hand, human capital is found to have negative effect on GDP growth rate. However, it has a positive effect on economic growth after a year. A one-year lag value of human capital has a positive and significant effect on the GDP growth rate at 5% significance level, a two-year lag value of human capital is significant at 10% significance level. Hence, human capital affects GDP growth rate after a time lag.

B. The effect of structural change on GDP growth in the long run

In addition to the short-run relationship, the long-run relationship is also estimated and presented in table 4.10. Based on the estimation result, structural change term is found to affect the GDP growth rate in the long run positively at 1% significance level. A 1% increase in labor productivity due to relocation of labor from one sector to the other, long-run growth rate of the country increases by 3.8%. This has a huge implication for economic policy. On an average basis, as long as the relocation of labor contributes to the increase in labor productivity, the growth rate of GDP will increase both in the long run and short run. This result is consistent with Mironov and Konovalova (2019) where they came up with similar relationships for the world economy and Russia, Zulkhibri et al. (2015) for Malaysia, Nigeria, Turkey, and Indonesia over 1960-2010, Nguyen (2018) for Vietnam between 1990 and 2013.

4.6 Conclusion

In this chapter, ARDL model is employed to determine the effect of structural change on the GDP growth rate of the Ethiopian economy by recognizing both investment fundamentals from the Solow growth model and structural change from Lewis' duality model. Structural change term and within sector labor productivity are extracted from aggregate labor productivity and sectoral share of employment by using a shift-share decomposition technique. Other variables used in the analysis are taken from World development indicators (WDI) for 1991-2017.

The structure of Ethiopian economy has shown drastic change over 1991-2017 both in terms of sectoral share of total employment and GDP. For example, the contribution of the agriculture sector to GDP by the year 1991 was 58.7% but it has declined to 33.8% by the year 2017 which is a 24.9% decline over 26 years. The share of employment in this sector has also been declined from 90.1% to 68.22% during the same period. On the contrary, the share of the service sector has been increasing both in terms of share of total employment and its contribution to GDP. By 1991, the service sector was accounted for 29.67% of the total GDP and 15.92% of total employment. But by the year 2017, its share of GDP has increased to 36.92% while its share to the total employment became 21.48%. As a result, the service sector becomes the dominant sector in the economy in terms of its contribution to GDP. It is also the fastest growing sector in the economy in terms of its contribution to the total employment.

To determine the effect of structural change on GDP growth rate both in the long run and short run, the Autoregressive distributive lag (ARDL) estimation technique is used because it can handle a mixture of stationary and non-stationary variables together. Also, this technique estimates parameters for both short-run and long-run scenarios. As a result, the gain in labor productivity due to relocation of labor from low productive to high productive sectors increases the GDP growth rate of the economy both in the long run and short run. This may include the relocation of labor from agriculture and manufacturing sectors to the service sector in the short run and relocation of labor from agriculture to modern sectors in the long run.

Therefore, the country shall promote the relocation of labor from agriculture to modern sectors so that it can achieve a high level of growth rate of GDP both in the short run and long run.



CHAPTER 5

5. CONCLUSION

Structural change is a shift in the relative importance of sectors in an economy. It involves the transformation of an economy from low productive and labor-intensive to high-productive and skill-intensive economic activity. It is a change in the aggregate component of the economy. It happens when some sectors grow faster than others due to the increases in productivity of modern sectors which further results in a shift in the sectors to the total aggregates.

There are two divergent structural change theories known to literature. The first theory is contributed by Kongsamut et al. (2001). This theory is based on Kaldor's balanced growth theory. Introducing the consumer non-homothetic preference to Kaldor's balanced growth theory induces imbalance in the productivity growth of sectors. This further ignites relocation of resources and then change in the production structure of the economy. The second theory is developed by Baumol (1967) and it is based on sector biased technical change. Sector biased technological change leads to the rise in productivity of one or more of the sectors which leads to the shift in the sectoral contribution of GDP.

Empirically, structural change trends in developed and developing countries are dissimilar. While developed countries successfully transform their economies to highly productive service sector dominant economies after the two stages of structural change, developing countries are demonstrating a diverse structural change trends. For example, African countries are growing service sectors at very low level of GDP per capita while Latin American countries deindustrialize at the same stage. Asian countries are showing a structural change trend that is similar to that of developed countries.

For better representation of the difference in the structural change trends of developed, low-income developing and lower-middle income developing countries, I employed a framework used by Bah (2011). This framework predicts the value-added share of sectors based on their respective per capita income. Accordingly, for all groups of countries, the share of agriculture to the overall GDP of the country is dependent on

the level of GDP per capita. The share of agricultural GDP is higher for low-income developing countries than other group of countries. In other words, the rate of decline in the share of agriculture declines as GDP per capita of the country increases.

On the other hand, the value-added share of the manufacturing sector is found to have a positive relationship with GDP per capita for of low and lower-middle income countries. As these countries grow richer, the share of manufacturing sector to GDP increases. However, for developed countries, it has a non-linear relationship with GDP per capita. I.e. GDP per capita has a positive effect on the share of manufacturing sector but its marginal effect declines as the country grow richer. It becomes negative as log of GDP per capita passes 10.5.

Therefore, identifying factors that determine structural change of different groups of countries helps to track the difference in structural change trends. To this end, I have conducted a panel GLS estimation technique due to its advantage over heteroskedasticity and autocorrelation problems. The summary of results are presented in table 2. 4 and table 2. 5. Accordingly, the main factors that results in a difference in structural change, which is measured based on growth rate of labor productivity due to relocation of labor between sectors, are relative dependency on raw material export, regulation quality index, the ratio of service GDP to manufacturing GDP, within sector labor productivity and GDP per capita of countries. While dependency on raw material export, agriculture sector employment, and GDP per capita increased structural change in developing countries, regulatory quality index and the ratio of service GDP to manufacturing GDP serves the opposite. But for developed countries, while dependency on raw material export GDP per capita affects structural change negatively, the ratio of agricultural employment to manufacturing employment increases structural change.

On the other hand, structural change has a far-reaching influence on economic performance. Its effect can be witnessed at different levels of aggregation. It results in a change in the importance of major sectors in an economy. For example, when labor moves from low productive sector to high productive sector, aggregate productivity rises, and income expands. However, it may not be always true, especially for low-income developing countries. Therefore, I investigated (1) whether a shift in structural change

leads to a change in TFP growth of the overall economy (2) the effect of the shift in structural change at disaggregated sectoral level labor productivity.

As a result, structural change has a positive effect on the growth rate of TFP for a sample of African countries. This implies that relocation of labor towards more productive sector increases TFP growth rate. Hence, countries shall work to advance the relocation of labor from the low productive sectors to the high productive sectors so that they can increase total factor productivity growth of their economy.

However, structural change doesn't have any effect on sector-specific labor productivity. Since a considerable number of labors are joining agricultural sector every year, the change in productivity of labor in the agriculture sector due to relocation of labor is insignificant. On the other hand, relocation of labor is a long-term and costly decision and it follows a relatively slow process. Therefore, even if there is a high level of sectoral labor productivity gap between modern and traditional sectors, it takes time to fill the gap through a slow process of relocation. As a result, the modern sector may not be matured for a while to result in a change in labor productivity as a consequence of labor mobility. Moreover, the underdeveloped service sectors that resides in urban areas provides an opportunity as a new area of employment and business startups for the relocated labor which keeps its effect on labor productivity non-existent.

Finally, the dissertation aimed at showing the effect of structural change on the growth rate of GDP in Ethiopia. I formulated a combined theoretical framework based on Solow's growth model and Lewis' duality model to predict the impact of structural change on growth rate of GDP. By using ARDL model, I found that, the change in the production structure of the country helps to increase GDP growth rate both in the short-run and long-run. Therefore, the country is recommended to relocate labor from agriculture to the service sector so that aggregate productivity increases and by implication the growth rate of GDP.

My recommendation for future research includes developing a better measure of structural change of an economy. In particular, measuring the change in the structure of the economy by using a change in aggregate labor productivity due to relocation is a bit

sloppy. Therefore, there is a dire need to develop a better measure of structural change. My second recommendation will be including recent developments that reversed international integration and globalization. To be more specific, following the financial crisis of 2008 and later COVID pandemics in 2019, countries intend to close their borders for the movement of people and products. Therefore, determining the effect of these factors on the structural change trends of countries may have an interesting implication.



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