Essays on The Path to Industrialization in Ethiopia

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A Dissertation Submitted to the Department of Economics School of Graduate Studies of Addis Ababa University in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in Development Economics

Addis Ababa University
Addis Ababa, Ethiopia
June 2020

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Acknowledgments[2]

I am most grateful to my main supervisor Professor Almas Heshmati for his continuous engagement in guiding and supervising me. This long journey would not have come to an end without his serious follow up at every step of my work for this thesis. Professor Heshmati has truly been an inspiration and motivation in this process. He is extraordinarily knowledgeable, hardworking, punctual, and kind to all of his students. He was critical and essential in the development of this thesis. He taught me to value knowledge first and foremost, to work hard, to focus, be punctual, to be independent and generously share what I learned with others. I would also like to express my appreciation for my AAU supervisor Dr Atlaw Alemu for his valuable inputs for this thesis through the discussions that we had on each paper and for the material he provided which was valuable for my study. My sincere gratitude also to my external reviewer Professor Anna Bottasso for exhaustively reading and critically commenting on my thesis which helped me improve it. I am also very grateful to my external examiner Professor Surafel Girma and my internal examiner Professor Tasew Weldehana for their critical comments and suggestions on the thesis.

Many thanks to Professor Charlotta Mellander, Associate Professor Mikaela Backman, Associate Professor Pia Nilsson, Dr Sofia Wixe, Dr Johannes Hagen, and Dr Andrea Schneider for their assistance in reading my thesis and providing comments which enabled me to upgrade it to its current version based on their critical comments. My heartfelt thanks also for Neway Gebreab for the detailed discussions we had and his valuable comments which I used as inputs while writing the thesis. I am also grateful for the critical comments on the first draft of my paper by senior researcher Dr Mulu Gebereeyseus who he is an Ethiopian senior expert in firm and industry research at EDRI. I also would like to recognize Naod Mekonnen's support; he is a PhD candidate, senior researcher at the World Bank and a staff member at the Addis Ababa University Technology Institute. He has been reading and providing comments on the thesis and discussed all the sections in the papers almost every day with me. I cannot thank him enough for sharing his time, knowledge, and skills. Yonatan Desalegn is a PhD candidate at the Department of Economics, Addis Ababa University. He is a very special human being and a very knowledgeable young man who provided his support throughout my study period. I would like to appreciate his support on this long journey.

Many thanks also to Professor Alemayehu Geda, Dr Zerayehu Semi, Ato Kagnew Wolde, Dr Hibret Belete, Dr Seid Nuru, Dr Assefa Admase, Dr Solomon Tsehay, and Dr Kahesay Berhane for spending time reading my papers and providing applicable and valuable comments. My cordial thanks to H.E. Dr Arkebe Oqubay for spending time discussing my thesis and providing documents which were valuable for my study. I would like to express my special gratitude to Professor Hans Lööf for organizing a seminar at KTH, Royal Institute of Technology in Stockholm, Sweden. I am also grateful for the contribution of the Swedish International Development Agency (SIDA), the Jonkoping International Business School (JIBS), Addis Ababa University (AAU) Department of Economics and College of Business and Economics (CoBE), and staff members of all institutions. Monica Bartels' contribution to this thesis is significantly huge in organizing and facilitating trips to Jonkoping for me to present my papers at seminars. Likewise, I am indebted to all staff members at the Jonkoping International Business School (JIBS), mainly all staff members of the economics doctoral program at JIBS, in Sweden. Many thanks for their significant

[2] Thank You God!

contributions during the seminar presentations and providing applicable and valuable comments which I used for improving the thesis.

My family is the most important priority in my life. My family acted as the first school I ever attended, as they taught me the fundamental values necessary for this journey in life. I am who I am today because of my family. I would not trade their love, support, guidance, prayer and reliability for anything on earth. Wendimgashe, my kind uncle Tesfaye Wondimu, I do not have enough words to express my gratitude for your fatherhood and your trust in my potential. You taught me what forgiveness and true love means. I thank you for being a kind father who was there for me at the lowest and highest moments in my life. My mom is the strongest women I have ever seen in my life. My mother is a determined woman, with undeniable and unwavering strength. Any goal she sets will undoubtedly be accomplished. My mom is a true visionary. She has bestowed upon me her strength, her commitment, her dedication to hard work and her best life skills. She constantly motivates me with words of encouragement coupled with relentless prayer for me. Without her prayer and support, I could not have made it this far. To my angel, Henosye, you are the most precious gift in my life and the reason why I must strive to be the best version of myself. I love you more than words can express; and, I will work so hard to be the best role model for you.

Many thanks go to my dad who believes in education for all, particularly educating women. He inspired me to proceed in my career and encouraged me to pursue the highest education level that I could attend. I am thankful for his inspiration and strong wish to see me at the highest point. Ermiye and Dawitye are my brothers who raised me and loved me as if I were a princess. They trusted in me more than I trust in myself. I have a great deal of love and respect for them both. Ermiye, I will not forget the critical advice you gave me back when I was in the eleventh grade, as it was a turning point in my life. You saw my potential and encouraged me to reach it. With the help of God, we did it. This was the life path I always dreamed and worked hard for. Linda Lee, I am so grateful for all your kind support and consistent sisterly love. Arsu and Dilu, my little sisters, I will be there for both of you whenever needed as I am responsible for guiding your future careers. I love you both. Last but not the least, my appreciation goes to my family friends Ato Dagnachew Tefera, Ato Getanhe Adera, Tolii Jambo, my very talented friend Eyayu Genet who always encouraged me to reach the highest level, my colleagues, and all the people who were there to support me in my study and my career.

Many thanks to all!

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Addis Ababa, Ethiopia, May 2020.

[3] This dissertation required an intensive engagement with detailed remarks of my main supervisor along with many other high-profile scholars; all errors that remain are mine.

Dedication[4]

The thesis is dedicated to my family and my country!!!

[4] I will strive to be the best version of myself for both of you!!!

Abstract

This study explores the overall performance of the manufacturing sector in Ethiopia over time. It addresses two fundamental research questions: What is the long run impact of manufacturing growth on the Ethiopian economy? and what have been the major explaining factors of Ethiopian manufacturing performance overtime? It uses the endogenous growth theory, specifically the Kaldor growth hypothesis; the heterodox economic approach with a focus on institutions, balanced and unbalanced theories of growth and the public policy endogenous growth theory as theoretical formulations to empirically investigate the research questions. The research covers five independent articles addressing the two major questions using different dataset and estimation approaches. For the time series data, it uses the vector error correction model (VECM), Granger causality, the impulse response function and the autoregressive distributive lag (ARDL) parametric estimation approaches. For cross-sectional data, a non-parametric social accounting matrix (SAM) multiplier analysis is computed. The research also uses industry level panel data for exploring the link between energy use and labor productivity in the manufacturing sector with a dynamic panel estimation approach.

The findings show that there is a long run positive relationship between manufacturing and economic growth validating Kaldor's growth hypothesis in Ethiopia. The empirical analysis of the political economy of industrialization in Ethiopia shows that institutions, especially political institutions, have been one major setback limiting the performance of the manufacturing sector in the country. This shows that the heterodox economic approach with its institutional economic perspective is another framework to better understand the industry and economic structure of Ethiopia. The sectoral linkage analysis shows a weak direct and total linkage of multi-faceted industries with other sectors. Results, suggests that the agriculture-based industry is relevant for Ethiopia with higher output, GDP, demand and income multiplier coefficients. The research further validates the public policy endogenous growth theory in Ethiopia at the industry level, with a significant effect of public policy instruments on Ethiopian industry growth in the long run. The last paper confirms that energy has been other major factor affecting manufacturing productivity in Ethiopia. Yet, the research validates different theories empirically taking Ethiopia as a case study. In a nutshell, the study [5]implies a focus should be given to the political economy environment, agriculture-based industries, public policy instruments and efficient energy use to induce industrialization in Ethiopia.

Keywords: Kaldor's growth hypothesis; Manufacturing growth; Political Economy: Sectoral linkage; Public policy; Energy; Productivity; Ethiopia

JEL Classification Codes: C21; E12; O14; C60; E62; Q4; D2

[5] Policy implications of the studies are presented separately in individual papers

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Acronyms

ADLI: Agricultural Development Led Industrialization

AIC: Akaike Information Criterion

ARDL: Autoregressive Distributive Lag Model

AVA: Agricultural Value Added

CSA: Central Statics Authority

DGMM: Difference Generalized Method of Moments

EDRI: Ethiopian Development Research Institute

EEA: Ethiopian Economic Association

EOI: Export Oriented Industrialization

EPRDF: Ethiopian People's Revolutionary Democratic Front

EPZs: Export Processing Zones

EPRDF: Ethiopian People Republic Democratic Front

FDRE: Federal Democratic Republic of Ethiopia

FE: Fixed Effect

FFYP: First Five-Year Plan

GCC: Gulf Cooperation Council

GDP: Gross Domestic Product

GGDC: Groningen Growth and Development Center

GMM: General Moment Method

GTP I: Growth and Transformation Plan One

GTP II: Growth and Transformation Plan Two

GVA: Gross Value Added

HQIC: Hannan Quin Information Criterion

ICT: Information and Communication Technology

IDS: Industrial Development Strategy

IFPRI: International Food Program Research Institute

IPDC: Industry Park Development Cooperation

IPS: Industry Parks

IRF: Impulse Response Function

ISI: Import-Substitution Industrialization

ISIC: International Standard Industrial Classification

IT: Information Technology

IVA: Industry Value Added

MCI: Ministry of Commerce and Industry

MoFEC: Ministry of Finance and Economic Cooperation

MP: Manufacturing Productivity

MPED: Ministry of Planning and Economic Development

MVA: Manufacturing Value Added

NBE: National Bank of Ethiopia

OLS: Ordinary Least Square

PASDEP: A Plan for Accelerated and Sustained Development to End Poverty

PPP: Private Public Partnership

RE: Random Effect

R&D: Research and Development

SAM: Social Accounting Matrix

SBIC: Schwartz Bayesian Information Criterion

SDPRP: Ethiopian Sustainable Development and Poverty Reduction Program

SEZ: Special Economic Zones

SFYP: Second Five-Year Plan

SGMM: System General Method of Moments

2SLS: Two Stage Least Square

SVA: Service Value Added

TFYP: Third Five-Year Plan

TYPP: Ten Years Prospective Plan

TSCS: Timeseries Cross-sectional

UNCTAD: United Nations Conference on Trade and Development

UNIDO: United Nation Industrial Development Organization

VECM: Vector Error Correction Model

WDI: World Development Indicator

1. Introduction and Summary of the Thesis

1.1 Introduction

In a broad sense, development can be considered as a process and pathway for reconciling the economic and social dimensions of human life. This can be done through the promotion of sustainable agriculture and industrial production, education, innovation with different forms of knowledge, and recognition of cultural values (Baker, 2015). The quest for sustainable growth and development became the most captivating topic for economists all over the world ever since Adam Smith's inquiry of the wealth of nations in the late 18th century (Smith, 2010). It was after the industrial revolution that economies accelerated with innovations and industrial upgrading (Lin, 2012). Industrialization is treated as a key element of development in literature with different strategies for pursuing it (Echevarria, 1995; Lewis 1954).

Industrialization entails a transformation in humankind and explains the differences in economic performance across nations. It basically starts with industrial revolutions that began in the second half of the 18th century (Lin, 2012; Schwab, 2016). The first industrial revolution started with the steam engine and transformed society from farming to new manufacturing processes. This was followed by the second industrial revolution in 1900 which ushered in an era of rapid industrialization with electricity and oil powering mass production (Xu et al., 2018). The third industrial revolution started in the 1960s with automatic production using electronics and information technology. The fourth industrial revolution is wider in scope in areas ranging from renewables to quantum computing and from gene sequencing to nanotechnology (Schwab, 2016).

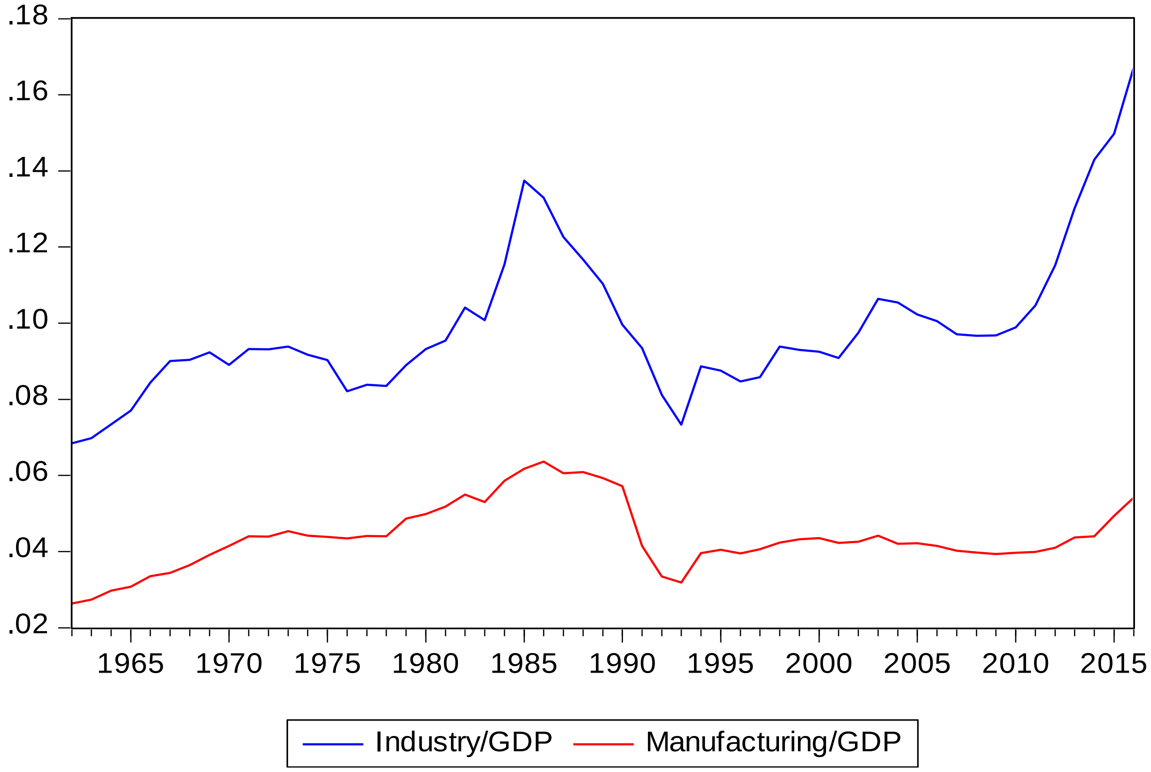
All countries in the world were poor at the beginning of the 18th century. Economies in the developed countries predominantly relied on agriculture with a very low growth of GDP per capita during the first half of the 18th century (Lin, 2012). In their course of agro-industrialization, development's priority focused on labor intensive agriculture-based industries such as freshwater fisheries, livestock, horticulture, tea and fruit growing, and other off-farm activities along with large scale farming (Chuanmin and Falla, 2006). In Africa, till recently agriculture is the primary source of livelihood and the backbone of the economy which accounted for 25 percent of the continent's GDP with the lowest and decreasing share of manufacturing in GDP (Woldemichael et al., 2017). In fact, the share of manufacturing in GDP decreased from 12 percent to 10 percent between 1996 and 2015 while the service sector contributed 50 percent to GDP and employed 60 percent of the workforce in some African countries. This shows [6]premature deindustrialization with a dominant service sector followed by agriculture and a very low share of the manufacturing sector in GDP (Rodrik, 2016; Woldemichael et al., 2017).

In Ethiopia, industry emerged as an economic unit only at the turn of the 20th century (Gebreeyesus, 2010). The famine in the 1980s and the low level of urbanization led to

[6] Premature deindustrialization indicates the dominance of service sector over agriculture sector with a very low contribution of manufacturing sector in the economy (Rodrik, 2016).

agriculture receiving high priority for social and food security reasons (UNIDO, 2018). For decades, economic progress was sluggish with poor performance of all the sectors including agriculture and industry (Ejigu and Singh, 2016). The contribution of manufacturing to Ethiopian GDP did not exceed 5 percent for decades and recently the dominance of agriculture has been overtaken by the service sector (EEA, 2017; Ejigu and Singh, 2016; Gebreeyesus, 2010; Rodrik, 2016).

Two fundamental facts motivated this study. In Figure 1.1, the vertical line represents share of manufacturing to GDP while the horizontal line represents the year from 1960 to 2016. The figure shows the first underlying fact, that the share of manufacturing to GDP in Ethiopia has never exceeded 5 percent for decades indicating [7]output deindustrialization (EEA, 2017; Gebreeyesus, 2010).



[8]Figure 1-1: Manufacturing's share in GDP over time (1961-2016)

The second motivating fact is that the dominance of agriculture in the economy has been overtaken by the service sector. [9]Figure 1.2 gives the three sectors' share in GDP in Ethiopia from 1960 to 2016. In the figure the vertical line shows the share of sectors to GDP while the horizontal line indicates the year from 1960 to 2016. Recently, the share of

[7] Output deindustrialization indicates the low share of manufacturing to GDP of an economy (Cáceres, 2017).
[8] In figure 1.1, the top line indicates the share of industry to GDP while the bottom represents share of manufacturing to GDP
[9] In figure 1.2, the top line represents the share of agriculture to GDP while the middle line stands for the share of service to GDP and the line in the bottom shows the share of industry to GDP in Ethiopia overtime.

the service sector in GDP is followed by agriculture with a very low share of manufacturing indicating premature deindustrialization in Ethiopia (Ejigu and Singh, 2016; Rodrik, 2016).

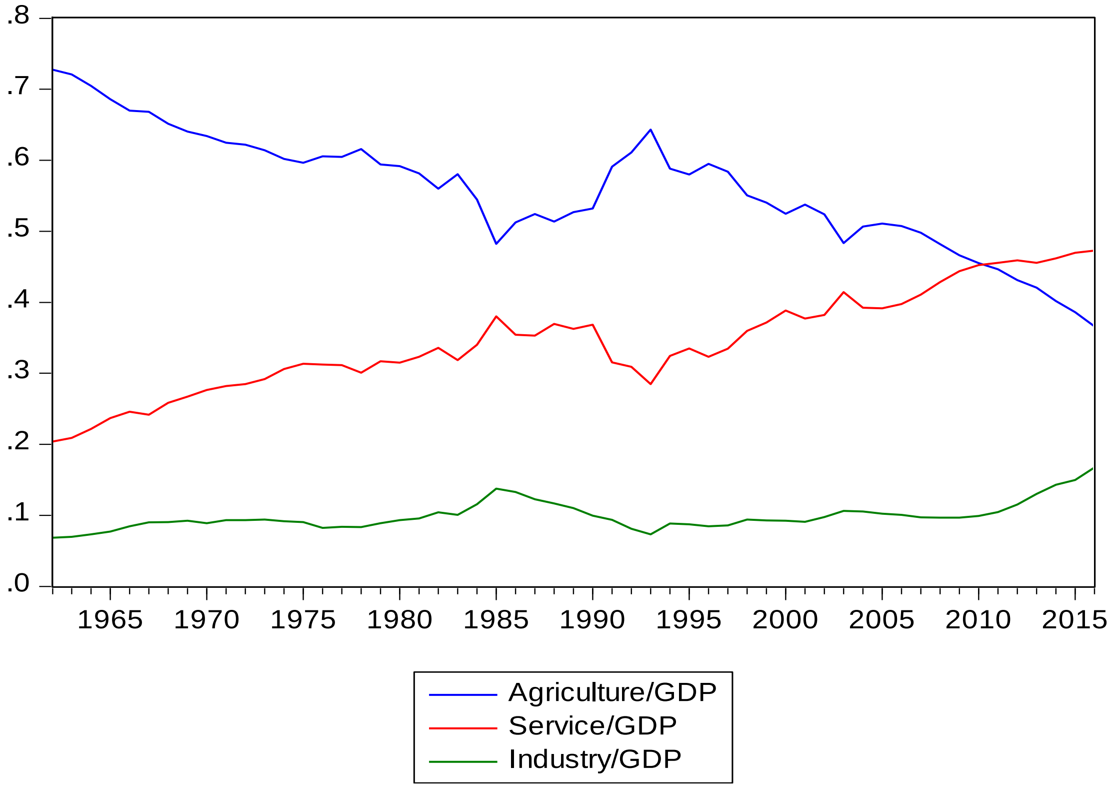


Figure 1.2: Sectors' shares in Ethiopia's GDP over time (1960-2016)

The two figures above indicated the industrialization pattern overtime in Ethiopia. However, empirical studies related with output and premature deindustrialization in Ethiopia is scantly available. Yet, literature that validates the impact of manufacturing on Ethiopian economic growth rarely studies the factors that explain this fact. This requires serious engagement for identifying and prioritizing the major constraints in the industry sector, targeted interventions for each constraint, and presenting a clear account of the required inputs, technology, management and skills in both the short and long run. To address this research gap, this thesis produced five independent articles. The first article explores the long run association between manufacturing growth and the Ethiopian economy. The remaining four articles investigate the empirical impact of the political economy, sectoral linkages, public policy instruments, and energy use on manufacturing growth in Ethiopia using different datasets and methodologies.

1.2.Research Questions

There are two contrasting facts about people's living standard across the world. The developed nations are better-off while many developing countries are suffering from inequalities, multidimensional poverty, and poorly managed use of resources leading to poor growth below their potential (Kim and Heshmati, 2014). In development literature, structural change is the core to explain the two contrasting facts which indicates a change in the composition of an aggregate. It basically reflects the reallocation of resources for increasing production and changing the share of sectors that make up the economy in terms of value added (Alcorta, 2015; Syrquin, 2007). Structural transformation represents the transition from low productive to higher productive activities in economies (Oyelaran-Oyeyinka and Lal, 2016).

Structural change is strongly associated with industrialization which shifts economies from agriculture to manufacturing (Alcorta, 2015). Industrialization has been the path followed by the modern world which enabled sustaining productivity growth that resulted in the division of the world into poor and rich economies. It is also pivotal for trade and investments (Oyelaran-Oyeyinka and Lal, 2016). It can be measured either by the share of manufacturing output to GDP or the share of manufacturing employment to total employment (Cáceres, 2017; Grabowski, 2015; Oyelaran-Oyeyinka and Lal, 2016). Indeed, it has been a core stone for catching up and convergence for emerging economies (Rodrik, 2016). Agriculture-based industrialization was the focus soon after the Second World War which resulted in enormous leaps in agricultural productivity through the specialization and mechanization of agricultural production. Recently the fourth-generation industrialization has reached the most updated cyber physical systems (Lin, 2012; Schwab, 2016).

Empirical literatures validate that, the economies of the United States and Europe managed to structurally transform themselves through industrialization while non-western countries like Japan, South Korea, and Taiwan managed to catch up and converge with them through industrialization (Chang, 2002; Rodrik, 2016; Syrquin, and Chenery,1989). However, for most developing and sub-Saharan African countries which are struggling with poverty, industrialization is one candidate to facilitate catch up and lead to convergence in their growth (Oyelaran-Oyeyinka and Lal, 2016; Woldemichael et al., 2017). In Ethiopia, the manufacturing sector has had a very low share in GDP for decades combined with the service sector’s dominance recently in the economy indicating premature deindustrialization (Ejigu and Singh, 2016; Gebreeyesus, 2010; Rodrik, 2016). There are very few empirical studies that explore the association between manufacturing and growth in the long run on the one hand, and the pillars that explain industrial growth on the other in the case of Ethiopia. Hence, this thesis addresses two main research questions.

1. What is the effect of manufacturing growth in the Ethiopian economy?

The first research question has four disaggregated specific questions all being addressed in the first paper mainly focusing on exploring the impact of manufacturing growth on Ethiopian economy overtime. The specific research questions are:

- How does manufacturing growth impact economic growth in Ethiopia in the long run? (Kaldor growth hypothesis)
- How does manufacturing growth affect productivity in the sector? (Kaldor second law)

- What is the impact of manufacturing growth on the productivity of other sectors? (Kaldor third law)
- Is the contemporary premature deindustrialization pattern empirically valid in Ethiopia? (Rodrick model)

2. What are the major pillars of manufacturing growth in Ethiopia?

The second research question aims at empirically identifying the major explaining factors of manufacturing growth in Ethiopia overtime. It is disaggregated in to four independent questions each research question being addressed independently in an individual paper:

- How does the political economy affect industrialization in Ethiopia overtime?
- What is the direct and total linkage of the industry with other sectors in Ethiopia?
- What is the role of public policy instruments in industry growth in Ethiopia?
- How does energy use affect labor productivity in Ethiopian manufacturing industries?

1.3.Objective of the Study

This research explores the path to industrialization in Ethiopia and assesses the performance of manufacturing industry in Ethiopia overtime. To address the research questions listed above it focuses on the following objectives:

- To empirically investigate the effect of manufacturing growth in Ethiopian economy in the long run. (paper 1)
- To explore the impact of political economy on Ethiopian industrialization process across different political regimes. (paper 2)
- To examine the direct and total linkage of industry with other sectors in Ethiopian economy. (paper 3)
- To investigate the effect of public policy instruments such as tax and public expenditure on industry performance in Ethiopia. (paper 4)
- To empirically assess the effect of energy use on manufacturing labor productivity in Ethiopia. (paper 5)

1.4.Theoretical Framwork [10]

Different schools of thought have emerged to explain the nature of human behavior and the interactions among human beings. The idea of explaining human behavior and the differences between people's standard of living emerged in classical economists with the works of Adam Smith, Malthus, Ricardo, and Marx (Dutt, 2017). Essentially, there are two distinct school of thoughts emanated to explain the structure of an economy and interaction of the stakeholders. Adam Smith made a significant contribution to the analysis of economic development by providing general economic principles including division of

[10] This thesis adopts a deductive approach of reasoning starting with a general perspective of the research topic. Empirical literature is organized based on the countries' economic development levels and it starts with the context for developed nations and moves to developing nations' context

labor, accumulation of capital, and a huge focus on specialization relating it to improvements in skills, saving, time, technological progress, and investment expansion (Letiche, 1959). Yet, neoclassical economics frames the structures of the economies with a rationality and utility maximization, emphasizing equilibrium while ignoring some uncertainties (Dequech, 2007). Heterodox economics on the other hand, is different from mainstream economics in terms of the theory, method, and policy implications used as a framework for explaining societies' economic structures. It is an umbrella for various economic schools of thought with a broad definition encapsulating the common features of these multiple schools of thoughts (Jo et al., 2018). This approach developed an additional perspective of the evolution of the economic system for understanding the complex and uncertain nature of socio-historical evolution. Institutional economics is one approach in heterodox economics which has recently been recognized as a relevant framework for explaining the differences in economic performance across societies (Ayres 1936; Jo et al., 2018).

Since post World War II, literature on economic growth and development have been dominated by different models of economic growth ; Rostow's stages of growth, the Harod-Domar growth model, Lewis' two-sector models, the Solow growth model, endogenous growth theories, and recently institutional economics (Acemoglu et al.,2005; Dutt, 2017; Lewis, 1954; Ray, 1998; Todaro and Smith, 2015). Most of the theories argue that the source of economic growth is the availability of labor, technology, and capital but economic growth goes beyond this (Todaro and Smith, 2015). In Rostow's stages of growth, a country passes through sequential stages in its development which starts with a traditional society, pre-conditions for takeoff for self-sustaining growth, takeoff, the drive to maturity, and the age of high mass consumption; the Harrod-Domar model attributes growth to savings and the capital-output ratio (Ray, 1998; Todaro and Smith, 2015). For others in many economies an unlimited supply of labor is available at a subsistence wage, where this labor from the traditional agriculture sector is transferred to the modern industrial sector that absorbs the surplus labor to promote industrialization (Lewis, 1954; Todaro and Smith, 2015).

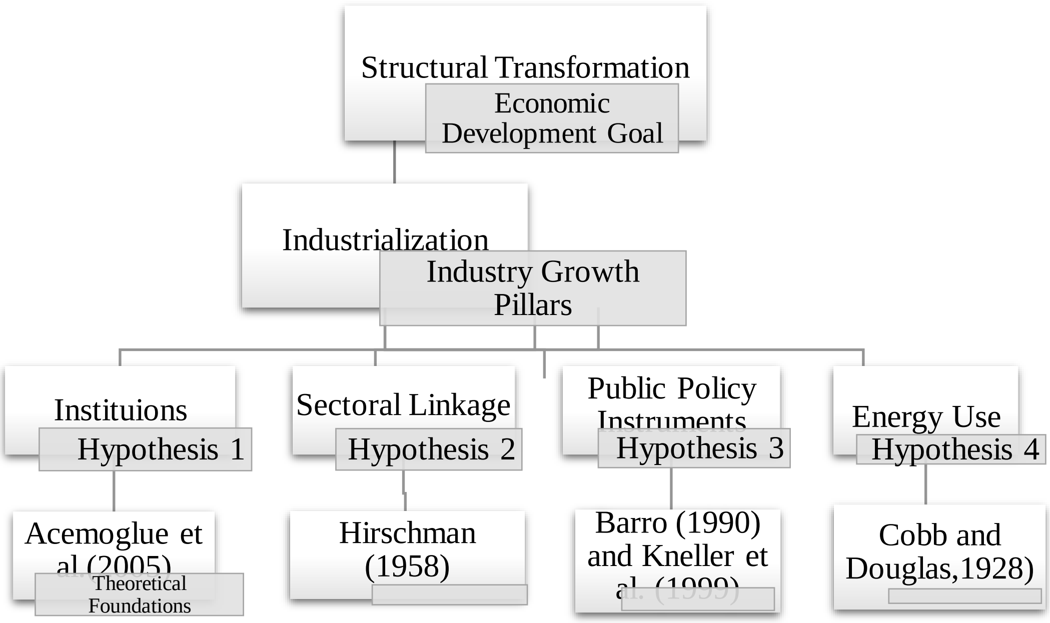
In the neoclassical Solow model long-run growth is determined by exogenous factors like the rate of labor augmenting technological progress and population growth because of which the model is also referred to as an exogenous growth model (Heijdra & Ploeg, 2002; Romer, 2011). It is presumed that traditional neoclassical approaches are incapable of explaining the extensive disparities in the pace of economic growth across countries (Agénor and Montiel, 2008). Following an extension of the neoclassical model, Ramsey endogenized ad-hoc savings into the model by introducing infinitely lived optimizing consumers. Another stream in growth literature is endogenous growth which can be divided into three major approaches developed around capital accumulation, human capital investments, and research and development (Heijdra, 2002; Romer, 2011). The economic implications of learning by doing was contributed by Arrow (1962) to endogenous growth literature. This replaces the exogenous growth explanatory variables with the argument that key determinants of growth are explicit within the model.

Recently, there has been a lot of emphasis on the role of institutions for augmenting long run growth and sustainable development. Among other factors, institutions are perceived to be important for determining economic growth and sustainable development (Acemoglu et al., 2005; Lin and Nugent,1995; North, 1981, 1990). Differences in human capital, physical capital, and technology are considered as proximate causes of growth in the long run in the sense that they pose the next question of why some countries have less human capital, physical capital, and technology and make worse use of their factors and opportunities (Acemoglu and Robinson, 2008; Acemoglu et al., 2001; Casey et al., 2012). In this regard, institutions which are very broadly constructed become a fundamental reason for differences in economic growth and development across countries. This makes it possible to develop a coherent framework for understanding why and how institutions differ across countries, and how they change (Acemoglu and Robinson, 2008).

Likewise, several literatures relate industry to growth of which the Kaldor growth and Cornwall models are classical models while Rodrick model is a recent phenomenon. The Kaldor gives three laws of economic growth for explaining the manufacturing sector's growth and its correspondence with an economy (Kaldor, 1966; Mamgain, 1999). The three laws related to manufacturing and economy growth are: a positive impact of manufacturing growth on economic growth, termed the Kaldor growth hypothesis as his first law. The second law is the Kaldor-Verdoorn law which argues that manufacturing growth will increase labor productivity in the manufacturing sector (Mamgain, 1999). The third law states that the rate of manufacturing output growth is related to the non-manufacturing sector's productivity (Mamgain, 1999; McCombie, 1983). Likewise, the industry sector's growth or the manufacturing sector's growth are considered significant variable that influence economic growth (Cornwall, 1977; Guadagno, 2012). Manufacturing is a tradable sector with a limited demand constraint controlled by manufacturing export. Yet, compared to other sectors manufacturing can absorb technology and it induces productivity (Rodrick 2013, 2014). However, a recent model of industrialization argues that when an economy has a service sector dominating without having experienced proper industrialization it indicates the existence of a premature deindustrialization (Rodrik, 2016).

With a related note, industrialization are explained by several factors such as the efficient use of factors of production, relevant policies, institutions, sectoral linkage, innovations, research and developments and economies specific circumstances (Aghion and Howitt, 2009; Chang, 2002; Hirschman, 1958; Rodrik, 2013). For instance, public policies and institutions are recognized as the pillars of industrialization and economic development of a nation by being a bridge for successful implementation of industrial policies (Chang, 2002). Unbalanced growth theories disagree with a simultaneous and balanced expansion of different sectors in the economy instead creation of imbalance will provide opportunities for further investment and induces industrialization that stimulate growth (Hirschman, 1958). Schumpeterian industrial model also argues that innovations are the key for industrialization and structural transformation (Aghion and Howitt, 2009). Relative to other sectors, industry is more energy intensive and it promotes sustainable industrial development (Fallahi et al., 2010; OECD, 2012). Basically, the interdependence between energy and industry is a crucial tool for sustainable economic development (UNIDO,1984). In a nutshell, economic development and structural transformation are inseparable and industrialization clears the path for structural transformation. Therefore, empirically investigating the industrialization process and the pillar factors will be mandatory to understand the existing fact and related problems.

Accordingly, Figure 1.3 presents a general framework of the thesis. The goal of economic development is to assure structural transformation. One domain path is industrialization which requires industry growth. Indeed, there are several explaining factors for industry growth. Among others, we hypothesize political economy, sectoral linkage, public policy instruments and energy use are critical explaining factors of industrial development in Ethiopia. Accordingly, an independent investigation is made to empirically validate the impact of those factors in explaining Ethiopian industrialization path overtime.



Source: Author's Construction

Figure 1-3 General framework for the pillars of industrial growth

1.5. Data and Empirical Strategy[11]

To address the research questions this thesis uses time series data, cross sectional data, and panel data in the respective individual papers. The data sources for the study are different institutions including the Ethiopian Central Statistics Authority (CSA), Ministry of Finance and Development Cooperation (MoFEC), Ethiopian Economic Association (EEA), International Food Program Research Institute (IFPRI) in Ethiopia, the Ethiopian Development Research Institute (EDRI), and the World Bank Development Indicators' database. For the time series data, the vector error correction model (VECM), Granger causality, impulse response, and autoregressive distributive lag (ARDL) parametric methods of estimation are used. For the cross-sectional, social accounting matrix (SAM) database and a non-parametrical multiplier coefficient estimation is computed. For the panel data, dynamic panel data estimator is used. The time series data covers the period 1975-2016 while the cross-sectional data is for 2011 which is the latest data published in the country. The panel data covers the period 2005 to 2016.

To empirically address the research questions this thesis uses different theoretical frameworks. In the first article, the three classical Kaldor laws and the contemporary Rodrick model are used as the theoretical framework. For the political economy of industrialization, the Acemoglu et al. (2005) theoretical framework that links long run growth with political and economic institutions is adopted. Yet the empirical model is formulated based on the growth literatures of (Barro, 1991,1996; Mankiw et al., 1992). For sectoral linkages, Hirschman's (1958) unbalanced growth theory is used as the framework. For public policy instruments, Barro (1990) and Kneller et al.'s (1999) endogenous growth models form the theoretical foundations. For energy and manufacturing productivity, a Cobb Douglas production function (Cobb and Douglas,1928) is used for modeling the relationship empirically. Accordingly, the research starts with the first question and investigates the long run empirical relationship between manufacturing and economic growth in Ethiopia. Then, four possible determining factors of the manufacturing sector's growth are empirically investigated. This forms a separate article with its own contribution and policy implications. Figure 1.3 presents the hierarchical relation of the factors with industrialization and structural transformation.

Different empirical strategies are used for the different data sets to address the specific research questions independently. To investigate the long run association between manufacturing and Ethiopian economy the vector error correction (VEC) estimation approach is used for a time series data from 1975-2016. The existence of long run relationship is validated using Johansson cointegration test. The long run and short run coefficients are estimated after a test for bidirectional causal relationship using Granger causality test. Impulse response analysis is also made to check for the impact of a shock in the manufacturing and its outcome on the rest of the economy. A diagnostic test is conducted for robustness check. To explore the impact of political economy on industry growth a qualitative and empirical estimation is made. A narrative approach is used to

[11] The empirical models and methods are discussed in individual papers

analyze the effect of different industrial policy and form of government on the performance of Ethiopian industry across regimes. For the empirical estimation autoregressive distributive lag model (ARDL) is used to estimate the effect of form of governance on industry growth using a polity2 index as a proxy variable. The effect of public policy instruments on industry growth is another research objective empirically estimated using a timeseries data and ARDL approach.

To investigate the direct and total linkage of industry with other sectors, a cross sectional Social accounting matrix (SAM) multiplier analysis is used. The direct production linkage of industries is estimated along with the multiplier coefficients for a shock in the sectors. A simulation is made to introduce a shock in agriculture-based industries and manufacturing industries to compare the outcome on output, demand, income and employment respectively. The impact of energy use on labor productivity is estimated using panel data for 15 manufacturing industry groups with 12 years' time span from 2005 to 2016. A static and dynamic panel models are estimated to evaluate the effect of energy use on labor productivity. across different estimation approaches taking Ethiopian manufacturing industries as a case study.

1.6. Summary and Contribution of Each Paper

This section gives a summary of the five individual papers with their respective research objectives, data, empirical methods, empirical findings, and implications followed by their independent contributions.

1.6.1. Manufacturing Sector in the Ethiopian Economy: An Empirical Test of Kaldor's Growth Hypothesis

Summary: This is the first paper of the thesis and it investigated the role of manufacturing growth in the Ethiopian economy using time series data from 1962 to 2016. It uses Kaldor's three growth laws as a theoretical formulation to empirically assess this relationship along with estimating the recent Rodrick premature deindustrialization pattern overtime in Ethiopia. The vector error correction (VEC) model is used for estimating the coefficients while the Granger causality test is used for investigating their causal relationships. The impulse response function is estimated to see the effect of a shock to manufacturing sector on the rest of the economy. The results show that manufacturing growth has a positive and statistically significant effect on the growth of the non-manufacturing sector. This empirically validates Kaldor's growth hypothesis in Ethiopia. The second and third Kaldor laws are weakly supported in Ethiopian case. Existing industries in Ethiopia have been employing unskilled labor and hence growth in manufacturing might not increase productivity, which it would have if skilled labor were employed in labor-intensive industries. The problem of weak institutions that sucks away opportunities of reinvesting in physical and human capital could be some other reasons explaining the poor productivity along with the weak linkage among sectors. This implies the need for extensive policy interventions to lift the manufacturing sector and for tackling problems of weak institutions. The study confirms that in the long run, the pattern in Ethiopia coincides with

Kaldor's growth hypothesis. The study also validates Rodrick's premature deindustrialization pattern overtime in Ethiopia.

Contributions: This study makes number of contributions. The first is that it empirically validates the three classical Kaldor laws on manufacturing and economic growth using Ethiopian data. It also empirically validates Rodrick's contemporary premature deindustrialization model in the Ethiopian context. This enables a comparison of the empirical results of the classical Kaldor growth hypothesis with the recent Roderick deindustrialization model. The study confirms the existence of a long run relationship between manufacturing and economic growth in Ethiopia coinciding with Kaldor's growth hypothesis. It also finds that demography and per capita incomes significantly affect deindustrialization pattern in Ethiopia which coincides with Rodrick's prediction. In addition to empirically validating the existence of long run association between manufacturing and economic growth in Ethiopia, the study adds to the literature through its empirical comparison of classical and contemporary theories of industrialization and their respective implications using Ethiopian dataset.

1.6.2. Political Economy of Industrialization and Industrial Parks in Ethiopia

Summary: This is the second paper of the thesis and it investigated the political economy of industrialization in Ethiopia. It discusses the economic and political institutions that existed under three political regimes for decades corresponding with the industrial sector's performance across the three regimes. It evaluates the different industrial strategies and the organizational structures used for implementing the industrial policies together with the current industrial park strategy and its impact on employment creation, export promotion, foreign exchange generation, value chain, and spillover effects. The political strategies used by different political regimes to support development were different. The article distinguishes between two extreme political strategies and concludes that the new industrial park strategy has limitations when it comes to its implementation. It fails to provide technology and knowledge spillovers due to large unskilled labor employment and underutilization of the agriculture-base industry advantage that the country has by focusing mainly on textiles and apparel. Raw material for the companies is imported from the rest of the world limiting the domestic industries' value chain contributions. The results support the design and implementation of an industrial policy based on the existing opportunities and resources along with expected economic outcomes in Ethiopia instead of implementing policies based on the political interests of the regime in power. The empirical results further show that political institutions have been negatively impacting industrial growth in Ethiopia.

Contributions: As there is very little empirical literature related to the impact of institutions on economic performance and the impacts on industry growth this paper contributes to the body of literature by empirically investigating the effect of political institutions on Ethiopia's industrialization process. It also gives a historical perspective of industrialization in Ethiopia. As it traces institutional economics using the heterodox economic approach, this paper shows that industrialization and the economic structures of developing countries can be explained with the heterodox framework along with using the mainstream perspective. This paper also has policy implications and contributes to literature by identifying the political environment as a major factor in explaining industrialization. Results indicated that priority focus on political issues than economic necessities negatively impacted industrialization process in the case study country.

1.6.3. Linkages Between Industry and the Other Sectors of the Ethiopian Economy: A SAM Multiplier Analysis

Summary: This is the third paper of the thesis and it investigated the linkages of the industry sector with other sectors of the Ethiopian economy. It stresses on the direct forward and backward production linkages of the sector with agriculture and service sectors along with output, GDP, income, and demand multipliers. It also discusses the import penetration and export intensity of the agriculture-based industry[12] and manufacturing industry sectors. The Ethiopian social accounting matrix (SAM) for 2011 developed by the International Food Program Research Institute (IFPRE) is used for the analysis. To explore the linkages and estimating the coefficients, the paper uses a SAM multiplier analysis. The results show that in Ethiopia, agriculture has direct backward and forward linkages with the other sectors of the economy while agriculture-based industry has weak forward linkages and the manufacturing sector has weak backward and forward linkages with other sectors of the economy. The multiplier analysis also shows that an exogeneous shock to agriculture-based industry has a higher multiplier effect than a shock to the manufacturing sector. The elasticity of production, value added, rural household incomes, and demand are considerably high for agriculture-based industry investments as compared to investments in manufacturing. The results also show that policy needs to focus on agriculture-based industry investments to positively augment the overall economy along with following other industrial and developmental policies and strategies. The findings coincide with the unbalanced growth theories with a policy implication to focus on agricultural-based industries among other sectors.

Contributions: The study empirically shows the production linkages of multi-faceted industries with other sectors in Ethiopia using a SAM based multiplier analysis. The unbalanced growth theory is empirically validated based on the simulation shocks to agriculture-based industries and manufacturing industries. The output, demand, value added, and income multipliers for an investment shock to agriculture-based industries are found to be huge as compared to the manufacturing sector. The agriculture-based industries are identified as a priority sector. This can complement the abundant labor force and agriculture competitive advantage of the country. The result is similar with the unbalanced theory of growth.

[12] While aggregating the SAM agroindustry refers agriculture-based industries in Ethiopia not only food processing ones. The details for classification are attached in the appendix Table A2.7

1.6.4. Public Policy Instruments and the Manufacturing Sector Growth in Ethiopia: a Case of Taxation and Public Expenditure

Summary: This is the fourth paper of the thesis and it investigated the role of public policy instruments in the growth of Ethiopian manufacturing. It uses endogenous growth models as a theoretical formulation. The empirical investigation use time series data from 1975 to 2016. For its advantages of handling a small sample size, a mixed order of integration and the endogeneity problem, the study uses the ARDL approach to quantitatively estimate the long and short run coefficients. The bound test for the existence of a long run relationship shows the case to be true as in the long run, productive government expenditure is positively associated with manufacturing growth in Ethiopia. Direct taxation also significantly affect growth in manufacturing in the long run. In contrast, unproductive government expenditure and indirect taxes have neutral effect on manufacturing growth in the long run; this coincides with theoretical predictions. In the short run, productive government expenditure and the direct tax variables are significant in positively augmenting the manufacturing sector's growth. The study shows that public policy instruments are essential for the manufacturing sector growth in Ethiopia.

Contributions: The study starts with an empirical validation of the endogenous public policy growth theory using Ethiopian dataset. The study confirms the existence of a long run relationship between industrial growth and public policy instruments of tax and government investments. Besides, it explicitly shows the effects of direct taxes, indirect taxes, productive government investments, and unproductive government investments on Ethiopian industry's growth. This gives a policy input with respect to public policy instruments and their respective effect on industrial growth in Ethiopia.

1.6.5. Energy Use and Labor Productivity in Ethiopia: The Case of Manufacturing Industries

Summary: This is the fifth paper in the thesis, and it uses a panel data for examining the relationship between energy use and manufacturing productivity in Ethiopia. Specifically, it empirically investigates the impact of energy on manufacturing productivity by including labor, capital, and technological change as control variables in the model. A panel dataset of 15 industry groups for 12 years is used to estimate the coefficients. The estimation results confirm that energy use and capital are positive factors affecting manufacturing productivity. Similarly, more labor employment increases labor productivity due to increasing return to scale and the dominance of labor-intensive manufacturing industries in Ethiopia. Capital and technological change are also positive factors to boost labor productivity in the manufacturing industries. This implies a need for an efficient use of energy, capital, and labor for promoting industrial growth in Ethiopia.

Contributions: This paper empirically validates the effect of energy on manufacturing labor productivity in Ethiopia using a panel dataset. It finds energy use to be a productivity inducing factor in the Ethiopian manufacturing industries. This has policy implications as it identifies other productivity augmenting factors besides energy: capital, labor, and technology. It also shows the need for an efficient use of energy and these resources to boost manufacturing productivity of the labor-intensive industries in Ethiopia. There are mixed empirical findings about the role of energy on productivity mostly conducted at national level. This study particularly adds to the literature through empirical investigation of the role of energy on labor productivity in the case of Ethiopian manufacturing industries.

1.7. Scope and Limitations

This study mainly focuses on the long run relationship between manufacturing growth and the Ethiopian economy along with the four pillars of industrial growth. It initially starts with exploring the existence of empirical relationship between manufacturing and growth in Ethiopia. Then, an empirical investigation is made to empirically test the four-hypothesis listed as major determining factors of industry performance in Ethiopia, using different datasets. The effect of political economy, sectoral linkage, public policy instruments and energy use on industry performance are empirically investigated taking Ethiopia as a case study. An effort is made to be as exhaustive as possible in triangulating the industry performance and the explaining factors in Ethiopian case. Here, a focus is given for the manufacturing industry and its overall performance overtime along with its major explaining factors. Indeed, more can be explored about industrialization in Ethiopia but due to time, data availability, and cost limitations this research only focuses on the scope of the study. However, the study is not without limitation as structural models are not used, nonlinearity and structural breaks are not addressed suggesting a further study controlling for these limitations. Yet, as growth and structural transformation are explained by multiple factors, further study can be made on estimation of production efficiency, cost efficiency and labor efficiency of the manufacturing firm in Ethiopia. The study indicated the dominance of Asia on the trade sector, but a further study is suggested to explore the impact of China and Asian countries dominance on the trade sector and the overall Ethiopian Economy. A SAM decomposition analysis will also give more detailed policy inputs and are suggested for further study. 2016 SAM data is accessed very lately that an update is suggested for further study by altering the methodology (CGE) to see if results could change or stick where there are. Public policy instruments have huge impact in developing countries economy and a further study is suggested to explore the impact of the instruments such as tax and government expenditure more disaggregated it to specific components and using a firm level dataset. Besides, the effect of monetary policy instruments on Ethiopian industry performance is suggested for future study. Yet, industrialization in Ethiopia can be explored more by making an impact evaluation of a specific industrial policy suggested as a further study in the future.

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Collection of Papers in the Dissertation

Paper 1:

Manufacturing Sector in the Ethiopian Economy: An Empirical Test of Kaldor's Growth Hypothesis

Selamawit G. Kebede

Paper 2:

Political Economy of Industrialization and the Industrial Parks in Ethiopia

Selamawit G. Kebede and Almas Heshmati

Paper 3:

Linkage of the Industry Sector with other Sectors in the Ethiopian Economy: A SAM Multiplier Analysis

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Paper 4:

Public Policy Instruments and Manufacturing Sector Growth in Ethiopia: The Case of Tax and Government Expenditure

Selamawit G.Kebede

Paper 5:

Energy Use and Labor Productivity in Ethiopia: The Case of Manufacturing Industries

Selamawit G.Kebede

2. Manufacturing Sector in the Ethiopian Economy: An Empirical Test of Kaldor's Growth Hypothesis[13]

Paper One

Selamawit G. Kebede

Abstract

This research investigates the role of manufacturing growth in Ethiopia using time series data from 1962 to 2016. It uses the classical Kaldor's growth laws as a theoretical formulation to empirically assess the role of manufacturing in the overall economy. It also empirically demonstrated Rodrik's recent model of deindustrialization pattern overtime. Vector error correction (VEC) model is used to estimate the coefficients and Granger causality test is used to examine the causal relationship among variables of interest. The research further estimates impulse response function to see the effect of a shock in manufacturing sector to the rest of the economy. The study confirms that in the long run, the pattern in Ethiopia coincides with Kaldor's growth hypothesis. The manufacturing sector's share in the economy has been very low overtime. The economy earlier was dominated by agriculture and recently by service sector coinciding with Rodrick's premature deindustrialization premise. Results also show that deindustrialization in Ethiopia has been more rapid in recent periods. Yet, output and employment deindustrialization in Ethiopia are explained by demography and per capita GDP. The study implies that extensive policy interventions in the manufacturing sector are needed for successful industrialization.

Keywords: Kaldor's growth law; manufacturing growth; non-manufacturing growth; Ethiopia

JEL Classification Codes: C21; E12; F43

2.1. Introduction

Economic growth is a central step in development and achieving sustainable economic growth has been a central theme for many world economies (Chenery, 1982; Mulungu and Ng'ombe, 2017**).** Currently, per capita income and output per worker across countries show large differences where per capita income in the developed countries is 30 times more than that in their bottom counterparts (Acemoglu, 2007). The whole world is cautious about these income differences across countries as high income is attributed to a high standard of living, better quality of life, better education and health conditions (Romer, 2011; Mulungu and Ng'ombe, 2017). Output growth by and large depends on the accumulation of physical capital, human capital of the labor force and technological capabilities. Yet, growth responds to the proportion of the national product devoted to these activities (Chenery, 1982).

[13] A previous draft of this paper was presented in Jonkoping, Sweden, at the Jonkoping International Business School and in Kigali, Rwanda, the 4th Eastern Africa Business and Economic Watch 2019, annual international conference. I would like to thank the participants of both the seminars.

Different explanations have been given for deviations in incomes across countries. Old classical economists provided many basic reasons for these deviations including competitive behavior with equilibrium dynamics, diminishing returns and relating them to physical and human capital accumulation, the interplay between the population growth rate and per capita income, and the effect of technological progress in terms of labor specialization along with discoveries of new production techniques and methods (Solow, 1956; Barro and Sala-i-Martin, 2004). Traditional neoclassical growth models attribute growth to exogenous technological progress which they presume can explain the wide disparities in economic growth in different countries (Agenor and Montiel, 2008). Hence, considerable efforts have been made to explain the divergent patterns of growth across countries.

A view of economic growth that heavily depends on an exogenous variable which is difficult to measure is hardly satisfactory from an intellectual perspective (Arrow, 1962). Accordingly, in the 1980s the endogenous growth theories flourished to explain differences in growth and divergent patterns among nations relating it with investment in human capital, knowledge and innovation (Agénor and Montiel, 2008). An alternative endogenous growth theory is the Schumpeterian framework according which growth is caused by a random sequence of quality-improving innovations (Aghion et al., 2014). This model grew out of the modern industrial organization theory that sees innovations as an important dimension of industrial competition (Aghion et al., 2014; Aghion and Akcigit, 2015). According to this model, growth generated by innovations is a result of entrepreneurial investments and how new innovations replace old technologies or growth involves creative destruction (Aghion et al., 2014). Thus, endogeneity in state interventions in the form of investments in developing infrastructure and improving the quality of institutions to promote entrepreneurship, innovativeness, technological capabilities, and productivity explain the growth gap between nations (Aghion and Akcigit, 2015).

In contemporary growth and development literature, the competitive advantage theory maintains that countries ought to specialize in industries in which they can produce at a lower cost than their competitors whereas the other strand of thought relates to post Keynesian economics asserting that countries should focus on strategic sectors that can stimulate innovations and productivity in the entire economy (Cantore et al., 2017). More recently, growth's explanatory variables such as physical capital, human capital, and technology are only seen as proximate reasons for economic growth instead fundamental factors such as geographical locations, institutional differences, environmental factors, and other related aspects are presumed to be fundamental reasons for growth divergences across countries (Acemoglu, 2007).

Kaldor in the 1960s challenged the idea that the source of economic growth is the availability of factors of production such as labor, technology, and capital. He argued that economic growth is grounded in increasing returns to scale in an economy and a manufacturing sector with higher economic returns determines economic growth (Kaldor, 1966; Keho, 2018).This is based on the grounds that unlike agriculture and services which are subject to diminishing returns the manufacturing sector is subject to static and dynamic increasing returns (Obioma et al., 2015). The static increasing return refers to the low average cost due to the large size of the sector while the dynamic is related with induced effect of output growth on technological progress and capital accumulation (Kaldor, 1966; Obioma et al., 2015). Besides, when the manufacturing sector expands and draws labor from other sectors, productivity automatically increases in these activities (Keho, 2018; Lewis, 1954).

Several special characteristics are attributed to the manufacturing sector such as rapid technological changes, easy integration with global production networks, economies of scale, and high productivity relative to other sectors (Lavopa and Szirmai, 2014; Su and Yao, 2017; Szirmai, 2012). Contrary to endogenous growth theories and their emphasis on supply-side issues, Nicholas Kaldor was the first to consider the role of increasing returns emphasizing the importance of the exogenous components of demand in explaining economic growth in the long run (Libanio and Moro, 2011). Relative to other sectors, manufacturing is a technologically dynamic and tradable sector with limited demand constraints (Rodrick, 2016).

A range of literature stresses the role of manufacturing as an engine of growth and regards industrialization as the most significant engine of economic growth (Cornwall,1977; Syrquin, and Chenery,1989; Su and Yao, 2017; Giovanini and Arend, 2017). Industrialization has been a major path towards economic growth and development of many economies in the world (Rodrick, 2016). For a country to be recognized as industrialized at least a quarter of its GDP should come from industry, particularly the manufacturing sector and at least one-tenth of the population should be employed in the industry sector (Obioma et al., 2015). Table 2.1 highlights the percentage share of manufacturing to GDP in different countries including both developed and developing ones.

Table 2-1: Manufacturing Value Added as a Percentage of GDP in Advanced and Developing Countries (2016)

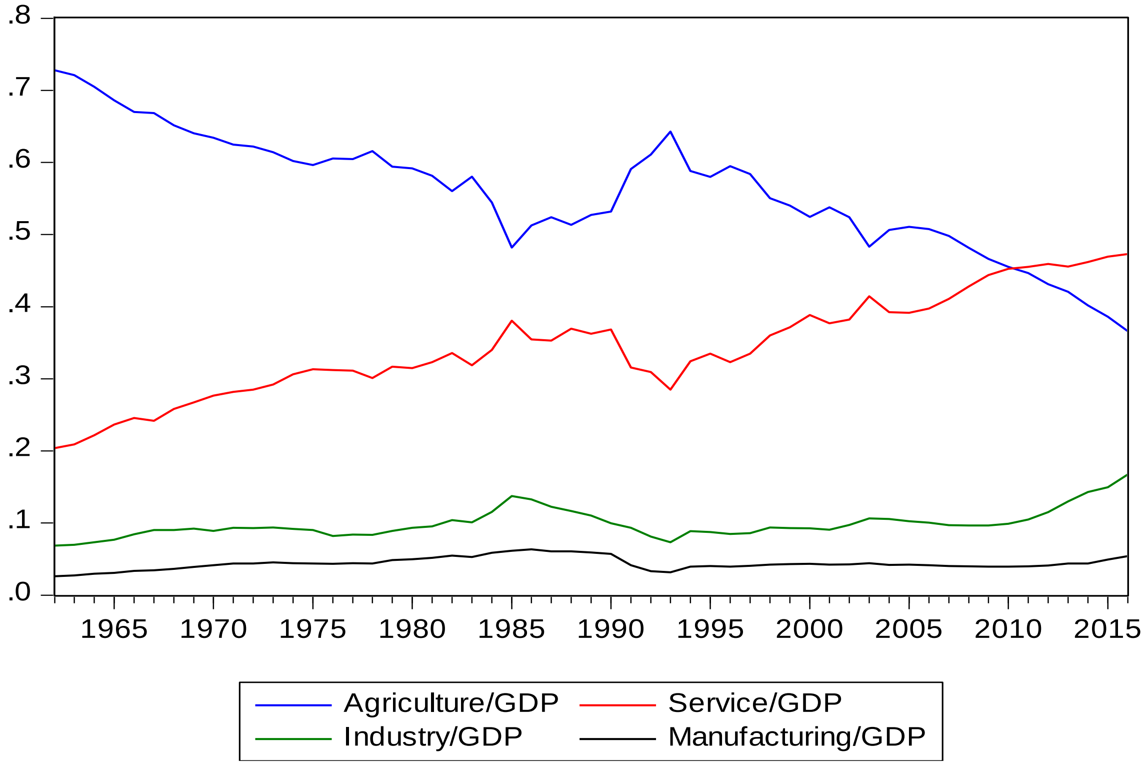
Region	Manufacturing value added as percentage of GDP (average)	Maximum value in a region	Minimum Value in a region	Year
Europe	15.44	34.69 (Ireland)	3.60 (Andorra)	2016
North America	11.17	19.00 (Mexico)	2.70 (Greenland)	2016
South America	16.04	43.38 (Guyana)	11.71 (Argentina)	2016
Central America & Caribbean	10.66	46.75 (Puerto Rico)	0.96 (Cayman Islands	2016
Middle East	12.67	21.67 (Turkmenistan)	6.82 (Kuwait)	2016
Asia	13.85	29.38 (China)	0.78 (Macao SAR, China)	2016
Africa	9.40	33.23 (Swaziland)	1.98 (Sierra Leone)	2016
East Africa	6.08	10.03 (Kenya)	2.89 (Djibouti)	2016

Source: Author's calculations using the World Bank database.

Table 2.1 includes the following regions: Europe, North America, South America, Central America and the Caribbean, Middle East, Asia, and Africa. In Europe, manufacturing contributes 34.69 percent to GDP at the highest level with an average of 15.44 percent. For North America, the maximum share of manufacturing is 19 percent while the average share is 11 percent. In South America, the maximum share of the manufacturing sector is 43 percent and its average share is 16 percent. In Central America and the Caribbean, its maximum share is 47 percent with an approximately 11 percent average share. The maximum share of manufacturing in the Middle East, Asia, Africa, and East Africa is 22, 29, 33, and 10 percent respectively with an average share of 13 percent (Middle East), 14 percent (Asia), 9 percent (Africa), and 6 percent (East Africa). Table 2.1 also shows that in advanced countries the share of manufacturing is on average more than a quarter of their GDP while for developing countries this share is in a single digit indicating output deindustrialization in the developing countries.

In Ethiopia, the percentage share of the various sectors to GDP is presented in Figure 2.1. The vertical line in the figure represents the share of sectors to GDP while the horizontal line shows the time period from 1961 to 2016. For decades, the contribution of the manufacturing[14] sector on average did not exceed 5 percent implying output deindustrialization which is also the case in most developing countries. During earlier periods, agriculture dominated Ethiopian economy followed by the service sector while of late the service sector has been dominating the economy implying deindustrialization coinciding with Rodrick's (2016) model of premature deindustrialization (see Figure A1.1 and Table A1.1 in the Appendix).

[14] According to International Standard Industrial Classification (ISIC) Manufacturing refers to the physical and chemical transformation of martials in to new forms of products using power driven machines or manually which could be done in factory or at home and products can be sold at wholesale or retail base.(CSA, 2015)



[15]Figure 2-1: Percentage Sectoral Share in Ethiopia (1962-2016)

Source: MoFEC unpublished material

This study accordingly uses Kaldor's classical insights of industry and economic growth to empirically explore the case of Ethiopia. It discusses three Kaldor laws: the first law proposes that manufacturing is the engine of economic growth in the long run and is termed as the growth hypothesis (Kaldor, 1966). The second law is termed as Kaldor-Verdoorn's law which postulates that growth in manufacturing productivity is related to the growth of the sector, and the third law asserts that there is a positive causal relationship between non-manufacturing productivity growth and the manufacturing sector's growth (Kaldor, 1966; Libanio and Moro, 2011; Thirlwall, 1983; Verdoorn, 1980). However, to explain beyond the classical industrilaization model this research also investiages Rodrick's (2016) recent deindustrialization pattern overtime emperically to identify the policy implications of the classical and recent models of industrialization taking Ethiopia as a case study for developing countries.

Accordingly, this study addresses the following research questions:

- Is the manufacturing sector the engine of economic growth in Ethiopia in the long run? (Kaldor's first law)
- Is the manufacturing sector's productivity positively related to the growth of the Ethiopian manufacturing sector? (Kaldor-Verdoorn law)

[15] In Figure 2.1 The top line represents agriculture share to GDP, the second line is service share to GDP, third line is industry to GDP while the line in the bottom is for manufacturing share to GDP overtime

- Is growth in the productivity of the non-manufacturing sector in Ethiopia positively related to growth in the manufacturing sector? (Kaldor's third law)
- How valid is the Rodrick deindustrialization pattern overtime in Ethiopia?

The basic aim of this research is investigating the role of manufacturing growth in the Ethiopian economy using time series data from 1962 to 2016. Kaldor's three laws are used as theoretical formulations to empirically assess the causal relationships between the manufacturing value-added growth and non-manufacturing value added growth. The Granger causality tests' results show that manufacturing output growth has a positive and statistically significant effect on the growth of the non-manufacturing sector's output. This confirms that Kaldor's growth hypothesis is empirically validated in Ethiopia. The flow of labor to manufacturing affects the relative productivity of the different sectors. The manufacturing sector's growth serves as a pillar of Ethiopian economic growth and it is a potential candidate for structurally transforming its economy. This coincides with Kaldor's growth hypothesis and is a contribution of this research to the existing literature. Empirical validation of Rodrick deindustrialization pattern has also been made taking Ethiopia as a case study for developing countries. The results are in line with the predictions of the model.

The rest of the chapter is organized as follows. Section 2.2 provides a review of related theoretical and empirical literature. Discussion of the methodology used is in Section 2.3 which presents the analytical framework and empirical model. Section 2.4 gives the data and an overview of the Ethiopian economy and performance of the industry sector. The study results are discussed in Section 2.5 and Section 2.6 gives the conclusion and policy implications based on the findings of the study.

2.2.Review of Related Literature[16]

2.2.1. Theoretical Review on Industry and Economic Growth

Economic development can be explained in different ways. For example, it can be viewed as the mobilization of human, physical, financial, organizational, institutional, and natural resources for improving the welfare of society by providing competitive and quality services and products (Aghion and Akcigit, 2015; Cornwall,1977; Lankausklene and Tvaronavlclene, 2013). In general, economic development encompasses extensive economic growth which includes increasing output using more resources and inclusive economic growth which consists of increasing productivity, creating new jobs, and implementing innovations (Lankausklene and Tvaronavlclene, 2013).

Literatures recognize different determinants of economic development in countries and the effect of manufacturing on economic development has also been widely discussed. In fact, a strong and thriving manufacturing sector usually triggers industrialization. Very few economies have been able to grow and accumulate wealth without investing in their

[16] This review of literature is not in a chronological order and is structured based on countries' level of economic development beginning with the developed countries' context which is followed by developing countries context, including previous studies in Ethiopia.

manufacturing industries where the manufacturing sector is widely considered to be the ideal sector for driving development (Chenery, 1982; Kaldor, 1966; Syrquin, 1986; Syrquin, and Chenery,1989; Obioma et al., 2015). Industrialization has been the major explaining factor for the division of the world economy into poor and rich. In fact, convergence and catch-up by non-western countries made possible through industrialization (Rodrick, 2013, 2016).

The thinking that investments in the industrial sector are a fundamental element in the economic development was initiated by Kaldor who argued that faster economic growth rates were invariably associated with rapid growth in the manufacturing sector (Bakari et al., 2017; Kaldor, 1966). Others also discussed the link between the industrial sector and economic growth (Syrquin, and Chenery,1989; Bakari et al., 2017; Chenery et al., 1986). Chenery (1982) argues that the industrial sector basically grows more rapidly than other sectors that eases transformation of the production structure. Manufacturing productivity is attributed to changes in the composition of demand, international trade, and the labor force. Indeed, changes in economic resources are equally influenced by different government policies and development strategies (Chenery, 1982; Chiang, 2002). Chenery identified common features shared by economies that he said were relevant for industrialization which consisted of economies with a large population, substantial progress in industrialization, and middle-income levels (Chenery, 1982). Yet, others indicate that the linkage and spillover effects of manufacturing is stronger than agriculture and traditional service with the advantage of positive externalities to investment in terms of knowledge and technology spreads (Hirschman, 1958; Cornwall, 1977; Szirmai and Verspagen,2015).

Another theoretical framework of the modern industrial organization theory is Schumpeterian model which is based on the idea of innovation. It brings firms and entrepreneurs to the heart of the growth process (Aghion and Akcigit, 2015). This model relies on three main ideas: long run growth relies on innovations and these could be product innovations or producing new products; process innovations or increasing the labor or capital's productivity; and organizational innovations or making factors of production more efficient (Aghion and Akcigit, 2015). The Schumpeterian model focuses on innovations that are quality improving (Aghion and Howitt, 2009). Innovations that are a result of investments in research and development (R&D), a firm's skills, and a search for new markets for successful innovators are motivated by prospects of monopoly rents (Aghion and Akcigit, 2015). Creative destruction is another core idea in the Schumpeterian paradigm which implies that new innovations tend to make old skills, technologies, and innovations obsolete. In this case growth will lead to a conflict between new and old innovations (Aghion and Akcigit, 2015; Aghion and Howitt, 2009).

In the 1960s, Kaldor used stylized facts to explain the difference between economic performance among countries by including manufacturing in the framework. By expressing dissatisfaction with Solow's model in explaining cross-economy growth disparities (Kaldor, 1966; McCombie, 1984; Mamgain, 1999); he endogenized technological progress using the Verdoorn law and dynamics of increasing returns to scale together with giving demand a central role in the long run (McCombie, 1982). Kaldor came up with three laws: the first law articulates a positive association between a country's gross domestic product and manufacturing output growth (Kaldor, 1966; Stoneman, 1976). This argument is termed as the growth hypothesis which links a country's economic growth to the growth of the manufacturing sector (Pacheco-López and Thirlwall, 2013). The second law states that an increase in labor productivity in the manufacturing sector is a result of an increase in manufacturing output. This law is called the Kaldor-Verdoorn law (Mamgain, 1999). Productivity in this case will be induced due to technical progress and tradability characteristics of the manufacturing activity unlike other sectors (Kaldor, 1966; Rodrick, 2013). The third law argues that the rate of manufacturing output growth is positively related to the non-manufacturing sector's productivity (McCombie, 1983; Mamgain, 1999). Essentially, the non-manufacturing sector has diminishing return to scale feature and when resources are moved to manufacturing sector the productivity of those remained in other sectors will increase (Kaldor, 1966; Keho, 2018; Lewis, 1954; McCombie, 1983; Mamgain, 1999).

Recently, the service sector is dominating the economies in countries which have not experienced proper industrialization, and this is termed as a premature deindustrialization (Rodrick, 2016). Premature in this case refers two fundamental facts; the first is on the ground that recent low and middle-income countries are deindustrializing much earlier than the historical patterns. The second fact is early deindustrialization has a negative impact on growth as it limits the growth inducing instruments of manufacturing growth in terms of productivity, technological progress, sectors tradability and its static and dynamic increasing return to scale advantages (Keho, 2018; Lewis, 1954; Rodrick, 2013, 2016). If there are no manufacturing industries, then a way needs to be found for discovering new growth models which service led growth can be considered as one option. However, the services should be productive and tradable mainly consisting of IT and financial services which are high skilled intensive and have limited capacity to absorb abundant labor unlike the labor-intensive manufacturing industries (Rodrick, 2016). Services must be transformed into producing materials than focusing on consumption to make countries self-sufficient in production, supply materials to the industry sector and mechanization of agriculture (Dasgupta and Singh 2006; EEA, 2017).

Basically, high value-added activities vary in different countries and are different across time, for example, the manufacturing of wool cloth in the 14^{th} and 15^{th} centuries were a high value-added manufacturing activity with industrial policies at a very emerging stage. However, now based on the technological dynamics a high value-added industry can be in the service sector instead of being in the manufacturing sector (Chiang, 2002). Growth can also be attained by improving some fundamental factors such as growing the human capital stock, skills, knowledge, and better institutions (Chiang, 2002; Rodrick, 2016). However, countries considering specific stages of development should do a detailed exploration of the relevant industries, industrial policies, and institutions keeping in mind their economic, social, cultural and political conditions (Chang, 2002).

The review thus far has focused on elements of growth in line with the link between industry and growth. As has been shown, industrialization has been the path for sustainable growth and attaining high economic development. However, recent literature shows deindustrialization at early stage of economic development indicating a dominance of the service sector without experiencing proper industrialization pattern. This study selected Kaldor's classical laws as its theoretical approach for the empirical analysis on the association between manufacturing and economic growth in Ethiopia. Yet, the recent deindustrialization model adopted from Rodrick (2016) is estimated to empirically observe the policy implications of the classical and contemporary industrialization models respectively.

2.2.2. Empirical Literature Review[17]

Several empirical studies have been done on growth and its elements in both the developed and developing worlds. Reviewing the history of most advanced countries is valuable even though current problems in industrialized countries are different from those in industrializing countries (Chenery, 1982). Accordingly, this section presents related empirical literatures on the link between manufacturing and growth with a focus on Kaldorian formulation.

Sustained economic growth in the United States and Europe was enabled by the industrial revolution and some countries like Japan, South Korea, and Taiwan managed to catch up through industrialization (Rodrick, 2016). Infant protection industrialization was a very prominent and successful policy followed by most nations that are rich today when they were developing countries back then (Syrquin, and Chenery,1989; Chang, 2002). Historical developments in advanced countries show that they used policies and institutions towards promoting their economic development which are different from the ones that they established later for developing countries (Chang, 2002).

Coming to the Kaldor's framework, Stoneman (1976) evaluated Kaldor's law and British economic growth using a dataset covering the period 1800-1970. He did a time series analysis of Britain's economy to give an insight into controversies surrounding the different methodologies used for cross-sectional analyses by Kaldor and others. His main finding is that Verdoorn's law holds for the manufacturing sector and not for the agriculture sector when the sample is not corrected for autocorrelation problems but when an approach that corrects the autocorrelation and simultaneity problem is used the result is no longer sustainable. Likewise, Drakopoulos and Theodossiou (1991) did an empirical investigation of Greece's economy based on the Kaldorian theoretical formulation using historical data from 1967 to 1988. Their study confirmed Kaldor's first and second laws in the Greek context but the R^2 for the third law was very small implying weak support for Kaldor's third law in the Greek economy.

Alexiou and Tsaliki (2010) examined Kaldor's laws in the Mediterranean region in countries like Spain, France, Italy, Greece, and Israel. They collected time series cross-

[17] The empirical studies are not in a chronological order and are instead presented based on nations' level of development starting with the advanced nations and moving to the developing countries.

sectional data for the period 1975 to 2006. They used the Kaldorian growth hypothesis for their empirical analysis and subjected it to econometric testing and came up with evidence supporting Kaldorian postulates which shows that resource mobilization in manufacturing in the region for attaining higher levels of economic growth and development is needed. Similarly, Martinho (2012) investigated Verdoorn's law in the Portugal economy using panel data to find out whether output growth in the industry affected productivity. He confirmed the increasing returns to scale hypothesis of the law. Accordingly, his findings showed that in Portugal, the industry's output growth affected productivity growth and that in this sector increasing returns to scale existed. Yamak (2016) examined the Kaldor growth hypothesis in the Turkish economy using quarterly data and the ARDL (autoregressive distributed lag) approach. His results confirmed that industry as an engine of growth in the economy; this also is confirmed using the Granger causality test.

In countries and regions of the developing world there are remarkable differences where some countries and regions like East Asia are catching up with the industrialized countries rapidly whereas others like those in sub-Saharan Africa are lagging far behind (Kniivilä, 2008). The empirical impact of manufacturing as an engine of growth in these countries is mixed (Szirmai and Verspagen,2015). Mamgain (1999) studied the role of the manufacturing sector in the economic performance of newly industrialized countries like Thailand, Singapore, Indonesia, Malaysia, South Korea, and Mauritius. His study used macroeconomic data from the World Bank database and estimated the Verdoorn law. His findings show that high growth in manufacturing did not translate into economic growth in Thailand, Singapore, Indonesia, and Mauritius but it did affect the South Korean economy. Kniivilä (2008) confirmed that industrial development played a significant role in the economies of China, Taiwan, Indonesia, and the Republic of Korea.

Pacheco-López and Thirlwall (2013) established a relationship between manufacturing and export growth across a wide sample of developing countries by providing an alternative open economy interpretation of the link between manufacturing output and export growth. Theirs was the first attempt at establishing a link between manufacturing output growth and export growth across a wide sample of developing countries. Their study aimed at providing an alternative open economy interpretation of the strong link between manufacturing output growth and GDP growth (Kaldor's first law). This link was established through the impact that manufacturing output growth had on export growth and the effect that export growth had on GDP growth. This growth was achieved by providing foreign exchange for imports and relaxing balance of payments and constraints on demand. The authors differentiated 89 developing countries as low income, lower middle income, and upper income used for their study. The countries they included were from Africa, Asia, and Latin America.

Obioma et al. (2015) studied the role of industrial development in Nigeria's economic growth using time series data. Taking GDP as the dependent variable, they included industrial output, foreign direct investments, inflation, and savings in the regression as explanatory variables and came to the conclusion that industry's role in economic growth was statistically insignificant even if its sign coincided with economic theories. Gylych, and Mohammad, (2016) investigated the role of industrial development in the Nigerian economy using OLS and found that industrial development had a statistically insignificant and negative impact on the economy. Bakari et al. (2017) studied the role of industrial investments in Tunisia's economic growth using time series data and a cointegration analysis. Their study showed that in the long run, the role of industrial investments in the economy was not statistically significant and instead it negatively affected the economy implying that industrial investments were not a pillar of Tunisia's economic performance in the study period.

Adugna (2014) investigated the role of manufacturing in Ethiopia's economic growth using a descriptive as well as econometric analysis and estimated the regression equation using the OLS approach. His results showed that manufacturing played a key role in the Ethiopian economy. But, a major limitation of his study is a spurious regression result using the OLS method of estimation for non-stationary variables in the model. The dependent variable used is per capita GDP while the explanatory variable is manufacturing output growth which has a shortcoming of netting out manufacturing from the dependent variable. Besides, it lacks an exogeneity test of the estimated model to check the existence of the endogeneity problem in the specified model. This research overcomes these limitations and provides long run and short run coefficients for the model.

Equally important is the [18]deindustrialization pattern of different economies. Deindustrialization in advanced countries and developing countries has different patterns with distinct explaining factors. According to Baumol (1967) deindustrialization in advanced economies is essentially the consequence of dynamism in the industry of these economies attributed to labor substituting technological progress in the manufacturing industry. Rowthorn and Ramaswamy, (1999), shows that deindustrialization in advanced economies are explained by internal factors such as the relative productivity growth in manufacturing as compared to services and the relative decline in the price of manufactures. Likewise, Rodrik (2013), showed that manufacturing ceased its place to service in advanced economies. He presented that, advanced economies like the UK, the US, Sweden and Germany have gone through a similar cycle of deindustrialization following their industrialization peak of 45 %. 27% 33%, and 40 % respectively. Recently the employment share of manufacturing in those countries is nearly 10 % on average showing a downward trend. Giovanini and Arend (2017) studied the effect of service growth on industry growth with a fifth kaldor law formulation. The new law is tested for 8 developed countries for a period 1980 to 2009 using panel VAR models. Results in the study indicates that service sector induces industrial productivity and economic complexity.

Rodrik (2016) shows that deindustrialization in developing countries has different pattern with slow industrialization process and with much sooner deindustrialization pattern from a historical trend perspective. Dasgupta and Singh (2006) examined deindustrialization pattern in developing countries using Kaldorian framework taking India as a case study.

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[18] Deindustrialization represents the decline in share of manufacturing employment and output to their respective totals (Rowthorn and Ramaswamy, 1999).

Their results indicate that manufacturing has a critical impact for growth and the service sector mainly related with ICT are key and positive factors for growth in Indian economy. Di, Meglio et al. (2018) contributes to the premature deindustrialization debate by analyzing the effect of service on the growth of output and productivity using Kaldorian framework for 27 developing countries in Asia, Latin America and Sub Saharan Africa from 1975to 2005. Their finding shows that manufacturing and tradable services induces productivity growth while other services slowdown output growth and aggregate productivity. The preceding paragraphs presented the industry and growth association in advanced economies and developing countries mainly focusing on Kaldorian formulation. Table 2.2 gives a summary of the empirical studies consisting of their theories, data, methods, and key findings.

Table 2-2: Summary of Empirical Studies

Author	Theory	Data	Method	Key Findings
Stoneman (1976)	Kaldorian Growth Hypothesis	Timeseries (1800-1970)	OLS & 2SLS	Growth hypothesis validated for UK. Verdoorn law works for agriculture rather than manufacturing in UK.
Drakopoulos and Theodossiou (1991)	Kaldorian Growth Hypothesis	Timeseries (1967-1988)	Simple Regression	The first and second Kaldor laws are validated for Greece. The third law is weakly supported.
Alexiou and Tsaliki (2010)	Kaldorian Growth Formulation	Timeseries cross-section (1975-2006)	TSCS	The growth hypothesis for Spain, France, Italy, Greece, and Israel validated.
Martinho (2012)	Verdoorn's law	Panel	FE	The law is confirmed for the Portugal economy.
Yamak (2016)	Kaldor's laws	Quarterly data (1998-2015)	ARDL	Manufacturing is confirmed to be the engine of growth in Turkey.
Mamgain (1999)	Kaldor's Growth Laws	Macro data (1960-1988)	Cross-country Regression	Growth hypothesis does not hold in countries like Thailand, Singapore, Indonesia, and Mauritius but holds for South Korea.
Obioma et al., (2015)	Lewis Model	Timeseries	OLS	Industry output is found to be statistically insignificant in the Nigerian economy.
Bakari et al., (2017)	Kaldor Growth Hypothesis	Timeseries	Cointegration	Industry is statistically insignificant in effecting the Tunisian economy.
Gylych, and Mohammad, (2016)	Kaldor First Law	Timeseries	OLS	The hypothesis is not validated in the context of the Nigerian economy.

Adugna (2014)	Kaldorian Approach	Timeseries	OLS	Industry and the Ethiopian economy are positively related.

This empirical review discussed several studies which are relevant for the research. The core idea was exploring how industrial development, specifically manufacturing growth, affects the economic performance of developed and developing countries. Literature arrives at inconclusive results which vary according to economic development level of countries and methodologies used. For most developed countries, industrial development is crucial for boosting their economic performance. However, in the context of the developing world, the results are mixed where for some countries industrial development is an engine of growth whereas it is not so for others. In this regard, the inconclusive results about the role that industry or manufacturing growth plays, together with mixed outcomes in different analytical methodologies and data types inspired to take up this study which evaluates the role of industry, specifically the manufacturing industry in the Ethiopian economy using Kaldor's growth laws as the analytical framework. In addition, the contemporary premature deindustrialization model by (Rodrik, 2016) is estimated using Ethiopian data to empirically compare the implications of the classical and current industrialization models which makes this study different than other existing related studies.

The study uses time series data, as in a country an increase in the industry's share in total output happens over several decades and can best be estimated using a time series analysis (Chenery, 1982; Stoneman 1976). Further, using OLS for estimating time series data for the growth hypothesis will have econometric problems of simultaneity and an endogeneity bias that this research addresses the methodological and data gaps taking Ethiopia as a case study for developing countries. Besides, different studies have investigated the validity of the Kaldor growth hypothesis by regressing industrial output on aggregate output. If they come up with positive and significant coefficients, then they conclude that industrial production partially or totally determines economic growth. This is inappropriate because of a potential bidirectional causality issue and the fact that a long run relationship between the variables cannot be properly estimated using a simple regression analysis (Yamak et al., 2016). Moreover, not every developed country's structural transformation is industry driven as there are some advanced countries like Australia, Canada and New Zealand which rely on modern agriculture and have high per capita incomes by being an agriculture led economies (Obioma et al., 2015). Likewise, not all developing countries have the potential to rely on industry for their transformation; instead a boom in the service sector can be significant reason for structurally transforming their economies, for example, the Indian economy has a service led growth (Sahoo and Bhunia, 2014). Yet, some other countries depend on industry led growth (Syrquin, and Chenery,1989; Chang, 2002;) Rodrik, 2016). Hence, another reason for undertaking this growth analysis of the Ethiopian economy is to find out if the economy is potentially capable of being industry driven for achieving structural transformation using the Kaldorian growth framework. The deindustrialization pattern in Ethiopia will be empirically analyzed using the contemporary

Rodrik's premature deindustrialization framework. Ultimately, results using these approaches leads to relevant and wider policy implications for Ethiopia and will be used as a groundwork for other developing countries.

2.3. Methodology

2.3.1. Analytical Framework and Empirical Model

This study uses Kaldor's growth laws as a theoretical framework to make an empirical analysis of the role that industry or manufacturing plays in the Ethiopian economy and in the productivity of different economic sectors. The Rodrick (2016) premature deindustrialization model is used as a framework for capturing the recent industrialization model and its implications for Ethiopia. In 1966, Kaldor presented the first formulation of his model to explain UK's slow rate of economic growth (Drakopoulos and Theodossiou, 1991; Kaldor, 1966). The main idea behind Kaldor's law of economic growth is that the manufacturing sector is the engine of progress in a modern economy (Alexiou and Tsaliki, 2017; Cornwall, 1976). Kaldor made three major arguments regarding economic growth and its link to the manufacturing sector. The theoretical arguments and mathematical expressions of these three laws are:

(I) Kaldor's First Law (Growth Hypothesis)*:* There is a positive relationship between manufacturing growth and output growth in an economy and this can be denoted as the following linear function (Kaldor, 1966; McCombie, 1983; Stoneman, 1976). But in our case, we estimate Equation (2.1a) as a Kaldor growth hypothesis to net out manufacturing value added from the national GDP to overcome the empirical problem of endogeneity to a certain degree. Yet, Equation (2.1b) is estimated by including control variables into the basic formulation to check the consistency of the specified relationship between manufacturing and growth in Ethiopian case:

$$(eq2.1). \quad gGDP_t = \beta_1 + \beta_2 gMVA_t + \varepsilon_t$$
$$(eq2.1a). \quad gNMVA_t = \alpha_1 + \alpha_2 gMVA_t + \varepsilon_t$$
$$(eq2.1b) \quad gNMVA_t = \gamma_1 + \gamma_2 gMVA_t + \gamma_3 L_t + \gamma_4 K_t + \varepsilon_t$$

In Equation (2.1), β1 is a constant term, gGDP refers to the growth in gross domestic product, and gMVA represents the growth in manufacturing value added while in Equation (2.1a), gNMVA stands for the growth of non-manufacturing value added. The coefficient β_2 and α_2 in the respective equations is expected to be positive and statistically significant. In our case equation (2.1a) will be estimated to control for endogeneity problem to some extent. Yet, eq. (2.1b) is estimated including control variables labor (L) and capital (K) to explore the reliability of the Kaldor growth hypothesis including control variables in the original specification.

(II) Kaldor's Second Law (the Kaldor-Verdoorn Law): Growth in the productivity of the manufacturing sector is positively related to the growth in the output of the manufacturing sector which is not true for other sectors like agriculture and services (Kaldor, 1966; McCombie, 1983; Stoneman, 1976; Verdoorn, 1980; Yamak et al., 2016). This law is called the Kaldor-Verdoorn law which can be mathematically expressed in two ways as:

$$(eq. 2.2).\ \ gMP_t = \alpha_1 + \alpha_2 gMVA_t + \varepsilon_t,\ \ \alpha_2 \neq 0$$
$$(eq. 2.2a). gMq_t - gMe_t = \theta_1 + \theta_2 gMVA_t + \varepsilon_t, \theta_2 \neq 0; KaldorVerdoorn\ Model\ I$$
$$(eq. 2.2b).\ gMe_t = \gamma_1 + \gamma_2 gMVA_t + \varepsilon_t, \gamma_2 \neq 0; Kaldor - Verdoorn\ Model\ II$$

In Equation (2.2), α1 is a constant and the dependent variable is growth in the manufacturing sector's productivity (gMP) and the explanatory variable is growth in manufacturing value added (gMVA). However, this model has two versions based on the definition of the dependent variable. In Model 1 or Equation (2.2a) the dependent variable is defined as the difference between manufacturing output growth (gMq) and manufacturing employment growth (gMe), θ_2 is the Verdoorn coefficient provided that θ_2 is greater than zero. The second notation for Kaldor-Verdoorn's law is in Equation (2.2b) where the dependent variable is manufacturing employment growth (gMe) and the explanatory variable denotes manufacturing value added growth (gMq), and the Verdoorn coefficient in this case will be 1-γ_2; and γ_2 must be greater than zero. In all the models ε represents the error term and t denotes that the data used in the model is a time series and α_1, θ1, and γ_1 represents intercepts in each equation respectively.

(III) Kaldor's Third Law**:** Productivity growth in an economy is positively linked to the growth in manufacturing output (Alexiou and Tsaliki, 2017; Kaldor, 1966) and is mathematically represented as:

$$(eq2.3).\ \ pGDP_t = \beta_1 + \beta_2 gMVA_t + \varepsilon_t,\quad \beta_2 \neq 0$$
$$(eq2.3a).\ pNMVA_t = \mu_1 + \mu_2 gMVA_t + \varepsilon_t,\ \mu_2 \neq 0$$

In Equation (2.3), β_1 is a constant, pGDP represents productivity growth in the economy, gMVA is growth in manufacturing value added, and β_2 is greater than zero. However, for the same reason as in the first Kaldor growth hypothesis we estimate Equation (2.3a) for the third law by taking the dependent variable as the productivity growth of the non-manufacturing sector (pNMVA) which nets out manufacturing value added and growth of manufacturing value added (gMVA) as explanatory variable. In the equation, μ_1 is a constant and μ_2 is the coefficient to be estimated and expected to be greater than zero.

(IV) Rodrik's (2016) model is adopted to empirically examine the deindustrialization pattern overtime taking Ethiopia as a case study for developing countries. The thinking is that in developing countries the share of manufacturing sector is low and recently is surpassed by the service sector neglecting the normal path of starting with agriculture proceeding to the manufacturing sector, and to the service sector along with an increase in per capita GDP. Rodrik (2016) estimated manufacturing share of GDP and manufacturing employment share as indicators of industrialization to measure how rapid is deindustrialization pattern in recent period by including time dummies in the regression and controlling for both demography and per capita GDP. Accordingly, this study estimates the recent Rodrik empirical model of deindustrialization overtime in Ethiopian case controlling for demography and income. Both manufacturing value-added and employment share as indicators of industrialization are specified as:

$$(eq. 2.4).\quad {MVA}/{GDP_t} = \alpha_1 + \alpha_2 lnpopn_t + \alpha_3 (lnpopn)_t^2 + \alpha_4 lnPGDP_t + \alpha_5 (lnPGDP)_t^2 + \alpha_6 TT + \varepsilon_t; Rodrik\ Model\ I$$

$$(eq. 2.4a).\quad {Memp}/{Temp_t} = \beta_1 + \beta_2 lnpopn_t + \beta_3 (lnpopn)_t^2 + \beta_4 lnPGDP_t + \beta_5 (lnPGDP)_t^2 + \beta_6 TT + \varepsilon_t; Rodrik\ Model\ II$$

Equation (2.4) represents the first Rodrik model and the dependent variable is manufacturing's share of GDP (MVA/GDP). The explanatory variables are lnpopn which stands for the logarithm of total population, $lnpopn^2$ represents the squared population amount, lnGDP per capita denotes the national per capita GDP of Ethiopia, and ln GDP per $capita^2$ represents when the per capita GDP of the country becomes very large. The β's represents parameters to be estimated and ε stands for the error term and t indicates the data is time series data. Equation (2.4a) represents the second Rodrik model and the dependent variable here is share of manufacturing employment to total employment (Memp/Temp). The explanatory variables in this model are defined as they are in the first model. By making the necessary modifications based on the availability of data the three Kaldor law equations and the two Rodrick model equations are estimated using reliable secondary data sources and relevant estimation approaches.

2.3.2. Estimation Method

This study uses time series data for estimating the empirical equations using an appropriate econometric approach. The data was sourced from the Ethiopian Central Statistics Authority (CSA), the Ministry of Finance and Economic Cooperation (MoFEC) of Ethiopia, Ethiopian Economic Association (EEA), the World Bank Development Indicators (WDI) database and the Groningen Growth and Development Center (GGDC) database.

For Kaldor's first law, two equations[19] were estimated and the dependent variable for the first equation was per capita GDP while non-manufacturing sector's output growth was the dependent variable in the second equation, provided that in both cases the manufacturing sector's output growth was the explanatory variable. For the second law, we wanted to estimate the Kaldor-Verdoorn coefficient and to make sure that there is an increasing return in the sector. Since we have two equations in this case, the dependent variable for the first one is productivity growth of the manufacturing sector whereas the regressor is manufacturing output growth but the risk here is that productivity is defined as the difference in output and employment growth in the manufacturing sector and this

[19] While estimating the equations, the estimated coefficient's results for different datasets were compared to find out how the results were different in the different datasets.

might lead to spurious regression results. For this reason, the second equation has employment growth in the manufacturing sector as a dependent variable and output growth in the sector as an explanatory variable. In Kaldor's third law, our dependent variable is productivity growth in the economy or the non-manufacturing sector which is explained by the manufacturing sector's output growth. In the Rodrik model two indicators of industrialization are estimated independently with time period dummies, demography and per capita GDP as explanatory variables.

This study uses a vector error correction model (VECM) for the estimation to determine the long and short run coefficients (Verbeek, 2019) for the three Kaldor hypotheses. We also did a Granger causality test to identify the bidirectional relationship between the dependent and explanatory variables in our empirical model. Along with this, the impulse response function (IRF) was also estimated to capture the effect of a shock on the manufacturing sector's growth and how other sectors in the economy responded to it. Both OLS and VEC models are estimated for Rodrik deindustrialization model. Ultimately, the necessary pre- and post-estimation tests are also done to ensure the reliability of the estimated coefficients.

2.4. Data

2.4.1. Overview of the Ethiopian Economy and Its Industry Sector

This section gives an overview of the Ethiopian economy and discusses the industry sector, to give the overall performance of the economy and its different sectors. This forms the basis for the regression analysis of the relationship between industry and the Ethiopian economy using the Kaldor's growth laws and the Rodrick deindustrialization empirical formulation.

Ethiopia is a developing country located in the Horn of Africa and is categorized as one of the faster growing and emerging countries. It is also one of the fastest growing, non-oil, and non-mineral economies in the world (CSA, 2014). In the last two decades, Ethiopia has come up with different development plans at the national level targeting poverty reduction and structural transformations. Table 2.3 presents the four development plans: the Ethiopian Sustainable Development and Poverty Reduction Program (SDPRP) from 2001 to 2005; a Plan for Accelerated and Sustained Development to end Poverty (PASDEP) from 2006 to 2010; the Growth and Transformation Plan One (GTP I) from 2011 to 2015; and the Growth and Transformation Plan Two (GTP II) from 2016 to 2020. We use these plan periods to classify the time span while discussing the economy and industry's performance in the country across these time periods.

Table 2-3: Ethiopian National Development Plans (2001-2020)

National Development Plans	Acronym	Duration
Ethiopian Sustainable Development and Poverty Reduction Program	SDPRP	2001-2005
A Plan for Accelerated and Sustained Development to end Poverty	PASDEP	2006-2010
Growth and Transformation Plan One	GTP I	2011-2015
Growth and Transformation Plan Two	GTP II	2016-2020

Source: MoFEC

Table 2.4 gives Ethiopia's GDP at constant prices, population in millions, and per capita GDP over time and across the developmental plan periods. Ethiopian GDP grew from 88, billion birr in 1960s to 1,498 billion birr in early GTP II plan period with a population that ranged between 28 million to 105 million for the respective years. Plus, Ethiopian per capita GDP in terms of birr was on average estimated to be 3,192 in 1960s and reached to14,270 birr in GTP II.

Table 2-4: GDP and Per Capita GDP in Ethiopia Overtime[20] (1960-2017)

Variables/Time	1960s	1970s	1980s	1990s
GDP at constant price in millions of birr	88,895	117,907	138,991	159,962
Population in million	28	32	40	56
Per capita GDP in birr	3,192	3,703	3,452	2,852
	SDPRP	PASDEP	GTP I	GTP II[21]
GDP at constant price in millions of birr	220,648	355,011	575,612	1,498,468
Population in million	72.2	82.9	95.4	105
Per capita GDP in birr	3,055	4,397	6,031	14,270

Source: Author's manipulation based on raw data

Table 2.5 gives the annual growth rate of real GDP and the growth rate of the agriculture, industry, and service sectors. In 1960s the growth rate of agriculture, industry, service and GDP has been 2, 8.9, 8.6 and 4 percent respectively. However, the growth rate for all has declined in the subsequent decades. During the SDPRP period, the GDP growth rate was 5.9 percent while the growth rate for agriculture, industry, and services was 5.6, 7.9, and 5.9 percent respectively. In the PASDEP period, the growth rate of real GDP and the sectors growth showed an increasing rate of 10.9 percent for GDP, 8.3 percent for agriculture, 10.1 percent for industry, and 14.1 percent for the service sector. However, in GTP I, only industry showed an increase from the previous period when it grew at 19.6 percent while agriculture, services, and real GDP showed a slightly declining rate of 6.5,

[20] All values reported in the paper all in real terms and 2010 is the base year to change the variables into real terms.

[21] The exchange rate on average is approximated to 1USD=21.8 birr (NBE, 2016)

10.9, and 10.0 percent respectively. In the current GTP II, we have two-year values which in general show a significant decline in agriculture's annual growth rate and real GDP. But, on average, industry shows an increase in its growth rate.

Table 2-5: Ethiopian Sectors 'and GDP Growth Overtime

Sectors/Periods	1960s	1970s	1980s	1990s
Agriculture	2.3	1.2	1.3	2.4
Industry	8.9	1.7	4.2	0.9
Services	8.6	3.8	3.3	2.8
GDP growth	4.2	1.9	2.1	2.1
	SDPRP	PASDEP	GTP I	GTP II
Agriculture	5.6	8.3	6.5	2.3
Industry	7.9	10.1	19.6	20.6
Services	5.9	14.1	10.9	8.7
GDP growth	5.9	10.9	10.1	8.0

Source: Author's manipulation based on raw data

According to Table 2.6, the share of agriculture in 1960s was 68 percent, industry 8 percent and service was 24 percent. For the subsequent decades, the share of agriculture has been declining to 61 and 54 percent in 1970s and1980s respectively. In contrast, the share of industry and service for the same subsequent decades has been increasing. Yet, the share of agriculture was 51.1 percent of the GDP and it played a leading role during the SDPRP period compared to the industry and service sectors which contributed 10 and 39.1 percent respectively. In PASDEP and GTP I, the percentage contribution of agriculture reduced to 48.2 and 41.7 percent respectively whereas the contribution of services increased to 42.7 and 46.1 respectively. In the first two years of GTP II, the service sector took over the leading role by contributing 39.4 percent on average followed by agriculture contributing 37.1 percent and industry, 24.8 percent to the real GDP of the country.

Table 2-6: Share of the Sectors to Ethiopian GDP (in Percent)

Sectors/Periods	1960s	1970s	1980s	1990s
Agriculture	68.4	61.2	54.2	58.2
Industry	8.1	8.9	11.3	8.8
Service	23.6	29.9	34.5	33.3
	SDPRP	PASDEP	GTP I	GTP II
Agriculture	51.3	48.2	41.7	37.1
Industry	10.1	9.8	12.9	24.8
Service	39.1	42.7	46.1	39.4

Source: Author's manipulation based on raw data

In Ethiopia, the industry sector comprises of four sub-sectors: mining and quarrying, manufacturing, electricity and water utilities, and construction. An average growth rate and share of the industry sub-sectors is presented in Table 2.7. Construction industry and electricity and water industry had 13.0 and 6.5 percent growth in SDPRP followed by mining and quarrying and manufacturing with growth rates of 5.2 and 5.1 percent respectively. In PASDEP, mining and quarrying took the lead role with construction, manufacturing, electricity and water following. In GTP I manufacturing industry revived itself and took the second place following the construction industry. In GTP II, manufacturing made a huge contribution with 18.4 growth rate next to construction while electricity plus water and mining plus quarrying took the third and fourth positions. In GTP II, mining and quarrying differently revealed a negative growth rate which was -3.3 which could be attributed to the political unrest in the country whereas the other sub-sectors had positive growth with construction taking the first position and manufacturing the second one followed by electricity and water.

Likewise, the manufacturing industry in SDPRP has 42 percent share of the total industry production followed by construction, electricity and mining with 35, 11.7 and 10.1 percent share respectively. However, in GTP II construction contributed 70 percent share while manufacturing took 25 percent share, 3 percent share of electricity and water and 1.4 share of mining and quarrying. This implies that recently construction is dominating the industry by being three quarter of the total share followed by the manufacturing sector (see Table 2.7).

Table 2-7: Growth and share of the Industry's sub-Sectors in Ethiopia

Industry/Time/Growth	SDPRP	PASDEP	GTP I	GTP II
Mining and Quarrying	5.2	14.0	9.6	-3.3
Manufacturing	5.1	9.5	15.1	18.4
Electricity and Water	6.5	7.0	10.8	15.0
Construction	13.0	11.1	27.8	25.0
Share	SDPRP	PASDEP	GTP I	GTP II
Mining and Quarrying	10.1	8.4	11.6	1.4
Manufacturing	42.6	40.9	34.5	25.1
Electricity and Water	11.7	10.9	8.7	3.1
Construction	35.6	39.8	45.2	70.3

Source: Author's manipulation based on raw data

Table 2.8 gives the share and contribution of the industry sub-sectors to real GDP. Mining and quarrying never reached a 2 percent share of GDP for two decades and its contribution to GDP was very low at 0.1 percent which fell to -1.3 percent during GTP II. On average, manufacturing had a 4.5 percent share of GDP during the four national development plan periods. Its contribution to GDP growth was 0.2 and 0.4 in the SDPRP and PASDEP periods respectively. But it showed an increase during GTP I and GTP II growing at 1.5 and 2.4 percent respectively. On average, the share of electricity and water was 1.1 percent for the development plan periods and its contribution to GDP growth never exceeded 0.4 percent on average in the same periods. Construction showed an increase in its share in GDP from 3.6 percent in the SDPRP period to 8.9 percent in the first two years of GTP II. It contributed 0.2 percent to GDP growth in the SDPRP period which is the lowest and contributed its highest to GDP growth during GTP I (2.8 percent).

Table 2-8 Share of Industry's Sub-sectors to GDP and contribution of the sub-sectors to GDP growth (in Percent)

Industry/T	SDPRP Share	PASDEP Share	GTP I Share	GTP II Share
Mining and Quarrying	1.0	0.8	1.3	0.8
Manufacturing	4.3	4.0	4.4	5.2
Electricity and Water	1.2	1.1	1.0	1.1
Construction	3.6	3.9	6.2	8.9
Contribution of Industry's Sub-sectors to GDP Growth (in Percent)				
	Contribution	Contribution	Contribution	Contribution
Mining and Quarrying	0.1	0.1	1.0	-1.3
Manufacturing	0.2	0.4	1.5	1.4
Electricity and Water	0.1	0.1	1.1	0.25
Construct	0.2	0.4	2.8	1.4

Source: EEA and author's calculations.

The manufacturing sector in Ethiopia has two sub-sectors: large and medium scale manufacturing industries and small-scale and cottage industries. Tables 2.9 and 2.10 give the growth and share of the manufacturing sub-sectors, their share in GDP and their respective contribution to GDP growth. The share of large and medium manufacturing during SDPRP was 57 percent while the share of small scale and cottage industry in the same period was 43 percent. In the subsequent plan periods the share of medium and large-scale manufacturing has increased to 61, 69 and 74 percent during the PASDEP, GTP I and GTP II plan periods respectively. The share of small scale and cottage industries on the other hand have declined to 39 percent in the PASDEP and to 30.6 in GTP I and further declined to 26.5 in GTP II (see Table 2.9). Similarly, the growth rate of the large and medium scale manufacturing industries was 4.6 and 11.9 percent in the SDPRP and PASDEP plan periods respectively. The tables also show an increase in the growth of medium and large manufacturing industries during GTP I and GTP II with a growth rate of 17.2 and 23.2 percent respectively. This shows that the large and medium scale manufacturing industries showed increased growth. The growth rate of small scale and cottage industries on average was 4.72 for the national development plan periods which seems relatively small.

Table 2. 10 shows the share and contribution of the two manufacturing subsectors to GDP and GDP growth respectively. The large and medium scale industries had 2.4 share to GDP during SDPRP and it had 4.1 share to GDP on GTP II. The small scale and cottage industries had 1.8 share of GDP in SDPRP and 1.05 share in GTP II. Similarly, the contribution of medium and large manufacturing to GDP growth was 0.1 in the SDPRP period and reached 1.7 in GTP II while the small scale and cottage industries on average has on average contributed 0.25 to GDP growth across the four plan periods (see Table2.10).

Table 2-9: Average Growth and Share of the Manufacturing Sub-sectors

Manufacturing/Time/Share	SDPRP	PASDEP	GTPI	GTP II
Large and Medium Scale	57.1	61.1	69.4	73.5
Small Scale and Cottage	42.9	38.9	30.6	26.5
Manufacturing/Time/Growth	SDPRP	PASDEP	GTPI	(GTP II)
Large and Medium Scale	4.6	11.9	17.2	23.2
Small Scale and Cottage	5.8	5.97	4.1	2.8

Source: Author's manipulation based on raw data

Table 2-10: Share and Contribution of Manufacturing Sub-sectors to GDP and GDP Growth (in Percent)

Manufacturing/Time	SDPRP	PASDEP	GTP I	GTPII
	Share	Share	Share	Share
Large and Medium	2.4	2.5	3.1	4.1
Small Scale & Cottage	1.8	1.6	1.2	1.05
	Contribution	Contribution	Contribution	Contribution
Large and Medium	0.1	0.3	2.0	1.7
Small Scale & Cottage	0.1	0.2	0.4	0.3

Source: EEA and author's calculations.

We now move to trends in agriculture, industry, service, and manufacturing sectors over a relatively longer time period taking the real value added for each of them. Figure 2.2 gives the manufacturing and industry values as a share of GDP from 1961 to 2016. With some alterations, the development of industry was consistent till 1980s. But it revealed a stepper increase and later declined which might be due to the war during the military regime in the country. Then, started witnessing an increase with a steeper trend very recently which could be due to attention given by the government to the industry sector and especially to the manufacturing sector. The manufacturing share to GDP throughout is stable and has never exceeded 5 percent for those decades which might be attributed to several factors such as institutions, linkage, energy etc. However, a further empirical investigation is required to identify the factors that explain the performance of manufacturing in Ethiopia overtime.[22]

[22] An empirical investigation of the explanatory factors for the performance of manufacturing sector in Ethiopia overtime is addressed in the following four individual papers focusing on political economy, sectoral linkage, public policy and energy use.

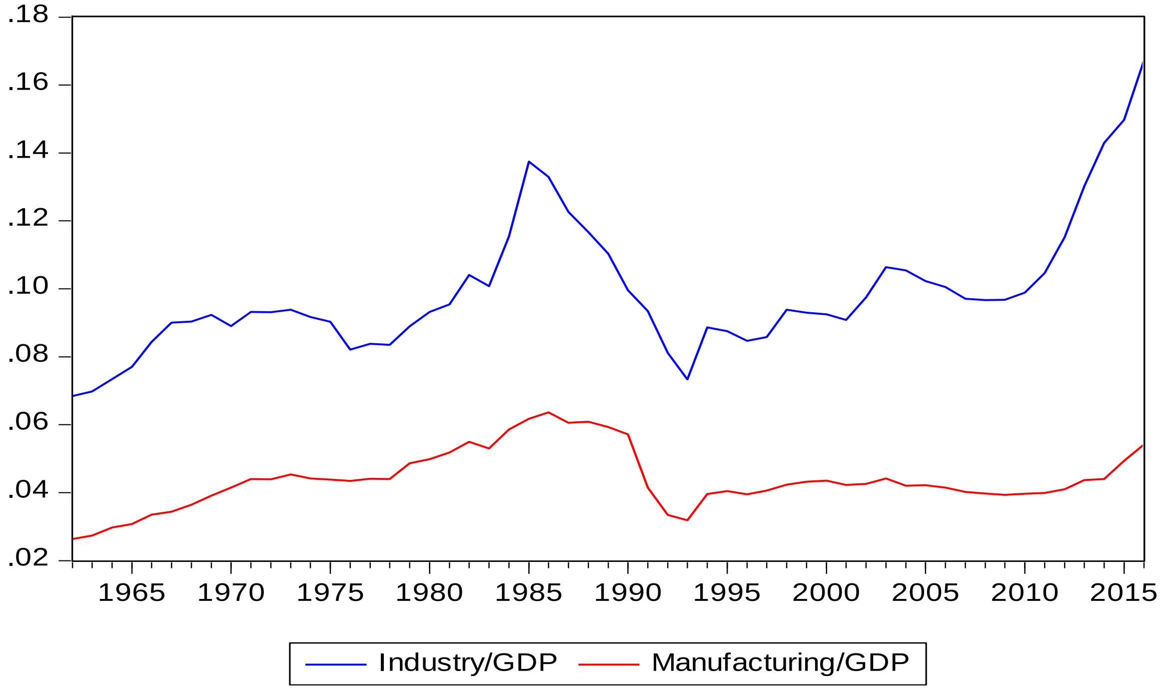

Figure 2-2: Manufacturing and Industry as a Share of GDP Over Time

Source: Author's manipulation based on raw data

Figure 2.3 shows that agriculture was stable from the early 1960s till the mid-1980s after which it started fluctuating and went up till the end of the 1990s. From 2006 till very recently it had a steeper upward trend which could be attributed to good weather conditions for agricultural production and agricultural productivity growth attributed to technological adoption and/or utilization of fertilizers to produce agricultural products.

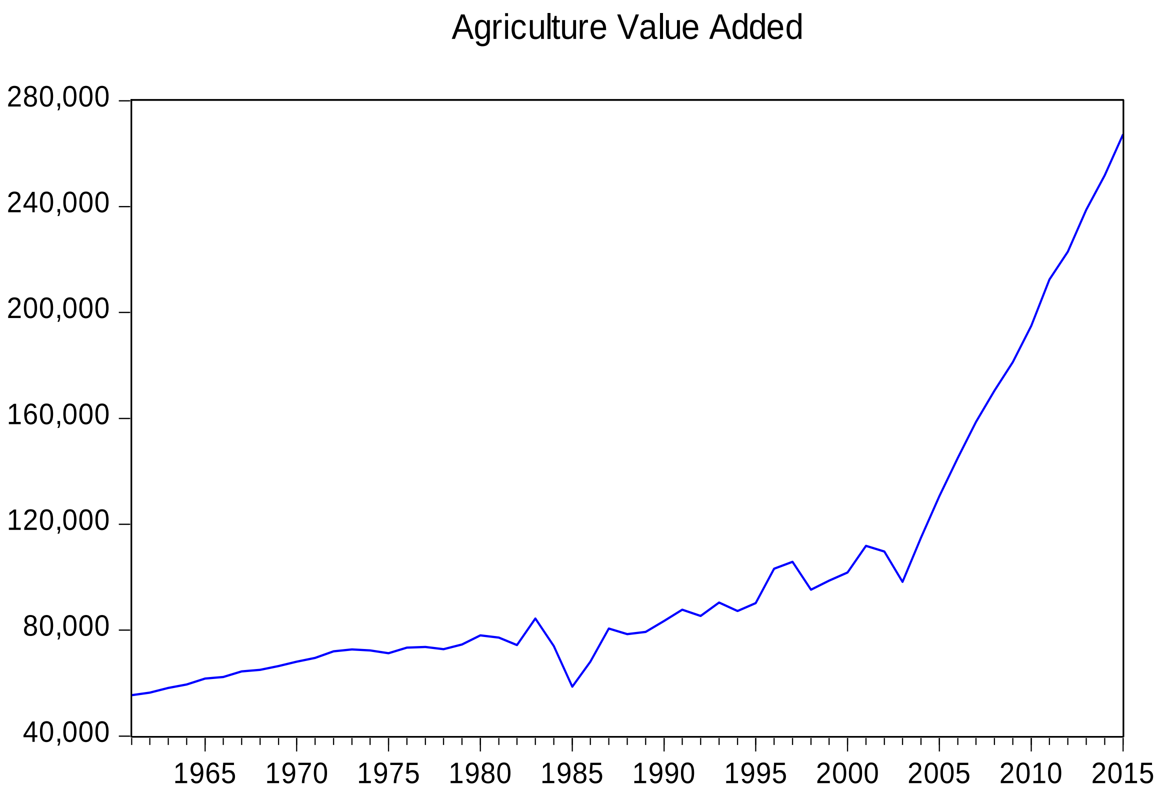

Figure 2-3: Agriculture Value Added in Millions of Birr Overtime (1961-2016)

Source: Author's manipulation based on raw data

Figures 2.4 and 2.5 give information on trend behaviors of the industry and service sectors respectively. Industry's contribution to GDP was relatively low starting in the early 1960s and remained so till the mid-1990s. This can be attributed to several factors such as institutions, lack of required skilled and professional human capital, and irrelevant industrial policies in terms of different economic systems and political ideologies of those in power. But, recently due to the government's attention to the sector we see a steeper increasing trend in the industry sector's value added. The service sector had the same trend in the early years but recently it too has been showing an increasing trend which could be attributed to its quick pay-off for investors compared to the other sectors. Investors in this sector are basically local and, in a majority, who had rather invest in the service sector than in manufacturing to avoid unnecessary bureaucracy, extensive costs of machine, and a relatively delayed pay-off on their investments.

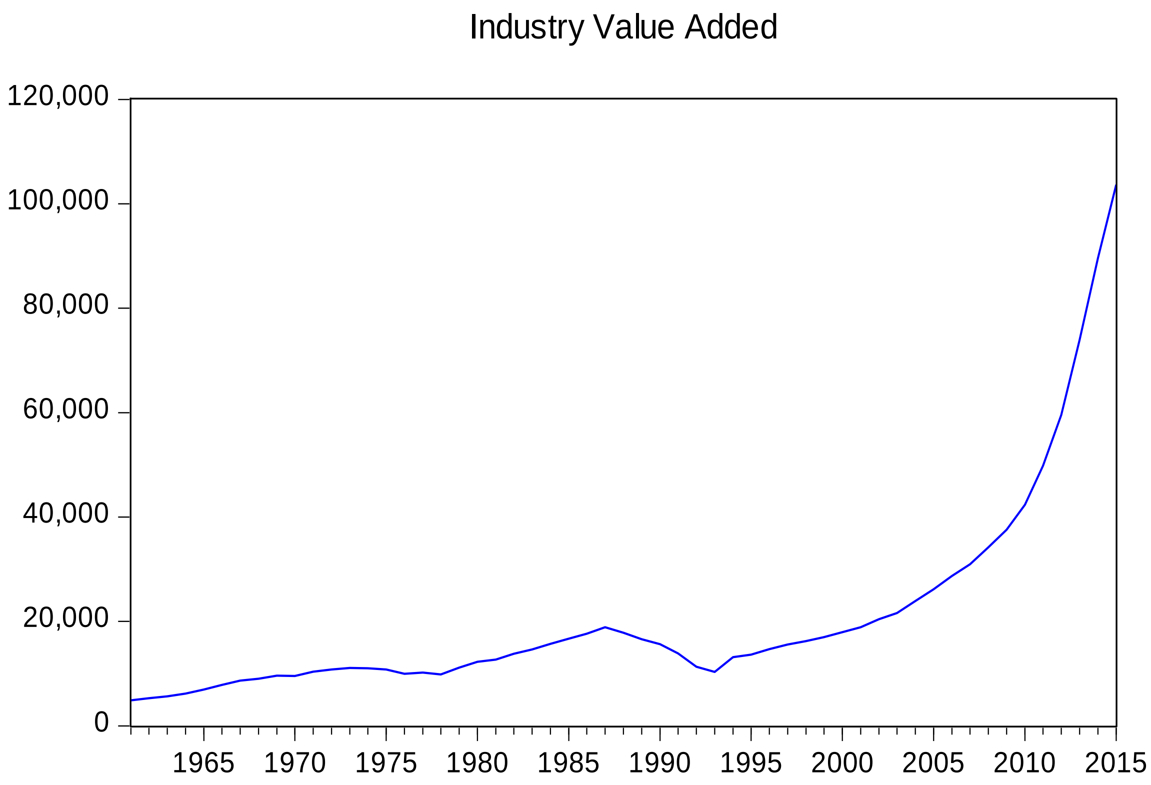

Figure 2-4: Industry Value Added in Millions of birr Overtime (1961-2016)

Source: Author's manipulation based on raw data

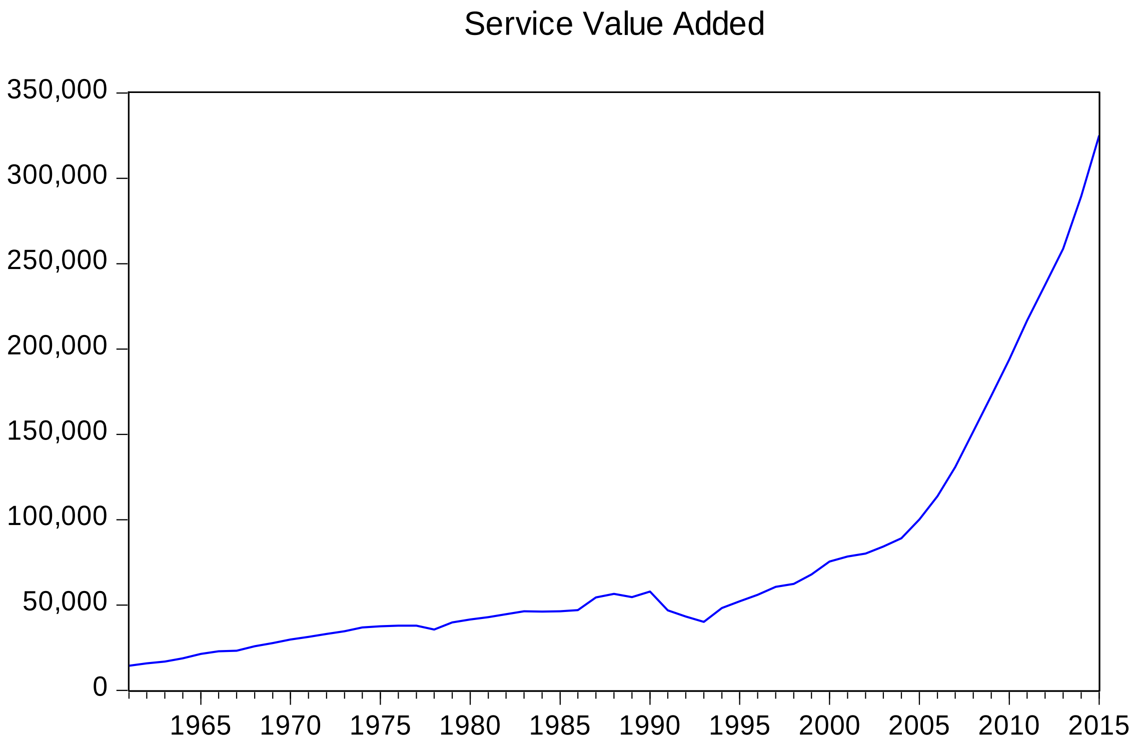

Figure 2-5: Service Value Added in Millions of birr Overtime (1961-2016)

Source: Author's manipulation based on raw data

Figure 2.6 gives the share of the three sectors over time. In the early periods, agriculture dominated the economy followed by the service sector while the industry sector was last. But, of late the position has switched and the service sector is playing a leading role followed by agriculture and finally by industry. However, one important thing here is that the industry sector is also showing sharp improvements which if sustained and improved could lead to another shift and a chance for structurally transforming the economy by making the industry sector play the leading role. Yet, this requires identifying the limiting factors for the performance of the industry sector in Ethiopia.

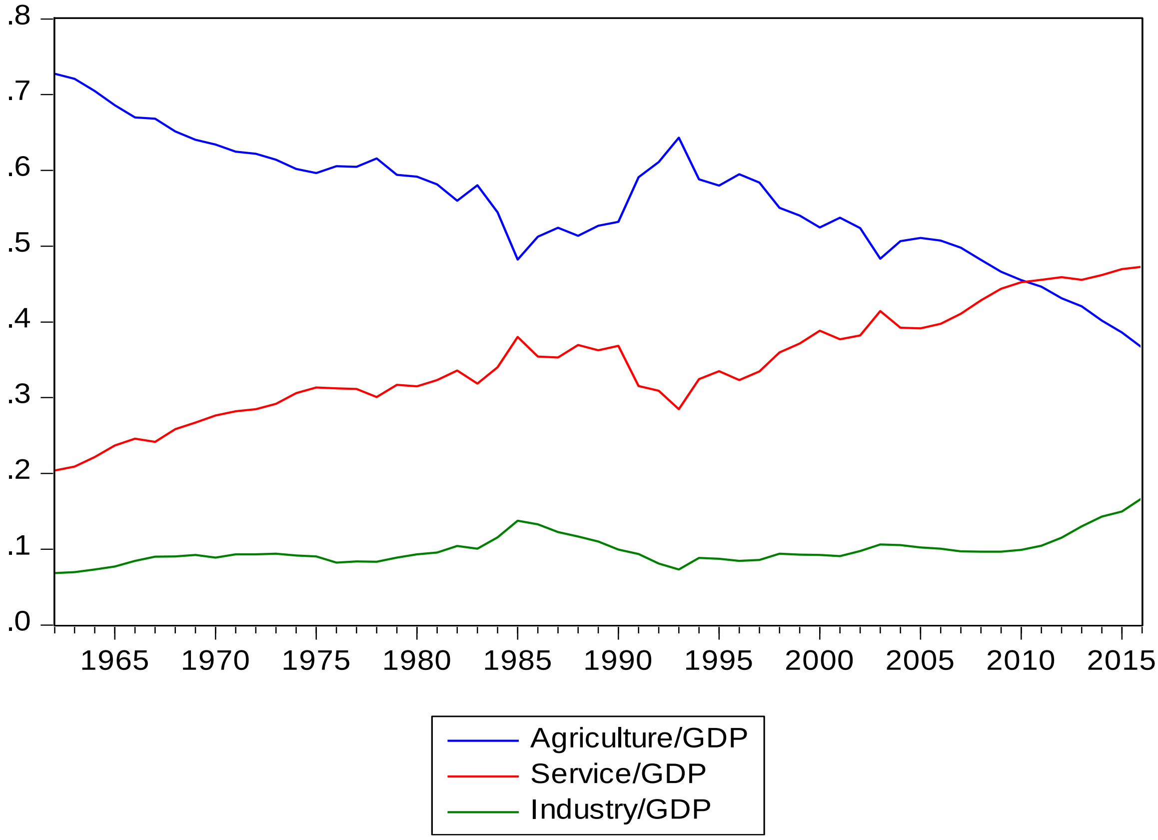

Figure 2-6: Agriculture, Industry, and Service Shares to GDP Over time

Source: EEA and author's calculations.

2.4.2. Descriptive Statistics

This section gives the summary statistics for the variables included in the Kaldor's growth hypothesis. Based on Table 2.11, we have time series data with 55 yearly observations from 1962 till 2016 for variables such as GDP growth rate, the growth rate of non-manufacturing value added (gNMVA) which is a sum of the service and agriculture value added excluding the industry sector, growth rate of the manufacturing value added (gMVA), growth rate of the industry value added (gIVA). According to Table 2.11, mean growth rate for GDP and NMVA is 4.4 and 4.2 respectively whereas the mean growth rate for manufacturing and industry value added is 6.16 and 6.43 respectively. The table also gives the minimum and maximum value of the variables.

Table 2-11: Summary Statistics for Kaldor's Growth Hypothesis' Variables (1962-2016)

Variable	Obs	Mean	Std.Dev	Minimum	Maximum
gGDP	55	4.4242	5.5782	-10.4438	15.9213
gNMVA	55	4.2270	5.7249	-12.6742	17.2965
gMVA	55	6.1641	9.5189	-31.4330	31.0829
gIVA	55	6.4374	8.6258	-18.2593	27.4018

2.5. Discussion of the Results

In this section, pre-estimation tests including the stationarity test, optimal lag length, and the rank selection for the model to be estimated are presented. The Granger causality analysis for Kaldor growth hypothesis and estimation of the error correction model for the same model is discussed. Then, the Kaldor-Verdoorn law and the third Kaldor law are empirically estimated and are discussed followed by estimation of the Rodrick model of deindustrialization pattern overtime in Ethiopia.

2.5.1. Pre-estimation Tests

Before doing a time series analysis, the first step is ensuring the stationarity of the series to overcome the problems of spurious regression results. Thus, we used the Augmented Dickey Fuller (ADF) and Philips Perron (PP) unit root test statistics to check the variables' stationarity. The null hypothesis for these tests is a series has a unit root, meaning it is not stationary. If the p-value of the estimated coefficient is less than 5 percent or 1 percent, then we reject the null hypothesis at 5 and 1 percent significance levels respectively. This ensures the stationarity of the series. If we fail to reject the null hypothesis then we should take the difference in the series and see if it is stationary or not. In our case we did the tests under two cases: with constant and constant and trend specifications. The test statistic results indicated that all the variables are not stationary at level but are stationary at first difference implying that they all are integrated of order one (Table 2.12).

Table 2-12: Unit Root Test Results for Kaldor's Growth Hypothesis

	ADF Test		PP Test		
Variables at level					
Variable	With constant	With constant and Trend	With constant	With constant and Trend	Conclusion
GDP	1.0000	0.9998	1.0000	1.0000	Fail to reject H_0
NMVA	1.0000	0.9982	1.0000	0.9970	Fail to reject H_0
MVA	0.9996	0.9835	0.9999	0.9811	Fail to reject H_0
IVA	0.9889	0.9437	0.9826	0.9312	Fail to reject H_0
Variables at first difference					
GDP	0.0026	0.0004	0.0026	0.0008	Reject H_0
NMVA	0.0008	0.0019	0.0026	0.0030	Reject H_0
MVA	0.0006	0.0012	0.0008	0.0017	Reject H_0

IVA	0.0008	0.0039	0.0009	0.0039	Reject H_0

Notes: p values are reported for both ADF and PP unit root tests
H_0= A series has unit root.

Another important step before estimating the models is selecting the optimal lag length using different criteria. We used the Akaike Information Criterion (AIC), the Hannan Quin Information Criterion (HQIC), and the Schwartz Bayesian Information Criterion (SBIC). Based on the three criteria's the optimal lag length is decided to be 1 (see Table 2.13).

Table 2-13: Optimal Lag Length of the Model for Kaldor's Growth Hypothesis

Optimal Lag Length	AIC	HQIC	SBIC
0	-5.0479	-4.9737	-5.0194
1	-5.2185*	-4.9955*	-5.1327*
2	-5.1665	-4.7947	-5.0235
Sample			1966 -2016
Number of Observations			51

To estimate the vector error correction model, we must first test for a cointegrating rank using different test statistics. We used trace statistics and maximum Eigen value tests. The null hypothesis is based on the maximum rank and if the trace statistic is zero it means there is no cointegrating vector, if it is one it means there is one cointegrating vector, and if it is n, it means there are n-number of cointegrating vectors (Green, 2002; Johansen,1988). In our case the null hypothesis of a zero cointegrating vector is rejected and the null hypothesis of one cointegrating vector fails to be rejected statistically by both tests because the value of the test statistics is greater than the critical value at the 5 percent significance level (see table 2.14). The existence of a long run relationship between manufacturing and economic growth in Ethiopia coincides with empirical studies in most developed countries (Alexiou and Tsaliki**,** 2010; Drakopoulos and Theodossiou**,** 1991; Stoneman**,** 1976).Similarly, it coincides with results for countries like China, Taiwan, Indonesia, and the Republic of Korea that industrial development played a significant role in their economies (Kniivilä, 2008).

Table 2-14: Johansen Test for VECM's Cointegrating Rank for Kaldor's Growth Hypothesis

Maximum Rank	Eigen Value	Trace Statistics	5% Critical Value
0		14.8409	15.41
1	0.2856	6.1926*	3.84
Maximum Rank	Eigen Value	Max-Eigen Statistics	5% Critical Value
0		13.6837	14.26
1	0.1108	6.1926*	3.84

2.5.2. Granger Causality Test and Estimation of the VECM for the [23]Kaldor Growth Hypothesis

To verify the bidirectional relationship between the variables of interest we used the Granger causality test. The null hypothesis for this test is the independent variable does not Granger cause the dependent variable, if its probability value at the 5 percent significance level is less than 5 percent or if the test value is larger than the critical value, then we reject the null hypothesis and accept the alternative which confirms that the independent variable Granger causes the dependent variable (Granger, 1969). For the null hypothesis that MVA's growth does not Granger cause GDP growth, we reject the null hypothesis and statistically accept the alternative. This confirms that manufacturing growth Granger causes GDP growth. However, the null hypothesis that GDP growth does not Granger cause MVA's growth is also rejected implying that GDP growth also leads to manufacturing growth and thus confirms the bidirectional relationship between the two variables.

Our other null hypothesis is that MVA's growth does not Granger cause NMVA's growth and we reject the null hypothesis and statistically accept the alternative ensuring that manufacturing growth leads to non-manufacturing growth. In contrast, we fail to reject the null hypothesis that NMVA's growth does not Granger cause MVA's growth and are assured that non-manufacturing growth does not lead to manufacturing growth with the implication that there is a one directional relationship that goes from manufacturing to non-manufacturing growth. In our case, NMVA represents the rest of the economy excluding the manufacturing industry. It basically represents the agriculture and services, intuitively, our agriculture is traditional, and service is dominantly non-tradable that it makes sense that growth in those sectors might not cause growth in the manufacturing sector in practice.

Another null hypothesis is that IVA's growth does not Granger cause NMVA's growth and we reject this hypothesis at the 5 percent significance level and the counter hypothesis that NMVA's growth does not Granger cause IVA's growth is rejected confirming that non-manufacturing growth leads to industry's growth. The theoretical hypothesis that we started with is that manufacturing growth positively augments the economy's growth which is defined as the first Kaldor law. Based on the Granger causality test result, manufacturing and GDP have a bidirectional relationship which limits to estimate the model with GDP as dependent variable and MVA explanatory one. The other result confirms that manufacturing growth leads to non-manufacturing growth but not the other way around thus coinciding with Kaldor's first growth hypothesis (see Table 2.15).

[23] The Kaldor Growth hypothesis is exhaustively calibrated in the analysis as the major objective of the chapter is to investigate the existence of empirical relationship between manufacturing and Ethiopian economy in the long run.

Table 2-15: Granger Causality Tests' results[24]

Null Hypothesis: H_0	Alternative Hypothesis:H_1	p value	Decision
gMVA does not Granger cause gGDP	gMVA does Granger cause gGDP	0.03	Reject H_0
gGDP does not Granger cause gMVA	gGDPdoes Granger cause gMVA	0.02	Reject H_0
gMVA [25]does not Granger cause gNMVA	gMVA does Granger cause gNMVA	0.01	Reject H_0
gNMVA does not Granger cause gMVA	gNMVA does Granger cause gMVA	0.10	Fail to reject H_0
gIVA does not Granger cause gNMVA	gIVA does Granger cause gNMVA	0.10	Fail to reject H_0
gNMVA does not Granger cause gIVA	gNMVA does Granger cause gIVA	0.02	Reject H_0

Note: Fail to reject/reject Ho at the 5% level of significance.

In addition, we estimated the long run and short run coefficients for Kaldor's first law or the growth hypothesis. Table 2.16 below shows growth in non-manufacturing value added is the dependent variable and manufacturing output growth is an explanatory variable. Our results confirm that manufacturing growth is statistically significant and positively affects the other sectors' growth in the long run. This result coincides with empirical results in (Alexiou and Tsaliki**,** 2010; Drakopoulos and Theodossiou**,** 1991; Kniivilä, 2008; Stoneman**,** 1976). In the short run, the coefficient of manufacturing growth is statistically significant and positively affects the non-manufacturing sector's growth. Besides, the error correction term is statistically significant and with a negative coefficient value confirming adjustment to the long run equilibrium. The adjustment coefficient is negative and between 0 and 1that adjusts to the long run equilibrium annually (Table 2.16). As manufacturing sector is adynamic with the advantage of technology and knowledge transfer the adjustment coefficient can be relatively large in this sector relative to other sectors.

Table 2-16: Coefficients of VECM for Kaldor Growth Hypothesis with gNMVA as Dependent Variable

Long run Coefficients			
Variables	Coefficients	Std. Error	P-value
gMVA	0.4019	0.0918	0.0001
Constant	0.0177	0.0098	0.0757
Short run Coefficients			
Variables	Coefficients	Std. Error	p-value
(D)gMVA	0.3162	0.0685	0.0000
ECT-1	-0.7868	0.1141	0.0000

[24] The Granger Causality Test is annexed on Appendix A4 (page 201)
[25] The objective of the Granger causality is to check for bidirectional relationship between GDP and MVA against NMVA with MVA.

Table 2.17 presents an estimation result of the Kaldor growth hypothesis including some control variables in the model. The results of the OLS model are reported for comparison reason. Since all variables are confirmed to be non-stationary at level but are stationary at first difference the results of the least square model will be spurious. Thus, the VEC model results are reported to explain the relationship among the variables. The first column in the VEC model indicates that manufacturing growth positively affects the non-manufacturing sector's growth. In the second column which gives the VEC coefficient only labor is included as a conditioning variable and both manufacturing growth and labor are statistically significant and positive. In third column of the VEC model, labor and capital are included as control variables. They all are statistically significant in affecting non-manufacturing growth. In the third case, labor, capital and manufacturing growth affect the rest of the economy positively. This model is estimated as a robustness check for the consistency in the relationship between manufacturing growth and its effect in the economy.

Table 2-17: Estimation Results for the Kaldor Growth Hypothesis with Control Variables and Non-Manufacturing Value added growth as a Dependent Variable

		OLS Model		VEC Model		
Variables	Coef.	Coef.	Coef.	Coef.	Coef.	Coefficient
gMVA	2.2447**	1.5895**	1.6300**	0.4019**	1.4784**	1.5108**
	(0.0207)	(0.1000)	(0.0755)	(0.0918)	(0.1598)	(0.0696)
Labor	-	0.4692	0.5432**	-	0.5428	0.6907**
		(0. 0708)	(0.0549)		(0.1077)	(0.0496)
Capital	-	-	0.0997	-	-	0.2676**
			(0.0851)			(0.1187)
Constant	-0.0457	0.9360	0.8398**	0.0177	1.1198	0.9164
	(0.0721)	(0.1566)	(0.1189)	(0.0098)		
R-squared	0.9962	0.9983	0.9990	0.9943	0.9945	0.9955
Adjusted R-squared	0.9963	0.9982	0.9989	0.9937	0.9935	0.9944

Note: ***, **, and * indicate rejection of the null hypothesis at 1%, 5%, and 10% significance levels.

2.5.3. Impulse Response Function for the Kaldor Growth Hypothesis

The impulse response function shows how a one SD shock or impulse to a variable will lead to a change in the response of other variables for consecutive time periods. Accordingly, a one SD shock to manufacturing value added growth initially had a positive and increasing impact on non-manufacturing value added growth until the third period while it radically declined and even became negative in the fifth period. Beyond the fifth period, non-manufacturing growth positively responded to the shock in manufacturing growth till the tenth period. The implications of this impulse response are that a shock to manufacturing growth will positively augment the other sectors in the first three-year period. Yet, shocks to the manufacturing sector will asymmetrically impact the non-manufacturing sector both in the short and long run (see Figure 2.7).

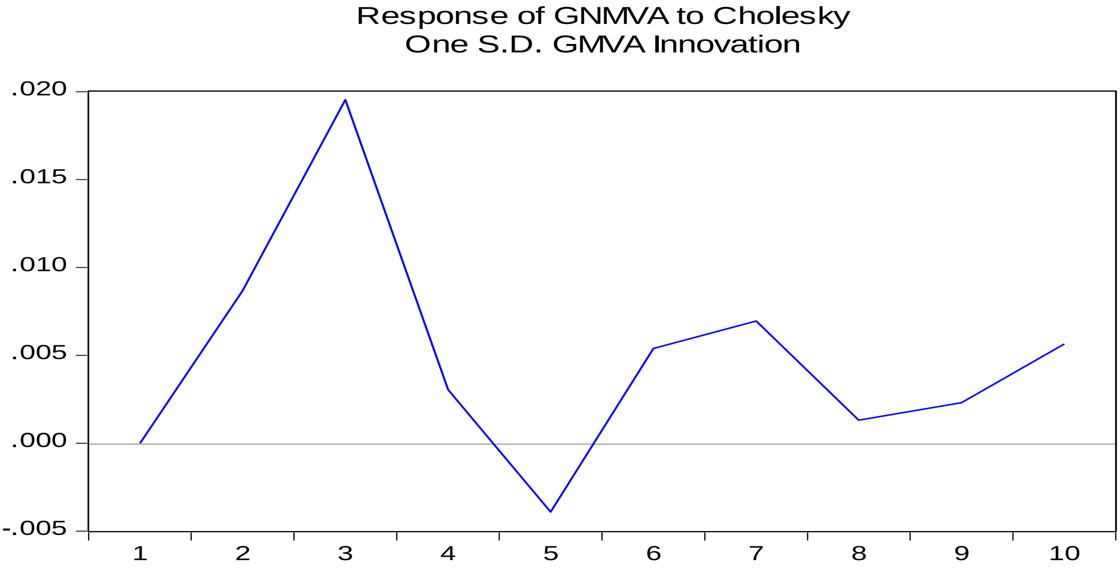

Figure 2-7: Impulse response of NMVA to a SD Shock to MVA

The diagnostic tests are equally important as estimating the coefficients because unless the post-estimation is correct, we cannot take the results for granted. We used the Lagrange multiplier test, the Jarque-Bera test, and the skewness test to check for autocorrelation and normality statistical problems. The null hypothesis for the Lagrange multiplier test is no autocorrelation and we fail to reject the null hypothesis confirming that there is no autocorrelation problem in our case. The null hypothesis for the other two tests is normal distribution and we fail to reject the null hypothesis like in the first test. Yet, the null hypothesis for homoscedasticity is failed to be rejected based on the white test. Therefore, we can use our estimates as the model is clear from statistical problems (Table 2.18).

Table 2-18: Post-estimation Tests

Diagnostic tests	Null Hypothesis:H_0	Alternative Hypothesis:H1	p-value	Decision
Lagrange-Multiplier Test	No autocorrelation	H_0 is not true	0.6670	Fail to reject H_0
Jarque-Bera test & Skewness test	Error is normally distributed	H_0 is not true	0.2000 0.4630	Fail to reject H_0
Heteroscedasticity White Test	Homoscedastic	H_0 is not true	0.1237	Fail to reject H_0

2.5.4. Empirical Tests for the Verdoorn-Kaldor Law in Ethiopia

The objective of this study is assessing the role that industry or manufacturing growth plays in the Ethiopian economy. The central theoretical framework that we used for the investigation is Kaldor’s laws which have been explained earlier. Kaldor’s first law was confirmed using the Granger causality and error correction model estimations. In this section, Kaldor’s second law or the Kaldor-Verdoorn law is put to an empirical test using Ethiopian data. We start with summary statistics, unit root test, lag, and rank selection before finally coming up with the estimated coefficient results.

Table 2.19 gives 39 observations from 1977 to 2015. We have three variables for estimating Kaldor-Verdoorn's law: growth rate of manufacturing output (gMq), growth rate of manufacturing employment (gMe), and productivity growth in manufacturing which is the difference in output growth and employment growth in the manufacturing sector. The mean for manufacturing output growth and employment growth is 5.5 and 5.3 percent respectively with 0.14 productivity growth in the manufacturing sector. The minimum and maximum values for all the variables are given in Table 2.19.

Table 2-19 Summary Statistics for Variables in Kaldor-Verdoorn Model (1977- 2015)

Variable	Obs	Mean	Std. Dev	Minimum	Maximum
gMq	39	5.5075	10.7580	-31.4330	31.0829
gMe	39	5.3624	14.2040	-28.4909	48.4881
(gMq-gMe)	39	0.1450	17.2797	-52.1538	59.5738

As we did for Kaldor's first law variables, a stationarity test is done before estimating the coefficients using the Augmented Dickey Fuller test as well as the Philips Perron (PP) unit root test statistics. The statistics show that the three variables are non-stationary at level as we fail to reject the null hypothesis that a series has unit root for each case. However, variables are stationary at first difference. This means the variables are integrated of order one (see Table 2.20).

Table 2-20: Unit Root Test for the Verdoorn-Kaldor Law

	ADF Test		PP Test		
Variables at level					
Variable	With constant	With constant and Trend	With constant	With constant and Trend	Conclusion
Mq	0.9996	0.9835	0.9999	0.9811	Fail to reject H_0
Me	1.0000	0.9990	0.9999	0.9978	Fail to reject H_0
M(q-e)	0.6744	0.5651	0.9888	0.9432	Fail to reject H_0
Variables at first difference					
Mq	0.0006	0.0012	0.0008	0.0017	Reject H_0
Me	0.0002	0.0003	0.0002	0.0004	Reject H_0
M(q-e)	0.0217	0.0056	0.0315	0.0059	Reject H_0

Notes: p values are reported for both ADF and PP unit root tests
H_0= A series has unit root

The next step is confirming the lag length for which we used AIC, HQIC, and SBIC to identify the optimal lag length of our model and three of the criteria confirmed one as the optimal lag length in our case (see Table 2.21).

Table 2-21: Optimal Lag Length of the Kaldor-Verdoorn Law Model

Optimal Lag Length	AIC	HQIC	SBIC
0	15.9518	15.9825	16.0406
1	15.6211*	15.7132*	15.8878*
2	15.7960	15.9494	16.24040
Sample			1981 -2015
Number of Observations			35

We used the Johansen test for cointegration to see the cointegration rank for our model and the null hypothesis that the maximum rank is zero, is failed to be rejected statistically thus confirming that there is no cointegration in our case (see Tables 2.22 and 2.23).

Table 2-22: Johansen Test of Cointegrating Rank for the Kaldor-Verdoorn Model-1 (gMq-gMe with gmva)

Maximum Rank	Eigen Value	Trace Statistics	5% Critical Value
0	0.2953	15.5329*	15.4947
1	0.0675	2.5856	3.8414

Table 2-23: Johansen Test of Cointegrating Rank for the Kaldor-Verdoorn Model-2 (gMe with gmva)

Maximum Rank	Eigen Value	Trace Statistics	5% Critical Value
0	0.2953	15.5329*	15.4947
1	0.0675	2.5856	3.8414

Table 2.24 shows the short run coefficients of Kaldor-Verdoorn's law for the two models. In the first model manufacturing productivity is the dependent variable and manufacturing growth output is an explanatory variable whereas in Model 2, growth in manufacturing employment is a dependent variable and output growth in manufacturing is an independent variable. In the first model manufacturing output growth positively affects productivity growth in the sector but the coefficient is not statistically significant. In the second model, manufacturing output growth negatively affects employment growth in the sector, but its coefficient is not statistically significant. However, the error correction term in both the models is negative and statistically significant.

Table 2-24 : Short Run Coefficients of Kaldor-Verdoorn's Law for Models 1and 2

Model 1 (gMq-gMe) as dependent variable			
Variables	Coefficients	Std. Error	p-value
D(gMq(-1))	0.0132	0.3386	0.969
C	-0.1828	2.6166	0.944
ECT-1	-1.6686	0.2982	0.000
Model 2 (gMe) as dependent variable			
Variables	Coefficients	Std. Error	p-value
D(gMq(-1))	-0.3781	0.2378	0.112
C	0.3746	2.6345	0.887
ECT-1	-1.0896	0.3005	0.000

The VCEM estimation provides the long run estimates that are statistically significant and positive coefficients in both the models. The p-value confirms that in the first model manufacturing output growth positively and significantly affected productivity growth in the sector and the second model shows that growth in manufacturing output positively and significantly affected growth in manufacturing employment at 5 percent significance level. However, the cointegrating rank test confirms that there is no cointegration (see Table 2.25). This finding coincides with some countries' empirical experiences (Drakopoulos and Theodossiou**,** 1991; Martinho**,** 2012). Kaldor's second law is different from the first law as it is estimated in two models and the results might be altered based on the definitions of the variables in the model. The researcher suggests a further study on the second law by including more variables in the model and considering the variables' definitions to check if the results could change.

Table 2-25: Long Run Coefficients of Kaldor-Verdoorn's Law for Models 1and 2

Model 1 (gMq-gMe) as dependent variable			
Variables	Coefficients	Std. Error	P-value
gMq	0.4368	0.1752	0.013
Constant	1.8924		
Model 2 (gMe) as dependent variable			
Variables	Coefficients	Std. Error	P-value
gMq	0.9463	0.2341	0.001
Constant	2.1999		

Finally, we did a diagnostic test of autocorrelation and normality using the Lagrange multiplier test and the skewness test statistics respectively for the Kaldor-Verdoorn model. Our results show that we failed to reject the null hypothesis for both indicating no problem of autocorrelation and issues related with normality (see Table 2.26).

Table 2-26: Post-estimation Test of the Kaldor-Verdoorn Model

Diagnostic tests	Null Hypothesis:H0	Alternative Hypothesis:H1	P value	Decision
Lagrange-Multiplier Test	No autocorrelation	H0 is not true	0.3863	Fail to reject H_0

Jarque-Bera test and Skewness test	Error is normally distributed	H0 is not true	0.1102 & 0.1129	Fail to reject H_0

2.5.5. Empirical Validation of Kaldor's Third Law in Ethiopia

The third law states that manufacturing growth stimulates the productivity of other sectors in the economy. Accordingly, the equation for the third law is estimated with non-manufacturing productivity as the dependent variable and manufacturing growth as the explanatory variable in a baseline regression. Before estimating this, a unit root test must be done to check stationarity of the variables. Both the variables were found to be non-stationary at level and stationary at first difference (see table 2.28). Optimal lag is chosen to be one based on the AIC, HQIC, and SBIC criteria with a sample size of 46 years (see Table 2.27).

Table 2-27: Unit Root Test for the Kaldor's third Law's Model

	ADF Test		PP Test		
		Variables at level			
Variable	With constant	With constant and Trend	With constant	With constant and Trend	Conclusion
Mq	0.9996	0.9835	0.9999	0.9811	Fail to reject H_0
NMe	0.3647	0.3668	0.2265	0.3542	Fail to reject H_0
		Variables at first difference			
Mq	0.0006	0.0012	0.0008	0.0017	Reject H_0
NMe	0.0313	0.0010	0.0285	0.0492	Reject H_0
		Optimal Lag Length			
	AIC	HQIC	SBIC	Sample	Number of Observations
0	-1.3224	-1.2444	-1.2929	1964 -2012	46
1	-9.3054*	-9.0716*	-9.2171*		
2	-9.1892	-8.7994	-9.0419		

Notes: p values are reported for both ADF and PP unit root tests
H_0= A series has unit root.

The next step is checking for the existence of a long run relationship between manufacturing growth and productivity of the non-manufacturing sector. Based on the trace statistics as well as the Max-Eigen statistics we fail to reject the null hypothesis of no cointegration among the variables as the statistics' values are less than the critical values at 5 percent level of significance (see Table 2.28). Therefore, based on our sample data there is no long run relationship between manufacturing growth and non-manufacturing productivity. This result coincides with those for some Asian countries and the Greek economy as well (Drakopoulos and Theodossiou, 1991; Mamgain, 1999). No coefficient result is reported for this specific law in the text because it empirically rejects the existence of long run relationship based on the sample data (see Table A1.3). This result motivates to do a further study using different sample sizes, different estimation methods and control variables to check if results could change.

Table 2-28: Cointegration test for the existence of a long run Relationship for Kaldor's Third Law

Maximum Rank	Max-Eigen Statistic	5% Critical Value	Trace Statistics	5% Critical Value
0	7.3901	14.2646	8.8596	15.4947
1	1.4694	3.8415	1.4695	3.8415

2.5.6. Empirical Validation of the Rodrick Deindustrialization Model in Ethiopia

Table 2.29 presents the test static result of the Augmented Dickey Fuller (ADF) unit root tests for variables in Rodrick model. In this model, we have two dependent variables representing industrialization/deindustrialization. One is the ratio of manufacturing value added to GDP and the second one is the share of manufacturing employment to total employment. The objective in this model is to examine the deindustrialization pattern overtime in Ethiopia empirically. The first step in any timeseries analysis is to check for stationarity of the series to overcome spurious estimation results. Accordingly, all variables in the model are found to be non-stationary at level based on the test statistics. They are stationary at first difference and integrated of order one variables.

Table 2-29: Unit Root Test Results for Rodrick Deindustrialization Model

Variable	ADF test at level With constant	ADF test at level with constant and trend	ADF test at first difference With constant	ADF test at first difference with constant and trend	Conclusion
Manufacturing Output Share	0.2331	0.5591	0.0025	0.0249	I(1)
Manufacturing Employment Share	1.0000	0.9999	0.0472	0.0001	I(1)
ln population	0.8542	0.8141	0.0010	0.0001	I(1)
ln GDP per capita	0.9975	0.9875	0.0002	0.0074	I(1)
ln population squared	0.8964	0.6993	0.0009	0.0001	I(1)
ln GDP per capita squared	0.9986	0.9918	0.0002	0.0018	I(1)

Notes: p values are reported for the ADF Test
H_0= A series has unit root.

Table 2.30 gives the estimation output for the deindustrialization pattern over time in Ethiopia with two proxy variables as indicators[26] of industrialization: manufacturing output share and employment share which are estimated independently. The results for the OLS model are reported for a comparison reason as all variables in the model are found to be non-stationary at level and they become stationary at first difference.

The VEC estimation result confirm that, for the manufacturing output share, an increase in population initially increases industrialization and a higher population increase leads to deindustrialization. An increase in per capita GDP induces industrialization initially and leads to deindustrialization with a higher increase in income in the case of Ethiopia coinciding with theoretical predictions (Rodrik, 2016). An increase in per capita income will cause deindustrialization in the manufacturing output which could be due to society's focus on productive services attached to dynamic technologies and could be labor saving technical change that increases productivity.

Regarding to employment share indicator of industrialization, an increase in the population will aggravate employment deindustrialization. But very large population is an opportunity being a demand for industrial products which will increase production capacity that requires additional employment coinciding with our coefficient for population squared in the second VEC model. On the other hand, an increase in income will increase investment capacity with a large possibility for job opportunities such that the pattern in employment share increases with an increase in income. However, when per capita income is very huge then demand will diverge to services and employment will be substituted by technology and will lead to an increase in employment deindustrialization; our results also confirm this. The required diagnostic tests are made to ensure the reliability of the estimated parameters in the model (see Table 2.30). Overall, results coincide with Rodrick's explanation (Rodrick, 2016) of the pattern of deindustrialization overtime taking Ethiopia as a case study.

The study also examined the trend of the two industrialization indictors overtime using period dummies. The coefficients of the period dummies will tell the effect of common shocks felt by manufacturing during each time period. Accordingly, in the manufacturing share the effect of the shock is negative for both periods inducing deindustrialization. Yet, deindustrialization is more rapid in recent times comparing the shock in 1990s with 2000s. Likewise, the coefficient for the employment share model indicates deindustrialization has been more rapid in recent periods in Ethiopia.

[26] The data for both indicators starts from 1981 to 2012.

Table 2-30: Deindustrialization Pattern Overtime in Ethiopia (Rodrik Model)

	Manufacturing Output Share		Manufacturing Employment Share	
Variables	OLS Coefficient	VEC Coefficient	OLS Coefficient	VEC Coefficient
ln population	5.4760**	4.7936*	-32.9271**	-15.6957**
	(2.6023)	(0.6795)	(13.327)	(0.8425)
ln population squared	-0.4076**	-0.2746*	2.8732*	0.9147**
	(0.1690)	(0.0431)	(0.8648)	(0.0537)
ln GDP per capita	0.6214	0.3331*	1.8634	4.1409**
	(0.4985)	(0.1413)	(2.9742)	(0.1938)
ln GDP per capita squared	-0.1266	-0.0803*	-0.2174	-0.8685**
	(0.1061)	(0.0302)	(0.6345)	(0.0415)
1990s	-0.0114*	-0.0139*	-0.1003*	-0.0038**
	(0.0032)	(0.0009)	(0.0229)	(0.0011)
2000+s	-0.0130**	-0.0162*	-0.0949*	-0.0116**
	(0.0049)	(0.0014)	(0.0326)	(0.0017)
Constant	18.8233	-20.3833	84.1275	61.8095
	(7.6287)		(51.6751)	
R-squared	0.8408	0.9139	0.9948	0.7984
Adjusted R-squared	0.7944	0.8335	0.9938	0.7178
Normality	0.1924	0.2161	0.2205	0.2518
Serial Correlation	0.2402	0.2909	0.1593	0.3701
Heteroscedasticity	0.4152	0.5178	0.2094	0.4528

EViews 10 Estimation results

Note: *, **, and *** indicate rejection of the null hypothesis at the 1%, 5%, and 10% significance levels. For the diagnostic checks p-values are reported.

2.6. Conclusion and Policy Implications

This chapter assessed the role that manufacturing growth plays in Ethiopian economic performance using the classical Kaldor growth laws as the theoretical formulation. It also used the recent Rodrick premature deindustrialization framework to evaluate the deindustrialization pattern overtime taking Ethiopia as case study for developing countries. Both descriptive and econometric analyses were undertaken using time series data from 1962 to 2016. Because of limited data availability for some variables, two types of datasets with different time lengths were used to empirically estimate Kaldor laws.

The descriptive analysis showed that the agriculture sector had the lion's share of the economy followed by the service sector in the earlier years. However, recently this situation has changed, and the service sector is leading, and the agriculture sector is following. This coincides with the premature notation of deindustrialization as given by Rodrick (2016). The industry's share was very low in the 1960s and even in later decades but started growing recently with very low share of manufacturing to the GDP overtime.

Regarding to Kaldor's first law or the growth hypothesis, Ethiopian data confirmed its validity using the Granger causality and error correction methods of estimation. Our results showed that manufacturing output growth is statistically significant and positively affects non-manufacturing output growth both in the short and long run. The Granger causality test confirmed a one directional causality relationship that runs from manufacturing output growth to the other sectors' output growth but not the other way around. For the Kaldor growth hypothesis, we included additional control variables to make the model more robust. Labor and capital were included in the model with a statistically significant effect on the economy. In all the models, manufacturing growth was found to be statistically significant and positive in affecting the growth of the non-manufacturing sector in the Ethiopian economy. For the first Kaldor law, an impulse response function is estimated to see the effect of a shock in the manufacturing sector on the other sectors. The impulse response function's results show that a one SD shock in the manufacturing sector's growth has a positive and increasing effect in the consecutive three-year periods.

Kaldor's second law or the Kaldor-Verdoorn law was supported by Ethiopian data but not as strongly as the first law. This can be attributed to the models and the methods that are used which need further investigation using this result as a groundwork. For this law two cases were estimated. One is productivity growth as a dependent variable and manufacturing growth as an independent variable and in this case, the coefficient is positive but statistically insignificant in affecting productivity growth in the sector. In the second case, employment growth in manufacturing is the dependent variable and output growth is the explanatory variable and the coefficient was negative and statistically insignificant. The error correction term was negative and statistically significant as it was expected to be. In the long run, manufacturing output growth is statistically significant and positively affects manufacturing productivity and employment growth respectively.

Kaldor's third law in Ethiopia is not empirically supported because there is no long run relationship between manufacturing growth and productivity in the economy which can be attributed to the weak linkages among the sectors. Yet, as the manufacturing sector in Ethiopia is not well established, it is not in the position to withdraw labor from other sectors and induce their productivity implicitly. This inspires us to undertake a further study using different datasets and empirical strategies to make sure if results remain as they are or if they could change.

For the recent Rodrick premature deindustrialization framework two indicators of industrialization are estimated: one for manufacturing output share and the other is the share of manufacturing employment. The results in both cases showed that output and employment industrialization indicators are determined by demography and per capita GDP in Ethiopia. Yet, it is empirically confirmed that a shock in the manufacturing has a negative impact which is more pronounced in recent periods. Results show that, deindustrialization has been more rapid in recent periods in Ethiopia.

This study shows the need for encouraging the manufacturing sector's growth to lift the performance of the other sectors in the economy. The manufacturing sector should be empowered for it to take on the leading role in the economy followed by the other sectors. Plus, the link between labor productivity and the manufacturing sector is weakly supported. Major policy interventions are required to overcome the challenges in the sector. Therefore, besides other productivity enhancing factors, encouraging manufacturing growth can induce productivity. Our results also show that demography and per capita GDP are pillars for managing output and employment patterns of industrialization in Ethiopia.

This study also shows that for many decades industry's growth was low and did not show any progressive growth for various reasons which might be attributed to poor infrastructure, weak institutions, and weak sectoral linkage problems. However, a further empirical investigation is needed for identifying limiting factors of manufacturing growth in Ethiopia. Therefore, together with working on relevant policies to boost the industry there should be a way to deeply investigate the limiting factors to smooth out the path to industrialization and structural transformation.

In Ethiopia, since the service sector is consuming imported durable goods and materials used in production, an ideal transformation of the industry sector can be in material extraction along with focusing on agriculture-based industries which is the competitive advantage of Ethiopia. This will be a determinant for making the country self-sufficient in production and supply of materials to be used in the industry sector and its development as also the mechanization of the agriculture sector. Following the development of the industry and agriculture sectors there can be a transformation of the service sector into a productive one. This will promote welfare, well-being, quality of life, and capacity to participate in the reconstruction and development of neighboring countries. Ultimately, this enables the government to invest in infrastructure to increase technological and human capital's capacities to achieve sustainable and balanced industrial development for a knowledge-based society.

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Appendix A1

Table A1 1: Rank of Countries in the World based on Manufacturing Value added as a percentage share of GDP

Africa				**Asia**			
Rank	Country	Value	Year	Rank	Country	Value	Year
1	Swaziland	33.23	2016	1	China	29.38	2015
2	Dem. Rep. Congo	19.32	2016	2	Korea	29.34	2016
3	Morocco	17.91	2016	3	Thailand	27.42	2016
4	Lesotho	17.35	2016	4	Myanmar	22.79	2016
5	Egypt	17.07	2016	5	Malaysia	22.27	2016
6	Tunisia	16.67	2016	6	Turkmenistan	21.67	2004
7	Côte d'Ivoire	14.38	2016	7	Indonesia	21.27	2016
8	Madagascar	14.35	2008	8	Japan	20.55	2015
9	Mauritius	13.91	2016	9	Philippines	19.65	2016
10	Benin	13.72	2015	10	Singapore	19.62	2016
11	Senegal	13.50	2014	11	Turkey	18.83	2016
12	South Africa	13.34	2016	12	Bahrain	18.28	2016
13	Cameroon	12.86	2015	13	Jordan	18.17	2016
14	Namibia	11.98	2016	14	Bangladesh	17.91	2016
15	Equatorial Guinea	11.62	2016	15	Cambodia	17.24	2016
16	Burkina Faso	11.01	2016	16	Sri Lanka	16.94	2016
17	Guinea-Bissau	10.73	1999	17	Kyrgyz Republic	16.64	2016
18	Malawi	10.30	2016	18	India	16.51	2016
19	Burundi	10.08	2016	19	Vietnam	15.86	2016
20	Kenya	10.03	2016	20	Russia	13.72	2016
21	Zimbabwe	9.55	2016	21	Israel	13.04	2016
22	Mozambique	9.53	2016	22	Saudi Arabia	12.87	2016
23	Uganda	9.50	2016	23	Pakistan	12.80	2016
24	Nigeria	8.77	2016	24	Iran	12.30	2016
25	Seychelles	8.45	2014	25	Georgia	12.05	2016
26	Congo	8.22	2016	26	Kazakhstan	12.00	2016
27	Zambia	8.07	2016	27	Afghanistan	11.82	2016
28	São Tomé and Principe	7.44	2016	28	Brunei	11.46	2016
29	Central African Republic	7.20	2015	29	Tajikistan	11.19	2013
30	Mauritania	6.88	2016	30	Yemen	11.05	2016
31	Guinea	6.60	2005	31	Armenia	10.21	2016
32	Sudan	6.33	2011	32	Lebanon	9.06	2016
33	Rwanda	6.26	2016	33	Qatar	9.05	2016
34	Algeria	6.07	2016	34	Lao PDR	8.78	2016
35	Botswana	5.68	2016	35	Oman	8.46	2016
36	Eritrea	5.65	2009	36	United Arab Emirates	8.09	2010
37	Ghana	5.63	2016	37	Syrian Arab Republic	7.99	2002
38	Tanzania	5.54	2016	38	Mongolia	7.91	2016

39	The Gambia	4.85	2016
40	Togo	4.69	2016
41	Somalia	4.62	1990
42	Mali	4.54	1979
43	Libya	4.49	2008
44	Ethiopia	4.34	2016
45	Angola	3.87	2001
46	Chad	3.21	2016
47	Gabon	3.13	2015
48	Liberia	3.05	2016
49	Djibouti	2.45	2007
50	Sierra Leone	1.98	2016

North America

Rank	Country	Value	Year
1	Mexico	19.11	2016
2	United States	12.27	2015
3	Canada	10.62	2013
4	Greenland	2.66	2015
North America		11.165	Average
Mexico		19.00	MAX
Greenland		2.70	MIN

South America

Rank	Country	Value	Year
1	Guyana	43.38	2016
2	Argentina	16.43	2016
3	Ecuador	15.87	2016
4	Uruguay	14.45	2016
5	Peru	13.86	2016
6	Venezuela	13.55	2014
7	Bolivia	13.43	2016
8	Suriname	13.35	2016
9	Colombia	12.58	2016
10	Chile	12.01	2016
11	Paraguay	11.87	2016
12	Brazil	11.71	2016

	East Africa		
Rank		Value	Year
1	Kenya	10.03	2016
2	Uganda	9.50	2016
3	Eritrea	5.65	2009
4	Tanzania	5.54	2016
5	Somalia	4.62	1990
6	Ethiopia	4.34	2016
7	Djibouti	2.89	2016

39	Bhutan	7.82	2016
40	Kuwait	6.82	2016
41	Nepal	5.97	2016
42	Azerbaijan	5.59	2016
43	Hong Kong SAR, China	1.11	2016
44	Timor-Leste	0.79	2015
45	Macao SAR, China	0.78	2015

Europe

Rank	Country	Value	Year
1	Ireland	34.69	2016
2	Czech Republic	27.08	2016
3	Hungary	23.54	2016
4	Slovenia	23.24	2016
5	Germany	22.91	2016
6	Belarus	22.75	2016
7	Slovak Republic	22.62	2016
8	Romania	21.44	2016
9	Poland	20.42	2016
10	Serbia	18.97	2016
11	Lithuania	18.97	2016
12	Turkey	18.83	2016
13	Switzerland	18.36	2016
14	Austria	18.20	2016
15	Finland	16.91	2016
16	Bulgaria	16.64	2016
17	Italy	16.27	2016
18	Estonia	15.75	2016
19	Denmark	15.32	2016
20	Macedonia	15.32	2016
21	Sweden	15.28	2016
22	Bosnia and Herzegovina	15.00	2016
23	Croatia	14.87	2016
24	Belgium	14.26	2016
25	Spain	14.19	2016
26	Ukraine	14.19	2016
27	Portugal	13.92	2016
28	Moldova	13.89	2016
29	Latvia	12.27	2016
30	Netherlands	12.15	2016
31	Iceland	11.61	2015
32	France	11.38	2016
33	United Kingdom	10.13	2016

				34	Greece	9.87	2016
				35	Malta	8.76	2016
				36	Norway	7.62	2016
				37	Albania	6.45	2016
				38	Luxembourg	5.58	2016
				39	Cyprus	5.03	2016
				40	Montenegro	4.57	2016
				41	Andorra	3.60	2015
Central America & Caribbean				**Middle East**			
Rank	Country	Value	Year	Rank	Country	Value	Year
1	Puerto Rico	46.75	2013	1	Turkmenistan	21.67	2004
2	El Salvador	20.66	2016	2	Turkey	18.83	2016
3	Guatemala	19.37	2016	3	Bahrain	18.28	2016
4	Honduras	18.83	2016	4	Jordan	18.17	2016
5	Nicaragua	14.98	2016	5	Kyrgyz Republic	16.64	2016
6	Dominican Republic	14.70	2016	6	Israel	13.04	2016
7	Cuba	14.35	2015	7	Saudi Arabia	12.87	2016
8	Costa Rica	13.24	2016	8	Pakistan	12.80	2016
9	Jamaica	9.14	2016	9	Iran	12.30	2016
10	Belize	8.25	2015	10	Afghanistan	11.82	2016
11	St. Kitts and Nevis	6.85	2016	11	Tajikistan	11.19	2013
12	Trinidad and Tobago	5.94	2016	12	Yemen	11.05	2016
13	St. Vincent and the Grenadines	5.54	2016	13	Lebanon	9.06	2016
14	Panama	5.47	2016	14	Qatar	9.05	2016
15	Grenada	3.94	2016	15	Oman	8.46	2016
16	Barbados	3.81	2015	16	United Arab Emirates	8.09	2010
17	The Bahamas	3.09	2016	17	Syrian Arab Republic	7.99	2002
18	Antigua and Barbuda	2.79	2016	18	Kuwait	6.82	2016
19	Dominica	2.63	2016				
20	St. Lucia	2.60	2016				
21	Cayman Islands	0.96	2012				

Source: The World Bank's National Account; OECD National Account Files; and the Index MUNDI Ranking.

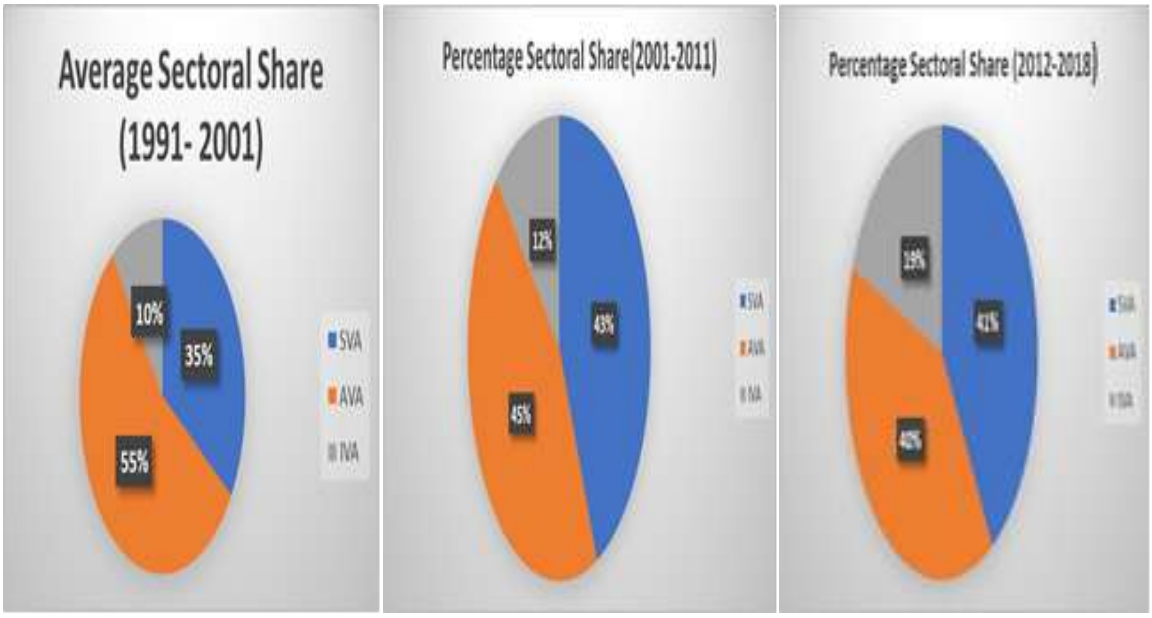

Figure A1 1: Sectoral Percentage Share (1991-2018)

Table A1 2: Share of Manufacturing Value added, Employment, and Exports in Ethiopia

Time	Percentage share of manufacturing value added (average)	Percentage share of Industry employment (average)	Percentage share of Industry export (average)
1991-2001	4.9387	6.2877	9.2646
2002-2005	5.4325	6.9585	8.4088
2006-2010	4.2359	7.7588	9.1370
2011-2015	3.8401	8.7456	8.3702
2016-2018	5.8999	11.4383	

Source; EEA

Table A1 3: Non-manufacturing productivity as the Dependent Variable

Variables	OLS Coefficient	VEC Coefficient
Manufacturing Growth	1.7564 (0.0477)	1.1837 (0.2430)
Constant	1.5094 (0.1604)	-3.4420

3. Political Economy of Industrialization and Industrial Parks in Ethiopia[27]

Paper Two

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Abstract

This study investigates the political economy of industrialization in Ethiopia. It discusses the economic and political institutions during three political regimes and assesses the industrial sector's performance across these different regimes. Further, it evaluates the different industrial strategies and organizational structures for implementing the industrial policies together with the current industrial park strategy and its contemporary impact on employment creation, export promotion, foreign exchange generation, the value chain, and spillover effects. Both narrative and quantitative approaches are used for exploring the role of political economy in Ethiopian industrialization. Different political strategies were followed by the political regimes to support the industrial sector. The paper distinguishes between two extreme political strategies. The study confirms that political institutions negatively impacted industry for several decades. The results support focusing on institutions to successfully implement industry policies for inducing the industrialization process in the country. Policies must be implemented considering existing opportunities and resources in the country along with their respective economic outcomes instead of excessive priority being given to the political interests of the regime in power.

Keywords: Industrialization; Industrial Parks; Political Economy; Industry Growth; Ethiopia

JEL Classification Codes: J24; O14; O25; O47; P48

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[27] A previous draft of this paper was presented in Stockholm at the KTH Royal Institute of Technology and at the Jonkoping International Business School, Jonkoping, Sweden. We would like to thank Professor Hans Lööf and the participants of both the seminars.

3.1. Introduction

Industrialization traditionally includes manufacturing, mining, construction, and utilities such as water, electricity, and gas but recently it has expanded to include the process of development that is balanced and sustainable as far as the sociopolitical and economic realms of a society are concerned (Nzau, 2010; Oyenga, 1968). It is also a generic term for a set of economic and social processes related to the discovery of more efficient ways of creating value (Simandan, 2009). Industrialization provides several advantages such as reducing unemployment, technology transfers, economic diversification, and welfare enhancement (Beji, and Belhadj, 2014; Mayer, 2004). It also contributes significantly to the accumulation of human, physical, infrastructural capital and provides substantial backward and forward linkages with the other sectors of the economy. It facilitates relatively well-paid jobs for large number of unskilled and low skilled workers which increases their incomes and domestic demand for industrial products as well (Signe, 2018). Industrialization plays a key role in the process of a nation's economic development and inclusive growth by enhancing an efficient use of resources, generating employment and incomes, and facilitating international trade (Martorano et al., 2017; UNIDO, 2018a).

Deindustrialization on the other hand occurs when employment in the manufacturing sector shrinks through time or it represents a decline in the share of manufacturing value added to the total GDP of an economy (Peneder and Streicher, 2018; Rowthorn and Ramaswamy, 1997). A steady share of manufacturing value added to GDP in an economy or the process by which the manufacturing sector is skipped in the process of development can also be termed as deindustrialization (Cáceres, 2017; Grabowski, 2015). De-industrialization is also considered as the fall in the share of industrial employment in total employment and industrial output in GDP (Schweinberger and Suedekum, 2015). De-industrialization can be excessive or premature indicating the failing competitiveness of manufacturing while the former is related with high per capita income and the later with low level of economic development (Peneder and Streicher, 2018; Rodrick, 2016). In fact, premature deindustrialization is related with poor industrial performance perhaps rooted in political economy and other features while excessive deindustrialization is entirely a normal process of economic development related with high per capita income (Alderson, 1999).

Various studies document that countries have managed to structurally transform their economies through industrialization. The empirical experience of early industrializers such as the UK, US, France, and Germany and new industrializers, more prominently East Asian and Latin American countries provides practical evidence of how industrialization in its different forms enables a structural transformation of their economy (Beji and Belhadj, 2014; Shafaeddin, 1998). Early industrializers managed to industrialize by protecting their infant industries through government interventions in terms of protection and subsidies. There are many explanations for the successful industrialization of late industrializers particularly the East Asian countries including their political economy, cultural, institutional, and international approaches complementing each other (Lajciak, 2017; Shafaeddin, 1998).

On the other hand, deindustrialization in advanced and developing countries has different reasons and implications (Caceres, 2017; Rowthorn and Ramaswamy, 1997). Recently, deindustrialization in most western countries has shown a declining level of employment in manufacturing which is attributed to huge per capita incomes and prosperity inclined more towards the service sector instead of the primary or secondary sectors of agriculture and industry respectively (Caceres, 2017; Grabowski, 2015; Rowthorn and Ramaswamy, 1997). In contrast, deindustrialization in most developing countries including sub-Saharan Africa, shows low per capita income, low employment levels, and value added in the manufacturing sector which is attributed to several factors and has implications of a poverty trap (Acemoglu, 2007; Acemoglu and Robinson, 2012; Caceres, 2017; Grabowski, 2015; Rowthorn and Ramaswamy, 1997).

Currently, Ethiopia is Africa's second most populous country with very low per capita income and a dominating service sector (Oqubay, 2018). In Ethiopia, the idea of industrialization and its whole process can be assessed starting from the imperial regime in 1930 till the recent times. Modern history in the country is classified into three periods: the pre-1974 or the Imperial period ruled by a king, the Derg regime from 1975 to 1990, and the post-1991 period which is referred to as the EPRDF regime (Suleiman, 2000). Before 1974, Ethiopia was an empire with a feudal system of government headed by Emperor Haile Selassie from 1930 onwards (Briggs, 2012: Gebreeyesus, 2010; Suleiman, 2000). Following the 1974 revolution, a military regime known as the Derg appeared as a revolutionary government which was followed by the post-1991 EPRDF regime (Briggs, 2012). The EPRDF regime aimed at leaving the history of feudalism, a destructive war prone economy, and extensive rent seeking behavior behind and came up with pre-conditions for a market oriented and socially inclusive industrial transformation. The government showed pragmatism and flexibility in adapting and choosing the industrial policies (Altenburg, 2010). During this regime, Agricultural Development Led Industrialization (ADLI) development strategy is introduced. Yet, Ethiopia adopted a new federal constitution in 1994 decentralizing many aspects of the economy (Briggs, 2012).

Despite the different policies and regime changes manufacturing as a share of GDP remained to be less than 5 percent for decades (Gebreeyesus, 2010; Gedaand and Berhanu, 1960). All this meant that the country pursued different political ideologies, economic institutions, and industrial strategies and their organizational structures in the process of industrialization though it missed achieving the intended impact of building a strong economy and a dominant industrial sector. Hence, this study investigates in detail the different institutions that came up during the different regimes and their respective outcomes on the economic variables along with evaluating why the efforts made were not able to meet their targets. Hence, this paper addresses the following major research question:

- What effect does political economy has on industrialization in Ethiopia?

This paper discusses the economic and political institutions during three political regimes and provides detailed information on the economic systems, political strategies, prioritized industries, and the contributions of the industrial sector to GDP during the three political regimes. During the Imperial regime, the economic system was market oriented with a centralized administration. The economic policy followed then for encouraging the industrial sector was import substitution. Thus, labor-intensive industries were encouraged as they had the advantage of human resources being available in the country. During the Derg regime, the economic system was organized in a different manner. It was a centralized command system that promoted import substitution under central planning by the government. The labor-intensive industries contributed not more than 5 percent to the GDP of the Ethiopian economy. In the latest political regime, a decentralized market-oriented system was followed promoting exporting industries which contributed 4 percent to GDP, on average.

Even in the last decade, Ethiopia achieved double digit economic growth with agriculture and service sectors accounting 41% and 45% of GDP respectively. However, the contribution of manufacturing to GDP is only 4 percent and manufacturing as a share of urban employment is 6 % indicating limited structural transformation despite the high growth achievements (Alebel et al., 2017). In a nutshell, there were differences in policy directions, the ownership of resources, and in development policies and planning during the three regimes. However, the performance was poor and did not lead to significant changes in industrialization in Ethiopia. Instead there was more of deindustrialization implying an indigenous policy solution with inclusive institution which can smoothly bridge the gap between the contextual industrial policies and their effective implementation.

The rest of this paper is organized as follows. Section 3.2 reviews theoretical and empirical literature related to institutions and growth, the concept of industrialization and deindustrialization, along with different industrial policies and their implementing structures. Section 3.3 gives the data and methods used, and Section 3.4 has descriptive analysis and discussion of the empirical results. Section 3.5 gives the conclusion and discusses the policy implications of the findings.

3.2.Review of Related Literature

In this section theoretical and empirical literature is reviewed on institutions and growth, industrialization versus deindustrialization and industrial policy strategies as well as their organizational structures. The empirical experience of different countries is discussed which is followed by a critical review of literature and the gaps that exist.

3.2.1. Overview of the Literature on Institutions and Growth

The issue of why some countries are rich and others are not is a core question in development economics literature and different theories have tried to address it in different angles. Starting from classical theories of growth, structural models, neoclassical models, contemporary theories of development like endogenous growth theories, coordination failure approach, and more recently the institutional economics approach have given several explanations about the growth differences across countries as well as the reasons behind them (Dang and Sui, 2015; Acemoglu and Robinson, 2012; Chenery et al., 1986;

Mankiw et al., 1992). However, our focus is to see how a political economy or political institutions affect economic performance through their role in industrialization taking Ethiopia as a case study for developing countries.

In social science, the most important subject is identifying the causes of the differences in economic growth and development across countries. Several aspects have been discussed for explaining the differences in economic performance across nations. The differences in performance are mostly attributed to factors such as accumulation of factors of production like human and physical capital, and technological innovations, geography, culture and others (Acemoglu et al., 2005; Acemoglu and Robinson, 2008). But, above all, institutions either extractive or inclusive, have gained weight in explaining the disparities in incomes across nations. In fact, extractive institutions are presumed to lead to a failed state rather than geographic or cultural factors. This requires comprehensive economic and political institutions to get out of the vicious cycle and break the mold to get rid of poverty and moving towards prosperity (Acemoglu et al., 2001; Acemoglu and Robinson, 2012). Inclusive institutions include formal property rights and liberal forms of democracy that shape the economic and political progress of a society (Acemoglu and Robinson, 2012). Extractive institutions on the other hand, with centralized power are a boon for politicians or public officials as they allow unaccountable use of resources for political and private purposes (EFB, 2016).

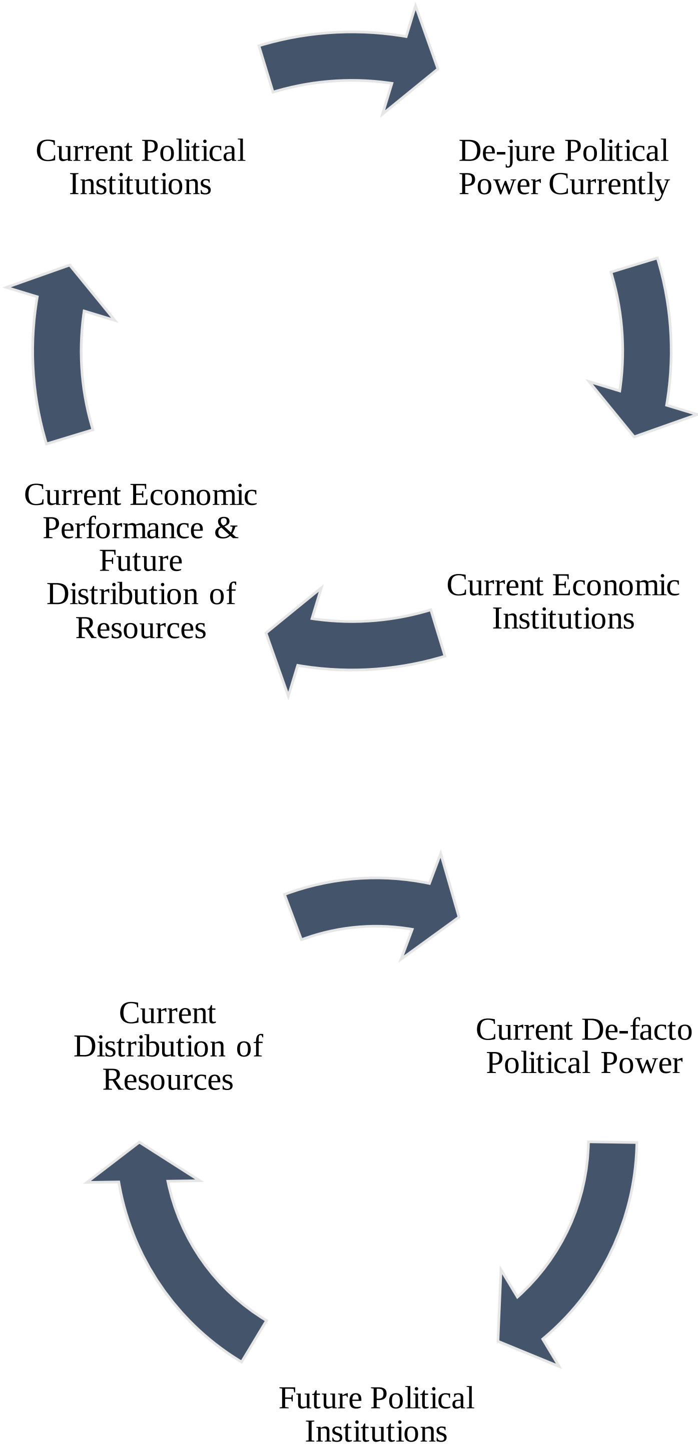
Broadly speaking, institutions are viewed as a fundamental factor in the differences that exist across countries (Acemoglu and Robinson, 2008). Specifically, economic institutions are recognized as being critical for making a society economically successful by providing incentives and opportunities in the economic environment to shape investments and innovations that significantly correlate with their economic performance (Acemoglu et al., 2001; Acemoglu and Robinson, 2012, 2016). Economic institutions differ widely across societies and political institutions are major factors behind these differences (Acemoglu and Robinson, 2016). Different political choices, institutional structures, and the form of government influence the economic choices made by a government and their economic outcomes (Adam and Dercon, 2009). The role of the state in relation to the private sector can play an impeding role in economic development and industrialization due to the distrust and discrimination against the private sector because of political ideologies (Vu-Thanh, 2014).

In different disciplines, institutions are defined in diverse ways but in our case, they have the following features: humanly devised rules of the game setting constraints on human behavior through incentives (Acemoglu and Robinson, 2008; Duncan, 2010; North, 1981, 1990). Institutions are different across societies either because of their economic institutions or their formal methods of collective decision making like democracy versus dictatorship (Acemoglu and Robinson, 2008, 2012). One way of classifying institutions is as political and economic institutions and the way in which they have an impact on incentives for different decision-making units and economic outcomes (Acemoglu and Robinson, 2008). Economic institutions can be characterized by the enforcement of property rights, entry barriers, corruption, trade openness, and risk of expropriation that are directly related to the cost of doing business and investors' decision-making processes (Becker et al., 2009; North, 1981). On the other hand, political institutions are attached to the level of democracy, competitiveness in the elections, countries' electoral systems, and forms of government (Bonnal and Yaya, 2015; North, 1981). Whether a democratic form or a dictatorship secures property and human rights is controversial, but literature supports that authoritarian rulers are against the objective of output maximization while under democratic rule there is pressure for immediate consumption that might hinder investments and productive growth (Przeworski and Limongi, 1993).

Literature shows that differences in institutions play a major role in economic development across countries. The incentives for and the constraints on economic actors are determined and shaped by institutions (Acemoglu et al., 2005). Nowadays, questions such as how a political economy, particularly political choices, forms of governance, and institutional structures influence economic outcomes is becoming the central focus (Adam and Dercon, 2009). Institutions are core factors that determine agents' economic performance and decision making as well as their incentives. Basically, political power is a mediator between the institutions and the outcomes, that is, political power can emanate from political institutions which is de-jure political power or it can come from the advantage of resource distribution which is called de-facto power (Acemoglu et al., 2001, 2005). Then, it affects economic institutions and the economy (Acemoglu et al., 2005; Acemoglu and Robinson, 2008). Acemoglu et al. (2005) developed a framework for analyzing how these institutions are correlated and can affect societies' economic performance.

Figure 3.1 is adapted from Acemoglu et al. (2005) and it shows that there are two major sources of political power: political institutions which provide de-jure power and the power that comes from ownership of resources or de-facto power. Both have a direct effect on political power or decision making which impacts current economic performance and also the distribution of resources in the future. There are different routes through which institutions can affect industrialization and economic performance of which industrial policies and strategies are one.

Figure 3-1:Role of Political Institutions and Resource distribution in Economic Performance



Source: Authors' compilation based on Acemoglu et al. (2005).

3.2.2. Concepts of Industrialization and Deindustrialization

Industrialization can be expressed as a set of social and economic processes related to the discovery of more efficient ways of value creation under the label of industry or the secondary sector where the primary sectors refer to agriculture, resource extraction, hunting and fishing while the service sector is referred to as the tertiary sector (Simandan, 2009). Industrialization provides certain spillovers which complement other activities through enhancement of skills, dispersion of technologies, and managerial training (Kindeye, 2014; Simandan, 2009). Industrialization is ranked high in leading economies out of political, social, and economic backwardness (Hikschman, 1968). It is also an engine for creating employment opportunities, increasing production and productivity, and altering countries' economic structures (Kindeye, 2014). Along with promoting the manufacturing industry, exports are desirable for many reasons as they help overcome the obstacles of a limited market size and loosen balance of payments constraints which prevent existing industries' operational capacity and the establishment of new ones. Industries are forced to attain and maintain high standards of product quality and efficiency by competing in world markets (Hikschman, 1968).

Deindustrialization on the other hand, represents a decline in the manufacturing sector's value added as a share of gross domestic product (GDP) or it can also indicate a decrease in the share of the industry sector in total employment levels (Cáceres, 2017). Being expressed in different dimensions, deindustrialization also represents a fall in employment in manufacturing as a share of total employment and/or a declining or steady share of manufacturing value added in a country's GDP. The process by which the manufacturing sector shrinks can also be termed as deindustrialization (Cáceres, 2017; Grabowski, 2015). Literature shows that there are several factors which lead to industrialization or deindustrialization in countries on their path to structural transformation among which institutions are crucial factors (Acemoglu and Robinson, 2008; Acemoglu et al., 2005; North, 1981).

3.2.3. Industrial Policy Strategies and Implementing Structures

Industrial policy can be defined as a guide for government interventions in the economy or as a government's deliberate attempts at promoting industry (Naude, 2010; Robinson, 2009). Industrial policy is also an intervention or government policy for improving the business environment or changing the structure of economic activities to offer better prospects of economic growth and societal welfare (UNIDO, 2018b; Warwick, 2013). The role of industrial policy in development can be viewed from theoretical and empirical perspectives. From a theoretical perspective industrial policy can play a significant role in promoting development though empirically an industrial policy can play an augmenting role or it can also impede development depending on the politics behind the policy or the existing institutions in the platform (Dang and Sui, 2015; Robinson, 2009).

There are two major industrialization strategies: the protectionist imports substitution industrialization and the outward strategy export-oriented industrialization (Gall, 1997).

Import-substitution industrialization (ISI) was used as a strategy for the industrialization process in most developed countries during their early industrialization journeys (Hikschman, 1968). Export oriented industrialization (EOI) was used as a strategy by most late industrializers including East Asian countries (Kim and Heshmati, 2014). Recently, special economic zones (SEZ) or industrial parks (IPs) have become a common strategy for sustaining development and industrialization (Wang, 2014; Saleman and Jordan, 2014).

Special economic zones can be different based on establishment objectives, infrastructure and politics of the country as well as geographical locations, but it aims at inducing industrialization and economic development (Pakdeenurit et al.,2014). Despite their many variations, a special economic zone can be defined as an area with special fiscal and business laws which are different from those for other areas (Munyoro et al., 2017; OECD, 2013). Special economic zones can also be expressed as geographic areas demarcated within a country's national boundaries which follow different business rules and principally deal with investment conditions, taxation, international trade and customs, and a regulatory environment that is different from what prevails elsewhere (Farole and Akinci, 2011). Special zones can be classified as free trade zones, export processing zones, single factory industrial parks, enterprise zones, free ports, and specialized zones (Munyoro et al., 2017; Wang, 2014). We are most concerned with two specific forms of economic zones: industrial parks (IPs) and export processing zones (EPZs) as they are adopted as the new industrialization strategy in Ethiopia.

The idea of industrial parks can be traced back to the 18th century industrial revolution when they were formed to facilitate industrialization in countries, and they varied depending on the types of operations and the sources of the resources. IPs can be classified as domestic resource parks, external resource parks, and mixed resource parks (Alebel et al., 2017). Export processing zones on the other hand are export oriented zones that create value chains through the production of high value goods that meet the standards of the export market (Morley and Hugh, 2010; Munyoro et al., 2017). Export processing zones (EPZs) are areas for manufacturers to produce goods that aimed for the export markets. In these zones trade transaction costs are reduced by allowing duty free imports of raw materials, intermediate goods and capital goods. There is also fiscal incentives of a corporate tax holidays and training of new staff often provided with a short-term period to reduce startup cost of the firms (Engman and Farole, 2012).

The objective of export processing zones is to boost exports and foreign exchange earnings, induce diversification and industrialization along with access to management expertise and foreign technology to increase productivity (Engman and Farole, 2012). Likewise, industrial parks have a rationale to provide spillover effects inside in terms of knowledge and technology spillover, the development of markets and specialization and division of labor among enterprises (Saleman and Jordan, 2014). Industry parks are key strategies to promote investment, technological learning and upgrading and provides stable and decent employment. The role of industrial parks and export processing zones in underdeveloped economies has several dimensions such as improving the sustainability and resilience of economic growth, enhancing manufacturing's contribution to the national economy, stimulating stagnant exports and foreign direct investments, alleviating foreign exchange shortages, creating employment opportunities, and facilitating spillover effects (UNIDO, 2018a).

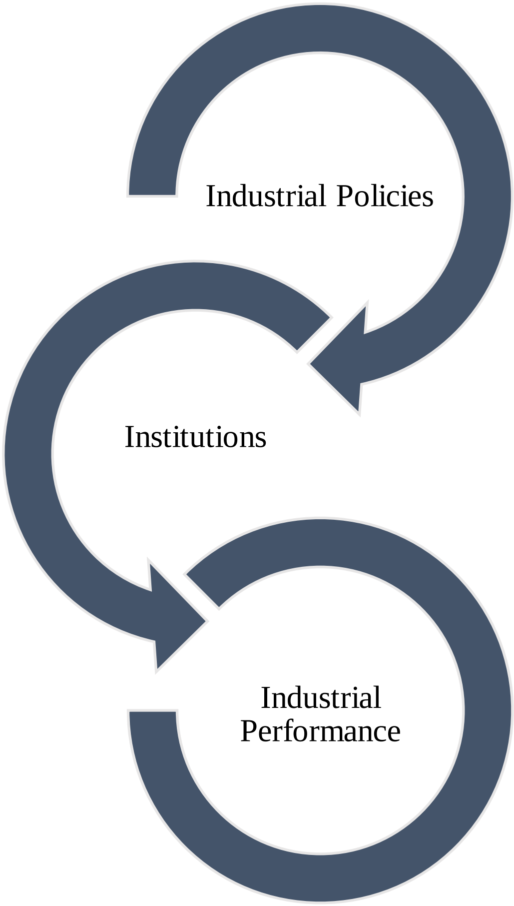
Successful implementation of industry parks and export processing zones depends on governance system, administrative pattern, policy preference, linkage to the rest of the economy and investment promotion (Alebel et al., 2017; Saleman and Jordan, 2014). Yet, industrial parks or export processing zones requires strategic resources such as land, labor, strategic locations, product markets, legal systems for the park and country as well as special policies (Alebel et al., 2017; UNIDO, 2018b). Successful zones have linkages to the domestic market, so that their investors buy production factors from domestic sources (Moberg, 2015; Farole and Akinci, 2011). To complement successful implementation of industry parks different support instruments are available including administrative support, organization of infrastructure and tax reliefs (Jasiniak and Koziński, 2017).

The structural orientation of industrial policies is equally important as the strategies for smoothening the industrial development process (Tesegaye, 2015). There are two organizational structures of industrial policies: centralization and decentralization. The former refers to a case where industrialization's tasks and responsibilities are organized by the federal government whereas in the latter case these are allocated to federal and regional governments (Tesegaye, 2015; Vu-Thanh, 2014). Decentralization in the sense of transfer of power from the central to local governments is necessary for providing incentives to the local governments to stay closer to local people and industrial businesses (Vu-Thanh, 2014).

Industrial policies and strategies can have two distinct outcomes based on government interventions. On the one hand, it is widely accepted that countries need proactive policies for a transition from low productivity, informal, and resource-based countries to more productive formalized and knowledge-based countries. On the other hand, deliberate government interventions may end up reducing the allocative efficiency and limit the incentives for investors (Altenburg, 2010). Yet, the relationship between the state and the private sector is one key determinant of industrial development's performance. A political compromise on the role of the private sector is a foundation on which industrial and economic policies are shaped. For instance, in adhering to a communist ideology states distrust and discriminate against the private sector depending on the tradeoff between economic legitimacy and political ideology is one major factor which changes the direction of the process in the wrong direction (Vu-Thanh, 2014).

All in all, industrial policy has great potential for promoting industrialization and economic development, but this can only be realized if the political environment is right. Variations in the adoption and success of different industrial policies and strategies is explained by the differences in the ideologies of different policymakers and the ideas of their economists (Robinson, 2009). Industry policies only promotes economic growth and development in the right institutional context and robust political economy while it can cause misallocation of resources and rent seeking if implemented with the wrong institutional context (Moberg, 2015; Farole and Akinci, 2011). Figure 3.2 presents institutions as a bridge in the successful implementation of industrial policies to bring about effective industrialization. As the figure shows, the coordination of the industrial policies with industry's performance depends on the institutions. If institutions are established right, then it provides room for a smooth relationship between the policies and industrial performance on the ground.

Figure 3-2 Institutions as a bridge between industrial policies and industrial performance



Source: Authors' illustration.

3.2.4. Empirical Literature Review[28]

This section provides the background for the empirical experiences of different countries on their industrialization paths and the core factors that smoothen or impede this process with more focus on industrial policies and institutions.

Shafaeddin (1998) empirically shows how early industrialized countries like the UK, US, Germany, and France managed to boost their industrial performance by protecting their

[28] The empirical literature is not organized in a chronological order. Instead it is based on the level of economic development of countries starting from the developed countries' context and then moving to developing countries, including African economies' context along with previous empirical studies in Ethiopia to show the research gap.

infant industries and huge government interventions in the early stages of their development. In these countries, apart from other factors capital accumulation, institutional development, and infrastructure played a significant role. Adelman (1999) confirmed that during the 19th century, the government supported industrialization in Europe, the UK, and the US and it played an important role in promoting the industrial revolution. For late industrializers, Hikschman (1968) assessed the characteristics of the import substitution industrialization strategy in Latin American countries and identified sociopolitical factors as impeding in the implementation process. Vedovato (1986) studied the industrialization process in the Dominican Republic where unlike many developing countries, industrialization did not get any momentum until end of the Second World War. He indicated that industrialization was given an impetus at the end of the 1960s by the state intervention through promoting the industry sector which ultimately resulted in entrepreneurial slack, inefficiency and promoted a rent seeking system.

In the second half of the 20th century, an economic transformation in Northeast Asian countries like Japan, North Korea, and lately Taiwan in the form of an industrialization process and rapid economic development occurred which gradually spread to other parts of the continent (The World Bank, 1993). Lajciak (2017) gives different explanations for the success stories of East Asian industrialization and attributes it to political economy and institutional, cultural, and international approaches which complemented other factors. The secret of their success is not only policies and instead is competent execution of appropriate policies with the government playing the central role along with the integration of policies with social patterns and behavioral modes which gave East Asian economies a comparative advantage. Robinson (2009) showed that the success of industrialization depended on industrial policies complemented by an optimal political environment. For instance, East Asian countries like South Korea and Taiwan were engaged in export promotion and Brazil, a Latin American country, promoted import substitution but they ultimately managed successful industrialization which is attributed to their optimal political economy which made them successful while implementing distinct industrial polices.

After reforms and opening up, within three decades China transformed from a traditional agricultural economy to a modern industrialized one in which employment in the industry to the total population was 30.3 percent in 2012 and the share of manufacturing value added to total GDP reached 43.89 percent in 2013 (Xiaoyon, 2014). The study showed that China's industrialization does not follow a universal path and instead it has its own unique features attached to historical, social, political, and cultural conditions and in the process huge problems of environmental degradation such as water and air pollutions as well as land contamination have increased social inequalities. China's industrialization can be divided into three stages where the first stage prioritized heavy industries with a centrally planned economy, the second stage witnessed the promotion of light industries and the last stage was the reappearance of heavy industries along with more knowledge intensive sectors (Xiaoyon, 2014). Rasiah and Nazeer (2016) studied the industrialization process in Pakistan comparing it with more and less successful East Asian economies to understand how to structurally transform its economy and revise its industrial policy which missed technological upgrading as its integral part along with several other core factors.[29]

In sub-Saharan Africa, the case is different where there is more deindustrialization. In fact, economists argue that economic growth in the region has been characterized by deindustrialization due to a bad environment for business decision making, failures in governance, lack of investments in infrastructure, education, and foreign investments, and lack of openness to trade (Grabowski, 2015). Mendes et al. (2014) show that in sub-Saharan African countries there are two phases of the industrialization process of which the first started in the 1920s and lasted till the 1940s and the second started in the late-1950s with import substitution industrialization strategies similar to the Latin American countries but it failed due to internal and external constraints. Likewise, in most African countries the industrial policy was a total failure attributed to an inconvenient political economy existing in the economies (Robinson, 2009). Beji and Belhadj (2014) empirically explored the relationship between industrialization and its different determinants for 35 African countries using a dynamic panel data approach and concluded that financial development, governance, and labor market regulations had an augmenting effect on industry's performance and they found that exchange rate appreciation was detrimental to the process of industrialization in these countries. Ethiopia has achieved little in terms of industrialization and structural transformation with 5 percent manufacturing share of GDP and 6 percent urban employment share of the manufacturing industry despite its remarkable economic growth over the last decade (Weldesilassie et al., 2017; Alebel et al., 2017).

Empirical evidence on the role of institutions and their effect on the differences in economic performance argues that institutional failure is a core factor that stops societies from adopting technologies and impedes economic performance and industrial development (Acemoglu and Robinson, 2000). To see the effect of institutions on economic performance, European mortality rates have been exploited in different colonies. For places where Europeans faced high mortality rates, extractive institutions were set up so that people could not settle where these institutions were present (Acemoglu et al., 2001). In fact, they adopted two extremely different strategies of colonization in which countries such as the United States, New Zealand, and Australia set up institutions that encouraged investments and enforced the rule of law whereas on the other extreme countries like Congo and Gold Coast set up extractive institutions which enabled them to transform resources even if the institutions were detrimental to the economic performance of the colonies (Acemoglu et al., 2001). Acemoglu and Robinson, (2008). shows that the economies of South and North Korea diverged because of the differences in their economic institutions where the former has been pursuing capitalist institutions and has grown rapidly whereas the latter follows communist economic institutions and policies. It should

[29] For developed countries deindustrialization is not a negative phenomenon and is instead a result of the faster growth of productivity in the service sector than in the manufacturing sector and advances in the tertiary sector are likely to encourage improvements in living standards in developed countries in the future (Rowthorn and Ramaswamy, 1997).

be noted that this gap between the two can to a large extent be attributed to decades of US sanctions against the North. Lee and Lim (2010) did a case study in Korea and empirically showed that the governance approach generated successful policy outcomes in an era of democratization. Their study showed that in terms of social trust, good governance and transparent policymaking enhanced government policy outcomes and enabled it to successfully implement policies.

Yildirim and Gokalp (2016) explored the association between institutional structure and macroeconomic performance empirically where institutions were proxied by indicators such as integrity of the legal system, regulations on trade barriers, restrictions in foreign investments, judiciary's independence, and political stability for 38 developing countries using a panel data analysis. Their results confirmed that regulations on trade barriers and restrictions on foreign investments had a positive effect while judiciary's independence and political stability had a negative impact on the macroeconomic performance of the 38 developing countries. Bates and Block (2018) empirically examined the change in political regime from authoritarian to a democratic system in many African countries using the test for the existence of a causal relationship and their results showed that democratic reforms led to economic growth.

Chole and Manyazewal (1992) examined the macroeconomic performance of the Ethiopian economy during the Derg regime when there was a very low contribution of industry as a share of GDP. They attributed this to different factors including war and the policy environment. They stressed on general factors instead of stressing on a specific relationship. Geda and Berhanu (1960) investigated the political economy of growth in Ethiopia and found that the absence of structural transformation for four decades is attributed to initial conditions and structural problems. Their study also confirmed that productivity growth had a negative role which they attributed to an economy operating in a hostile policy environment and external shocks. Berhanu and Poulton (2014) examined the political economy of the agricultural extension policy in Ethiopia with the empirical finding that there was conflicting interest between the objective of stimulating agricultural growth by extensively penetrating society and winning elections which reduced returns to investments for the agricultural extension strategy.

To conclude, several studies confirm that industry policies can augment industrialization that can change the structure of the economy. However, this largely depends on the type of institutional environment which can be a tool that facilitates optimal industrialization or leads to deindustrialization. If inclusive it could lead to industrialization but could also be an impeding factor for industrialization if it is extractive. Table 3.1 summarizes the empirical studies and their major findings.

Table 3-1: Summary of Empirical Studies

Author	Data	Analytical Method	Key Findings
Shafaeddin (1998)	Historical data	Comparative Approach	In the UK and US, there was infant industry protection and huge government interventions while in Germany and France besides the protection, foreign direct investments contributed to industrial development.
Adelman (1999)	Historical data	Descriptive Analysis	The role of the government in supporting industrialization in the UK, the US, and Europe was big.
Hikschman (1968)	Country specific data	Descriptive Analysis	In Latin American countries, import substitution industrialization was pursued but this failed due to sociopolitical factors.
Vedovato (1986)	Country specific data	Descriptive Analysis	There were large government interventions in the Dominican Republic's industrialization that brought momentum in the early 1960s but ultimately resulted in entrepreneurial slack, inefficiency, and promoting rent seeking behavior.
Lajciak (2017)	Historical data	Comparative Approach	The success story of East Asian industrialization is attributed to the countries' political economy and their institutional, cultural, and international approaches.
Xiaoyon (2014)	Country specific data	Descriptive Analysis	China's industrialization does not follow a universal path and instead has its own unique features attached to historical, social, political, and cultural conditions.
Grabowski (2015)	National Accounting data	Comparative Approach	Sub-Saharan Africa has been characterized by deindustrialization due to a poor environment for business decision making, failures in governance, lack of investments in infrastructure and education, foreign investments, and lack of openness to trade.

Rowthorn & Ramaswamy (1997)	Historical data	Comparative Approach	For developed countries deindustrialization is not a negatives phenomenon and instead is a result of the faster growth of productivity in the service rather than the manufacturing sector.
Acemoglu & Robinson (2000)	Historical data	Comparative Approach	For places where Europeans faced high mortality rates, extractive institutions were set up so that people could not settle there. These institutions remain even today.
Acemoglu & Robinson (2008)	Historical data	Comparative Approach	South and North Korea diverged because of the differences in their economic institutions; the former pursued capitalist institutions and has grown rapidly whereas the latter was under communist economic institutions and policies.

Source: Authors' compilation.

A careful assessment of the theoretical and empirical literature related to industrialization revealed that industrialization was a major pillar for structural transformation in many countries and institutions were major determining factors in the success or failure of countries' industrialization. In almost all the countries, institutions, specifically the political economy were at the heart of successful industrialization on the one hand and deindustrialization on the other. For instance, for early industrializers the political economy of protecting infant industry was the best strategy for their successful industrialization in the early stages; there were also huge government interventions. For late industrializers too the political economy had a significant effect along with other factors. Coming to developing countries including sub-Saharan African ones, the role of political economy in industrialization had contrasting effects where for some it brought a momentum to their industrialization processes whereas for most countries it had a negative impact leading to negative connotations of deindustrialization. Hence, this study investigates the role of political institution on industry performance overtime along with the assessment of different industrial policy strategies and their organizational structures relating it with the performance of the Ethiopian industry and the economic structure.

3.3. Data and Methodology

3.3.1. The Empirical Model

Of late there has been a lot of interest in exploring the role of institutions in promoting growth in developing and emerging economies urging empirical studies to determine the extent to which institutions affect growth (Aron, 2000; Stiglitz, 1998; WB, 1993, 1997). The empirical model for specification of institution and growth is formulated based on the growth literatures of (Barro, 1991,1996; Mankiw et al., 1992; Zakaria and Fida, 2009). In our study, an extension is made to sectoral growth taking Ethiopia as a case study for developing countries.

$$(eq. 3.1).\quad Y = Af(L, K)$$

In Equation (3.1), Y represents production and the right-hand side variables represent inputs that explain the variations in production; A represents technological progress, L stands for labor while K is capital. To include institutional differences in the regression, literature maintains that institutional quality affects technological progress implying that technological progress is not constant across countries and instead depends on the differences in their respective institutions (Aron, 2000). Equation (3.2) gives the functional relationship of production growth with institutional variables and covariates as control variables in the model with an error term and subscript t for time. In this equation, Y represents production and I stand for institution which can be political or economic while X stands for other factors that determine production. The role of political institution in the manufacturing industry's growth is empirically modeled in a time series ARDL framework as:

$$(eq. 3.2).\ LogY_t = \alpha + \sum_{i=1}^{K} \beta_i I_{it} + \sum_{j=1}^{n} \gamma_j X_{jt} \beta + u_t$$

Apart from investigating the existence of an empirical relationship between institutions and growth, this study explicitly estimates the long run and short run coefficients in the model. In Equation (3.2) Y is the dependent variable representing production but, in our case, the dependent variable is manufacturing industrial production. α is a constant parameter to be estimated. I_{it} represents institutional variables. The polity2 index represents political institutions while the percentage of exports and imports to GDP is used as a proxy for openness. X_t represents a vector matrix consisting of the control variables. In our case we have labor and capital with γ_1 and γ_2 parameters to be estimated as coefficients for the control variables and ε_t represents the error term. In our case OLS is estimated for a comparison while the autoregressive distributed lag model (ARDL) is used as the main estimation approach because of the data requirement as labor is stationary at level and others are stationary at first difference with a mixed order of integration which can only be estimated by ARDL. Before the estimation, the bound test for the existence of a long run relationship between the variables is checked. Then equation (3.3) is estimated to get the long run parameter estimates as:

$$(eq. 3.3).\ LogMVA_t = \alpha_0 + \sum_{i=0}^{p} \alpha_1 \, logMVA_{t-1-i} + \sum_{i=0}^{q} \alpha_2 logI_{t-i} + \sum_{i=0}^{q} \alpha_3 logL_{t-i} + \sum_{i=0}^{q} \alpha_4 logK_{t-i} + \varepsilon_t$$

$$(eq. 3.3a).\ LogMVA_t = \beta_0 + \sum_{i=0}^{p} \beta_1 \, logMVA_{t-1-i} + \sum_{i=0}^{q} \beta_2 logPolity2_{t-i} + \sum_{i=0}^{q} \beta_3 \, logopnness_{t-i} + \sum_{i=0}^{q} \beta_4 logL_{t-i} + \sum_{i=0}^{q} \beta_5 logK_{t-i} + \varepsilon_t$$

Equation (3.4 and 3.4a) presents the short run specification of the ARDL model. In these equations, the dependent variable is logarithm of manufacturing value added while institutions are a major variable of interest proxied with the polity2 index which is a proxy for regime change (political institutions) and trade openness as economic institutions. Labor and capital are included as control variables in the model. Error correction term (ECM) is included to show to what extent the model adjusts to the long run equilibrium annually:

$$(eq. 3.4). \quad dlogMVA_t = \alpha_0 + \sum_{i=0}^{p} \alpha_1\, dlogMVA_{t-1-i} + \sum_{i=0}^{q} \alpha_2 dlogI_{t-i} + \sum_{i=0}^{q} \alpha_3 dlogL_{t-i} + \sum_{i=0}^{q} \alpha_4 dlogK_{t-i} + \lambda_1 logMVA_{t-1} + \lambda_2 logI_{t-1} + \lambda_3 logL_{t-1} + \lambda_4 logK_{t-1} + \gamma ECM_{t-1} + \varepsilon_t$$

$$(eq. 3.4a). \quad dlogMVA_t = \beta_0 + \sum_{i=0}^{p} \beta_1\, dlogMVA_{t-1-i} + \sum_{i=0}^{q} \beta_2 dlogPolity2_{t-i} + \sum_{i=0}^{q} \beta_3 dlogOpnnes_{t-i} + \sum_{i=0}^{q} \beta_4 dlogL_{t-i} + \sum_{i=0}^{q} \beta_5 dlogK_{t-i} + \lambda_1 logMVA_{t-1} + \lambda_2 logPolity2_{t-1} + \lambda_3 logOpnness_{t-1} \lambda_4 logL_{t-1} + \lambda_5 logK_{t-1} + \gamma ECM_{t-1} + \varepsilon_t$$

3.3.2. Data and Estimation Method

The overall objective of this study is showing how the different political regimes as institutions as well as industrial policy has had an impact on the performance of the industrial sector for multiple decades using a descriptive and an empirical analysis. This study uses primary and secondary data taken from the Ministry of Finance and Development Corporation (MoFEC), the National Bank of Ethiopia (NBE), Ethiopian Economic Association (EEA), the Ethiopian Central Statistical Authority (CSA), the Industry Park Development Corporation (IPDC) in Ethiopia.[30], and United Nations Conference on Trade and development (UNCTAD). For the primary data, informal interviews, focus group discussions, and personal observations were used along with an extensive document review of different policies, plans, and reports on the industry and the economy for the study period to make a narrative analysis on the industrial policy strategies. Secondary data on polity2 was taken from the Polity IV project dataset[31]. Polity2 score is an index ranging from -10 to +10 representing full autocracy and complete

[30] The primary data is collected to supplement the analysis of industry parks based on secondary data. The data is collected from Bole Lemi I during the study period, as Hawassa and Bole Lemi I were the only operational industrial parks.
[31] The Polity project has proven its value to researchers over the years, becoming the most widely used resource for monitoring regime change and studying the effects of regime authority with a polity2 variable in Polity IV data series used to measure regime change in timeseries analysis. It is used for the purpose of quantitative and comparative analysis (Users' Manual, 2002).

democracy respectively while the range between -5 to 5 represents anocracy which the data is taken from Polity IV dataset (Zakaria and Fida, 2009; Marshall et al., 2002). It is used to represent the level of democracy or to represent a political regime change as an index. The data for openness and capital are accessed from UNCTAD while data for labor and manufacturing value added data was taken from MoFEC.

A multivariate regression analysis is done to empirically complement the qualitative analysis of the political economy of industrialization in Ethiopia taking the manufacturing value added as the dependent variable and polity2 as the proxy for political institutions which is a major variable of interest. The expected sign for polity2 is negative indicating that a political regime change has a negative impact on manufacturing growth. The expected sign for openness is positive with the implications of a positive trade impact on manufacturing growth. Both are expected to be statistically significant. In the estimation, labor and capital as well are considered as control variables with expected positive signs respectively.

A time series ARDL framework is used for estimating the parameters. The ARDL approach is robust and efficient for estimating a small sample size dataset. Unlike many other models it allows us to include variables with a mixed order of integration which is less than I(2)[32] and it enables an estimation of long run and short run coefficients for a specified model (Pesaran et al., 2001). The ARDL approach also provides unbiased coefficient estimates even when the explanatory variables are endogenous (Harris and Sollis, 2003; Pesaran et al., 2001; Pesaran and Shin,1999). The first estimation procedure is testing for the existence of a long run relationship among the variables using the bound test. The null hypothesis for the bound test is no cointegration then if the F-statistic's value is higher than the upper critical value, we reject the null and confirm the existence of a long run relationship. The opposite holds true that if the F-statistic at a given significance level is less than the upper critical value (Pesaran et al., 2001) we fail to reject the null and long run cointegration is denied. The next procedure is estimating the long run and short run coefficients of the specified model. Ultimately, diagnostic checks are done to test the reliability of the estimated parameters.

3.4.Discussion of the Results

3.4.1. Descriptive Analysis

This section discusses the performance of the manufacturing and industry sectors, their export and import share, major export and import items, the contribution of the industry sector to employment, value added, exports and foreign exchange generation across the regimes. Economic and political institutions, industrial policies, and organizational structures are also discussed followed by the different development and industrial strategic plans. Ultimately, the industrial parks in Ethiopia and the performance of the operational ones is evaluated to find out their contribution to employment generation, export

[32] I(2) refers to integration of order two implying a series will be stationary after the second difference.

promotion, foreign exchange generation, and value chain contribution along with indications of their limitations for future policy use.

3.4.2. Industry and Economic Performance in Ethiopia Across Regimes

Table 3.2 gives the contribution of agriculture, industry, manufacturing, and service sectors to the overall economy across the three regimes. During the Imperial regime, agriculture dominated the economy with a 66 percent share of GDP followed by service and industry sectors with 25 percent and 8 percent share respectively. During the Derg regime, the contribution of agriculture declined by 8 percent though it was still the leading sector in the economy whereas the contribution of the service sector increased to 31 percent and the industry sector also had a 2 percent increase. In the current regime, on average, agriculture is contributing 50 percent to GDP, the service sector is contributing 39 percent, and the industry sector 10 percent. The manufacturing sector had a 3 percent share during the Imperial regime, 5 percent in the Derg period, and on average a 4 percent share in the current regime implying that for more than eight decades manufacturing's contribution to the economy did not exceed 5 percent due to many factors some of which are explained later.

Table 3-2: Sectoral Share to GDP and Their Respective Growth across Regimes in Percent

Regimes	Imperial (1930-1974)		Derg (1974-1991)		EPRDF (1991 onwards)	
	Share	Growth	Share	Growth	Share	Growth
Agriculture	66	2	53	2	50	6
Industry	8	7	9.6	1.8	10	10
Manufacturing	3	8	4.9	1.6	4	9
Service	25	7	31	1.6	39	12

Source: Authors' compilation based on EEA and MoFEC data.

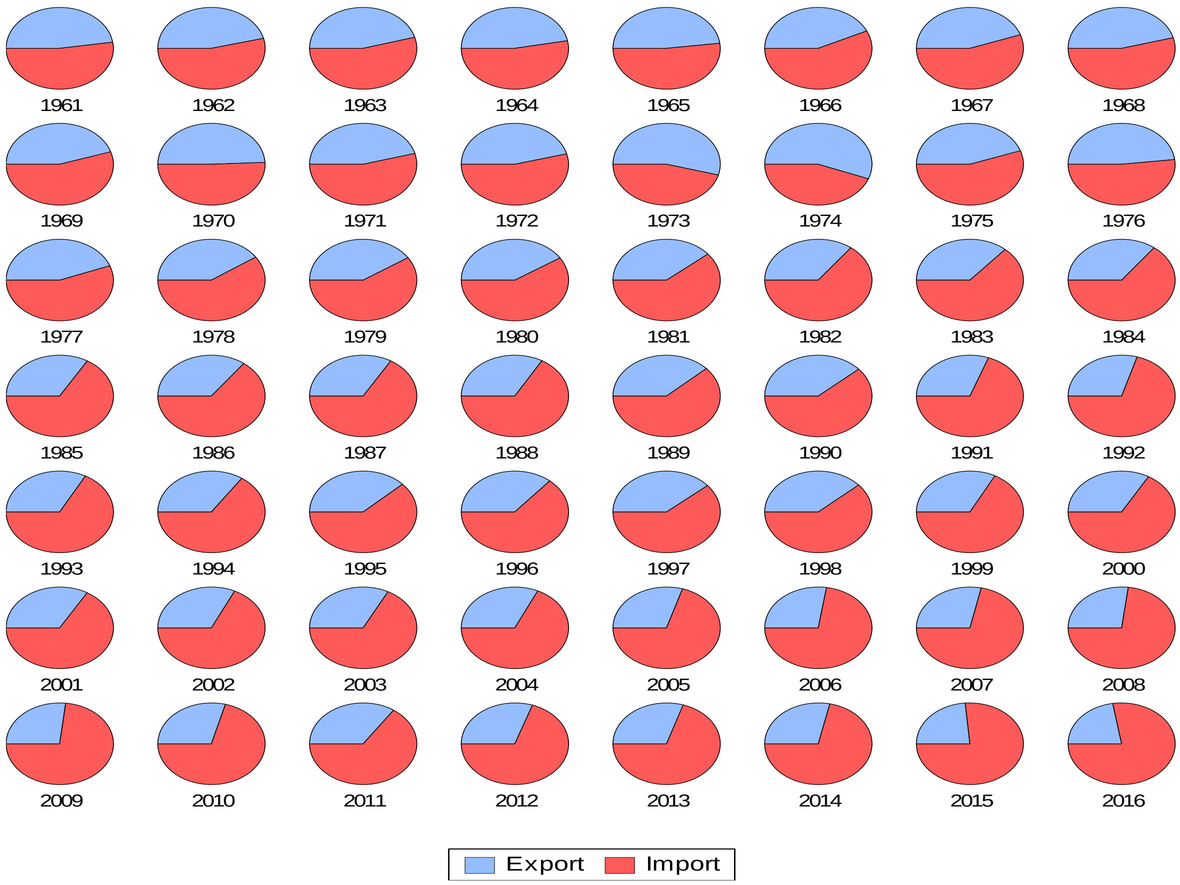


Figure 3-3: Export and Import share across regimes

Source: Authors' illustration.

Figure 3.3 plots the share of exports and imports across the three regimes. As can be seen in the figure, the top part of the pie represents exports and the bottom part gives imports' share. When the top share dominates it implies a positive trade balance. In contrast, if the bottom part dominates it signifies a trade deficit and if they are even it shows a trade balance. During the Imperial regime, the proportion of exports and imports seemed to be balanced with imports having a slight dominance. In the Derg regime, imports dominated and even in the recent regime the pie is dominated by imports indicating a negative trade balance or trade deficit which requires huge foreign exchange from other sectors as the export sector has failed to balance import expenditure. In sum, the data shows that Ethiopia has been experiencing trade deficit for decades which can be attributed to the low performance of the manufacturing and industry sectors. Manufacturing contributed less than 5 percent to the GDP for several decades which impeded the export sector and made the export to rely on primary commodities trade in the international market.

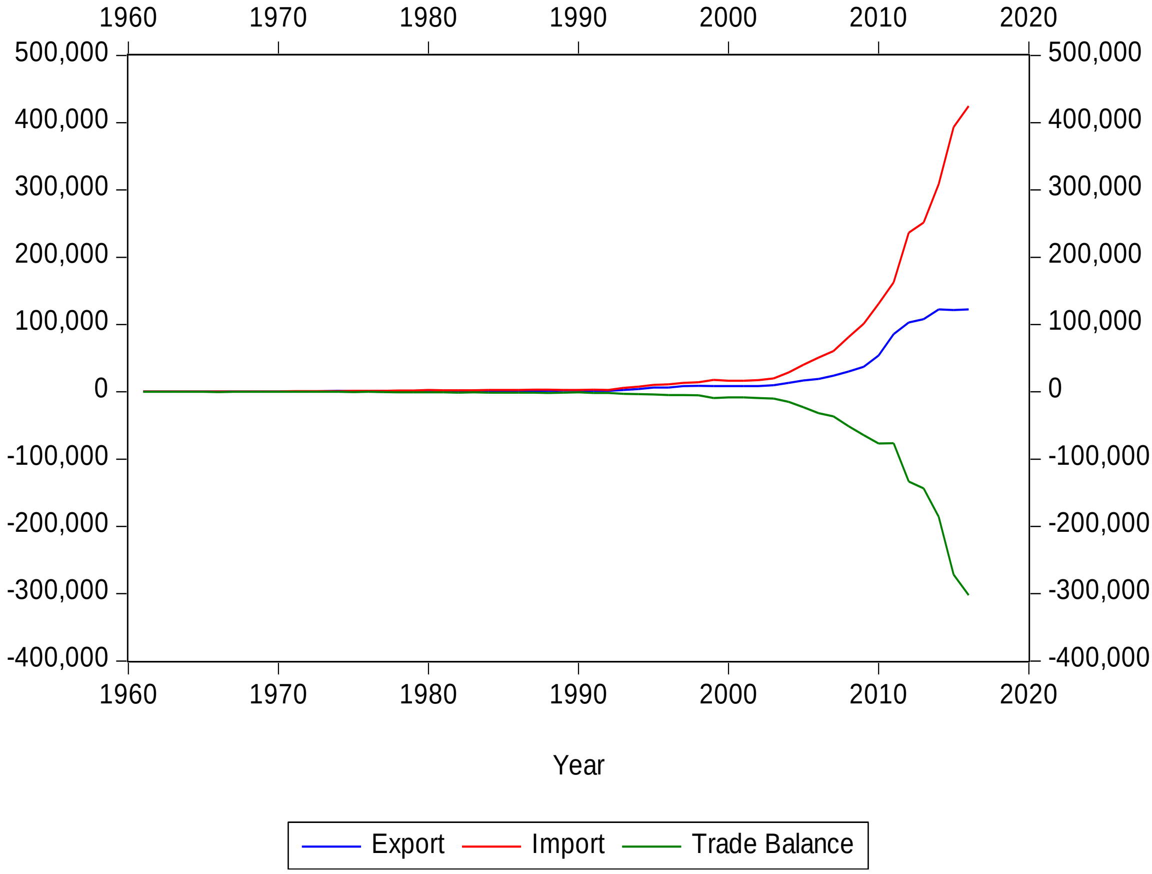


Figure 3-4: Trade Performance across the regimes

Source: Authors' computation.

In Figure 3.4, the trade balance or the difference between exports and imports for the three regimes is given. Relatively, the dominance of imports is significantly large in the current regime indicating a high trade deficit which weakens the sector and will be transmitted to the overall economy. The challenges of a large deficit will have an impact on the structural transformation that should take place in the country. Huge trade deficit implies an accumulated government debt and limited foreign exchange reserve of the country spent to pay for the imports in the international market.

Table 3-3: Major Export and Import Items across Regimes

Regimes	Major Export Items	Percentage Share	Major Import Items	Percentage Share
Imperial	Coffee	46	Cotton products	41
	Skin and Hide	18	Petroleum products	7
	Flour and Vegetable oils	17	Metal and metal products	5
	Cereals and Pulses	15	Salt and/or sugar	4
Derg	Coffee	64	Machinery and aircraft	16
	Leather and Leather products	16	Petroleum crude	13

	Oilseeds and Pulses	4	Road motor vehicles	12
	Chat	3	Food and live animals	11
EPRDF (ADLI)	Coffee	60	Petroleum production	14
	Leather and Leather products	13	Road motor vehicles	13
	Chat	9	Machinery and aircraft	12
	Oilseeds and Pulses	6	Others	17
EPDRF (IDS)	Coffee	31	Petroleum production	14
	Oilseeds and Pulses	22	Machinery and aircraft	14
	Chat	10	Metal and metal manufacturing	11
	Leather and Leather products	6	Others	22

Source: Authors' calculations using MCI (1955).

Table 3.3 provides the major export and import items during the three regimes. The table also classifies the current regime into the first decade where agricultural development led industrialization (ADLI)[33] was implemented and the later one which is after the introduction of the industrial development strategy (IDS)[34]. Coffee had the lion's share as a major export item across the three regimes. In the Imperial regime, apart from coffee, skin and hide, flour, vegetable oils, cereals, and pulses were dominant export items which all are categorized under agricultural or primary commodities. In the same regime, cotton was a major import item with a 41 percent share of the total import value in the country followed by petroleum, metal products, and salt having another 20 percent share in total imports. During the Derg regime, leather products were the second major exported item followed by oilseeds and pulses as well as chat. Machinery and aircraft were the major imported items along with petroleum, road motor vehicles, food, and live animals. During the Derg regime, the leather industry was relatively large because of demand by the military sector domestically.

In the early period of the contemporary regime, coffee was an exported item followed by leather products, chat, oilseeds, and pulses. Later, oilseeds became a dominant exported item with a declining share of leather products. Regarding import items, petroleum, road motor vehicles, and metal products became dominant. However, the import of food, live animals, and consumer goods is still significantly huge implying the weak engagement of

[33] The essence of ADLI is making huge investment on the agriculture sector to induce agricultural productivity and bring rapid industrialization through strong domestic linkage of manufacturing with agriculture (Adelman, 1986). Ethiopia adopted the agricultural Development Led Industrialization (ADLI) strategy in 1993 in aiming at enhancing industrial development, reducing poverty and ensuring a dynamic and sustainable growth in the agrarian nature of the Ethiopian Economy (Dube et al., 2019).

[34] The overall aim of industrial development strategy (IDS) in Ethiopia adopted in 2003 is to bring about structural change through industrial development. It further aims at building the industry sector with highest manufacturing capability in Africa with a diversified, environment friendly, globally competitive, and capable of improving the livelihood of the Ethiopian people significantly (FDRE Ministry of Industry,2013).

the domestic industries in working on their comparative advantages like cereal production, textiles, food, live animals, and leather products. In general, the trade sector shows that for decades the country was engaged in exporting a limited number of primary commodities and importing capital goods which shows an unexploited export sector that negatively impeded the trade balance due to a failure in diversifying the sector and neglecting to empower the domestic infant industry.

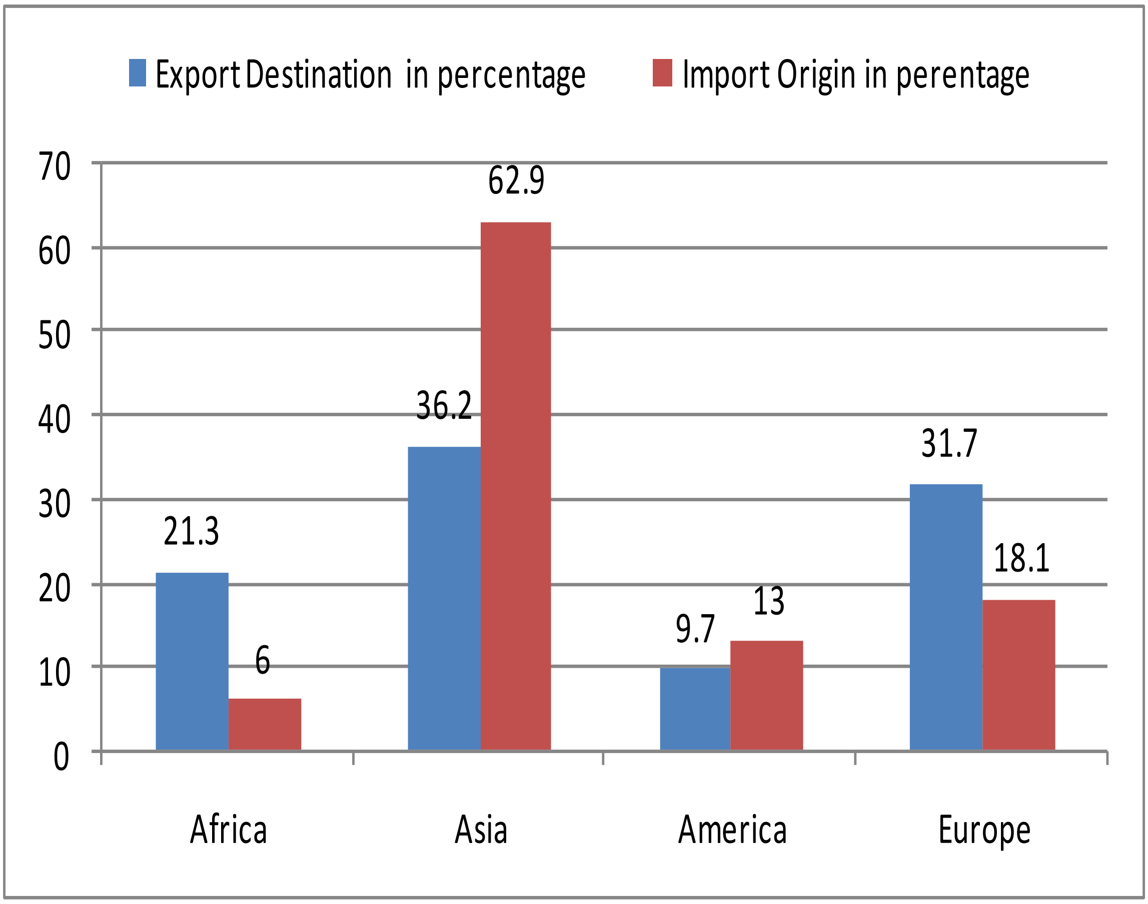


Figure 3-5: Ethiopia's current export destinations and import origins in percentage

Source: Authors' computation.

Figure 3.3 shows the current status of the main destinations of exports and imports by origin. Asia is a major source of Ethiopia's imports and destination for exports (36 percent and 62 percent out of the total respectively). The second destination of exports and source of imports is Europe at 32 percent of the exports and 18 percent of the imports. Africa is the third destination of exports at 21 percent but only 6 percent of the imports come from Africa. Ten percent of the exports go to the US and 13 percent of the total imports come from the US. This shows that the main source of imports and destination of exports is dominated by Asian countries mostly China which has strong implications on for the technology and skill spillover for Ethiopia. Ethiopia is a major export destination for Asian countries' products. Technology and knowledge spillover effects of trade are limited and are more inclined in Asia's favor. Asian companies are penetrating the country in the construction industry as well as the industrial park project because of the advantage of cheap labor and tax holiday. The managing positions of the projects are run by their human resource leaving no room for local experts with the same expertise capacity. This should ring alarm bells for Ethiopia to work on its international relations to get real transfer of knowledge, technology, and value chains for the local industries rather than providing cheap labor and tax holidays on the pretext of expanding its foreign direct investments. Yet, international relation should have a mutual benefit orientation as the ultimate objective is to establish business partnership.

Table 3-4: Industry and Manufacturing's Performance Indicators during the Imperial and Derg Regimes

Regimes	Industry Value added/GDP	Manufacturing Value added/GDP	Industry Export/Total Merchandize Export	Industry Export /GDP
Imperial	8	4	1.8	-
Derg	9	4	15.6	0.5

Table 3.4 gives the industry and manufacturing value added as a share of GDP and industry exports as a share of total merchandise exports and GDP respectively during the Imperial and Derg periods. As the table shows, industry did not exceed 10 percent and manufacturing value added as a share of GDP was 4 percent for the two periods. Industrial exports as a share of total exported merchandise was 16 percent and not more than1 percent of the total GDP during the same period. This shows that for almost five decades under these two political regimes the contribution of manufacturing industry and its exports share to GDP was close to nil.

Table 3-5: Industry and Manufacturing's Performance Indicators during the EPRDF regime

Plan Periods	Industry Value added/GDP	Manufacturing Value added/GDP	Industry Export/Total Merchandize Export	Industry Export/GDP
EPRDF	11	4	8	4
ADLI	8	3	12	1
SDPRP	9	3	11	2
PASDEP	9	4	6	4
GTP I	12	4	4	9
GTP II	24	6	4	4

Source: Authors' compilation.

Table 3.5 shows the manufacturing and industry's value-added share of GDP during the first ADLI implementation period and after the implementation of IDS complemented by consecutive development plans such as SDPRP, PASDEP, GTP I, and GTP II. Besides, it also shows the contribution of industry to the export sector and industry exports as a share of GDP. During the first decade, industry value added was 8 percent and manufacturing value added was 3 percent while industry exports as a share of GDP was only 1 percent.

These figures showed a slight improvement indicating the potential of the sectors to change from their steady stance for more than eight decades if supported by relevant industrial policies that go along with the competitive advantage of the country and its overall economic environment.

Table 3-6: Current Percentage Distribution of Industries by Regional States

Regions/Years	2012	2013	2014	2015	2016
Amhara	13	12	12	11	8
Afar	0.53	0.68	0.36	0.25	0.22
Tigray	8	8	8	7	14
Oromiya	26	27	30	32	28
Somalia	0.94	1.1	1.1	0.95	0.64
Benshangul Gumuz	0.20	0.34	0.36	0.19	0.17
Gambela	0.08	0.04	-	-	-
Harari	0.94	1.1	1.2	1.2	0.56
SNNP	12	11	12	10	9
Addis Ababa (City Administration)	37	33	33	35	36
Dire Dawa (City Administration)	2.5	2.9	3.3	2.9	2.9

Source: CSA.

Table 3.6 gives the current percentage distribution of industries across different regions in Ethiopia. When Ethiopia adopted a new federal constitution in 1994, with the borders defined along ethno-linguistic lines, the country was divided into a set of eight regions and three city states (Briggs, 2012). Currently, we have two city administrations Addis Ababa and Dire Dawa while the regions include Amhara, Tigray, Afar, Oromiya, Somaliya, Benshangul, Southern Nations, Nationalities and Peoples' State (SNNP), Harari,and Gambela (CSA, 2016). As the table confirms, on average, of the existing different industries in the country 34.8 percent are located in Addis Ababa. Oromiya, Amhara, and Tigray regions have 28 percent, 11.2 percent, and 9 percent share of the industries respectively.

3.4.3. Economic and Political Institutions across Different Regimes

Table 3.7 shows the political institutions in terms of forms of governance and government ideology and economic institutions across the three regimes. During the Imperial regime, there was a monarchical form of government in which political power was centralized in the hands of the king with an ideology of feudalism along with a parallel market-oriented economy. Whereas, during the Derg period there was dictatorship with a central planning ideology and a command economic system which gave a platform only to the public sector ignoring the private sector which is the seed for efficient production in any economy. The current regime has an anocracy form of governance with a developmental government ideology giving huge space to the government and the public sector for organizing production and administrating institutions along with private sector participation. The economic system is mixed which promotes public-private sector partnerships as the main actors in the economy. Hence, in the three regimes the political economy, government ideology, and economic institutions were different with the earlier ones influencing the later ones. Table 3.7 also shows that for the three political periods the contribution of manufacturing to GDP never exceeded 5 percent implying that even though the political institutions were different they were weak and were impeding the economic outcomes giving priority to political rent seeking behavior rather than finding national economic results.

Table 3-7: Political and Economic Institutions across Regimes in Ethiopia

Regimes	Forms of Government (Political Institution)	Government Ideology	Economic Institutions	MVA/ GDP in percent
Imperial (1930-74)	Monarchy	Feudalism	Market Economy	3
Derg (1974-91)	Dictatorship	Socialism	Command Economy	4
EPRDF **(**1991-todate**)**	[35]Anocracy	Developmentalism	Mixed Economy	4

Source: Compiled by the authors using different data sources.

3.4.4. Industrial Strategies and Organizational Structures in Ethiopia

During, the Imperial period economic development in the country was mainly relied on subsistence farming and with an almost non-existent industrial sector (David and Thomas, 2013). However, national development policies were implemented for promoting industrial activities under a series of three five-year plans. The plans focused on industry and provided development incentives such as tax exemptions, low interest rate loans, and favorable price policies (Suleiman, 2000; TGE, 1993).

During the Derg regime the industrialization policies could not be separated from the country's agricultural policies. Besides, the war time economic policy focused on a military crusade and mobilization of resources to serve the war economy and this did serious damage to the economy (Deguefee, 2006; Oqubay, 2018; Tiruneh, 1990). The overall objective of the government for development was building a socialist society where the major route to economic transformation was presumed to be central planning (Suleiman, 2000). In this regime, a significant number of manufacturing enterprises owned by foreigners in the Imperial period were nationalized (David and Thomas, 2013). The socialist policy also promoted public ownership of natural resources and organizations with respect to the industry sector (Suleiman, 2000). Among the key strategies in the Derg's industrial policy were import substitution, central planning, social ownership, and self-reliance (Oqubay, 2018). During the EPRDF regime, several reforms were introduced on the basis of which the long-term economic development strategy, the Agricultural

[35] Anocracy is a form of governance which is neither pure democrat nor does a pure autocrat. It combines both features (Deacon, 2009).

Development Led to Industrialization (ADLI) strategy was formulated. This new policy aimed at raising agriculture's productivity and promoting an export oriented agro-based industry sector. The target was achieving sustainable economic growth and development (Suleiman, 2000; TGE, 1993). The new policy was very general, and it has been employed in some form by many developing countries on the continent. The policy lacks a specific contextual disaggregation that presumes the existing situation in the country in terms of resources, institutions, infrastructure, and other related relevant issues (Briggs, 2012; Suleiman, 2000; TGE, 1993).

Table 3.8 gives the development plans and strategies that have been pursued by the country across different periods. During the Imperial regime, there were three consecutive five-year national plans: the first five-year plan (FFYP), the second five-year plan (SFYP), and the third five-year plan (TFYP) which all aimed to enhance the country's economic performance. During the first decade of the Derg regime there was no plan at the national level but for its second decade the government came up with a 10-year prospective plan. During the current regime, different development plans have been introduced at the national level such as the sustainable development and poverty reduction program (SDPRP), a plan for accelerated and sustained development for ending poverty (PASDEP), growth and transformation plan I (GTP I) and the recent growth and transformation plan II (GTP II) all aimed at reducing poverty and achieving sustainable development.

Table 3-8: Development Plans and Strategies across Regimes[36]

Regime	Development Plans	Development Strategy
Imperial	✓ First Five-Years Plan (FFYP) ✓ Second Five-years Plan (SFYP) ✓ Third Five-Years Plan (TFYP)	✓ Unstructured
Derg	✓ Ten-Year Prospective Plan (1984-1994)	✓ Unstructured
EPRDF	✓ Sustainable Development and Poverty Reduction Program (SDPRP) (2002/03) ✓ A Plan for Accelerated and Sustained Development to end Poverty (PASDEP) (2005/06) ✓ Growth and Transformation Plan I (GTP I) (2010/11) ✓ Growth and Transformation Plan II (GTP II) (2015/16)	✓ Agricultural Development led Industrialization (ADLI) (1994) ✓ Industrial Development Strategy (IDS) (2002)

Source: Authors' compilation.

[36] Agricultural Development Led Industrialization (ADLI) strategy was introduced with emphasis on addressing agricultural problems in the economy and lasted for two subsequent decades followed by the Industrial Development Strategy (IDS) which was adopted in 2003 with a focus on outward oriented industrialization (Oqubay, A. (2018).

In Table 3.8 different development ideologies are pursued giving the role of a follower and a leader to the industry for achieving structural transformation and poverty reduction goals. The first development plan was the agricultural development lead industrialization (ADLI) which gave priority to the agriculture sector and its development to bring about industrialization whereas the second was the industrial development strategy (IDS) which prioritized development of the industry as a means of achieving structural transformation targets. The ADLI mainly focuses on agriculture sector by improving the productivity of peasant farmers to enable the sector to contribute to economic growth from the supply and demand side. From the supply side it can provide food and raw martials along with export items while it creates demand for industrial products (MPED, 1993) The IDS mainly focus on labor intensive industries, export promotion industrial strategy, strong government leadership role, private public partnership (PPP) and considers the private sector to play a key role in the industrial development strategy (FDRE Ministry of Industry,2013). This shows that the country has been through different types of development plans across the regimes and pursued distinct development strategies and yet all of these have not been effective in transforming the structure of the economy for decades. The plans failed to industrialize the economy which can be attributed to weak institutions and unfavorable political environment which both are bridges for implementing industrial policies successfully.

Table 3-9: Industrial and Organizational Strategies across Regimes

Regimes	Strategies	Organizational Structures	Dominant Ownership	Prioritized Industries
Imperial (1930-74)	Import Substitution	Centralized	Foreign company	Labor intensive
Derg (1974-91)	Import Substitution	Centralized	Public sector	Labor intensive
EPRDF **(**1991-todate**)**	Export Promotion	Partially Centralized	Private sector	Labor intensive

Source: Authors' compilation.

Table 3.9 gives different specific industrial strategies, organizational structures, principal industry owning agents, and prioritized industries during the three governance periods. In the Imperial regime, import substitution industrialization was a major industrialization strategy with a centralized industrial policy organizing the structure and dominance of the foreign companies owning labor-intensive manufacturing industries. In the central planning period, the industrial policy was the same as the former regime, but the major actor was the public sector which was inefficient in production with a centralized organizational structure for light manufacturing industries. In the EPRDF period, the industrialization strategy was export oriented industrialization (EOI) with the domestic sector dominating as an agent of the labor-intensive manufacturing industries with a relatively loose centralized industrial policy organization structure. This shows that two extreme industrial strategies with different organizational structures were implemented in Ethiopia across these periods focusing on labor intensive industries with different agents as major players for industrialization. All in all, the manufacturing industry has been a steady sector for several decades which failed to respond to the different policies implemented so far. This can be attributed to the huge gap between the policies and the way they were implemented which did not consider the initial conditions in the country. Instead of focusing on the real situation, the focus was on producing documents for libraries or office shelves and political reports. Yet, it seems policies were implemented with a priority focus of the political goals than considering the economic outcomes.

3.4.5. Contribution of Industrial Parks and their Limitations in Ethiopia

Table 3.10 gives the number, type, location, and operational status of industrial parks in Ethiopia along with the type of employment in the production processes. As of date there are 11 industrials parks in the country located in different areas. Most of the parks are focusing on textiles, apparel, and garments except Killinto and Adama which are a pharmaceutical hub and a machinery equipment hub respectively. This shows that the parks are not fully considering the country's competitive advantage which is agroindustry and leather production along with textiles. Among these parks, only Bole Lemi I and Hawasa industrial parks have been operational for a while and are engaged in employment creation, production, and exports. Most of the industrial parks have become operational very recently. Regarding to employment, most of the employees are unskilled who are given short term training on how to run machines for the production process which to a large extent limits the technology and knowledge transfer goals of the industrial park industrialization strategy.

Table 3-10: Characteristics of Industrial Parks in Ethiopia

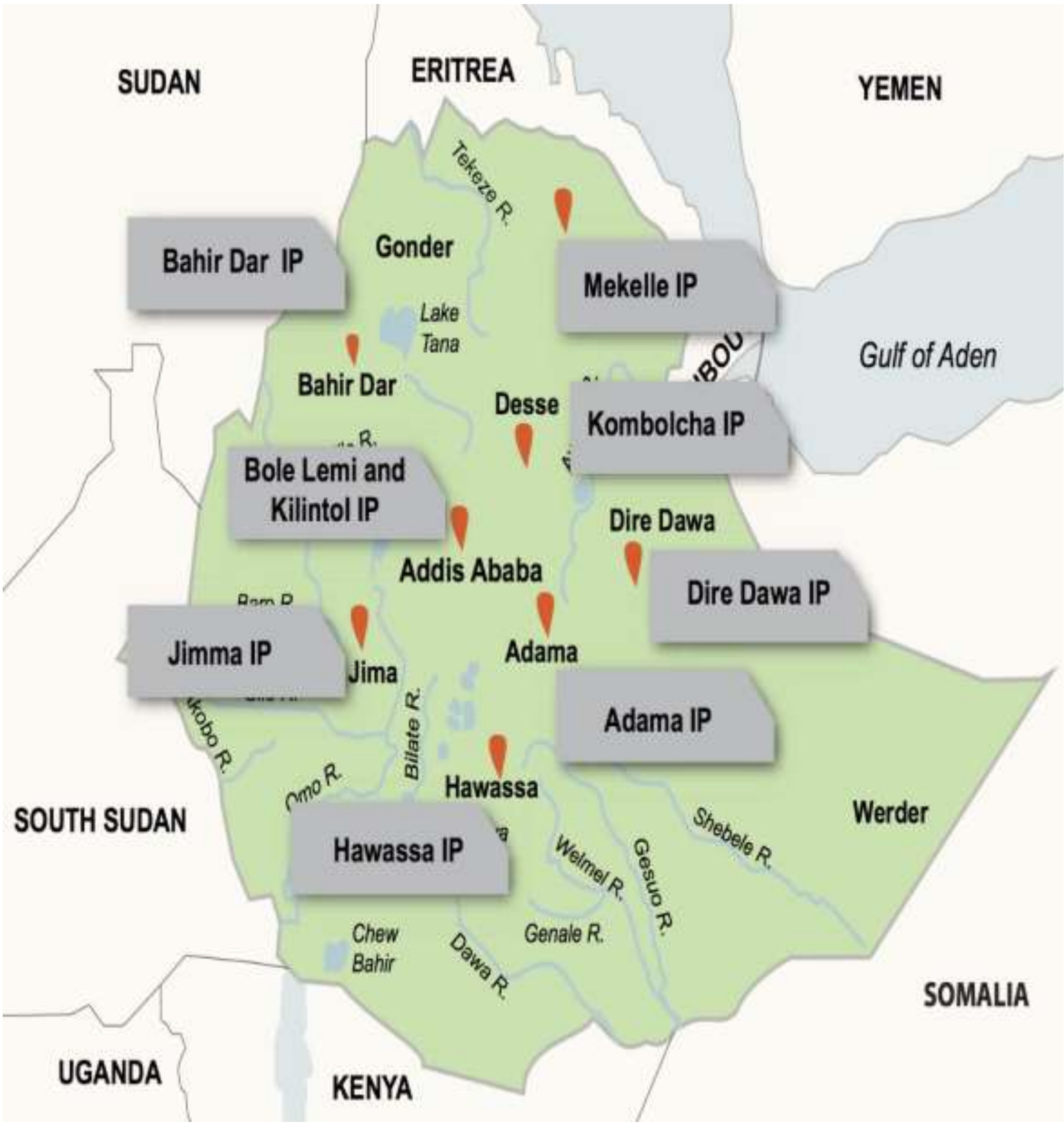
Establishment/Name of the IP	Types	Locations	Operational status	[37]Employment
Bole Lemi I	Apparel & Textile	Addis Ababa	Operational	Unskilled labor
Bole Lemi II	Apparel & Textile	Addis Ababa	Not Operational	-
Kilinto	Pharmaceutical Hub	Addis Ababa	Not Operational	-
Hawassa phase _I	Textile and Garment	Hawassa	Operational	Unskilled labor
Hawassa phase _II	Textile and Garment	Hawassa	Operational	Unskilled labor
Adama	Machinery, Equipment, Apparel and Garment	Adama	Not operational	-
Dire Dawa	Garment, Apparel and Textile	Dire Dawa	Not operational	-

[37] Employment in the industry park excludes the managerial positions of the companies which are managed by foreigners (IPDC, unpublished material)

Mekele	Apparel & Textile	Mekele	Operational	Unskilled labor
Kombolcha	Apparel & Textile	Kombolch a	Operational	Unskilled labor
Jimma	Apparel& Textile	Jimma	Inaugurated	Unskilled labor
Bahir Dar	Apparel and Garment	Bahir Dar	Not operational	-
Debre Birhan	Apparel &Garment	Debre Birhan	Inaugurated	Unskilled labor

Map 2.1 shows how the industry parks are dispersed across the country. As can be seen the parks are distributed all over Ethiopia without taking the logistical and infrastructural conditions into consideration. They are located on the grounds of political motivation of allocating parks to all areas in order to avoid sociopolitical unrest. Instead, the implementation should have been strategic and targeted based on static and dynamic outcomes of the industrial policy’s strategy by considering excessive investment cost saving. The optimal strategy should aim to augment the strategic policy in a way that exploits the competitive advantages of the parks and strengthens the infant domestic private industries that can sustain industrialization in the country.

Map 2.1: Map of Industrial Parks in Ethiopia



Source: Industry Park Development Corporation (2019) and www. EIPM.com

Table 3.11 presents the investment costs of the industrial parks in Ethiopia. The Hawasa industrial park was the first huge project set up at a cost of 6.8 billion Ethiopian birr followed by Dire Dawa and Adama industrial parks with 3 billion and 2.9 billon birr as investment costs respectively. Mekele, Kombolcha, Jimma, and Bahir Dar industrial parks, on average, cost 1 billion birr each. This implies that launching an industrial park involves fixed costs in billions and if they are not implemented properly the opportunity costs are

[38] Ethiopia industrial park map.

huge which significantly contribute to the accumulation of debt for future generations. In fact, instead of launching industrial parks in every part of the country with huge initial investment cost for each, strategic location would have save huge capital that could be used to support local industries to be engaged in production and improve the quality of their products that can meet international product quality standards.

Table 3-11: Project Investment Costs of Industrial Parks in Ethiopia

No.	Project name	Project investment cost in birr[39]
1	Bole Lemi I industrial park	525,620,305.72
2	Hawassa industrial park	6,830,726,518.66
3	Mekelle industrial park	1,837,235,012.81
4	Kombolcha industrial park	1,775,354,563.07
5	Adama industrial park	2,901,638,220.43
6	Diredawa industrial park	3,016,582,160.56
7	Dibrebirhan industrial park	952,798,094.06
8	Jimma industrial park	1,490,737,362.81
9	Bahirdar industrial park	1,125,626,510.11
10	Kilinto industrial park	8,590,522.81

3.4.6. Operational Industrial Parks and Their Contribution

Table 3.12 presents the major investors in the two operational industrial parks: Hawassa and Bole Lemi I along with their major sources of inputs for production in the parks. 75 percent of the investor companies are from Asia whereas another 5 percent are from the US, 5 percent from Africa, 10 percent from Europe, and only 5 percent are domestic investors. This shows that most investors in the operational parks are from the rest of the world implying the limited participation of local infant industries which are supposed to sustain the industrialization and structural transformation of the country. All the industries located in the parks use imported inputs leaving no space for the industrial parks to contribute to the value chain.

Table 3-12: Hawassa and Bole Lemi-I Industry Parks' Investors by origin in Percentage

[39] The exchange rate for the local currency varies over time and the average exchange rate in 2016 was approximately 1USD=27 Ethiopian birr (NBE, 2016)

Investors Country by Origin in Hawassa	Ownership in Percentage	Source of input	Investors by Country in Bole Lemi-I	Ownership in Percentage	Source of input
USA	5	Imported	India	45	Imported
Europe	10	Imported	China	27	Imported
Asia	75	Imported	South Korea	27	Imported
Africa	5	Imported	Africa	-	-
Ethiopia	5	Imported	Ethiopia	-	-

Source: Authors' compilation.

Table 3.13 gives the employment and export contributions of the two operational industrial parks in Ethiopia: Hawassa and Bole Lemi I. In Hawassa of the full capacity employment, 44 percent or 26,599 people were employed by the companies located in the park. In Bole Lemi, 67 percent or 16,763 people were employed in the park as of to date. Regarding to exports, Hawassa exported approximately 63 million USD and 40 million USD was generated from the Bole Lemi industrial park. This has an important implication that the parks create temporary employment opportunities for thousands of people but as it is indicated in Table 3.10 the employees are unskilled without the potential of taking advantage of technology and knowledge spillover effects. They are also unable to take over and sustain production in the absence of the owners of the companies in the industrial parks with more than 95 percent are from the rest of the world.

Table 3-13: Awasa and Bole Lemi I Industry Parks' Economic Contribution as of to Date

Operational Industry Parks	Employment	Employment at full capacity	Employment in percentage	Export in USD
Hawassa	26,599	60,000	0.44	62,982,463
Bole Lemi I	16,763	25,000	0.67	39,776,736

Source: Authors' compilation.

3.5.Regression Analysis of Polity and Manufacturing Industry's Growth in Ethiopia

This section empirically discusses the role of polity2 in the manufacturing industry's growth in Ethiopia across regimes. Polity2 measures the level of democracy across different regimes with a value ranging from -10 to 10 indicating autocracy (-10) in an extreme case and the democracy (10) level of a country. The values ranging from -5 to 5 represent a case in between which is called anocracy with the features of a mixed democracy and autocracy (Deacon, 2009). This section provides the overall trend in polity2 in Ethiopia across regimes followed by the regression output of the impact of the political institution proxied by polity 2 index on industry controlling, for openness, labor and capital in the regression analysis.

Figure 3.6 gives the overall trend of the polity2 index for the three political periods in Ethiopia. During the Imperial period, the polity2 was close to -9 indicating a level of democracy very close to autocracy with very centralized powers with the government. During the Derg regime, except for a few periods in which the index indicated anocracy the entire regime was autocratic with an economy that had centralized planning and an ideology of socialism. During the EPRDF period, the data for the index indicates that the anocracy level of democracy or governance altered at different levels (see Figure 3.6). This shows that the level of democracy measured by the index over time was more autocratic in the two regimes and currently more of anocracy with some level of democracy.

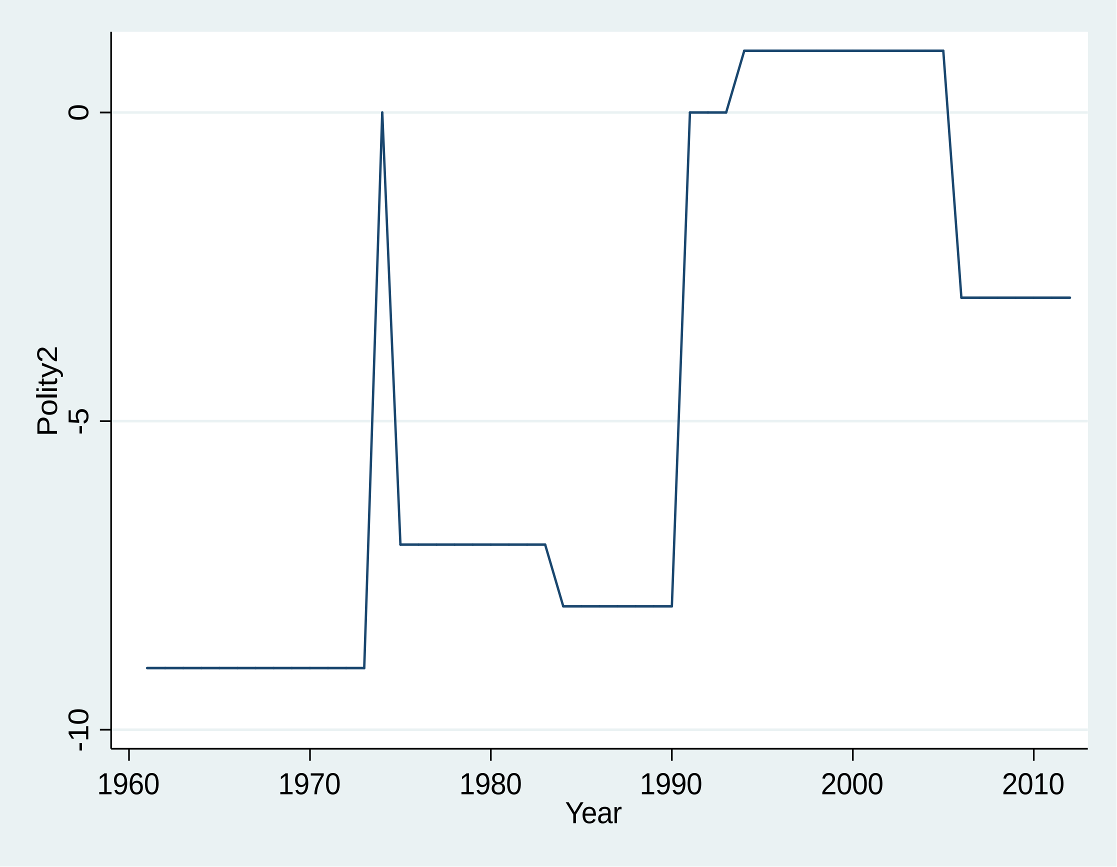


Figure 3-6: Development of Ethiopian Polity2 Index Trend Over time

The descriptive statistics for the variables in the regression are presented in Table 3.14. There are four explanatory variables in total and a major variable interest which is polity index measuring the form of governance over time in the country. The index indicates political institution while labor, capital and openness are considered as control variables in the model. The dependent variable is manufacturing industry's value added where for all variables (polity2 excepted) are transformed into logarithmic forms. In the sample, there are 44 observations from 1970 to 2013. The study period is limited by data availability on the polity index. Table 3.14 gives the summary statistics of the data prior to log transformation.

Table 3-14: Descriptive Statistics of the variables

	MVA	Labor	Capital	Polity2	Openness
Mean	8853038	54600855	17.28480	-3.79545	31.89541
Median	7611183	50516777	14.05242	-3.00000	30.04462
Maximum	24798230	95385785	37.09808	1.00000	51.08666
Minimum	4449098	28415077	7.50692	-9.00000	11.78992
Observations	44	44	44	44	44

The first step in any time series regression analysis is testing for the stationarity of the series using different unit root tests. Table 3.15 provides the Augmented Dickey Fuller unit root test's results for the variables in the model. Manufacturing value added, capital, and the polity index are non-stationary at level but stationary at first difference indicating that these variables are integrated of order one while labor is trend stationary and is integrated of order zero. Hence, this calls for a method of estimation that accommodates the mixed order of integration which the ARDL model does. Before the estimation, the optimal lag length is selected based on different selection criteria with two being opted for as an optimal lag length for the model. Table 3.16 shows all the variables in the model have two as the optimal lag length.

Table 3-15: Augmented Dickey Fuller Unit Root Test's Results

Variables	At level		At First Difference		Order of Integration
	Intercept	Trend with intercept	Intercept	Trend with intercept	
MVA	0.9631	0.8331	0.0055	0.0164	I (1)
Labor	0.9999	0.0022	0.6591	0.9642	I (0)
Capital	0.8512	0.2075	0.0000	0.0000	I (1)
Polity2	0.2266	0.3676	0.0000	0.0000	I (1)
Openness	0.6815	0.7409	0.0000	0.0004	I (1)

Table 3-16: Optimal Lag Length (Endogenous variables: LnMVA LnLabor LnCapital Polity2 LnOpenness)

Lag	LogL	LR	FPE	AIC	SC	HQ
0	21.5536	NA	5.09e-06	-0.8358	-0.6704	-0.7752
1	255.4789	412.1541	1.59e-10	-11.2132	-10.3858	-10.90
2	317.6206	97.6513*	1.81e-11*	-13.4105*	-11.9210*	-12.86*

The bound test for the existence of a long run relationship in Table 3.17 confirms the existence of a long run relationship between the form of government or political institutions and the manufacturing industry's growth in Ethiopia based on sample data. The value for the F-statistic is greater than the upper and lower bound at the 1 percent level of significance. This result confirms the existence of long run relationship but does not provide the direction of the relationship and the magnitude of the relationship between the variables of interest. Hence, we proceed to the long run and short run estimation of the coefficients.

Table 3-17: Bound Test for the Existence of a Long Run Relationship

Test Statistic	Value	Significance	I(0)	I(1)
F-statistic	7.290334	10.0%	2.20	3.09
K restrictions	4	5.0%	2.56	3.49
		2.5%	2.88	3.87
		1.0%	3.29	4.37

Table 3.18 gives the OLS and ARDL estimation results. In both the cases polity2 is found to be statistically significant and negatively impacting manufacturing growth in Ethiopia. Trade openness in both the models is statistically significant and positive. However, the OLS coefficients are not taken because some variables in the model are not stationary at level resulting in a spurious regression output but corrected by the ARDL approach. Based on the ARDL estimation results, polity2 is significant with a negative coefficient. A one-unit change in polity2 or regime change from democracy to autocracy will reduce manufacturing growth in Ethiopia in the long run. This means when power is centralized it negatively impacts the performance of industry in Ethiopia. Similarly, the form of government is statistically significant and negatively affects manufacturing growth in the short run. Openness in the ARDL model's estimation is statistically significant and positive both in the long and short run. The adjustment coefficient is statistically significant with a negative coefficient value indicating 26 percent adjustment to the long run equilibrium annually (see Table 3.17).

Table 3-18: Regression results: Manufacturing Industry Value-added is the Dependent Variable

Variables	OLS		ARDL Long run		Variables	ARDL Short run	
	Coef.	p value	Coef.	p value		Coef.	p value
DMVA	-	-	0.6085	0.0000			
Labor	1.1602	0.0000	1.3707	0.0005	D(Polity)	-0.0089	0.0000
Capital	0.0898	0.4475	0.1970	0.4114	D(openness)	0.2949	0.0000
Polity2	-0.0284	0.0000	-0.0492	0.0003	D(openness (-1)	0.2928	0.0001
Openness	0.2224	0.0323	0.5366	0.0482	CointEq(-1)	-0.2575	0.0000
Constant	-2.5837	0.0156	-4.8426	0.0831			

R-squared = 0.8888
Adj R-squared = 0.8805
F Probability = 0.0000
Number of Observations = 44

To consider the implications of the estimated results one must check the model through diagnostic tests. In this study a post estimation test for normality, autocorrelation, heteroscedasticity, and model specification tests was done with the probability value of the tests statistics enabling us to reject the null hypothesis of the existence of the statistical problems. Table 3.19 presents the probability value for the diagnostic test's statistics. The diagnostic test results are in favor of the estimated model.

Table 3-19: Post-Estimation Test Results

Diagnostic Tests for ARDL Model	Probability
Jarque – Berra	0.8817
Prob (Jarque - Berra)	0.2501
Breusch-Godfrey Serial Correlation LM Test*	0.8306
Heteroskedasticity Test: ARCH*	0.4919
Heteroskedasticity Test: Breusch-Pagan-Godfrey*	0.1103
Ramsey RESET Test*	0.1145

Figure 3.7 shows the normality test of the residuals in the model with the null hypothesis that the residuals are normally distributed and the Jarque-Bera probability is 0.88. Based on that, we fail to reject our null hypothesis that the residuals in our model are normally distributed.

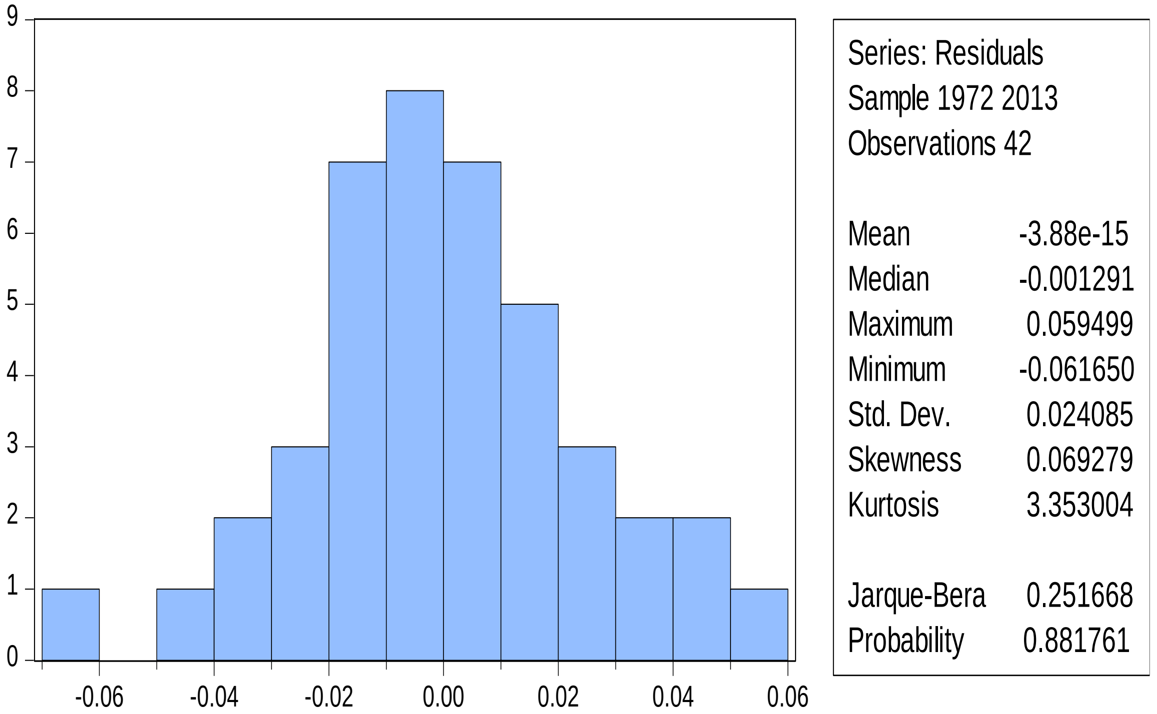


Figure 3-7 Residual Normality Test

Figure 3.8 presents the coefficient stability of the model. Results in the figure show that at the 5 percent significance level the estimated coefficients in the model are stable.

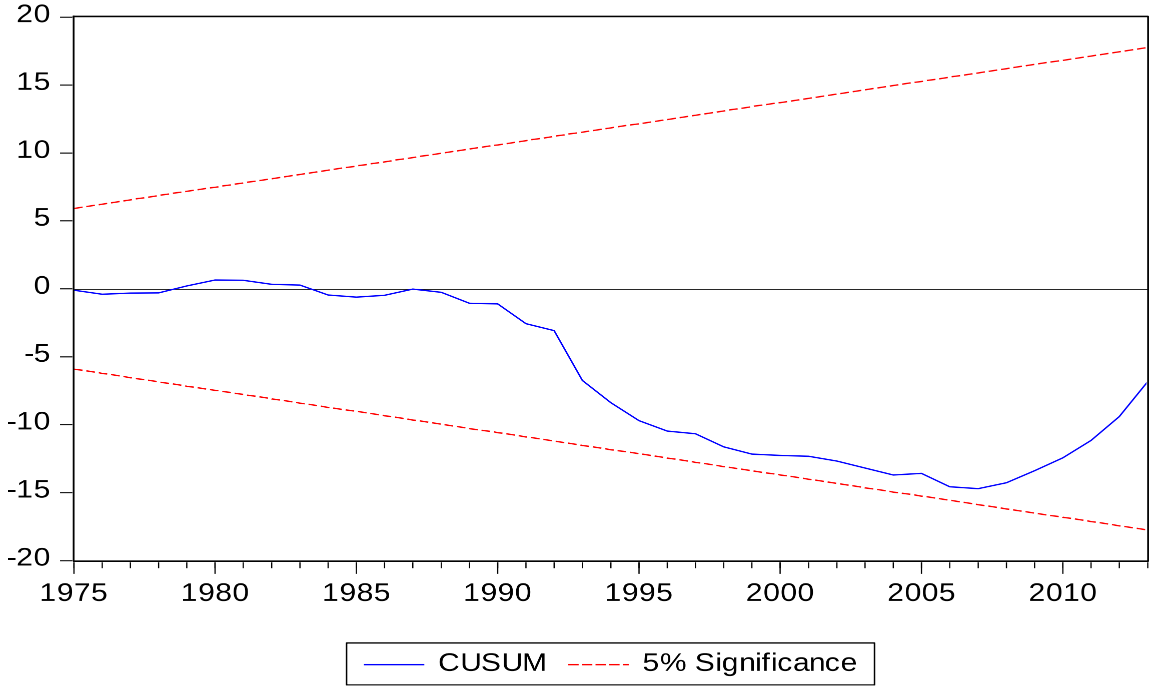


Figure 3-8: Coefficient Stability Test

3.6.Conclusion and Policy Implications

This study investigated the political economy of industrialization in Ethiopia. The Ethiopian modern history covers three political regimes that pursued different industrial policies organized in the framework of different economic systems. The Imperial period was characterized by a centralized market economy with an import substitution industrial policy for labor intensive industries. The Derg regime, which had a centralized command system, pursued an import substitution policy unlike the current regime which is organized as a non-centralized market-oriented system that promotes exports for labor-intensive industries.

In the three regimes, despite the different economic systems and policy strategies the contribution of the industry sector to GDP and employment was not significant. The share of manufacturing industry did not exceed 5 percent for several decades and the share of manufacturing exports in total exported merchandise and GDP was very minimal during the three political regimes. The trade sector across different regimes was also in deficit with the share of imports exceeding the share of exports. The study showed that coffee was a major export item during this period. In general, exports were dominated by primary commodities and capital goods were the major imports with an insignificant share of industrial products in the export sector. Currently, Asia is the dominant continent for international trade and Addis Ababa is a major city for industries (35 percent share) followed by Oromiya, Amhara, and Tigray with 28 percent, 11 percent, and 9 percent share respectively.

The political and economic institutions in the country too were different during the different regimes. For instance, the form of government during the Imperial regime was monarchical giving centralized powers to the king with a feudal ideology. But the economic system was centralized and market-oriented with 3 percent contribution of the manufacturing sector to GDP. In the Derg regime, the form of government was dictatorship with a socialist ideology and command economic institutions with a 4 percent share of manufacturing to GDP. In the recent regime, the form of government is anocratic with a developmentalism ideology and a mixed economic system. In all the three regimes, political institutions influenced economic institutions adversely and the manufacturing industry failed to contribute more than 5 percent to GDP.

The study also showed that different development plans and industrial strategies were implemented in the country during the three political regimes. Specifically, there were an industrial strategy of import substitution industrialization and an export-oriented strategy, but an analysis of the industry's performance shows that the policies failed to have an impact in both the cases. This result shows that something is missing between the policies and their optimal implementation which can be attributed to the government's focus on political issues rather than on economic priorities because of the tradeoff between the two.

Very recently, industrial parks (IPs) have become a strategy for industrialization and 11 industrial parks have been established across the country with a major focus on apparel and textiles. The good thing about the parks is that they are creating employment opportunities for the unemployed people in the country but with short term effects. The industries are dominated by foreign companies attracted because of cheap unskilled labor and tax incentives with convenient infrastructure that is advantageous for them as they can access national and African markets.

From Ethiopia's perspective, the employment potential in the parks does not absorb the technology and knowledge spillovers to take over production in the long run because of the dominance of an unskilled labor force .The parks focus more on apparel and textiles ignoring other agriculture-based industries which are the competitive advantage of the country. Again, the locations of the industries show that this selection is ad-hoc which violates the industrial parks' establishment objectives and full capacity operational requirements. The requirements clearly show that the parks must be strategically located taking the required infrastructure and logistics into consideration that can make the zones to be more competitive in the international market. However, for political reasons the industrial parks are located everywhere as painkillers for social unrest. Yet, all the companies in the parks import their raw materials from the rest of the world without using inputs produced by domestic industries. Excessive imports of raw materials put the sustainability of industrialization at a huge risk with nil linkages or value chain effects required to sustain the sector.

The bound test for cointegration confirmed the existence of long run relationship between political institution and manufacturing growth in Ethiopia empirically. Besides, the estimation results indicated that political institution is statistically significant factor that negatively affected industrial growth in Ethiopia both in the long and short run. Trade openness is statistically significant and a positive factor explaining the growth of manufacturing both in the long and short run. This shows that political institutions have a significant role in explaining the manufacturing industry's growth in Ethiopia.

Based on these findings, we conclude that the different policy strategies used by different regimes in the past alternated between import substitution, export promotion and recently industry parks. The policies did not bring about the expected outcomes in the form of industrialization and economic growth. Hence, relevant country specific research on indigenous opportunities and challenges faced by the industry and the economy should be conducted. Yet, the focus should be shifted from giving priority to political issues and replicate something from the rest of the world to focusing on the fundamental and competitive advantages of the country. In addition, the country needs a development strategy that gives weight to the sectors based on the competitive advantage of the country instead of focusing on agriculture and neglecting others as the agricultural development led to industrialization policy does or focusing on industry and ignoring others as the industrial development strategy does.

For several decades, the political institutions have been a major factor impacting economic institutions in the wrong direction and making the policies have a retarding impact on different sectors including the industry sector. Policy strategy and instruments should be managed in a way that they can bring real structural change by managing the political interests of a regime and its organization in favor of the economic outcome. This ultimately calls for a benevolent governance system that gives priority to the welfare of the people and the economy rather than focusing on how to sustain political power for unlimited time periods.

An optimal and efficient strategy to induce industrialization could be a development strategy that gives priority to the development of the mining industry for supplying raw materials to the industry sector along with a focus in the competitively advantageous sector in the economy. This will reduce Ethiopia's dependency on imported raw materials by enhancing its self-sufficiency. Investments in human capital combined with a regulation of foreign investments, especially mixed allocation of domestic and foreign low skill and high skill labor in production and management, will enhance local management and the technological capacity of the country. Ultimately, the progress gained in the development of mining and industry sectors and technological capabilities will spill over to agriculture, manufacturing, and ultimately to the service sectors as well as to governance and institutions. This ultimately will lead to economic development both in the sectors and regionally.

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4. Linkage of the Industry Sector with Other Sectors in the Ethiopian Economy: A SAM Multiplier Analysis

Paper Three

Selamawit G. Kebede

Abstract

This research investigates the industry sector's linkages with other sectors of the Ethiopian economy. It studies the forward and backward production linkages of the industry with agriculture and service sectors. Further, it examines the total linkage of multifaced industry with other sectors by estimating output, GDP, income, and demand multiplier coefficients. The import penetration and export intensity of the [40]agriculture-based industry and the manufacturing industry are also discussed. For the analysis, it uses the Ethiopian Social Accounting Matrix (SAM) database and made a multiplier analysis to explore the linkages and for estimating the coefficients. The results show that in Ethiopia, agriculture has strong backward and forward linkages while the agriculture-based industry has weak forward linkages and the manufacturing industry has weak backward and forward linkages with other sectors of the economy. The multiplier analysis shows that an exogeneous shock to the agriculture-based industry has a higher multiplier effect than a shock to the manufacturing industry. The elasticity of production, value added, rural household income, and demand are considerably high for agriculture-based industry investments as compared to the manufacturing industry. The results also show that policy should focus on agriculture-based industry investments to positively augment industrialization process and the overall economy. The results are in line with the unbalanced growth theories directing a focus on the competitively advantageous agriculture-based industry among the other sectors.

Keywords: Agriculture-based industry; Manufacturing; Linkages; SAM; Multiplier Analysis; Ethiopia

JEL Classification Codes: Q19; L60; C60

4.1. Introduction

Traditional agriculture and modern industrial sectors along with their interdependency are crucial for a country's overall economic development. Industrial demand for agricultural commodities determines agricultural growth whereas an increase in the purchasing power of the agricultural sector for the industry's products and the provision of raw materials for processing determine industry's growth (Koo and Lou, 1997). Every individual sector plays a role in the working of the whole economy which cannot be accomplished by other sectors. Indeed, one sector uses intermediate inputs from other industries for producing an output and part of its output is sold to the other sectors to be used as an input (Elbushra et al., 2000).

[40] In the text agricultural- based industries is interchangeably used with Agroindustry. The classifications made attached on the appendix A2.7.

In any industrialization path, linkages among the sectors of the economy is a crucial factor that plays a significant role by providing opportunities for further activities in different sectors (Wild and Schwank, 2008). Every sector's production output has two impacts on other sectors of the economy as backward and forward linkages (Mbanda and Bonga-Bonga, 2018; Miller and Blair, 2009; Saikia, 2009). Backward linkage signifies the demand of inputs by an activity or represents inducing local production of inputs while forward linkage indicates supply effects or providing inputs locally for downstream producers (Miller and Blair, 2009). There are two necessary conditions for these linkages to work. One is the scale effect or economies of scale without which the linkages will be meaningless, and the other necessary condition is the responsiveness of the private or public sectors to incentives (Hirschman, 1966).

The sectoral composition in Ethiopia showed that in earlier periods agriculture contributed the lion share percent to GDP and employment followed by service sector and industry respectively (Ejigu and Singh, 2016; Gebreeyesus, 2010). In contrast, recently, the service sector has 47 percent share while agriculture has 37 percent share followed by industry with 17 percent share of GDP (EEA, 2016; Kebede, 2018). This shows the dominance of the service sector followed by agriculture. In both cases, manufacturing industry contributed 5 percent to Ethiopian GDP (EEA, 2016).

Literatures consent with strong interdependency among economic activities as one factor that induces industrialization process and structural change (Koo and Lou, 1997; Saikia, 2009). Sectoral linkage also provides opportunity for further production in different activities (Wild and Schwank, 2008). However, despite extensive research on sectoral linkages, there is a gap in literature on linkage of the industry with the rest of the economy in developing countries including Ethiopia. Studies on the interdependency of industry with other sectors mainly focuses on developed countries (Kim and Kim, 2015; Ilhan and Vaman, 2011). In the case of developing economies, literature mainly focuses on the agriculture sector's linkages and commonly ignored the industry sector (Hafeez et al., 2010: Thaiprasert, 2006). Existing studies also do not provide an in-depth analysis of the linkages between agriculture-based and the manufacturing industry's with other sectors of the economy. Hence, this study addresses two specific research objectives:

- Examining the direct and total linkages of the industry sector with other sectors in the Ethiopian economy, and
- Identifying a priority sector for policy focus that can lead to economic development in Ethiopia

This research studies how the multi-faceted industry is inter-related with the other sectors of the economy taking Ethiopia as a case study. Our results show that agriculture has strong direct backward and forward linkages while the agriculture-based industry has weak forward linkages and the manufacturing sector has weak backward and forward linkages with the other sectors of the economy. The multiplier analysis shows that an exogenous shock to agriculture-based industry has a stronger multiplier effect as compared to a shock to the manufacturing industry. In fact, the economy is more elastic to a shock in the agriculture-based industry than in the manufacturing and other industries. Hence, the development policy should focus on investments in the agriculture-based for positively augmenting the overall economy coinciding with unbalanced development strategy in terms of sectoral linkage.

The rest of this chapter is organized as follows. Section 4.2 reviews relevant theoretical and empirical literature focusing on balanced versus unbalanced growth theories, sectoral linkages, and multiplier effects. The next section gives the social accounting matrix methodology and a multiplier analysis. Section 4.4 describes the data and the variables of interest with Section 4.5 discussing the results. The last section gives the conclusion and policy implications.

4.2.Review of Related Literature

This section discusses the theoretical literature on balanced and unbalanced growth along with linkages and multiplier effects. It also does an empirical review of linkages in the context of different countries with a critical evaluation of the empirical findings.

4.2.1. Balanced and Unbalanced Theories of Economic Growth and Development

In literature there are two contrasting theories of growth and development: the theory of balanced growth and the theory of unbalanced growth. The theory of balanced growth stresses the need for different sectors in a developing economy to avoid supply difficulties indicating that balanced growth is derived from the demand side (Hirschman, 1958). Lewis (1954) argues in favor of balanced growth in which the government plans investments that avoid unnecessary bottlenecks and shortages in the economy (Lewis,1954; Nath, 1962). Balanced growth is also suggested by others for all sectors to develop simultaneously for promoting economic development (Nurkse, 1953; Saliminezhad and Lisaniler, 2018). According to the theory of balanced growth, at every stage of development the pattern of resource allocations is chosen in a way that production capacity is fully utilized by all the sectors of an economy (Lewis, 1954; Wilfred, 1975).

The unbalanced growth theory, however, recognizes the problem of limited professional skills, inadequate capital supply, and low quality of labor in developing countries suggesting the need for a concentrated and sequential pattern of development that achieves economies of scale and could result in a significant breakthrough in inducing development (Hirschman, 1958; Wilfred, 1975). Others are not in favor of the balanced growth theory on the ground that for developing countries financial capital is limited for simultaneous investments in various sectors and it is difficult to create a climate for massive parallel investments at the same time (Saliminezhad and Lisaniler, 2018; Singer, 1958). Balanced growth requires a huge capacity for investments, enormous specific skills, and a conducive investment climate. Hence, Hirschman claims that unbalanced growth should focus on the strong sectors that can stimulate other sectors in the economy (Hirschman, 1958; Saliminezhad and Lisaniler, 2018; Singer, 1958). For developing countries, it is better to encourage sectors with strong linkages with other sectors instead of balanced investments in all activities in an economy (Hirschman, 1958).

4.2.2. Sectoral Linkages and Multiplier Effects

Sectoral linkages theoretically represent a sector's relationships with the rest of the economy concerning intermediate purchases and sales. Sectoral linkages can be discussed either from the perspective of the supply side or the demand side. The demand side refers to backward linkages that show the connection between a sector with the upstream sectors that supply intermediaries for it (Miller and Blair, 2009). These linkages arise through the interdependence of the sectors for meeting final consumption downstream (Saikia, 2009).

On the other hand, the supply side refers to forward linkages indicating a sector's linkages to the downstream sectors demanding its output (Mbanda and Bonga-Bonga, 2018; Miller and Blair, 2009). On the supply side, agriculture supplies food grains to industry which facilitates the absorption of labor in the industry sector; the agriculture sector provides inputs such as raw cotton, tea, coffee, and jute for food processing in the agroindustry. On the other side, industry supplies industrial inputs such as pesticides, fertilizers, and machinery to the agriculture sector. The agriculture sector creates demand for the industry sector through consumption and higher productivity. Savings in the agriculture sector can be used as a source of investments in the industry sector (Saikia, 2009).

Sectoral interdependence impacts the entire economy and each sector exerts a two-way impact on other sectors: first a sector receives or demands intermediate inputs from other sectors directly or indirectly which is called backward linkages. When a sector provides an intermediate output to all sectors directly and implicitly it is called forward linkages (Elbushra et al., 2000). Linkages can be direct or total, that is, either backward or forward linkages or direct as well as indirect effects denoted as a multiplier effect which shows the magnified effect of the direct forward and backward linkages among the sectors (Breisinger et al., 2009; Humavindu and Stage, 2013). Backward linkages measure the proportion of a sector's direct inputs that come from other sectors in the economy instead of primary inputs used in the production process. On the other hand, forward linkages measure the proportion of a sector's direct output that goes to the other sectors of the economy (Kim and Kim, 2015).

According to Hirschman's (1958) unbalanced growth theory the sectors with the highest linkages should stimulate a more rapid growth in production, employment, and income as compared to the other sectors. Basically, if the backward linkage of a sector is greater than one while the forward linkage is less than one, then this will be termed as strong backward linkage. If the backward linkage of the sector is less than one while the forward linage is greater than one, then we have strong forward linkage. When both forward and backward linkages of a sector is less than one it is termed as weak linkage sector (Temursho, 2016). Yet, when the linkage value of a sector is greater than one for both, then it is termed as a strong linkage sector (Ilhan and Vaman, 2011; Kim and Kim, 2015).

A multiplier effect shows the magnified effect of a shock and conventionally can be classified into two parts: output and input multipliers (Kim and Kim, 2015) or into three parts as output multiplier, GDP multiplier, and income multiplier (Breisinger et al., 2009). Output multiplier measures the total effect of a monetary unit change in the final demand for a sector's goods and services on the output of the other sectors of the economy. Input multiplier measures the effect of a monetary unit change in the primary inputs provided to a sector on the inputs of all sectors in the economy (Bon et al., 1999; Kim and Kim, 2015).

The results of a linkage and multiplier analysis help assess and improve policy decisions by identifying key linkage sectors; this also provides a better understanding of how exogeneous shocks will impact the complex structure of an economy (Blancas, 2006). Literature stresses that a country's optimal industrial structure is endogenous to its endowments (Dietsche, 2017; Lin and Chang, 2009). Under such conditions, any intervention should focus on encouraging the production of goods and services for which a country has abundant factors of production. In this case industries with comparative advantages should be encouraged through interventions along with a hands-off approach (Dietsche, 2017; Lin and Chang, 2009).

Industrial production especially manufacturing production through interdependence and forward and backward linkages, induces productivity in all the other sectors and it triggers a process of institutional, political, and infrastructural progress (Lin and Chang, 2009). Besides, the linkages between the different sectors of an economy and the sectoral composition of output has growth inducing effect (Wild and Schwank, 2008). Figure 4.1 shows how an exogeneous shock impacts the structure of an economy. As shown in the figure, a shock has both direct and indirect effects and the indirect effects can be classified into two parts as production and consumption linkages in which the former consists of backward and forward linkages. The total effect including production and consumption linkages is captured as a multiplier effect of an exogeneous shock (Breisinger et al., 2009; Hirschman, 1958).

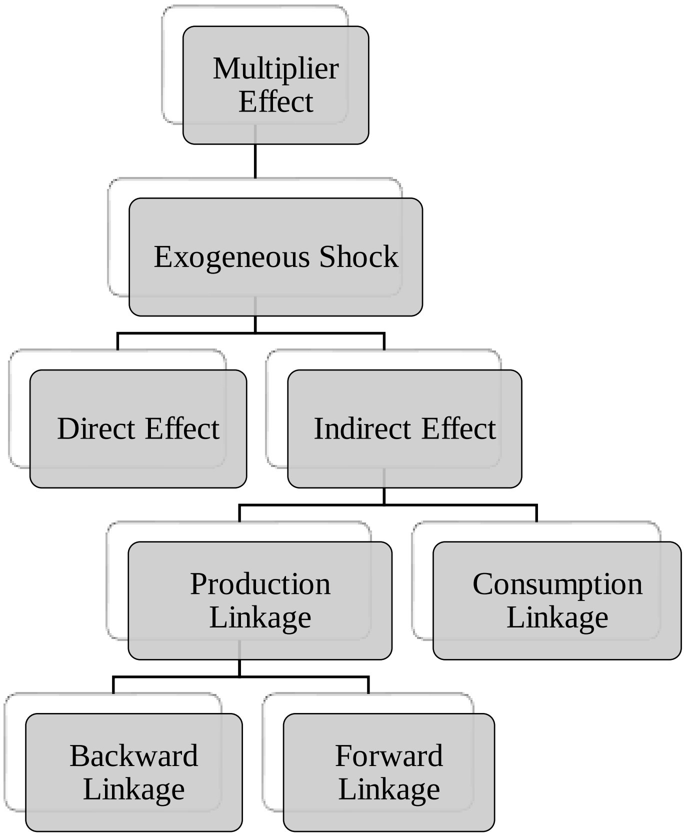

Figure 4-1. Basic framework for the linkage effects of an exogeneous shock

4.2.3. Review of Empirical Literature[41]

Empirical research on economic growth has expanded enormously and focuses on the determinants of aggregate economic growth with less emphasis on the determinants of sectoral growth. Some exceptions are the classical contributions of Lewis (1954) and Hirshmann (1958). These studies discuss the dual economic model explaining economic growth by emphasizing the role of the agriculture and industry sectors and the linkages between them (Lewis, 1954; Hirshmann, 1958; Subramaniam, 2010).

Very few empirical investigations at different levels of aggregation have been done in literature. Kim and Kim (2015) investigated the impact of the hotel industry on other industries in the Texas economy using an input-output approach for estimating employment, output, and income multiplier's coefficients. Their findings show that the hotel industry impacted Texas' economy due to a huge induced effect of output, income, and employment but with a relatively lower multiplier effect. The accommodation industry generated more labor income and employment opportunities than the hotel industry provided that the hotel industry had a strong interdependence on the finance and insurance industries.

[41] The literature review is not organized chronologically and is instead structured based on the level of economic development in the countries starting with the developed countries' experience and moving to the developing countries' empirical context.

Hampson (2012) on a review of the industry policy and its historical background in Australia he showed that since the 1980s reforms in the country's industrial policy followed an economically liberal approach. The study showed that leaving the industries to the market had strong implications on the interdependency of different sectors of the economy and the overall structure of the economy. However, this approach was compromised by political pragmatism and ultimately led to a need for an interventionist policy in selective industries.

Ilhan and Vaman (2011) studied the impact of the construction industry on the rest of the Turkish economy by doing a comparative analysis with EU countries following the input-output approach. The results of their study showed a strong backward linkage but weak forward linkages with the sectors of some EU countries such as the Czech Republic, Portugal, Slovakia, and Hungary showing the important role that the construction sector plays in the Turkish economy.

Subramaniam (2010) examined the role of market liberalization and its impact on the agriculture sector and intersectoral linkages between agriculture, industry, and service sectors in Romania, Poland, Hungary, and Bulgaria using the vector error correction model and the impulse response function. His results show that in the short run a sector can have negative linkages with the other sectors but not in the long run. The impulse response analysis showed that a shock in an endogenous variable was absorbed by the agriculture sector as well as by the other sectors in all the four countries.

Koo and Lou (1997) investigated the interdependency among the industry and agriculture sectors in China. They found the labor input to be significant for Chinese economic development while capital investments primarily impacted Chinese industrial development. However, labor contributed less to the agriculture sector while land contributed less to the development of both the agriculture and industry sectors in China. The Chinese agriculture sector depends on the industry sector, but the industry sector's growth does not rely on agricultural growth. Chen and Song (2019) investigated the forward and backward linkages in the Macau industry sector with other industries in the economy using the input-output approach and a direct coefficient analysis. Their findings show a weak linkage between both upstream and downstream industries though it made a significant contribution to Macau's overall economic performance.

Hafeez et al. (2010) examined the implications of service-led growth and an industrial policy along with its contribution to the Pakistan and Asian economies. They show that the sectoral composition of output and growth meant a structural transformation from an agrarian economy to a service sector dominating the economy. The industry structure too has transformed from an import substitution strategy to an export-oriented industry with an insignificant impact on the industry sector's diversification, employment contribution, and competitiveness. This shows the need for inclusive service led growth and industrial policy. Thaiprasert (2006) used a key sector and multiplier analysis to show that agriculture was a major sector impacting the development of Thailand's economy with high backward and forward linkages. Together with agroindustry the manufacturing sector made small contributions to the economy and a multiplier analysis confirmed the potential of the agriculture and agroindustry sectors as compared to the non-agriculture sectors.

Tadele (2000) investigated inter-sectoral linkages in Ethiopia using SAM for 2000. The multiplier analysis showed that in the agriculture sector, teff, maize, wheat, and coffee had relatively strong linkages with the rest of the economy. In the industrial sector food processing, beverages, metals, and textiles had a strong impact on labor incomes for an exogeneous shock in the demand for these activities. These linkages have strong implications for development strategies focusing on agriculture and other sectors.

The review so far shows that the existing empirical studies related to sectoral linkages in the different countries mainly focus on the tourism industry's linkages with other sectors, the game industry, the construction industry, and the agriculture industry using an input-output analysis. These studies focus on the direct linkages and skip the multiplier effect which signifies the direct effect of a shock. The studies also focus on other sectors than manufacturing and agriculture-based industry and this is a gap that the study will fill by exploring the Ethiopian case. Tadele (2000), investigated intersectoral linkages in Ethiopia by disaggregating the activities into micro level without a specific focus on a specific sector and neglecting the aggregated interlinkages among the sectors. This study however explores the industry's linkages classified into agriculture-based industry, manufacturing, and other industries with the rest of the sectors in the economy using a multiplier SAM analysis. The study uses an updated SAM database available in Ethiopia. This approach enables us to capture consumption linkages and the total multiplier effect of an exogenous shock.

4.3.Method

Different methodologies can be used for analyzing and estimating sectoral linkages such as the input-output (IO) approach, the simultaneous accounting matrix (SAM), and the computable general equilibrium (CGE), statistical causality tests, and econometric modeling (Breisinger et al., 2009; FAO, 2012). The input-output method is an economic model with a theoretical foundation in Walras' general equilibrium theory which reflects the mutual quantitative relationships between the inputs and outputs of various sectors in an economy. The input-output approach helps analyze the inter-related effects of each sector in the industrial structure and the whole economic system (Chen and Song, 2019). SAM, on the other hand, is a double entry and money metric economic accounting system recording transactions among economic activities. It shows the complete circular flow of income from production to distribution and expenditure reflecting the socioeconomic structure of the economy (Mbanda and Bonga-Bonga, 2018). SAM is also an accounting framework that represents the economy by assigning numbers to the income and expenditure in a circular flow diagram. In the square matrix, each row and column is called an account while each cell in it represents a flow of funds from a column account to a row account (Breisinger et al., 2009).

The entire circular flow of income in an economy is depicted in SAM in a square matrix form with each cell representing a flow of funds from a column account to a row account (Temursho, 2016). The columns track expenditure while the rows track the receipts and the total represents the total expenditure and total receipts respectively (Breisinger et al., 2009; Temursho, 2016). In SAM, we usually have six accounts aggregated as activities; commodities disaggregated into agriculture, industry, and services; factor account including labor and capital; institutions consisting of households and the government; capital account holding investments and savings; and the rest of the world account (Mbanda and Bonga-Bonga, 2018; Tadele, 2000). The latter comprises the balance of foreign exchange where the row indicates the outflows and the column indicates the inflows (Temursho, 2016).

However, SAM is not without limitations as it assumes a fixed price and the unconstrained one assumes unlimited supply response for a change in demand. The input output approach unlike SAM shows only the production linkage ignoring the consumption side. CGE relaxes the fixed price assumption and unconstrained supply sharing other assumptions with the two models (Breisinger et al., 2009; FAO, 2012). In comparing the different approaches this study does only a SAM multiplier analysis that addresses the research objective. SAM organizes the information about the economic and social structure of a country for a given period and provides a view of the flows of receipts and payments in an economic system (FAO, 2012). As compared to the other approaches, SAM has the advantage that it provides a chance to explore not only direct production linkages but also consumption linkages as well as the total linkages among the sectors (Breisinger et al., 2009). Further, a multiplier decomposition can also be done using a SAM based framework (Ge and Lei, 2013) which this is beyond the scope of this study.

Table 4.1 shows SAM's basic structure with its accounts and the transactions made among the accounts. As can be seen in the table, there are seven accounts: production activities, commodities, factors, households, government, capital account (savings and investments), and the rest of the world account. In the activity column, we have an intermediate demand for the commodity market and value added as a payment from the activity to the factors which give us the total of the intermediate and value added in the column as the gross output. In the rows the activity account gets domestic supply of an output through production activity which gives us total activity income. In the commodity column, it is an expenditure by the commodity account on activities for domestic supply of goods and services, a payment of sales tax and import tariffs for commodities imported from the rest of the world, and payment for total imported commodities which gives the total supply. In the rows of the commodity account income is generated from an intermediate demand from the activity account, consumption demand from households, recurrent demand for commodities by the government, and investment demand, income is generated from the rest of the world account from a demand for exports and the sum gives the total demand. The column on the factor account is an expenditure by the factors to the households which gives total factor spending while the row is income generated by the factors from an activity being used as value added which gives the total factor income.

Table 4-1: SAM’s Basic Structure

Total Activities	Rest of world	Savings and investment	Government	Households	Factors	Commoditie s	Activities	
Gross Output					Value Added	Intermediate demand		Activities
Total Supply	Import Payments		Sales taxes and import tariffs				Domestic Supply	Commodities
Total Factor spending				Factor payments to Households				Factors
Total Household Spending		Private Savings	Direct Tax			Consumptio n Spending		Households
Government Expenditure		Fiscal surplus		Social transfers		Recurrent Spending		Government
Total investment Spending						Investment demand		Savings and investment
Foreign Exchange		Current account	Foreign grant and	Foreign Remittance		Export earnings		Rest of world
	Foreign exchange outflow	Total Savings	Government Income	Total household income	Total Factor Income	Total Demand	Activity Income	Total Activities

In the household account, the column shows the expenditure on consumption of commodities, direct taxes paid to the government, and private savings which are summed as total household spending. The row side of the household account is an income that goes to a household as a factor payment as the household source of the factors, a social transfer income from the government, and a remittance transfer from the rest of the world account (family and friends etc.) which in sum is the total household income. Another institutional account is the government account with the column showing expenditure for commodities as recurrent expenditure, payment to households as a social transfer, and government savings as a fiscal surplus which give the government expenditure. The row in the government account gives the income for the government from the commodity market as sales tax and import tariffs, direct taxes from households, and loan and foreign grants from the rest of the world which make total government income.

The capital account consists of savings and investments in the column which is an expenditure as investments in the commodity market which gives the total investment spending. The row in the capital account shows income from household savings, fiscal surplus with the government, and the current account balance summing up to total savings. Finally, in the rest of the world account, the column is an expenditure for domestically produced commodities, transfers to households as remittances, foreign grants and loans for the government, and the current account balance for the capital account which add up to total foreign exchange inflows. In the row of this account an income from the rest of the world is generated from payments for imports in the commodity account which gives the total foreign exchange outflows. The accounting matrix SAM is also presented using alphabets in Table 3.2. The glossary of letters used in the table is:

A denotes activities,

C represents commodities,

F stands for factors of production,

H represents households,

E stands for the exogenous components of demand including government account, capital account, and the rest of the world account,

X represents the gross output of each activity,

Z stands for the total demand for each commodity,

V is total factor income, and

Y stands for total household income.

Table 4-2: SAM using Alphabets

		A_1	A_2	A_3	C_1	C_2	C_3	F	H	E	Total
Activities	A_1				X_1						X_1
	A_2					X_2					X_2
	A_3						X_3				X_3
Commodities	C_1	Z_{11}	Z_{12}	Z_{13}					C_1	E_1	Z_1
	C_2	Z_{21}	Z_{22}	Z_{23}					C_2	E_2	Z_2
	C_3	Z_{31}	Z_{32}	Z_{33}					C_3	E_3	Z_3
Factors	F	V_1	V_2	V_3							V
Household	H							$V_1+V_2+V_3$			Y
Exogenous demand	E				L_1	L_2	L_3		S		E
Total		X_1	X_2	X_3	Z_1	Z_2	Z_3	V	Y	E	

Source: Author's compilation based on Elbushra et al. (2000) and Breisinger et al. (2009).

Table 4.3 gives the basic multiplier matrix with the letters in Table 4.2 and the coefficients as ratios are defined as:

a's represent technical coefficients,

b's represent share of domestic output in total demand,

v's are value added or factors of production as a share of total output,

c's are household consumption expenditure,

s stands for the household saving rate,

l's are total demand value share of imports or commodity taxes

$a_{11} = Z_{11}/X_1,\ a_{21} = Z_{21}/X_1,\ a_{31} = Z_{31}/X_1$

$a_{12} = Z_{12}/X_2,\ a_{22} = Z_{22}/X_2,\ a_{32} = Z_{32}/X_2$

$a_{13} = Z_{13}/X_3,\ a_{23} = Z_{23}/X_3,\ a_{33} = Z_{33}/X_2$

$b_1=X_1/Z_1,\ b_2=X_2/Z_2,\ b_3=X_3/Z_3$

$v_1=V_1/X_1,\ v_2=V_2/X_2,\ v_3=V_3/X_3$

$c_1=C_1/Y$, c2= C_2/Y, $c_3= C_3/Y$ and s=S/Y

$l_1=l_1/Z_1,\ l_2=l_2/Z_2,\ l_3=l_3/Z_3$

Table 4-3: A Basic Multiplier Matrix

		A_1	A_2	A_3	C_1	C_2	C_3	F	H	E	Total
Activities	A_1				b_1						X_1
	A_2					b_2					X_2
	A_3						b_3				X_3
Commodities	C_1	a_{11}	a_{12}	a_{13}					c_1	E_1	Z_1
	C_2	a_{21}	a_{22}	a_{23}					c_2	E_2	Z_2
	C_3	a_{31}	a_{32}	a_{33}					c_3	E_3	Z_3
Factors	F	v_1	v_2	v_3							V
Household	H							1			Y
Exogenous demand	E				l_1	l_2	l_3		s		E
Total		1	1	1	1	1	1	1	1	1	

Source: Author's compilation based on Elbushra et al. (2000).

According to SAM, in each sector total demand is the sum of intermediate inputs, a household's consumption demand, and an exogeneous source of demand consisting of investments and public consumption. The total demand (Z) can be mathematically represented with the unconstrained multiplier matrix as: [42]

$$(eq. 4.1). \quad Z = aX + cY + E$$

where total demand Z has X, Y, and E as its components defined as intermediate inputs, consumption demand, and exogenous sources of demand such as investments and public consumption. The lower level characters a and c denote technical coefficients and the household expenditure's share defined as:

$$(eq. 4.2). \quad X = bZ$$

where X indicates gross output as part of total demand Z taken from Table 4.2, $b_1=X_1/Z_1$, $b_2=X_2/Z_2$, $b_3=X_3/Z_3$. The consumption demand is defined as:

$$(eq. 4.3). \quad Y = vX, Y = vbZ$$

Equation (4.3) denoting household income depends on the share of factor income. In Table 4.2 $V_1+V_2+V_3=Y$ and $V_1= v_1X_1$, $V_2= v_2X_2$ & $V_3= v_3X_3$ which gives Y=vX. Then, by substituting Equations (4.3) and (4.2) in the first equation we get Equation (4.4), with the total demand as:

$$(eq. 4.4). \quad Z = abZ + cvbZ + E$$

[42] The mathematical formulation of the multiplier matrix is adopted from Breisinger et al. (2009).

Now we can collect the coefficients of Z together leaving only the exogenous term to the right-hand side as:

$(eq. 4.5). \quad Z - cbZ - cvbZ = E$
$(eq. 4.6). \quad [I - cb - cvb]Z = E$

We can denote the term in the bracket as the difference between the identity matrix and the coefficient matrix (I-A) as:

$(eq. 4.7). \quad [I - A]Z = E$

After rearranging, we reach to the multiplier formula:

$(eq. 4.8). \quad Z = [I - A]^{-1}E$

Here the coefficient for the exogeneous demand E is defined as the multiplier matrix that shows the amplified effect of exogeneous demand on endogenous accounts. In this study, the Ethiopian SAM for 2011 is used as the database for examining the forward and backward linkages of the manufacturing industry with other sectors of the economy along with the output multiplier, GDP multiplier, income multiplier, and demand multiplier.

4.4.Data

This study uses the social accounting matrix (SAM) database for 2011 released by the International Food Program Research Institute (IFPRE) in Ethiopia. The SAM covers 75 sectors and there are 70 production activities, 71 commodities, and the factor account consists of 14 components with labor disaggregated based on the level of education, land, and capital. 15 household accounts are disaggregated based on location as urban and rural along with differences in the income percentiles. Other accounts include the government account, three tax accounts, the savings and investments account, transaction cost account, enterprise account, and the rest of the world account.

The objective of this study is examining the direct and total linkages of the industry sector especially the agriculture-based industry and manufacturing industry with the rest of sectors of the economy. The SAM must be aggregated to sectors to make it coincide with the objective of the study. Accordingly, the aggregated SAM has six production activities: agriculture, agriculture-based industry (agroindustry), manufacturing industry, other industries, trade services, and other services sectors. Likewise, the commodity account is aggregated into six sub-accounts: agriculture, agriculture-based industry (agroindustry), manufacturing industries, other industries, trade services, and other services. Factors are aggregated into three accounts as labor, land, and capital. Household account is aggregated into rural and urban households. Ultimately, the government account, capital account (savings and investments), and the rest of the world account are taken as they are.

4.5.Discussion of the Results

This section discusses SAM characterization, direct linkages consisting of both forward and backward production linkages along with the output, GDP, and income multipliers for the Ethiopian SAM of 2011. Import penetration and export intensity of the industry too are discussed. Special attention is paid to the agriculture-based industry and manufacturing industry towards exploring their direct and total linkages with other sectors of the economy.

4.5.1. SAM Characterization

The first thing to be done is aggregating the SAM database consistent with the specific objective of the study which in our case is exploring the direct forward and backward production linkages of industry basically the agriculture based industry and manufacturing industries with other sectors of the economy. Yet, it assesses the multiplier effects of an exogenous shock to these sectors on the overall economy. Accordingly, a SAM aggregation is done which consisted of activity and commodity accounts classified into agriculture, agriculture-based industry written on the tables as agroindustry, manufacturing, other industries, trade services, and other services. The factors are aggregated into labor, land, and capital. The household account is aggregated into rural and urban households while the government, savings and investments, with the rest of the world account being taken as they are (see Tables A3.1 to A3.9 in Appendix A3).[43] Then, using the technical coefficient matrix characterization of the SAM will follow through.

Table 4.4 shows the technical coefficient of the aggregated SAM. It shows that the agriculture sector used 10 percent intermediate inputs from agriculture, 4 percent from agriculture-based industry, 2 percent from manufacturing, 1 percent from other industries, and 6 percent intermediate inputs from the service sector. This implies that agriculture mostly relied on itself for intermediate inputs with little use of the manufacturing sector for inputs showing a traditional agriculture production system with limited room for commercialized agriculture. Agricultural production paid 45 percent for labor, 22 percent for land, and 10 percent for capital. This shows that the sector's production is not intermediate input intensive and is instead factor intensive. More specifically, agriculture is labor intensive (see Table 4.4).

The agriculture-based industry used 45 percent intermediate inputs from the agriculture sector, 12 percent from agriculture-based industry, 14 percent from manufacturing, 2 percent from other industries, and 4 percent from the service sector with total intermediate inputs used by the agroindustry is totally 78 percent. This industry paid 4 percent for labor, 19 percent for capital, and 23 percent for value added making it intermediate input intensive sector unlike the agriculture sector. The manufacturing industry used 2 percent agricultural intermediate inputs, 3 percent agroindustry inputs, 54 percent manufacturing inputs, 7 percent inputs from other industries, and 4 percent service inputs adding to 70

[43] The detailed procedures for account classification, SAM aggregation, and estimated results of the multipliers are given in Appendix A3.

percent intermediate inputs used by the manufacturing industry. Hence, the lion's share of intermediate inputs for the manufacturing sector came from the manufacturing sector indicating that it used very little from the agriculture and agroindustry sectors as intermediate inputs. This sector paid 5 percent for labor, 25 percent for capital, and 30 percent for value added showing that the manufacturing sector is intermediate input intensive unlike the agriculture sector and employs more capital than labor. Similarly, other industries used 50 percent intermediate inputs from the industry sector and 15 percent from the service sector with no intermediate inputs used from the agriculture and agroindustry sectors. Here, the percentage share of labor and capital used are 21 and 14 percent respectively.

The trade service sector used 2 percent intermediate inputs from the industry sector and 15 percent from the service sector, but it used no intermediate inputs from the agriculture sector. This sector used 47 percent labor and 36 percent capital adding to 83 percent value added and showing that production in the trade service sector is factor intensive. The other services sector used 2 percent intermediate inputs from agriculture, 5 percent from agroindustry, 20 percent from manufacturing and other services, and 9 percent from the service sector while it employed 37 percent labor and 27 percent capital with total value added of 64 percent making it a factor intensive sector.

Table 4-4: Technical Coefficient Matrix

	Agriculture	Agroindustry	Manufacturing	Other Industries	Trade Service	Other Service
Commodities:						
Agriculture Commodities	0.10	0.45	0.02	0.00	0.00	0.02
Agroindustry Commodities	0.04	0.12	0.03	0.00	0.00	0.05
Manufacturing Commodities	0.02	0.14	0.54	0.37	0.01	0.13
Other Industries Commodities	0.01	0.02	0.07	0.13	0.01	0.07
Trade Service Commodities	0.03	0.00	0.00	0.03	0.00	0.03
Other Services Commodities	0.03	0.04	0.04	0.12	0.15	0.06
Production factors:						
Labor	0.45	0.04	0.05	0.21	0.47	0.37
Land	0.22	0.00	0.00	0.00	0.00	0.00
Capital	0.10	0.19	0.25	0.14	0.36	0.27

Table 4.5 presents the share of domestically produced output of the total demand. Based on Table 4.5, 79 percent of agricultural commodities are supplied domestically while 54

percent and 11 percent commodities for the agroindustry and manufacturing sectors respectively are domestically supplied. Based on the coefficients from the table, 91 percent of other industries' commodity demands are supplied domestically with 100 percent and 85 percent domestic supply for trade services and other services respectively. This shows that the agroindustry and manufacturing sectors do not rely heavily on domestic production and instead there is more than 45 percent import leakage for agroindustry and approximately 70 percent import leakage for the manufacturing sector.

Table 4-5: Share of Domestic Output of Total Demand

	Agriculture Commodity	Agroindustry Commodity	Manufacturing Commodity	Other Industries	Trade Service	Other Service
Agriculture	0.79	0.00	0.00	0.00	0.00	0.00
Agroindustry	0.00	0.54	0.00	0.00	0.00	0.00
Manufacturing	0.00	0.00	0.11	0.00	0.00	0.00
Other Industries	0.00	0.00	0.00	0.91	0.00	0.00
Trade service	0.00	0.00	0.00	0.00	1.00	0.00
Other Services	0.00	0.00	0.00	0.00	0.00	0.85

Table 4.6 provides factor spending on households. Labor spent 73 percent on rural households while 27 percent went to urban households. Likewise, land spent 98 percent on rural households and the remaining on their urban counterparts. However, capital spent 83 percent on enterprises and the remaining on rural households. This implies factor spending concentrates on rural households than on urban households.

Table 4-6: Factor Spending on Households

	Labor	Land	Capital	Enterprise
Labor	0.00	0.00	0.00	0.00
Land	0.00	0.00	0.00	0.00
Capital	0.00	0.00	0.00	0.00
Enterprise	0.00	0.00	0.83	0.00
Rural HH	0.73	0.98	0.16	0.40
Urban HH	0.27	0.02	0.00	0.37

Table 4.7 gives the pattern of household expenditure where 21 percent of the rural household expenditure is on agricultural activities while 25 percent is consumption expenditure for agricultural commodities and 12 percent goes for consumption of agroindustry commodities. Rural households spent 18 percent of their incomes on other service commodities and 6 percent of their incomes is allocated for manufacturing commodities. This shows that the demand for agroindustry and manufacturing among rural households is relatively low compared to demand for other commodities. On the other hand, 25 percent of consumption demand for urban households is for agricultural commodities and 34 percent consumption demand is for services other than trade while the

consumption demand for agroindustry and manufacturing commodities among urban households is 9 and 7 percent respectively.

Table 4-7: Household Consumption Expenditure Patterns

	Rural Household Consumption Pattern	Urban Household Consumption Pattern
Activities:		
Agriculture Activities	0.21	0.01
Agroindustry Activities	0.00	0.00
Manufacturing Activities	0.00	0.00
Other Industries Activities	0.00	0.00
Trade Service Activities	0.00	0.00
Other Services Activities	0.00	0.00
Commodities:		
Agriculture Commodities	0.25	0.25
Agroindustry Commodities	0.12	0.09
Manufacturing Commodities	0.06	0.07
Other Industries Commodities	0.01	0.02
Trade Service Commodities	0.00	0.00
Other Services Commodities	0.18	0.34

The import penetration ratio and export intensity of the different sectors are given in Table 4.8. According to the results, the proportion of imports in total demand was 3 percent for agriculture, 18 percent for agroindustry, 56 percent for manufacturing, and 7 percent for the service sector with a huge import penetration for the manufacturing sector. The proportion of exports in the total output for agriculture is 17 percent, for agroindustry it is 11 percent, and for services it is 17 percent. Hence, the lion share of exports came from agriculture, but the largest proportion of imports is from manufacturing implying the existence of a huge trade balance deficit in the economy as the export earnings generated from agricultural commodities will fall short in covering the cost of capital intensive manufacturing goods from the rest of the world.

Table 4-8: Import Penetration Ratio and the Export Intensity of Sectors

	Import Penetration Ratio in Percent	Rank	Export Intensity in Percent	Rank
Agriculture	0.03	5th	0.17	1st
Agroindustry	0.18	2nd	0.11	3rd
Manufacturing	0.56	1st	0.05	4th
Other industries	0.07	4th	0.03	5th
Trade service	0.00	-	0.00	-
Other services	0.15	3rd	0.17	2nd

4.5.2. Direct and Total Linkages of Industry with other Sectors in Ethiopia

This section provides the industry sector's direct backward and forward production linkage with other sectors of the economy. In addition, it also discusses the multiplier effect of a shock on endogenous factors. Finally, simulation is made by introducing a shock on both exogeneous investment demand for agriculture-based industry and manufacturing to estimate the output, GDP, demand, and income effects on rural and urban households.

Table 3.9 presents the direct backward and forward production linkage of the sectors. The coefficient for direct backward linkages of the agriculture sector with other sectors is 2.86 which are greater than one and are found to be strong and the forward linkages are moderately strong compared to the other sectors. The results show that the agroindustry sector has a coefficient of 1.33 for backward linkages with other sectors, and it has forward linkage of 0.90 indicating strong backward but weak forward linkage with other sectors respectively. For manufacturing and other industries, the backward and forward linkages are considerably weak indicating that these industries are not using inputs from other sectors in the economy as they should be, and they are also not providing their production output to the other sectors of the economy. With respect to the service sector, both the trade and other services has strong direct backward linkages showing the extensive use of output produced by the other sectors. However, the forward linkage in the service sector is less than one indicating weak direct forward linkage with other sectors. These direct backward and forward linkages of the sectors show that the industry sector, mainly the manufacturing industry, failed to use inputs from the other sectors and to provide outputs for the other sectors. This is one reason for the sector's low contribution to GDP which has been limiting to achieve the poverty reduction and structural transformation goals of the country for several decades (see Table 4.9).

Table 4-9: Backward and Forward Linkages of the Industry sector with other Sectors in Ethiopia

	Backward Linkage	Linkage Status	Forward Linkage	Linkage Status
Agriculture	2.86	Strong	1.19	Strong
Agroindustry	1.33	Strong	0.91	Weak
Manufacturing	0.55	Weak	0.69	Weak
Other industries	0.80	Weak	0.41	Weak
Trade service	1.20	Strong	0.67	Weak
Other services	1.05	Strong	0.98	Weak

Table 4.10 gives the effects of an injection in the activity account and its effects on the production of activities, on commodity demand, value added, and household incomes. To begin with, an exogeneous shock to the agriculture sector will lead to an increase in agricultural production by a relatively huge point and value added of labor. It also has a high increasing impact on rural household incomes. A unit exogenous shock to agroindustry will boost both agroindustry and agricultural production. It will also increase labor value added and incomes of rural households. An exogeneous shock to manufacturing will increase its production and commodity demand but will not impact value added by labor. Relatively, it will increase rural household incomes rather than urban household incomes.

Table 4-10: SAM Output, Demand, Value added, and Income Multipliers for a Shock to Activities

	Agriculture	Agroindustry	Manufacturing	Other Industries	Trade Service	Other Service
Agriculture Activities	2.04	1.14	0.49	0.58	0.87	0.79
Agroindustry Activities	0.21	1.22	0.11	0.12	0.17	0.18
Manufacturing Activities	0.04	0.05	1.09	0.07	0.04	0.05
Other Industries Activities	0.11	0.11	0.13	1.21	0.11	0.15
Trade Service Activities	0.30	0.33	0.23	0.27	1.24	0.28
Other Services Activities	0.61	0.55	0.38	0.52	0.67	1.56
Agriculture Commodities	0.87	1.11	0.41	0.47	0.70	0.65
Agroindustry Commodities	0.38	0.40	0.20	0.22	0.32	0.33
Manufacturing Commodities	0.36	0.45	0.78	0.68	0.34	0.46
Other Industries Commodities	0.12	0.12	0.15	0.23	0.12	0.17

Trade Service Commodities	0.30	0.33	0.24	0.27	0.24	0.28
Other Services Commodities	0.72	0.64	0.45	0.61	0.79	0.66
Trc	0.29	0.35	0.26	0.26	0.25	0.26
Labor	1.32	0.94	0.56	0.84	1.25	1.10
Land	0.45	0.25	0.11	0.13	0.19	0.17
Capital	0.54	0.63	0.55	0.50	0.78	0.67
Enterprise	0.45	0.53	0.46	0.41	0.64	0.55
Rural HH	1.67	1.25	0.78	0.99	1.48	1.30
Urban HH	0.52	0.45	0.32	0.38	0.57	0.50

Table 4.11 presents demand multipliers measuring the effect of an exogenous shock to the commodity account and its impact on production of different activities, the demand for its own and other commodities, value added, and households' incomes. An exogenous shock to agricultural commodity demand increased its own demand by 1.81 percent, its production by 1.76 percent, value added by labor is 1.25 percent, and increased rural household incomes by 1.57 percent. A unit exogenous shock to the agroindustry's commodity demand will increase its own demand by 1.26 percent, increase agricultural commodity demand by 0.7 units, and increase agroindustry and agricultural production by 0.74 percent and 0.69 percent respectively. The same shock will also increase rural household incomes by 0.88 percent. A percentage exogenous shock to manufacturing commodity demand will increase its own demand by 1.16 percent but on average it will have a very low impact on its own production, and production in agriculture, agroindustry, and services. In addition, it has a very low value-added impact and low contribution to an increase in rural and urban household incomes.

Table 4-11: SAM Output, Demand, Value added, and Income Multipliers for a Shock to Commodity Demand

	Agriculture	Agroindustry	Manufacturing	Other Industries	Trade Service	Other Service
Agriculture Activities	1.76	0.74	0.22	0.55	0.87	0.67
Agroindustry Activities	0.19	0.69	0.05	0.11	0.17	0.15
Manufacturing Activities	0.04	0.03	0.13	0.07	0.04	0.04
Other Industries Activities	0.11	0.07	0.04	1.10	0.11	0.13
Trade Service Activities	0.42	0.32	0.23	0.27	1.24	0.24
Other Services Activities	0.63	0.41	0.21	0.49	0.67	1.32
Agriculture Commodities	1.81	0.70	0.18	0.44	0.70	0.55
Agroindustry Commodities	0.35	1.26	0.08	0.20	0.32	0.28
Manufacturing Commodities	0.35	0.30	1.16	0.63	0.34	0.39
Other Industries Commodities	0.12	0.08	0.04	1.21	0.12	0.14
Trade Service Commodities	0.43	0.32	0.23	0.27	1.24	0.24

Other Services Commodities	0.74	0.49	0.24	0.57	0.79	1.56
Labor	1.25	0.68	0.30	0.79	1.25	0.94
Land	0.38	0.16	0.05	0.12	0.19	0.15
Capital	0.56	0.45	0.21	0.47	0.77	0.57
Enterprise	0.46	0.37	0.17	0.39	0.64	0.47
Rural HH	1.57	0.88	0.37	0.93	1.48	1.11
Urban HH	0.51	0.32	0.14	0.36	0.57	0.42

Table 4.12 shows the effect of a shock to factors of production and its impact on output of activities, demand for commodities, value added, and income effect. A percentage shock to labor will increase labor value added by 1.84 percent, increase agricultural production by 1.02 percent, production of other services by 0.62 percent, increase demand for agricultural commodities by 0.81 percent, and demand for other services by 0.73 percent. The same shock will rural household incomes by 1.78 points. A unit shock to land will increase the value added to land by 1.24 percent and labor by 0.87 percent. It will also increase agricultural production by 1.10 percent and its demand by 0.81 percent. Other service production activities and commodity demand too will increase by 0.62 and 0.70 units respectively. A shock to land impacts rural household incomes (2.07) by a relatively high percentage than a shock to other factors of production. A unit shock to capital will increase agricultural activity production (0.78) and its commodity demand (0.64). It will also increase the production of other service activities (0.50) and commodity demand (0.59) relative to other sectors' production and demand. An increase in capital will also increase the incomes of rural households by 1.30 percent.

Table 4-12: SAM Output, Demand, Value added, and Income Multipliers for a Shock to Factors of Production

	Labor	Land	Capital
Agriculture Activities	1.02	1.10	0.78
Agroindustry Activities	0.20	0.21	0.15
Manufacturing Activities	0.04	0.04	0.03
Other Industries Activities	0.10	0.10	0.08
Trade Service Activities	0.26	0.27	0.21
Other Services Activities	0.62	0.60	0.50
Agriculture Commodities	0.81	0.84	0.64
Agroindustry Commodities	0.36	0.38	0.28
Manufacturing Commodities	0.35	0.35	0.28
Other Industries Commodities	0.11	0.11	0.09
Trade Service Commodities	0.26	0.27	0.21
Other Services Commodities	0.73	0.70	0.59
Labor	1.84	0.87	0.66
Land	0.22	1.24	0.17
Capital	0.42	0.43	1.33
Enterprise	0.35	0.36	1.11
Rural HH	1.78	2.07	1.30
Urban HH	0.62	0.39	0.59

Table 4.13 depict multiplier coefficients for the effect of a shock to household income categorized as rural and urban households and its impact on the output of different production activities, their commodity demand, value added, and their own incomes. The shock to the rural household account affects agricultural production activity, labor value added, and rural household incomes than other activities' output, demand, and value added. Likewise, a shock to the urban household account impacts incomes of urban households the most followed by agricultural production and commodity demand along with other service activities' production and demand respectively.

Table 4-13: SAM Output, Demand, Value added, and Income Multipliers for a Shock to Household Incomes

	Total Household Multiplier	Rural Household Multiplier	Urban Household Multiplier
Agriculture Activities	1.89	1.10	0.78
Agroindustry Activities	0.38	0.21	0.17
Manufacturing Activities	0.08	0.04	0.04
Other Industries Activities	0.21	0.10	0.11
Trade Service Activities	0.51	0.27	0.24
Other Services Activities	1.27	0.60	0.67
Agriculture Commodities	1.58	0.84	0.74
Agroindustry Commodities	0.69	0.38	0.32
Manufacturing Commodities	0.70	0.35	0.35
Other Industries Commodities	0.23	0.11	0.12
Trade Service Commodities	0.51	0.27	0.24
Other Services Commodities	1.50	0.70	0.79
Labor	1.62	0.87	0.75
Land	0.41	0.24	0.17
Capital	0.83	0.43	0.40
Enterprise	0.69	0.36	0.33
Rural HH	3.00	2.09	0.91
Urban HH	1.69	0.37	1.32

In the multiplier analysis, we analyzed the effect of an exogeneous shock on overall endogenous accounts in the economy and made two simulations. The first simulation is increasing the investment demand for agriculture-based industry by 10 percent and the second simulation is increasing investment demand for manufacturing by the same percentage. The outcomes in the form of output, GDP, and income multiplier are given in Table 4.14.

In simulation 1, an increase in agroindustry's demand by 10 percent increased agricultural output by 7.4 percent, agroindustry's demand by 6.9, manufacturing's demand by 0.32, other industries demand by 0.7, trade by 3.2, and other services by 4.14 percent. As a result, an increase in investment demand in this sector mostly augmented agriculture and agroindustry production. Agriculture demand increased by 7.0 percent, agroindustry demand by 12.6 percent, manufacturing by 3 percent, other industries by 0.81 percent, and service demand by 8 percent. In the same simulation, value added from labor increased approximately by 7 percent, from land by 2 percent, and from capital by 5 percent. The introduced shock to agroindustry increased rural household incomes by nearly 9 percent and urban household incomes by 3.2 percent showing that rural households generated huge incomes as compared to urban households when there is an increase in investments in agroindustry.

In simulation 2, a 10 percent increase in manufacturing investment demand is introduced to see its multiplier effects on the rest of the economy. The agriculture sector increased by 2.40 percent, agroindustry by 0.46, manufacturing by 1.25, other industries by 0.38, trade services by 2.28, and other services by 2.06 percent with a relatively lower response compared to an increase in investment demand by agroindustry. On the demand multiplier side, the same shock increased manufacturing demand by nearly 12 percent indicating high elasticity for the shock but the impact on demand from the rest of the sectors, on average, was not more than 2 percent which was also less elastic. In terms of value added, labor and capital had the value of 3 and 2 percent respectively. However, this shock positively impacted rural households' income by 4 percent while the corresponding impact for urban households is 1.4 percent in terms of increasing incomes. Comparing both simulations, the multiplier coefficients for the shock in agriculture-based industry has huge impact than the shock in manufacturing (see Table 4.14).

Table 4-14: Simulation Effect of an Exogenous Shock with Increase in Investments in the Agroindustry and Manufacturing sectors

	Simulation1	Simulation2	
	10 percent Increase in Agroindustry Investment	10 percent Increase in Manufacturing Investment	Multiplier Effect
Agriculture Activities	7.36	2.18	Production Multiplier
Agroindustry Activities	6.88	0.46	
Manufacturing Activities	0.32	1.25	
Other Industries Activities	0.74	0.38	
Trade Service Activities	3.22	2.28	
Other Services Activities	4.14	2.06	
Agriculture Commodities	6.99	1.78	Demand Multiplier
Agroindustry Commodities	12.64	0.84	
Manufacturing Commodities	2.95	11.56	
Other Industries Commodities	0.81	0.42	
Trade Service Commodities	3.22	2.28	
Other Services Commodities	4.87	2.43	
Labor Factor	6.79	2.97	GDP Multiplier
Land Factor	1.61	0.48	
Capital Factor	4.47	2.06	
Rural Household	8.76	3.66	

Urban Household	3.21	1.43	Income Multiplier

Table 4.15 gives the total multiplier effects of an exogeneous shock to both agroindustry and manufacturing investment demand. The total production multiplier for an exogenous shock to agroindustry is 23 percent whereas for the shock to manufacturing it is 8.6 units. The demand multiplier for simulation 1 is 31.5 percent while it is 19 percent for the second simulation. GDP multiplier for agroindustry simulation is approximately 13 percent while it is 5.5 percent for the manufacturing simulation. Ultimately, the income multiplier for a shock to the agroindustry is 12 percent while it is 5 percent for manufacturing. These results show that the total multiplier effect of the agroindustry shock is more elastic than the shock to manufacturing implying that policy needs to focus on investments in agriculture-based industry as they positively augment production, demand, value added, and rural household incomes. This should be combined with inclusive industrial and developmental policies to structurally transform the Ethiopian economy and to reduce multidimensional poverty.

Table 4-15: Total Multiplier Effects of a 10 Percent Increase on Agroindustry and Manufacturing Investments

Total Multiplier Effect	Simulation on Agroindustry	Simulation on Manufacturing
Production Multiplier	22.66	8.61
Demand Multiplier	31.47	19.30
GDP Multiplier	12.88	5.50
Income Multiplier	11.97	5.09

4.6.Conclusion and Policy Implications

This study investigated the direct and total linkages of the industry sector with the other sectors of the Ethiopian economy using the SAM database for 2011 published by the International Food Program Research Institute in Ethiopia. Direct production linkages are estimated to examine the backward and forward production linkages of the industry with a special focus on agroindustry and manufacturing. In addition, the import penetration and export intensity of these sectors are also investigated. In parallel, a multiplier analysis has been done to show total production, value added, and demand and income changes on the other sectors due to an exogenous shock to agriculture-based industry and manufacturing industry investment demand respectively.

The results showed that agriculture has strong backward and forward production linkages with the other sectors in a relative sense while agroindustry has backward linkages to some extent, but it does not have forward production linkage with the other sectors. Manufacturing has weak forward linkage with the rest of the economy which can be attributed to several factors such as limited infrastructure and weak institutions. Other industries and the service sector too do not have strong linkage with the rest of the economy. Among the different sectors studied, manufacturing is the first with a high proportion of import ratio out of total demand followed by the service sector while the export intensity is significantly huge in magnitude for the agriculture sector. This indicates a negative trade balance due to concentration of exports in the agriculture sector and imports in the manufacturing sector.

Two simulations are done to evaluate the impact of an exogeneous shock to agroindustry and manufacturing investment demand. A 10 percent increase in investment demand in agroindustry increased agricultural production by 7.4 percent and agroindustry demand by 12.5 percent respectively. Besides, an increase in agriculture-based industry investment demand increased labor employment by 7 percent and rural household incomes by 9 percent. On the other hand, a 10 percent increase in manufacturing investment demand increased manufacturing production by 12 percent, labor employment by 3 percent, and rural household incomes by 4 percent. Based on the two simulations an increase in agriculture-based industry investment demand has a considerably larger impact on production, demand, employment, and incomes of rural households. Similarly, the total multiplier coefficients for a shock to agroindustry production is nearly 23 percent, the demand multiplier is 31 percent, GDP multiplier is 12 percent, and income multiplier is 12 percent while for the manufacturing shock, production multiplier, demand, value added, and income multiplier is 9 percent, 19 percent, 6 percent, and 5 percent respectively. These results show that the multiplier coefficients of the manufacturing shock are less elastic than the agroindustry ones.

This study provided evidence on the possible effects of selective policy instruments for supporting the agriculture-based industry in Ethiopia for positively increasing production, demand, employment, and incomes of rural households. Hence, the policy on import duties should be revised to discourage imports of agroindustry products and encouraging the agriculture sector by enabling domestic industries to access a large local market. Yet, resources should be reallocated to the agriculture-based industries as it is the competitive advantage of the country. Another implication of the results is that policies should be as inclusive as possible complementing the existing development policies and industrial strategies as well as the overall economic and political conditions in the country.

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Appendix A2

Table A2 1:SAM Aggregation

	Agriculture	AgroIndust	AManufuct	AOther Ind	Atrade Ser	AOther Ser	Cagriculture	Cagro Ind	Cmanufctu	COther Ind	CtradeServ	Cother Ser	trc	FLabor	fInd	FCapital	ent	RHH	UHH	gov	TAX	s-i	row	total
Agriculture	0	0	0	0	0	0	173918.9723	0	0	0	0	0	0	0	0	0	0	74052.82	1393.052	0	0	0	0	249364.8
AgroIndustry	0	0	0	0	0	0	0	47640.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47640.4
AManufucturing	0	0	0	0	0	0	0	0	19906.38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19906.38
AOther Industries	0	0	0	0	0	0	0	0	0	99286.98	0	0	0	0	0	0	0	0	0	0	0	0	0	99286.98
AtradeService	0	0	0	0		0	0	0	0	0	88150.28	0		0		0		0	0		0			88150.28
AOther Services	0	0	0	0	0	0	0	0	0	0	0	224459.4	0	0	0	0	0	0	0	0	0	0	0	224459.4
Cagriculture	25524.2526	21518.127	368.10365	0	0	4694.377	0	0	0	0	0	0	0	0	0	0	0	89991.07	37637.12	0	0	0	41222.44	220955.5
CAgro Indust	9082.46966	5639.3229	524.34325	0	0	10850.25	0	0	0	0	0	0	0	0	0	0	0	42331.67	13998.69	0	0	0	5084.352	87511.1
Cmanufuctring	6120.70907	6748.8146	10700.122	36990.2	749.7315	30261.64	0	0	0	0	0	0	0	0	0	0	0	21239.12	11065.79	0	0	58555.09	925.094	183356.3
Other industries	2265.85696	768.63303	1402.7973	12943.06	1112.72	14767.37	0	0	0	0	0	0	0	0	0	0	0	5065.409	3507.754	0	0	63819.06	3472.568	109125.2
Ctradeservice	7144.57486	143.03425	31.486195	3056.707		6766.176	0	0	0	0		0	71046.67	0		0		0	0		0			88188.65
COther services	7832.16752	2038.4354	780.71987	11558.47	12989.53	14167.25	0	0	0	0	0	0	21170.85	0	0	0	0	64147.45	50566.58	40494.4	0	0	38276.16	264022
trc	0	0	0	0		0	40763.28004	12363.3	36825.21	2265.728		0		0		0		0	0		0			92217.52
Flabor	112418.955	1946.4579	1038.177	21258.5	41126.89	82339.71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	260128.7
fInd	54550.7124	0	0	0		0	0	0	0	0		0		0		0		0	0		0			54550.71
Fcapital	24425.1456	8837.5722	5060.6312	13480.05	32171.41	60612.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	148.7699	144736.2
ent	0	0	0	0		0	0	0	0	0		0		0		120174.4		0	0	30186.79	0		55263.77	205624.9
RHH	0	0	0	0	0	0	0	0	0	0	0	0	0	190956.4	53571.85	22705.63	82623.3	0	0	0	0	0	4018.252	353875.4
UHH	0	0	0	0	0	0	0	0	0	0	0	0	0	69172.3	978.8584	414.7274	75139.96	0	0	0	0	0	4446.685	150152.5
gov	0	0	0	0		0	0	0	0	0		0		0		0	3495.682	978.3043	4093.256		48998.8		28841.28	86407.32
Tax	0	0	0	0	0	0	284.3538811	11659.25	24301.5	135.9411	38.36614	175.589	0	0	0	0	10700.2	490.5938	1213.01	0	0	0	0	48998.8
s-i	0	0	0	0		0	0	0	0	0		0		0		0	33429.38	55433.79	26500.22	15553.42	0		-8542.66	122374.2
row	0	0	0	0		0	5988.88825	15848.16	102323.2	7436.579		39387.04		0		1441.46	236.3888	145.2048	177.061	172.712	0			173156.7
total	249364.843	47640.397	19906.381	99286.98	88150.28	224459.4	220955.4944	87511.1	183356.3	109125.2	88188.65	264022	92217.52	260128.7	54550.71	144736.2	205624.9	353875.4	150152.5	86407.32	48998.8	122374.2	173156.7	

Table A2 2: Technical Coefficient Matrix

	Agriculture	AgroIndust	AManufuct	AOther Ind	Atrade Ser	AOther Ser	Cagriculture	Cagro Ind	Cmanufctu	COther Ind	CtradeServ	Cother Ser	trc	FLabor	fInd	FCapital	ent	RHH	UHH
Agriculture	0.00	0.00	0.00	0.00	0.00	0.00	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.01
AgroIndustry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AManufucturing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AOther Industries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AtradeService	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AOther Services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cagriculture	0.10	0.45	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.25
CAgro Indust	0.04	0.12	0.03	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.09
Cmanufuctring	0.02	0.14	0.54	0.37	0.01	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.07
COther industries	0.01	0.02	0.07	0.13	0.01	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
Ctradeservice	0.03	0.00	0.00	0.03	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.77	0.00	0.00	0.00	0.00	0.00	0.00
COther services	0.03	0.04	0.04	0.12	0.15	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.18	0.34
trc	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.14	0.20	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Flabor	0.45	0.04	0.05	0.21	0.47	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
fInd	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fcapital	0.10	0.19	0.25	0.14	0.36	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.00	0.00	0.00
RHH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.73	0.98	0.16	0.40	0.00	0.00
UHH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.02	0.00	0.37	0.00	0.00

Table A2 3: Identity Matrix

	Agriculture	AgroIndust	AManufuct	AOther Ind	Atrade Ser	AOther Ser	Cagriculture	Cagro Ind	Cmanufctu	COther Ind	CtradeServ	Cother Ser	trc	FLabor	fInd	FCapital	ent	RHH	UHH
Agriculture	1.00																		
AgroIndustry		1.00																	
AManufucturing			1.00																
AOther Industries				1.00															
AtradeService					1.00														
AOther Services						1.00													
Cagriculture							1.00												
CAgro Indust								1.00											
Cmanufuctring									1.00										
Other industries										1.00									
Ctradeservice											1.00								
COther services												1.00							
trc													1.00						
Flabor														1.00					
fInd															1.00				
Fcapital																1.00			
ent																	1.00		
RHH																		1.00	
UHH																			1.00

Table A2 4: (I-A) Matrix

	Agriculture	AgroIndustr	AManufuct	AOther Ind	Atrade Serv	AOther Ser	Cagriculture	Cagro Ind	Cmanufctu	COther Ind	CtradeServ	Cother Ser	trc	FLabor	fInd	FCapital	ent	RHH	UHH
Agriculture	1.00	0.00	0.00	0.00	0.00	0.00	-0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.21	-0.01
AgroIndustry	0.00	1.00	0.00	0.00	0.00	0.00	0.00	-0.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AManufucturing	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	-0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AOther Industries	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	-0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AtradeService	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AOther Services	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	-0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cagriculture	-0.10	-0.45	-0.02	0.00	0.00	-0.02	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.25	-0.25
CAgro Indust	-0.04	-0.12	-0.03	0.00	0.00	-0.05	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.12	-0.09
Cmanufuctring	-0.02	-0.14	-0.54	-0.37	-0.01	-0.13	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.06	-0.07
Other industries	-0.01	-0.02	-0.07	-0.13	-0.01	-0.07	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.02
Ctradeservice	-0.03	0.00	0.00	-0.03	0.00	-0.03	0.00	0.00	0.00	0.00	1.00	0.00	-0.77	0.00	0.00	0.00	0.00	0.00	0.00
COther services	-0.03	-0.04	-0.04	-0.12	-0.15	-0.06	0.00	0.00	0.00	0.00	0.00	1.00	-0.23	0.00	0.00	0.00	0.00	-0.18	-0.34
trc	0.00	0.00	0.00	0.00	0.00	0.00	-0.18	-0.14	-0.20	-0.02	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
Flabor	-0.45	-0.04	-0.05	-0.21	-0.47	-0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
fInd	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
Fcapital	-0.10	-0.19	-0.25	-0.14	-0.36	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
ent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.83	1.00	0.00	0.00
RHH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.73	-0.98	-0.16	-0.40	1.00	0.00
UHH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.27	-0.02	0.00	-0.37	0.00	1.00

Table A2 5: Inverse Matrix for (I-A) (Multiplier Matrix)

	Agriculture	AgroIndustr	AManufuct	AOther Ind	Atrade Serv	AOther Ser	Cagriculture	Cagro Ind	Cmanufctu	COther Ind	CtradeServ	Cother Ser	trc	FLabor	fInd	FCapital	ent	RHH	UHH
Agriculture	2.04	1.14	0.49	0.58	0.87	0.79	1.76	0.74	0.22	0.55	0.87	0.67	0.82	1.02	1.10	0.78	0.73	1.10	0.78
AgroIndustry	0.21	1.22	0.11	0.12	0.17	0.18	0.19	0.69	0.05	0.11	0.17	0.15	0.17	0.20	0.21	0.15	0.15	0.21	0.17
AManufucturing	0.04	0.05	1.09	0.07	0.04	0.05	0.04	0.03	0.13	0.07	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.04	0.04
AOther Industries	0.11	0.11	0.13	1.21	0.11	0.15	0.11	0.07	0.04	1.10	0.11	0.13	0.12	0.10	0.10	0.08	0.08	0.10	0.11
AtradeService	0.30	0.33	0.23	0.27	1.24	0.28	0.42	0.32	0.23	0.27	1.24	0.24	1.01	0.26	0.27	0.21	0.20	0.27	0.24
AOther Services	0.61	0.55	0.38	0.52	0.67	1.56	0.63	0.41	0.21	0.49	0.67	1.32	0.82	0.62	0.60	0.50	0.49	0.60	0.67
Cagriculture	0.87	1.11	0.41	0.47	0.70	0.65	1.81	0.70	0.18	0.44	0.70	0.55	0.67	0.81	0.84	0.64	0.61	0.84	0.74
CAgro Indust	0.38	0.40	0.20	0.22	0.32	0.33	0.35	1.26	0.08	0.20	0.32	0.28	0.31	0.36	0.38	0.28	0.27	0.38	0.32
Cmanufuctring	0.36	0.45	0.78	0.68	0.34	0.46	0.35	0.30	1.16	0.63	0.34	0.39	0.35	0.35	0.35	0.28	0.27	0.35	0.35
Other industries	0.12	0.12	0.15	0.23	0.12	0.17	0.12	0.08	0.04	1.21	0.12	0.14	0.13	0.11	0.11	0.09	0.09	0.11	0.12
Ctradeservice	0.30	0.33	0.24	0.27	0.24	0.28	0.43	0.32	0.23	0.27	1.24	0.24	1.01	0.26	0.27	0.21	0.20	0.27	0.24
COther services	0.72	0.64	0.45	0.61	0.79	0.66	0.74	0.49	0.24	0.57	0.79	1.56	0.97	0.73	0.70	0.59	0.57	0.70	0.79
trc	0.29	0.35	0.26	0.26	0.25	0.26	0.46	0.37	0.28	0.26	0.24	0.22	1.24	0.27	0.28	0.22	0.21	0.28	0.25
Flabor	1.32	0.94	0.56	0.84	1.25	1.10	1.25	0.68	0.30	0.79	1.25	0.94	1.18	1.84	0.87	0.66	0.62	0.87	0.75
fInd	0.45	0.25	0.11	0.13	0.19	0.17	0.38	0.16	0.05	0.12	0.19	0.15	0.18	0.22	1.24	0.17	0.16	0.24	0.17
Fcapital	0.54	0.63	0.55	0.50	0.78	0.67	0.56	0.45	0.21	0.47	0.77	0.57	0.73	0.42	0.43	1.33	0.32	0.43	0.40
ent	0.45	0.53	0.46	0.41	0.64	0.55	0.46	0.37	0.17	0.39	0.64	0.47	0.60	0.35	0.36	1.11	1.27	0.36	0.33
RHH	1.67	1.25	0.78	0.99	1.48	1.30	1.57	0.88	0.37	0.93	1.48	1.11	1.40	1.78	2.07	1.30	1.17	2.09	0.91
UHH	0.52	0.45	0.32	0.38	0.57	0.50	0.51	0.32	0.14	0.36	0.57	0.42	0.54	0.62	0.39	0.59	0.63	0.37	1.32

Table A2 6: Simulation Matrix

	Simulation1 (A shock in agroindustry investment)	Simulation2 (A shock in manufacturing investment)
Agriculture	0	0
AgroIndustry	0	0
AManufucturing	0	0
AOther Industries	0	0
AtradeService	0	0
AOther Services	0	0
Cagriculture	0	0
CAgro Indust	10	0
Cmanufuctring	0	10
Other industries	0	0
Ctradeservice	0	0
COther services	0	0
Trc	0	0
Flabor	0	0
Fland	0	0
Fcapital	0	0
Enterprise	0	0
Rural HH	0	0
Urban HH	0	0

Table A2 7: Activities and Commodities as Components of the Aggregated SAM

Agriculture	**Agroindustry**	**Manufacturing**	**Other Industries**	**Trade Service**	**Other Services**
Maize	meat processing	wood	mining	trade service	transport
Sorghum	fish and seafood processing	paper	electricity		hotel
Rice	dairy	chemicals	water		accommodation
Teff	fruit and vegetable processing	nonmetals	construction		finance and insurance
Barley	fats and oils	metals			real state
Wheat	grain milling	machinery			business services
Pulses	sugar refining	equipment			public administration
ground nuts	Animal feed	vehicle			education
oil seeds	food processing	Other manufacturing			health
Root	beverage				other services
Vegetable	tobacco				

Sugarcane	textile
Tobacco	leather and footwear
Cotton	
Fruit	
Enset	
Coffee	
Leaf tea	
Chat	
Cut flowers	
other crops	
Cattle	
Milk	
poultry	
Sheep	
Goats	
Camels	
other livestock	
Forestry	
Fishing	

Table A2 8: Other Components of Aggregated SAM Matrix

Factors (Labor, Land & Capital)	Households (UHH & RHH)	Other Accounts
Labor - rural uneducated	Rural farm - quintile 1	Transaction costs
Labor - rural primary	Rural farm - quintile 2	Enterprises
Labor - rural secondary	Rural farm - quintile 3	Government
Labor - rural tertiary	Rural farm - quintile 4	Taxes - activity
Labor - urban uneducated	Rural farm - quintile 5	Taxes - direct
Labor - urban primary	Rural nonfarm - quintile 1	Taxes - export
Labor - urban secondary	Rural nonfarm - quintile 2	Taxes - factor
Labor - urban tertiary	Rural nonfarm - quintile 3	Taxes - import
Land - agricultural crops	Rural nonfarm - quintile 4	Taxes - sales
Capital - crops	Rural nonfarm - quintile 5	Savings-investment
Capital - livestock	Urban - quintile 1	Change in stocks
Capital - mining	Urban - quintile 2	Rest of world
Capital - other	Urban - quintile 3	
	Urban - quintile 4	
	Urban - quintile 5	

Table A2 9: Industrial Categories

Industry Category	Industrial Group
1	Food Products and Beverages Industry
2	Tobacco Products Industry

3	Textiles Industry
4	Wearing Apparel, Except Fur Apparel Industry
5	Tanning and Dressing of Leather; Footwear, Luggage and Handbags Industry
6	Wood and of Products of Wood and Cork, Except Furniture Industry
7	Paper, Paper Products and Printing Industry
8	Chemicals and Chemical Products Industry
9	Rubber and Plastic Products Industry
10	Other Non-Metallic Mineral Products Industry
11	Basic Iron and Steel Industry
12	Fabricated Metal Products Except machinery and Equipment Industry
13	Machinery and Equipment N.E.C Industry
14	Motor Vehicles, Trailers and Semi-Trailer Industry
15	Furniture; Manufacturing N.E.C. Industry

Source: CSA.

Table [44]A2 10:SAM Basic Structure

	Activities	Commodities	Factors	Households	Government	Savings and investment	Rest of world	Total Activities
Activities		Domestic Supply						Activity Income
Commodities	Intermediate demand			Consumption Spending	Recurrent Spending	Investment demand	Export earnings	Total Demand
Factors	Value Added							Total Factor Income
Households			Factor payments to Households		Social transfers		Foreign Remittance	Total household income
Government		Sales taxes and import tariffs		Direct Tax			Foreign grant and Loan	Government Income
Savings and investment				Private Savings	Fiscal surplus		Current account Balance	Total Savings
Rest of world		Import Payments						Foreign exchange outflow

[44] The same table is availed in the main text with different table structure for formatting reason. This is presented to ease for the reader to understand the column and raw accounts and the interpretation behind them in a simple SAM structure.

Total Activities	Gross Output	Total Supply	Total Factor spending	Total Household Spending	Government Expenditure	Total investment Spending	Foreign Exchange Inflow

5. Public Policy Instruments and Manufacturing Sector Growth in Ethiopia: Case of Tax and Public Expenditure

Paper Four

Selamawit G. Kebede

Abstract

This study investigates the role of public policy instruments in Ethiopian manufacturing industry growth. It uses endogenous growth models as a theoretical formulation. The empirical investigation uses time series data from 1975 to 2016.[45] For its advantages of handling a small sample size and a mixed order of integration, the study uses the autoregressive distributed lag (ARDL) approach to quantitatively estimate the long run and short run coefficients. The bound test for the existence of a long run relationship shows the case to be true. In the long run, productive government expenditure is positively associated with manufacturing growth in Ethiopia. Direct taxation also significantly affects growth in manufacturing in the long run. In contrast, unproductive government expenditure and indirect taxes have no effect on manufacturing growth in the long run in line with theoretical predictions. In the short run, productive government expenditure and direct tax variables are significant in positively augmenting the manufacturing sector's growth. This study also shows that public policy instruments are essential tools for the manufacturing sector's growth in Ethiopia.

Keywords: Public policy; Taxation; Expenditure; Manufacturing; Ethiopia

JEL Classification Codes: *E62; H27; H30; L6*

5.1. Introduction

One of the most notable features of human development is its ability to have a decent standard of living. Economic growth signifies the necessary conditions for economic development whereas accelerating the pace of structural transformation provides enough conditions for achieving it (Lopes et al., 2017; UNECA, 2013). This means that the absence of structural transformation will lead to growth without development (Lopes et al., 2017; IFAD, 2016).

A careful assessment of economies in most developing countries shows several important common features. Most economies are primarily driven by agriculture, extraction of natural resources, or supplying primary commodities (UNECA, 2016). The manufacturing sector remains stagnant thus limiting potential employment gains and value added in output (Ejigu and Singh, 2016; UNECA, 2013). Countries are diverging from conventional growth models and under certain circumstance that other sectors are leapfrogging the manufacturing sector (Ejigu and Singh, 2016). In these economies, the rural sector is highly underdeveloped, there exist high birth and death rates accompanied by large population

[45] The time period of the study is 1975-2016 because of limited data availability for the explanatory variables.

sizes, low productivity, and low per capita incomes with serious poverty levels (UNECA, 2013).

For these countries to mitigate these problems and experience rapid growth in productivity, major solutions include structural transformation and industrialization (Lopes et al., 2017; Murphy et al., 2000). Structural transformation as a requirement of sustainable development is regarded as a major priority for developing countries (IFAD, 2016; UNECA, 2013). Indeed, structural transformation can be viewed in several dimensions. It implies raising productivity in agriculture and the urban economy, a change in the composition of the economy from a predominance of agriculture to industry and services, increasing involvement in international trade, growing rural urban migration and urbanization, and the realization of a demographic transition from high to low birth rates (IFAD, 2016). Structural transformation also denotes a change in the sectoral composition of output or GDP and the patterns of employment of labor as the economy advances over a fairly long period of time (Lopes et al., 2017).

Transformation in general is a dynamic process through which a country's economy, society, and institutions modernize and move to a more developed and advanced level (EEA, 2015; Syrquin, 1988). Changes in the sectors' proportions in terms of factor use and share in GDP are believed to be critical signs of structural changes in addition to high rates of capital accumulation and high per capita income growth as necessary indicators of the intensity of the transformation (Acemoglu, 2011). It also refers to the reallocation of productive factors from traditional agriculture to modern agriculture, industry, and services (Ocampo, 2007; Todaro and Smith, 2015). It leads to deep political, cultural, social, institutional, and environmental stress, which must be managed for long term sustainability (IFAD, 2016; Syrquin, 1988; UNECA, 2013).

Industrialization has been the best pathway to pursue structural transformation and sustainable economic development for most societies (Lopes et al., 2017; Murphy et al., 2000). Traditionally, industry, particularly the manufacturing industry, has been a source of substantial employment generation in developed economies and currently in developing countries as well (Altenburg and Lutkenhorst, 2015; UNECA, 2014). This makes industrialization a precondition for achieving economic growth and sustainable development (UNECA, 2014). Economic development moves from the initial dominance of agriculture to an increasing role for manufacturing and ultimately services (Altenburg and Lutkenhorst, 2015). Industrial growth is an undisputed pre-requisite for economic growth and development and hence rapid industrialization is a huge goal to be pursued for transformation to take place which will help in reducing poverty (Ibbih and Gaiya, 2013; UNECA, 2013). Thus, industrial growth is the fundamental means of achieving economic development and significantly reducing poverty (UNECA and UNIDO, 2006).

Structural transformation and industrialization among other factors are determined by capital accumulation, institutions, public polices and respective instruments, human capital development, demographic transition, urbanization, exports, openness, and the introduction of new and productivity enhancing technologies (Altenburg and Lutkenhorst, 2015; Kim and Heshmati, 2014; Lopes et al., 2017). Institutions and public policies are recognized as major factors for increasing productivity and growth by inducing structural transformation (Lopes et al., 2017; UNECA and AUC, 2013).

Empirical literatures validate that industry growth has been essential for achieving accelerated economic growth and sustaining development for several economies. For instance, findings support that Western Europe, Canada, and the United States attained high levels of per capita income by shifting from an agrarian production base to manufacturing and service sector activities supported by sophisticated technologies (Lockwood, 1970). In the United States, the decelerating pattern of agriculture vanished, and accelerating growth started emerging with the effects of industry development in the form of machinery, equipment, fertilizers, and improved seeds (Kim et al., 2010). Likewise, empirical evidence shows that Japan's agriculture-based industry share in the economy was high enough to sustain craft or pro-industrial production both in rural and urban areas in the country (Athukorala and Menon, 1996).

Several Asian countries, like westerns have succeeded on their path to industrialization in the last few decades. There are four common factors in their transformation: export oriented manufacturing and external competition; a broadly sensible and appropriate development-oriented state public policy; encouraging high saving and investment rates; and a number of favorable pre-conditions such as high stocks of human capital, reasonable income and equality (Boltho and Weber, 2009). Kim and Heshmati (2014) compared the early industrialized countries with recent ones and came up with a catch-up illusion. Taking the difference between the speed of growth and the growth rate in the earlier industrialized countries and the latecomers, they concluded that recently industrialized societies will not overtake the earlier ones. In Africa, countries performed poorly in the initial stages of their industrialization processes. The region is expected to improve its political economy, public policy, governance and management, its business environment, and other institutional arrangements in a way that is consistent with the needs of the industrial and modern sectors (ECA, 2015).

Ethiopia shares common problems with other African countries and has been implementing different public policies and developmental plans targeting industrialization and structural transformation (MoFED, 2010; UNECA, 2013). Recently, the Ethiopian government developed a Growth and Transformation Plan (GTP) that coincides with the millennium development goals (MDGs) and the sustainable development goals (SDGs) for two consecutive five-year periods (2010-20). In both the plan periods, the main development goal is eradicating poverty through accelerated and sustained economic growth and promoting economic development (MoFED, 2010; Oqubay, 2015). Several strategic pillars have been developed for achieving these goals and creating conditions for the industry to play a leading and prominent role in the economy being the vital one (MoFED, 2010).

Nonetheless, studies show that despite the efforts and different policies at the national and industry levels, the contribution of the industry and manufacturing sectors in Ethiopia relative to the agriculture and service sectors has been minimal for decades (Gebreeyesus, 2010; JICA, 2011; Tsegaye, 2011). In Ethiopia, awareness about the need for industrialization can be traced back to the early 1960s but designing a strategy that had a structural transformation came late and has not been implemented (Tsegaye, 2011). Currently, the industry sector contributes 16.7 percent to Ethiopia's GDP while agriculture contributes the 36.7 percent and the service sector contributes 47.3 percent (NBE, 2016). Besides, different findings show that the contribution of the industry sector, particularly manufacturing, in the overall economy is less than 5 percent to GDP (Ejigu and Singh, 2016; NBE, 2016). In fact, there are scarce empirical studies investigating the effect of policies and instruments on Ethiopian industrialization and structural transformation. This motivates to undertake the study aiming at addressing the following research questions:

- Do public policy instruments have a long run effect on the manufacturing sector growth in Ethiopia?
- What is the impact of taxes and government expenditure on the performance of manufacturing sector in Ethiopia?

This study empirically investigates how public policy instruments have a long run impact on the manufacturing sector taking Ethiopia as a case study for developing countries. While investigating the role of public policy in the growth of the manufacturing sector in Ethiopia, government expenditure is classified as productive and unproductive whereas taxes are divided into direct tax and indirect tax revenues. For its advantages of handling a small sample size and a mixed order of integration, this study uses the ARDL approach to quantitatively estimate the long run and short run coefficients.

The study found the bound test for the existence of long run cointegration to be true in this empirical model. In the long run, productive government expenditure is significant in positively augmenting manufacturing growth in Ethiopia. At the same time, direct taxes also have a significant effect on manufacturing growth in the long run. In contrast, unproductive government expenditure and indirect tax revenues has a neutral effect on growth in the manufacturing sector in the long run which is in keeping with theoretical predictions. In the short run, indirect taxes as well as unproductive government expenditure did not affect the growth of the Ethiopian manufacturing sector. Instead, productive government expenditure and direct tax variables are statistically significant in positively augmenting the growth of the manufacturing sector in the short run. Along with this, the adjustment coefficient is also statistically significant and negative implying 45 percent annual adjustments from short run deviations to the equilibrium in the long run. The reliability of the estimated coefficients is confirmed through diagnostic tests. This study also shows that public policy is an indispensable instrument that affects the growth of the manufacturing sector. This makes public policy a vital instrument for transformation. These findings are in line with public policy endogenous growth theories (Barro, 1990; Kneller et al., 1999) which is the contribution of this study besides empirically identifying the effect of public policy instruments on industry growth taking Ethiopia as a case study for developing countries.

The rest of the chapter is organized as follows. Section 5.2 provides a review of theoretical and empirical literature. The research methodology is discussed in Section 5.3 while the data is presented in Section 5.4. Section 5.5 discusses the regression results and Section 5.6 gives the conclusion and policy implications of the study.

5.2.Literature Review

5.2.1. Theoretical Review on Public Policy and Growth

It is widely accepted that economic growth leads to an increase in a country's prosperity, extends its potential to fight unemployment and poverty, and helps solve other social problems. These are the main goals of economic policies around the world (Bleaney et al., 2000; Romer, 1990; Sharipov, 2015).

In the neoclassical growth model and its several extensions, long run growth is driven by external factors such as population and technology; policy factors such as taxation and government expenditure also affect the incentives to invest or save but these have a transitional effect rather than a long run growth effect (Bealenay et al., 2000; Solow, 1956). In this model, expenditure and tax measure affects the incentive to invest in either physical or human capital and the savings rate. These have no effect on the steady state growth rate and instead affect the equilibrium factor ratios (Kneller et al., 1999). Similarly, a one sector neoclassical technological model gives an endogenous explanation for the source of technological changes which are attributed to human capital (Romer,1990).

On the other hand, recent growth theories generate growth without relying on exogenous population growth or technological progress and show that policy variables too have a long run growth effect (Barro, 1990; Barro and Sala-i-Martin, 1995). In endogenous growth models, some elements of taxes and government expenditure affect long-term growth through investments in human and physical capital which affect growth in the long run (Kneller et al., 1999). In these models, the government's budget is classified into four elements: productive and non-productive government expenditure whereas tax is classified into direct (distortionary) and indirect taxation (non-distortionary) defined in the context of its effect on agents' investment decisions where the former distorts and the latter augments growth in the long run (Barro and Sala-i-Martin, 1992; Kneller et al., 1999).

Literature supports the link between national policies and long run growth as many public policies restrain incentives for growth because they reduce the rewards for the broad definition of capital encompassing physical and human capital (King and Robelo, 1990; Schultz, 1981). There is a deep-rooted argument that public investments, taxation, and other aspects of public policy contribute to growth miracles and are important growth determinants as well as ways of dealing with stagnation (Easterly and Rebelo, 1993). When it comes to human capital and endogenous growth, changes in taxes might alter the long run growth rate and equilibrium levels (Lucas, 1990).

As discussed so far, there are two extreme strands of thought on the long run growth determinants and structural transformation. According to the pioneering neoclassical models and their extensions, except population and technological growth, investments in human and physical capital do not have a long run growth effect (Kneller et al., 1999; Solow, 1956). New endogenous growth models propose several channels through which public policy can have substantial and enduring effects on growth rates and income levels in the long run (Barro, 1990; Gemmell, 2001; Kneller et al., 1999). Public policies bring about productivity growth through their influence on innovations and R&D, incentive effects on factor accumulation, productivity or efficiency differences between private and public enterprises, or decrease productivity through the crowding out effect of unproductive expenditure (Gemmell, 2001). It is also believed that public policies affect investment decisions in human and physical capital which have a long run growth effect (Bealenay et al., 2000; Kneller et al., 1999). Public policy instruments like government expenditure and taxation are taken for granted as long run growth determinants along with monetary policies (Easterly and Rebelo, 1993; Lucas, 1990; Richard and Festus, 2013)

As industrialization is the pathway for economic growth and structural transformation, empirically investigating the role of public policies on the performance of the industry and manufacturing sectors is very essential (Richard and Festus, 2013). Industrialization is simply the process of converting society into a socioeconomic order in which industry is dominant and involves large-scale introduction of manufacturing, advanced technical enterprises, and other productive economic activities in an area, society, country (Altenburg and Lutkenhorst, 2015; Encyclopedia Britannica, 2015; UNECA, 2015). In addition, it is a process of building a country's capacity to convert raw materials into new products (Tsegaye, 2011). A robust manufacturing sector is also an engine of growth and structural transformation in both developed and developing economies (Gebreeyesus, 2010; Sokunle et al., 2010; UNECA, 2015). A model for the path of newly industrialized countries shows that industrialization has its roots in a country's scientific and technological capacities to realize its development. Yet, several factors are availed to explain growth at sector and economy level including institutions, policies, technology and innovation-based development strategy along with a disciplined labor force, the emergence of a democratic political system, creating conditions for creativity, entrepreneurship, efficiency, and competition (Heshmati, 2007a, 2007b).

The relationship between the manufacturing growth and its determinants is mostly guided by the theoretical frameworks of different growth theories. The accelerator theory of investments argues that manufacturing firms' growth can be determined by interest rates and the inflow of direct investments (Clark, 1917). The neoclassical approach relates manufacturing growth to the cost of capital, inflation, and depreciation and it also explains that interest rates, investments, and fluctuations in the private sector have a profound effect on the manufacturing sector's growth (Hall and Jorgensen, 1971; Sokunle et al., 2010). The relationship is also directly implied by the endogenous growth theories relying on increasing returns to scale that are not constant as in the neoclassical framework (Kaldor, 1966). Further, the performance of the manufacturing sector can also be explained using endogenous growth theories. There are public policy endogenous growth theories that maintain long run growth is determined by public policies, particularly policy components like taxation and government expenditure which affect decisions about investments in human and physical capital (Barro, 1990; Bealenay et al., 2001; Easterly and Rebelo, 1993).

Based on a theoretical review of the relationship between industry and growth on the one hand and public policy and growth on the other, two strands of thought emerge. Classical theories and their extensions maintain that public policy does not have a long run impact on growth; instead it has a level effect in the short run. The other strand is the new endogenous growth models which hypothesize that public policy has a long run growth effect through agents' incentive decisions to invest with a broad definition of capital and the agents' willingness to save. Accordingly, this study focuses on the endogenous growth theory to theoretically formulate the relationship between public policy instruments and the growth of the manufacturing sector in Ethiopia.

5.2 2. Empirical Review[46]

Over the last two decades, economic growth and its determinants have been of great importance in both theoretical and applied studies. Starting from the neoclassical Solow growth model, several other growth models have also been introduced. In neoclassical models such as Solow, Ramsey, and OLG (overlapping generation) models the only determinant of per capita income growth other than capital is a mystery variable termed as the effectiveness of labor whose exact meaning is not specified and whose behavior is taken as exogenous (Romer, 2011). However, in general, these endogenous growth models focus on the accumulation of knowledge (Romer, 1996, 2011). In this model, capital accumulation and its role in production are treated in ways that are similar with earlier models. But it differs from the earlier models in explicitly interpreting the effectiveness of labor as knowledge and in modeling the determinants of its evolution over time (Romer, 1996; Sokunle et al., 2010).

An extended strand of endogenous growth models assumes constant returns to scale in a broad definition of capital by including tax financed government services that affect production or utility (Barro, 1990). Barro shows that growth and saving rates fall with an increase in consumption expenditure and the two rates increase with productive government expenditure but decline subsequently while an increase in distortive income tax impedes saving and growth rates. King and Rebelo (1990) examined why countries show considerable disparities in their long-term growth rates and attribute these to differences in national public policies that affect the incentives to accumulate both human and physical capital. They also show that taxation can substantially affect growth in the long run and argue that national taxation for small open economies with substantial capital mobility can lead to development traps or growth miracles. Lucas (1990) discusses the effects of a change in the tax structure on capital accumulation and his results show that eliminating capital income taxation increases the capital stock by about 35 percent.

Easterly and Rebelo (1993) used historical data and concluded that there is a strong relationship between the fiscal structure and the level of development. Their result show that fiscal policy is influenced by the scale of the economy, and the expenditure on transport and communications is highly correlated with growth. They argue that it is very

[46] Empirical literature is not chronologically organized. Instead, the review starts with classical models and proceeds to countries' experiences based on the level of their economic development.

difficult to isolate the effects of taxation empirically. Gerson (1998) investigated taxation and public expenditure's relationship with economic growth for assessing their role in the supply and productivity of labor and physical capital. His findings show that well targeted government expenditure on education, health, and infrastructure has a positive impact on growth while taxation has a muted role on labor, capital, and output growth.

Kneller et al. (1999) investigated the role of public policy variables in the long run growth rate using endogenous growth for 22 OECD countries using a panel dataset for 1975-95. Their results showed that productive government expenditure enhanced growth and distortionary taxes reduced growth whereas unproductive government expenditure did not enhance growth and indirect tax did not reduce growth. Bealenay et al. (2000) used data for OECD countries to investigate fiscal policy's role in long run economic growth. Their findings showed that productive government expenditure enhanced growth and distortionary taxation deterred growth when financed by a mixture of non-productive expenditure and non-distortionary taxation while a budget surplus financed in the same way was growth enhancing. Dalic (2013) investigated fiscal policy's role in new EU member states using panel data for 1999-2010. The effect of government expenditure on EU member states' growth was weakly supported while an improvement in the fiscal balance was found to be a statistically strong factor that affected growth. A lower volatility in government expenditure was growth enhancing in these countries.

Abdon et al. (2014) explored the association between fiscal policy and economic growth in developing Asia and compared this with advanced countries and found that the region's overall tax and government spending levels were substantially small. Their study showed that property tax had a stronger impact as compared to direct taxes and that education spending had a huge positive impact on economic growth in these countries. Gemmell (2001) assessed the impact of public investments, taxes, and a budget deficit on long term growth in low income countries by comparing them with middle- and high-income countries. His study suggests the insightfulness of fiscal policy in low income countries implying that these countries should be cautious while formulating and implementing fiscal policies. Jha (2007) gives an overview of the fiscal performance of developing countries and shows that tax and government expenditure's share of GDP was very low compared to developed countries. Besides, tax volatility is found to be huge in the developing countries.

Addison et al. (2018) assessed the role of natural endowments, political economy, history, and social structure vis-à-vis tax revenues and showed that progress had been made in tax capacity, but important challenges remained. They attributed these challenges to international aspects of taxation, countries' dependence on natural endowments, and the interplay between politics and tax revenues together with social structure and history. Olasunkanmi and Babatunde (2012) investigated the role of fiscal policy in Nigeria's economic growth using time series data from 1981 to 2010 using OLS and a cointegration analysis. Their results showed that direct taxes, productive government expenditure, deficit, indirect taxes have a growth effect on the Nigerian economy. They further concluded that there is a long run relationship between growth and the fiscal variables.

Richard and Festus (2013) researched the role of fiscal policy in the manufacturing sector's growth in Nigeria and found that it played an augmenting role. They found government expenditure to be a pillar that positively enhanced the sector's growth implying the need for an expansionary fiscal policy for enhancing the manufacturing sector's growth in the country.

The results in empirical literature are mixed and vary for different countries depending on the level of the countries' economic development, the analysis used, the way the policy variables are disaggregated and defined, and the way in which the models are specified. Besides, empirical research on public policy and growth at a sector or industry level is sparse. In Ethiopia, the idea of industrialization can be traced back to the 1960s, but the expected output has not been achieved. The private sector which was supposed to be in the driver's seat of industrialization has been investing in the service sector rather than in the manufacturing sector. Broadly speaking, the private sector in Ethiopia is predominantly agrarian. Besides, the shift from agrarian to localized services without investing in basic manufacturing capabilities is not an optimal approach.

Government and public policy can manipulate the direction of industrialization and the growth of the manufacturing sector. This study examines the long run relationship between public policy (basically fiscal policy's variables) and the manufacturing sector's growth using the Barro (1990) model refined by Kneller et al. (1999) as a theoretical framework. Yet, it empirically validates the public policy endogenous growth model by investigating the existence of long run relationship between public policy and growth at industry level taking Ethiopia as a case study for developing countries.

5.3. Methodology

5.3.1. Analytical Framework and Empirical Model

This study uses Barro's (1990) endogenous growth formulation which is refined by Kneller et al. (1999) as a base for the empirical model. The public policy variables and their long run growth effects are mathematically represented using these frames. However, this study extends the framework to sector level by considering the manufacturing sector in Ethiopia as a case study. In this framework growth is determined by non-fiscal variables on the one hand and fiscal variables on the other hand shown as:

$$(eq5.1) \quad g_t = \alpha + \sum_{i=1}^{K} \beta_i Z_{it} + \sum_{j=1}^{m} \gamma_j X_{jt} + u_{it}$$

where α is a constant and β represents the coefficient of the controlling variables, Z stands for control variables, X is a vector of fiscal (public policy) variables with γ standing for the coefficient of the fiscal variables, and u_{it} is the error term. However, if the government budget includes all its components Equation (5.1) becomes an identity equation:

$$(eq5.2). \quad \sum_{j=1}^{m} X_{jt} = 0$$

This identity equation will lead to collinearity problems unless one or more elements from the budget equation are removed from the regression Equation (5.1) which have a neutral effect on growth (Barro,1990; Kneller et al., 1999). Accordingly, Equation (5.1) can be rewritten as:

$$(eq5.3).\ \ g_t = \alpha + \sum_{i=1}^{K} \beta_i Z_t + \sum_{j=1}^{m-1} \gamma_{jt} X_{jt} + \gamma_m X_{mt} + u_t$$

Then, we omit X_{mt} to avoid multicollinearity and the regression equation to be estimated becomes:

$$(eq5.4).\ \ g_t = \alpha + \sum_{i=1}^{K} \beta_i Z_t + \sum_{j=1}^{m-1} (\gamma_j - \gamma_m) X_{jt} + u_t$$

Equation (5.4) is the empirical model to be estimated with a standard hypothesis test of zero coefficients of the policy variables and if this is $(\gamma_j - \gamma_m) = 0$ instead of $\gamma_j = 0$ then the correct interpretation of each fiscal variable's coefficient is that the effect of a unit change in the relevant variable is offset by a unit change in the category of the omitted variable; this is the implicit financing element. Theory comes up with two fiscal policy variables with a neutral effect on growth: indirect taxation and non-productive government expenditure (Bealenay et al., 2001; Kneller et al., 1999).

5.3.2. Specification of the ARDL Model

The autoregressive distributed lag (ARDL) model is frequently used for estimating the long and short run relationships among macroeconomic variables (Pesaran and Shin, 1999; Pesaran et al., 2001). The ARDL model was originally introduced by Pesaran and Shin (1999) and it deals with a single cointegration. It was further extended by Pesaran et al. (2001). The ARDL model has several advantages over other models including making it possible to estimate the relationships even if the explanatory variables are endogenous. The ARDL model also gives a consistent estimate of long run coefficients that are asymptotically normal irrespective of whether the variables are integrated of order zero I(0), integrated of order one I(1), or mutually integrated (Pesaran and Shin, 1999; Pesaran et al., 2001). Besides, the ARDL model can be applied to a small sample as in this study and this also enables us to estimate the short run and long run dynamic relationships among the macroeconomic variables of interest simultaneously (Green, 2007; Pahlavani et al., 2005).

A general ARDL (p, q) model for a scalar variable is given as:

$$(eq5.5).\ \ Y_t = \alpha_0 + \sum\nolimits_{i=0}^{p} \beta_i Y_{t-1-i} + \sum\nolimits_{i=0}^{q} \beta_j X_{i,t-1} + \mu_t$$

where α_0 is a constant, Y_t is the endogenous variable in our case representing manufacturing value added, $X_{i,t}$ are the ith explanatory variables, p is the maximum lag to be used for the dependent variable, q is the maximum lag to be used for the explanatory variables, β_i and β_j

are unknown parameters to be estimated, and μ_t is the white noise error with mean zero and a constant variance. Therefore, the ARDL model in our case is specified as:

$$(\text{eq.}5.6).\ \ln MVA_t = \alpha_0 + \sum_{i=0}^{p} \beta_1 \ln MSVA_{t-1-i} + \sum_{i=0}^{q} \beta_2 \ln L_{t-i} + \sum_{i=0}^{q} \beta_3 \ln INV_{t-i} + \sum_{i=0}^{q} \beta_4 \ln DTX_{t-i} + \sum_{i=0}^{q} \beta_5 \ln NDTX_{t-i} + \sum_{i=o}^{q} \beta_6 \ln PGE_{t-i} + \sum_{i=0}^{q} \beta_7 \ln UGE_{t-i} + \sum_{i=0}^{q} \beta_8 \ln DF_{t-i} + \mu_t$$

In Equation (5.6), lnMVA is the natural logarithm of manufacturing value added at time t

lnL represents the natural logarithm of labor force growth at time t

ln[47]INV represents the natural logarithm of investment as a percentage of GDP at time t

lnDTX represents the natural logarithm of direct taxation at time t

lnIDTX represents the natural logarithm of indirect taxation at time t

lnPGE denotes the natural logarithm of productive government expenditure at time t

lnUGE represents the natural logarithm of unproductive government expenditure at time t

lnDF represents the natural logarithm of deficit financing at time t

Further, the error correction model (ECM) is added to separate the long run and short run coefficients of the model. In our case the error correction form of the ARDL model is written as:

$$(eq.5.7).\ d\ln MVA_t = \alpha_0 + \sum_{i=0}^{p} \beta_1\, d\ln MVA_{t-i} + \sum_{i=0}^{q} \beta_2 dl\ln L_{t-i} + \sum_{i=0}^{q} \beta_3\, d\ln + INV_{t-i} + \sum_{i=0}^{q} \beta_4\, d\ln DTX_{t-i} + \sum_{i=0}^{q} \beta_5\, d\ln NDTX_{t-i} + \sum_{i=0}^{q} \beta_6\, d\ln PGE_{t-i} + \sum_{i=0}^{q} \beta_7\, d\ln UGE_{t-i} + \sum_{i=0}^{q} \beta_8 d\ln DF_{t-i} + \lambda_1 \ln MVA_{t-1} + \lambda_2 \ln L_{t-1} + \lambda_3 \ln INV_{t-1} + \lambda_4 \ln DTX_{t-1} + \lambda_5 \ln NDTX_{t-1} + \lambda_6 \ln PGE_{t-1} + \lambda_7 lnUGE_{t-1} + \lambda_8 \ln DF_{t-1} + \gamma ECM_{t-1} + \mu_t$$

In Equation (5.7), the manufacturing sector's value added is a dependent variable and variables such as labor and investments as a percentage of GDP are control variables whereas direct taxation, indirect taxation, productive government expenditure, unproductive government expenditure, and deficit financing are fiscal category explanatory variables in the ARDL regression model. All the variables in the model are log transformed to reduce the problem of heteroscedasticity and thus the parameter coefficients represent constant elasticities (Ejigu and Singh, 2016; Green, 2007; Gujarati, 2004).

[47] In the regression both labor and investment as a share of GDP are included as control variables. However, the later is excluded from the model as results in the estimation are exposed to collinearity statistical problem when the variable is included.

5.4.Data

This study uses time series data for 1975-2016 accessed from the Ministry of Finance and Economic Cooperation (MoFEC) in Ethiopia and the World Development Indicators' (WDI) database. The fiscal variables are classified into four: direct taxation (DTX), indirect taxation (IDTX), productive government expenditure (PGE), and non-productive government expenditure (NPGE). The labor force growth rate and investments as a percentage of GDP are used as control variables in the regression model. Direct taxes are defined as taxes consisting of personal income tax, rental income tax, business profit tax, agriculture income tax, capital gain tax, and interest income tax while indirect taxes mainly consist of consumption tax. Productive expenditure mainly consists of expenditure on road construction, transport and communications, health, education, and others. Non-productive government expenditure mainly consists of general services like defense and others like justice, public order, and security. Budget deficit is the difference between government revenue and expenditure. The classification and disaggregation of fiscal variables in this study is given in Table 5.1 with the hypothesized signs and significance levels after the estimation.

Table 5-1: Classification and Disaggregation of the Fiscal Variables

Fiscal Variables	Components
Direct taxation	Taxation with a major share of income and profit tax etc.
Indirect taxation	Taxation focusing on consumption taxation etc.
Productive government expenditure	Expenditure on economic and social development mainly focusing on road construction, transport and communications, health, and education etc.
Non-productive government Expenditure	[48]General service expenditure mainly on defense and others
Budget deficit	Difference between government revenue and expenditure

Table 5.2 gives the expected significance levels and expected signs of the fiscal variables to be estimated in our empirical model. Direct taxation and productive public expenditure are expected to be statistically significant with expected negative and positive signs respectively. While, indirect taxation and unproductive public expenditure are expected to be statistically insignificant in affecting manufacturing growth, the former is expected to be positive and the latter having an indeterminate status. Budget deficit is expected to be significant but with an indeterminate coefficient sign.

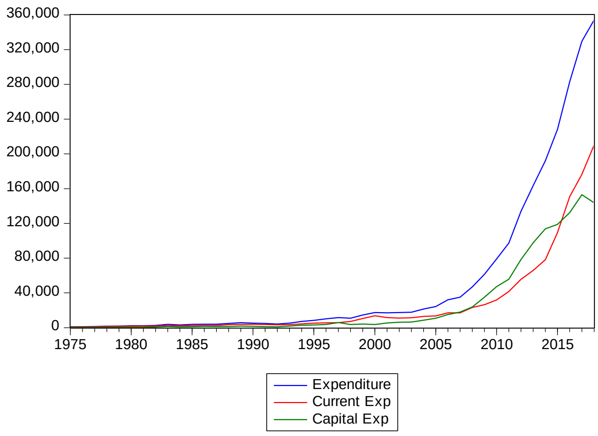
[48] Unproductive expenditure includes organ of the state, justice, defense, public order & security, general services are classified as non-productive government spending.

Table 5-2: Variables in the Empirical Model and their Expected Signs

Variables	Expected Significance	Expected Sign
Direct Taxation	Statistically significant	Negative
Indirect Taxation	Statistically insignificant	Positive
Productive Government Expenditure	Statistically significant	Positive
Non-productive Government Expenditure	Statistically insignificant	Indeterminate
Budget Deficit	Statistically significant	Indeterminate

5.4.1. Ethiopia's fiscal performance

This section explains the performance of the fiscal[49] variables for the study period. All fiscal variables are in real terms with 2010 being considered as a base year. Figure 5.1 gives the government's current capital and total expenditure in million birr[50] for 1975-2018. As can be seen from Figure 5.1, the expenditure was steady till 1995 after which there was an increase indicating a huge increase in government expenditure that is attributed to investments in power and road infrastructure. Figure 5.2 gives the government's tax, non-tax, and total revenue in million birr for the same years as the government expenditure. In this case, tax and non-tax revenues show different trends where non-tax revenue was relatively constant except for recent years. In contrast, tax revenue was steady till the 1960s after which it started increasing and became steeper; it recently increased at an alarming rate. This can be attributed to the increase in the tax base in recent years.



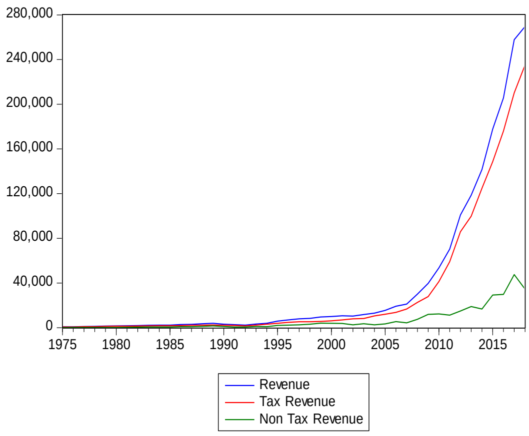
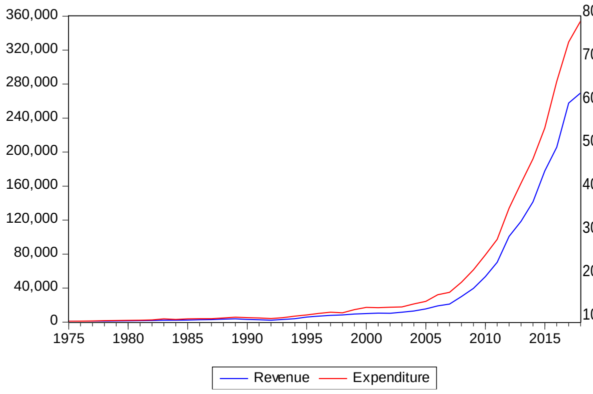


Figure 5-1: Government Expenditure (Current and Capital) Figure 5-2: Government Revenue (Tax and non-tax)

49 Fiscal variables are in millions of birr

50 The exchange rate for the local currency varies over time but is currently approximately 1USD=27 Ethiopian Birr (NBE, 2016).

Figures 5.3 and 5.4 show how government revenue deviated from government expenditure in Ethiopia throughout study period. The figures also show that revenue fell short of expenditure, that is, what was spent was more than what was earned with an increasing budget deficit at a considerable level till 2010 and with a huge increase in recent years.



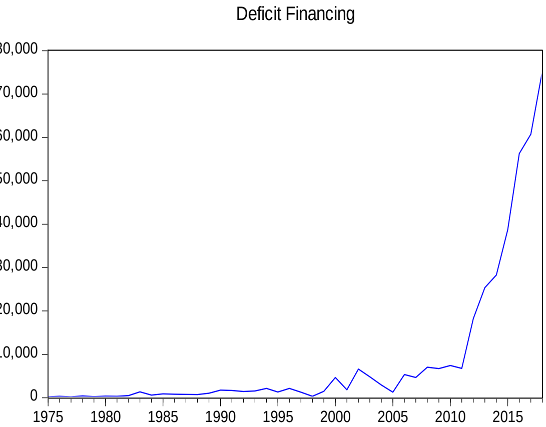


Figure 5-3: Government Revenue and Expenditure Figure 5-4: Fiscal Deficit (in million birr)

5.4.2. Industry's Performance in Ethiopia

Table 5.3 shows that Ethiopia has three major sectors in the economy that contribute to its real GDP. In the last five years the service sector has contributed the lion's share to GDP followed by agriculture and industry respectively.

Table 5-3: Sectoral Contributions to GDP (in billion birr, $1=27 birr)

Sectors/Year	2013	2014	2015	2016	2017
Agriculture	238.8	251.8	267.8	274.0	575.1
Industry	73.9	86.5	103.7	125.0	404.3
Services	259.0	292.0	325.0	353.0	620.2
Real GDP	568.0	627.0	692.0	747.0	1,577.1

Source: The National Bank of Ethiopia.

Table 5.4 gives real GDP growth and the contribution of each sector to this growth. Real GDP in Ethiopia grew by 9.9 percent on average between 2012-13 and 2016-17. In this, 2.26 percent growth was contributed by the agriculture sector. On average, the industry and service sectors contributed 3.04 and 4.62 percent, respectively. The percentage contribution of the agriculture and service sectors was relatively large. However, agriculture had a lower contribution. In contrast, the percentage contribution of the industry sector in these five years had a rising trend.

Table 5-4: GDP Growth and Sectoral Contributions to GDP Growth (2013-17, in percent)

Sectors/Year	2013	2014	2015	2016	2017
Growth Rates:					

Real GDP Growth	9.9	10.3	10.4	8.0	10.9
Agriculture	3.1	2.3	2.5	0.9	2.5
Industry	2.8	2.2	2.7	3.1	4.4
Services	4.1	5.8	5.2	4.0	4.0
Contribution in Percentage:					
Agriculture	31.2	22.3	24.0	11.3	22.9
Industry	27.9	21.4	26.0	38.8	40.4
Service	41.0	56.3	50.0	50.0	36.7

Source: The National Bank of Ethiopia.

Table 5.5 shows the growth and percentage contribution of the different sub-sectors in the industry sector. As can be seen from the table, there are four major sub-sectors in the industry sector: mining and quarrying, manufacturing, electricity and water, and construction. Of these, construction took the lead in percentage contribution and was followed by manufacturing which contributed the second highest to the growth of the industry sector. However, in terms of growth rate and percentage contribution, the electricity and water and mining and quarrying sub-sectors contributed relatively less.

Table 5-5: Growth and Percentage Distribution of Industrial Sub-sectors in Ethiopia (2013-17, in percent)

Year/ Sub-sector	Mining and Quarrying		Manufacturing		Electricity and water		Construction	
	Growth Rate	Share in %	Growth Rate	Share in %	Growth Rate	Share in %	Growth Rate	Share in %
2013	6.3	11.0	16.9	33.0	10.0	8.3	38.7	47.1
2014	-3.2	9.1	16.6	33.4	6.8	7.6	23.9	49.9
2015	-25.6	5.7	18.2	33.0	4.5	6.6	31.6	54.8
2016	-3.3	4.5	18.4	32.4	15.0	6.3	25.0	56.8
2017	-29.8	1.1	17.4	25.0	11.4	3.0	20.7	70.9

Source: The National Bank of Ethiopia.

5.5. Discussion of the Results

5.5.1. Descriptive Analysis

Table 5.6 gives the mean, median, maximum, and minimum values of the variables in the empirical model. It has 42 observations for the dependent variable, manufacturing value added and the explanatory variables labor, capital proxied by investment as a percentage of GDP, direct taxes, indirect taxes, productive government expenditure, non-productive government expenditure, and deficit financing in million birrs.

Table 5-6: Descriptive Statistics

Variables	Mean	Median	Maximum	Minimum	Observations

MVA	11,112,236	8,448,873	40,483,083	4,478,093	42
Labor	60,907,662	58,232,514	1.02E+08	32,566,821	42
Capital	67,273.660	7,559.070	588705.00	743.5167	42
Direct taxe**s**	8,164.643	1,532.713	70115.83	174.3640	42
Indirect tax**es**	5,613.751	1,050.562	44923.59	174.0000	42
Other revenues	13,112.510	3,695.616	90610.56	298.1030	42
Productive public expenditure	16,494.39	2,928.837	108145.50	196.9110	42
Unproductive public expenditure	7,128.830	2,016.505	45096.81	358.8010	42
Deficit financing	5,976.940	56,290.830	56290.83	225.3260	42

Source: Results arrived at using E-views.

5.5.2. Regression Results

The first step in a time series analysis is testing the stationarity of the series to overcome the problem of spurious regression results. Accordingly, we used the Augmented Dickey Fuller (ADF) and the Philip Perron (PP) unit root tests to check the status of the variables. While conducting the tests both with intercept and intercept with trend cases were considered. The two test statistics result confirm that except labor and deficit all variables are non-stationary at level but stationary at first difference implying that they are integrated of first order I(1). However, labor and deficit are integrated of order zero I (0) and become stationary when we include trend in the model making them trend stationary (see Table 5.7).

Table 5-7: Stationarity Tests

Variable Name	ADF Test With Intercept	ADF Test With Intercept and Trend	PP Test With Intercept	PP Test With Intercept and Trend	Order of Integration
MVA	0.0118**	0.0236**	0.0137**	0.0381**	I (1)
Labor	0.9041	0.0042***	0.6189	0.0043***	I (0)
Capital	0.0000***	0.0000***	0.0000***	0.0000***	I (1)
Direct Tax	0.0212**	0.0651*	0.0156***	0.0475**	I (1)
Indirect Tax	0.0015***	0.0035***	0.0012***	0.0033***	I (1)
O. Revenues	0.0000***	0.0002***	0.0000***	0.0002***	I (1)
PGE	0.0000***	0.0001***	0.0000***	0.0001***	I (1)
UGE	0.0002 ***	0.0010***	0.0002***	0.0005***	I (1)
Deficit	0.9450	0.0344**	0.9281	0.0375***	I (0)
O. Expenses	0.0001***	0.0001***	0.0001***	0.0001***	I (1)

Note: P values are reported as ***, **, and * implying a significance level at the 1%, 5%, and 10% level respectively.

Before estimating the optimal lag length using different lag length selection criteria, we used the Akaike Information Criterion (AIC), the Schwartz Bayesian Information Criterion (SBIC), and the Hannan Quin Information Criterion (HQIC) to decide the optimal lag length. SBIC gave 1 as the optimal lag length while the others gave 2 as the optimal lag length. We used SBIC for its efficiency in a small sample (Green, 2007) (see Table 5.8).

Table 5-8: Optimal lag length for the Model

Optimal Lag	LR	FPE	AIC	SBIC	HQIC
0	NA	5.57e-14	-13.49112	-13.23779	-13.3995
1	593.0172	5.41e-21	-29.66134	-27.88802*	-29.0201
2	72.19192*	2.56e-21*	-30.53512*	-27.24180	-29.3443*

One hypothesis of this study is the long run growth effect of public policy on manufacturing industry growth. To this end, the bound test for long run cointegration between manufacturing value added growth and fiscal variables was found to be true which validates Barro (1990) and Kneller et al.'s (1999) public policy endogenous growth theory using Ethiopian data in the manufacturing sector. Thus, our results show that there is a long run relationship between public policy instruments for taxes as well as public expenditure on manufacturing growth with a statistical validation of a 5.7 F-test statistic which is greater than the upper and lower bounds at 1 percent significance level. This enables us to reject the null hypothesis of no long run cointegration in the model and validates the existence of a long run relationship in line with empirical findings such as (Easterly and Rebelo, 1993; Gemmell, 2001; Kneller et al., 1999) (Table 5.9).

Table 5-9: Bound Test for long run cointegration

F-Test Statistic	Critical Value at the 5 and 10 percent Bound Level of Significance			
	5%		1%	
	I0 Bound	I1 Bound	I0 Bound	I1 Bound
5.70	2.86	4.01	3.74	5.06

5.5.2.1. Estimation of Long Run Effects

We used the ARDL approach for estimating the coefficients as it has the advantage of handling a small sample, a mixed order of integration of the variables in a specified model, and it also provides long run and short run coefficients independently. In the estimation of the long run model we had three cases: the first model is where indirect taxes which theoretically has neutral effect is omitted, a second one is when non-productive government expenditure with theoretically neutral effect is omitted, and the third model is when both are omitted from the regression model. A major reason for omitting the variables is the theoretical formulation of the model to control collinearity that requires excluding variables with a neutral effect on the dependent variable. In all cases, manufacturing output growth is the dependent variable.

In the long run, we found that direct taxes are statistically significant in affecting manufacturing growth in all the three cases. Productive government expenditure is also significantly positive in augmenting the manufacturing sector's growth in the long run. In the first model, we omitted indirect taxes and found non-productive government expenditure to be positive but statistically insignificant. In the second model where non-productive government expenditure is omitted, indirect taxes and budget deficit are not statistically significant. In Model 3, the two fiscal variables which has a neutral effect on growth are omitted and productive government expenditure is found to augment growth. This result is similar with other endogenous growth models such as those by Barro (1990) and Kneller et al. (1999). In our third model, budget deficit is negative but statistically insignificant while direct taxes are statistically significant and positively affected manufacturing growth in the long run (Table 5.10). Here, the positive impact of direct taxes on manufacturing growth is attributed to specific policy incentives for manufacturing firms in terms of tax exemptions and tax holidays if the firms engage in exports. This can also be attributed to a tax default and if that is the case this will reduce the costs for manufacturing firms (Engman and Farole, 2012; King and Rebelo 1990).

Table 5-10: [51]Long Run Regression Results
Estimation Technique: ARDL
Dependent Variable: MVA growth

Omitted Fiscal variables	Indirect tax revenue (IDTR)	Non-productive government expenditure (NPGE)	ITR & NPGE
	Coefficient	Coefficient	Coefficient
Labor	2.0251**	2.1467**	1.8748**
	(5.5606)	(3.6542)	(4.8151)
Direct tax revenue	0.2926	0.7492	0.4292**
	(1.8046)	(2.9513)	(2.8845)
Indirect tax revenue	-	-0.3859	-
		(-1.4729)	
Productive government expenditure	0.3850**	0.4569**	0.3722**
	(2.5053)	(2.3793)	(2.1224)
Non-productive government expenditure	0.1881	-	-
	(1.5048)		
Deficit financing	-0.0150	0.01675	-0.0039
	(-0.2665)	(0.2622)	(-0.0608)
Constant	19.3814**	20.3815**	18.5414**
	(8.0636)	(6.7475)	(7.0873)

Notes: ***, **, and * denote the statistical significance levels at 1%, 5%, and 10% levels, respectively.

[51] In the table, the values in the brackets are not standard errors they are t-statistic values.

5.5.2.2. Estimation of Short Run Effects

In the short run, we estimated three models where in the first model indirect tax revenue is omitted as was done in the long run estimation. In Model 2, non-productive government expenditure is left out, and in the third model both are left out. In the short run, the first model predicted that productive government expenditure and direct tax revenue are statistically significant whereas non-productive government expenditure is statically insignificant but positive in affecting the manufacturing sector's growth while deficit is statistically insignificant and negative. In Model 2, non-distortionary taxes are statistically insignificant but productive expenditure and direct tax revenues are significant. In Model 3, we omitted the two public policy instrument variables with neutral growth effect theoretically as well as empirically. In our case, a 1 percent increase in productive government expenditure increased manufacturing growth by 14 percent. Our estimated results also show that increasing direct taxes by 1 percent increased growth in the manufacturing sector by 16 percent. Besides, the error correction term is found to be statistically significant and negative which confirms a 45 percent adjustment to the long run equilibrium annually (Table 5.11).

Table 5-11: Short Run Regression Results
Estimation Technique: ECM
Dependent Variable: MVA growth

Omitted Fiscal variables	Indirect tax revenue (IDTR)	Non-productive government expenditure (NPGE)	IDTR & NPGE
	Coefficient	Coefficient	Coefficient
Labor	7.8896**	9.1680**	8.8190**
	(3.0269)[52]	(3.6542)	(3.4539)
Direct tax revenue	0.1304	0.2913**	0.1681**
	(1.6256)	(2.6921)	(2.1964)
Indirect tax revenue	-	-0.1500	-
		(-1.5779)	
Productive government expenditure	0.1716**	0.1776**	0.1458**
	(2.8633)	(2.9597)	(2.5243)
Non-productive government expenditure	0.0838	-	-
	(1.3889)		
Deficit financing	-0.0067	0.0065	-0.0015
	(0.2686)	(0.2600)	(-0.0609)
ECT	-0.4457**	-0.3888**	-0.3916**
	(-4.5175)	(-4.3226)	(-4.2622)

Notes: ***, **, and * denote the statistical significance levels at 1%, 5%, and 10% levels, respectively

[52] t values are reported for the short run and long run coefficients

5.5.2.3. Model Diagnostic Tests

Along with estimating the regression results, we also estimated reliable coefficients which are confirmed through diagnostic tests. Table 5.11 gives the model diagnostic tests' results such as normality test, autocorrelation test, heteroscedasticity test, model specification test, and the coefficient stability test. R-squared and adjusted R-squared is 99 and 98 percent respectively and the F-statistic is 134.7 with a 0.00 probability value. The null hypothesis for normality, serial correlation, heteroscedasticity, and correct model specification tests failed to be rejected confirming the non-existence of these problems in our model. In fact, the null hypothesis for all is positive. CUSUM and CUSUM of the square test for coefficient stability in Figure 5.6 also confirms the stability of the coefficients in the model. For this reason, we take the estimated coefficients in our model to explain the relationship between public policy instruments and manufacturing growth in Ethiopia (see Table 5.12).

Table 5-12: Model Diagnostic Tests

Post estimation test results	
R-squared	0.99
Adjusted R-squared	0.98
F-statistic	134.72
Prob(F-statistic)	0.00
Jarque – Berra	0.30
Prob (Jarque - Berra)	0.86
Breusch-Godfrey Serial Correlation LM Test*	0.16
Heteroskedasticity Test: ARCH*	0.21
Heteroskedasticity Test: Breusch-Pagan-Godfrey*	0.26
Ramsey RESET Test*	0.37

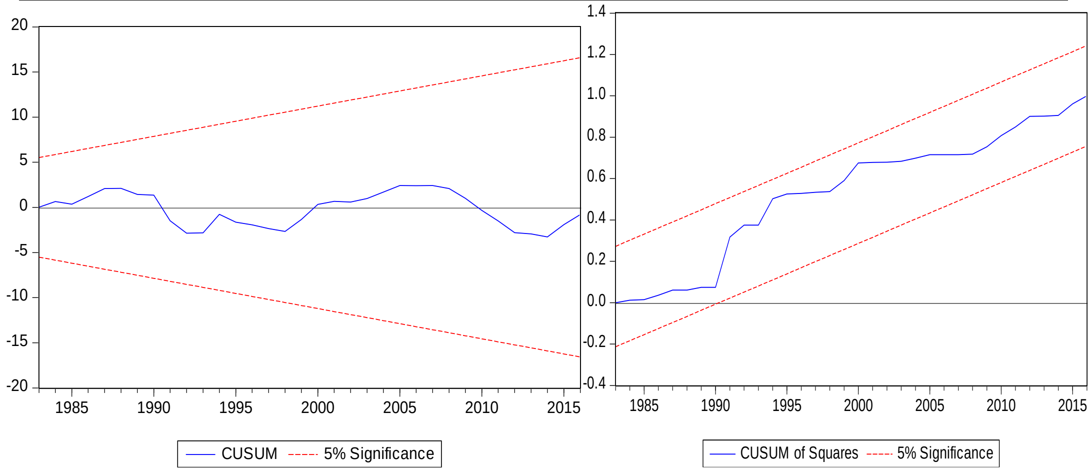


Figure 5-5: Coefficient Stability Test

5.6.Conclusion and Policy Implications

This study investigated the role of public policy instruments in the growth of the manufacturing sector in Ethiopia. It used annual data for 42 years obtained from the Ministry of Finance and Economic Cooperation (MoFEC) in Ethiopia and the World Development Indicators' (WDI) database. Because of its several advantages and its suitability for small sample sizes we used the ARDL approach for estimating the long and short run coefficients of the model. Before estimating the coefficients, the unit root test and bound test for long run cointegration are done and based on these it is confirmed that all the variables except labor and budget deficit are non-stationary at level but stationary at first difference implying that they are integrated order one variables. However, labor and budget deficit are found to be trend stationary.

In the fiscal performance, we found that the government's expenditure increased way more than its revenue implying a significant increase in the government's budget deficit. Our regression analysis confirmed the existence of a long run relationship between public policy variables and manufacturing growth in Ethiopia. The bound test for long run cointegration showed that our results are in line with public policy endogenous growth theories. Coming to the coefficient's estimation, in the long run direct taxation and productive government expenditure are statistically significant in enhancing manufacturing growth in Ethiopia. Indirect taxation and unproductive government expenditure are found to be statistically insignificant in affecting growth in the manufacturing sector; this result is in line with the theoretical prediction of their neutral effect (Bealenay et al., 2001; Kneller et al., 1999). Budget deficit has a negative but statistically insignificant effect in the long run. In the short run, both productive government expenditure and direct taxes are statistically significant whereas the other fiscal variables with neutral theoretical effects are found to be statistically insignificant; this finding is the same for the long run. Our results showed that the error correction term is negative and significant with a 45 percent adjustment to the long run equilibrium annually.

This study shows that as significant government expenditure increases with a considerable budget deficit there is a need for a counter increment in government revenues. This will enable the government to reduce the budget imbalance and debt accumulation used for temporarily filling the gap at the expense of livelihood opportunities for future generations. The study also shows that the government should focus on productive sectors like road construction, transport and communication, education, and health to complement the manufacturing sector's growth and structural transformation in general. Direct taxes are found to be growth enhancing instead of growth retarding in the manufacturing sector in Ethiopia. Hence, tax revenues should be used for financing the productive sectors to complement manufacturing growth. Besides, the tax base needs to be increased with a parallel focus on tax default controlling mechanisms. Yet, awareness to the public about tax and its positive return in the economy should be created along with establishing a mechanism to show how the collected money is going to be disseminated for social welfare enhancing purposes. As public policy is one instrument for encouraging economic agents, a tax holiday and tax exemptions should be properly implemented for manufacturing firms. Ultimately, public policy is not an exogenous factor that affects growth in the long run in

Ethiopia; this finding is in line with public policy endogenous growth theories (Barro and Sala-i-Martin, 1992; Kneller et al., 1999).

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6. Energy Use and Labor Productivity in Ethiopia: The Case of Manufacturing Industry

Paper Five

Selamawit G. Kebede

Abstract

This study investigates the effect of energy use on labor productivity in Ethiopian manufacturing sector. It uses panel data for the manufacturing industry groups to estimate coefficients using dynamic panel estimator. The study results confirm that energy use increases manufacturing labor productivity. The coefficients for control variables are in keeping with theoretical predictions. Capital positively augments productivity in the industries. Based on our results, technology induces manufacturing labor productivity. Likewise, more labor employment induces labor productivity due to increasing return to scale and the dominance of labor-intensive manufacturing industries in Ethiopia. Results imply that there needs to be focus on an efficient use of energy, labor, and capital along with technology to increase labor productivity in the manufacturing industries.

Keywords: Manufacturing; Labor productivity; Energy; Ethiopia

JEL Classification Codes: L60; J24; Q4

6.1. Introduction

Industrial expansion is essential for socioeconomic development as it generates different opportunities; capital accumulation, structural changes, technological innovations, and productivity that improve economic performance (Kaldor, 1966; Cornwall, 1977; Guadagno 2012). Industrialization or the shift from the agriculture to the manufacturing sector is key to development making development without industrializing an unthinkable process (Kaldor, 1966; UNECA, 2014). Industrial development is also the pathway for the structural transformation of an economy and society. High rates of economic growth and capital accumulation are essential but not adequate for structural transformation unless complemented with industrialization (Cornwall, 1977). Industrialization promotes economic diversification, inclusive growth, and efficient utilization of resources such as physical, human, and minerals which help eradicate poverty (UNECA, 2015).

The productivity advantage of manufacturing over other sectors is a major factor for pursuing sustained industrialization along with higher externalities that can arise from manufacturing growth (UNIDO, 2018). Unlike agriculture and the service sectors, manufacturing accelerates convergence and with its huge productivity advantage will enable developing economies to catch up with the developed counterparts (UNECA, 2014). Different factors are attributed to industrial growth and productivity including human or physical capital, labor, energy, innovations and capacity utilization (Otalu, and Anderu, 2015; Guadagno, 2012; Story,1980). Among others, energy is critical for productivity and growth which enables achieving an industrial development and structural transformation (UNDP, 2018). Indeed, the use of energy is a precondition for the development of human society and more energy use is required for sustaining industrial development (UNDP, 2018). Energy use is directly related to growth and economic development and is an essential input required for all production and consumption activities (Chen et al., 2012; Story,1980).

The causal relationship between energy consumption and growth has been investigated in different countries and the results remain controversial with diverse outcomes for different countries based on the econometric approaches[53] used and the time spans of the studies (Moghaddasi and Pour, 2016; Kebede et al.,2010; Chen et al., 2012; Al-Iriani, 2005; Cleveland et al., 2000). Some literatures validate the positive effect of energy on growth and productivity (Alaali et al. ,2015; Fallahi et al., 2010; Soytas and Sari, 2003) while others empirically confirmed negative impact of energy on growth and productivity (Moghaddasi and Pour,2016; Kebede et al.,2010).Yet, others found no causal relationship empirically (Chen et al., 2012; Akinlo, 2008).

In Ethiopia, the share of agriculture and services to GDP for decades have been more than 60 percent and 20 percent respectively, while manufacturing contribution to GDP being less than 5 percent with15 percent share of other industries (CSA, 2018; EEA, 2017). Currently, the service sector has been contributing 47 percent, agriculture 43 percent while industry making up the rest leaving very low share of manufacturing to GDP (Ejigu and Singh, 2016). Yet, existing literatures confirm that Ethiopian people for decades, have been depending on agriculture for their livelihood in terms of production and employment with a significantly small contribution of the manufacturing sector to the economy (Oqubay, 2018; Gebreeyesus, 2010). The dominance of first agriculture and later the service sector shows premature deindustrialization in Ethiopia while low manufacturing share overtime implying output deindustrialization (Rodrik, 2016; Ejigu and Singh, 2016).

Both indicators of low industry performance can be attributed to several factors such as inefficient use of labor, energy, human or physical capital, innovations and capacity utilization (Rodrik, 2016; Guadagno, 2012; Story,1980). As established theoretically, energy is one significant factor to determine sustainable industrial production. However, the empirical relationship between energy and growth is mixed. Besides, empirical studies are scantly available on energy and industrial productivity. Therefore, this motivates to undertake the empirical relationship between energy and labor productivity in the Ethiopian manufacturing industry. Accordingly, this study mainly addresses the following research question:

- How does energy affect labor productivity in the Ethiopian manufacturing sector?

The analysis emphasizes on the role of energy use in manufacturing labor's productivity in Ethiopia. The study uses panel data for estimating the empirical model using a dynamic system GMM estimator. The estimation results confirm that energy use positively affects

[53] Econometric approaches are one factor for mixed results on causal relationship between energy and productivity. To fill this gap, different econometric estimators are used to evaluate how does the effect of energy on labor productivity in Ethiopia behaves across different approaches.

labor productivity in the manufacturing sector in Ethiopia. This implies an efficient use of energy as a pillar for labor productivity in Ethiopian manufacturing industries.

The rest of this chapter is organized as follows. Section 6.2 reviews literature on energy and productivity. The empirical model and estimation approach are presented in Section 6.3 along with a definition of the variables used in the model. Data is discussed in Section 6.4. A descriptive and regression-based analysis of energy and labor productivity of the manufacturing sector in Ethiopia is discussed in Section 6.5. The final section gives the conclusion and the implications of the findings.

6.2. Literature Review

6.2.1. Theoretical Review on Energy and Productivity Growth

There are two empirically fundamental questions related to disparities in the level of economic development across nations. Economists inquire why some economies are so much richer than others, and what accounts for the huge increases in real incomes over time (Ray, 1998; Romer, 2011). An extensive dispersion of output growth rates across countries is a documented economic fact (Todaro and Smith, 2015). A comparison between countries shows that countries that at one time had similar levels of per capita income have consequently followed very different patterns with some seemingly caught in long-term stagnation while others have been able to sustain high growth rates (Agénor and Montiel, 2008).

Among several factors, productivity is one determining factor for growth at the national and industrial levels with increasing globalization and the expansion of competitive industrial product markets (Fallahi et al., 2010; Stern, 2010). High industrial labor productivity results in lower per unit costs and increases firms' ability to compete in global markets (Fallahi et al., 2010). There are several determinants of labor productivity mainly consisting of human or physical capital, energy, technology and others (Su and Heshmati, 2011; Stern, 1997, 2010). Yet, energy is an essential input that constrains or induces productivity growth in different firms (Stern, 1997, 2010). It is an essential factor of production that is required in all economic processes (Stern, 1997, 2010). This basic production input in economic activities provides a conducive platform for industrial growth and productivity. Efficient use of energy leads to higher productivity of resources and a more dynamically competitive economy that can respond to the required economic transition (OECD, 2012).

Energy has countless ways of empowering human beings through increasing productivity, powering industrial and agricultural processes, alleviating poverty, and facilitating sound social and economic development (UNDP, 2002). Limited access to energy cripple's economic growth and development which makes universal access to energy a major emphasis of the sustainable development goals (UNDP, 2018). Increased availability and use of energy increases productivity and enhances economic development (Toman and Jemelkova, 2003). Energy is primarily associated with the provision of power for agricultural or industrial production (Cabraal et al., 2005; Ejaz et al., 2016). In fact, sustainable development and modern industry require reliable, affordable, and available energy services for all on a sustainable basis (UNDP, 2002; UNDP, 2018). Access to energy is limited and is accompanied by low quality and poor reliability, affordability, and duration (UNDP, 2018). Energy can be measured in terms of cost or value and can be disaggregated into electricity or other energies based on types. It is possible to measure energy consumption with an equivalent to kilowatt hours (KWh) (Heshmati, 2003).

6.2.2. Empirical Review of Literature[54]

In the first part of this section an empirical review is presented on the relationship between energy and growth on the one hand and proceeds with studies on the determinants of labor productivity on the other hand to establish the rationale for undertaking this specific study that links energy with labor productivity at industry level in Ethiopian context.

Energy use is a major stimulating factor for industrial productivity (Fallahi et al., 2010; OECD, 2012). Public services and industrial production require access to energy use (Kebede et al., 2010). Recently, the demand for energy has been increasing with an increasing population in the world of over 7.2 billion (Rybár et al., 2015). Access to energy in Africa is low where out of ten people in sub-Saharan Africa (SSA) only four have access to electricity energy compared to global access which is nine out of ten people; 57 percent of the global electricity energy access deficit is in SSA (UNDP, 2018).

There is an increasing interest in identifying the role of energy in productivity as empirical findings on their causal relationship are mixed (Al-Iriani, 2005; Wolde-Rufael, 2009). For instance, Soytas and Sari (2003) examined the energy and income causality for 10 emerging markets excluding China because of limited data availability and the G-7 countries. Their results showed a bidirectional causality in Argentina, causality running from energy to GDP in France, Germany, Japan, and Turkey, and causality running from GDP to energy consumption in Italy and Korea. Mahadevan and Asafu-Adjaye (2007) investigated the nexus between energy and growth for 20 net importer and exporter countries from 1971 to 2002 using the panel vector correction model. Their findings show that for energy exporter developed countries the causal relationship was bidirectional while for developing countries energy stimulated growth in the short run.

Alaali et al. (2015) investigated the effect of energy consumption and human capital on economic growth for 130 oil exporting and developed countries from 1981 to 2009. Using GMM they estimated an augmented neoclassical growth model including education and health as human capital along with energy consumption. Their results show that energy had a positive and significant effect on the growth of the countries. Al-Iriani (2005) investigated the empirical relationship between energy consumption and gross domestic product of six Gulf Cooperation Council (GCC) countries using cointegration and causality methods. His results showed a unidirectional causal relationship running from GDP to energy consumption but not the other way around. Moghaddasi and Pour (2016) investigated the role of energy consumption on total factor productivity in Iranian

[54] The empirical review is not chronological and instead is based on the economic development levels of countries starting with developed economies and moving to developing countries.

agriculture using the Solow residual model and their results showed a negative impact which they attributed to cheap and inefficient use of energy in this sector.

Kebede et al. (2010) investigated energy demand for east, west, central, and south sub-Saharan countries using time series cross-sectional data for 20 countries for a 25-year time span. Their results show that energy demand was positively related to GDP, population growth rate, and agricultural expansion while it was negatively correlated with industrial development and the price of petroleum. Akinlo (2008) investigated the causal relationship between energy consumption and economic growth for 11 sub-Saharan African countries using the ARDL bound test and Granger causality. His results showed that there was cointegration between energy use and economic growth in seven countries included in the study: Ghana. Cameron, Senegal, Cote d'Ivoire, Zimbabwe, Gambia, and Sudan. In the case of Sudan and Zimbabwe the Granger causality ran from economic growth to energy use while for Cameroon and Cote d'Ivoire he found no Granger causality between energy consumption and economic growth.

Wolde-Rufael (2009) examined the causal relationship between energy consumption and economic growth for 17 African countries using the variance decomposition factor and impulse response analysis. The variance decomposition analysis confirmed that labor and capital were important, and energy was not as important as these factors. Chen et al. (2012) did a meta-analysis using a multinomial logit model for 174 samples to explore the relationship between energy and GDP with controversial outcomes. The results showed that the time span, econometric model, and selection characteristics affected the debatable outcomes of the casual relationship significantly.

The second part of this section is to explore labor productivity and its determinants which have been studied by different researchers. Su and Heshmati (2011) studied the development and source of labor productivity in 31 provinces of China for 2000-09. They used a fixed effect model adjusted for heteroscedasticity to estimate the coefficients' fixed assets, average wage for labor, total volume of business, post and telecommunications, and profits which had a positive effect on labor productivity. Velucchi and Viviani (2011) examined the determinants of labor productivity in Italian firms using panel data and a quantile regression. Their results showed that human capital and assets had a strong positive impact on fostering the productivity of low productive firms as compared to high productive ones. Islam and Syed Shazali (2010) studied the impact of the degree of skills, R&D, and a favorable working environment on the productivity of labor-intensive manufacturing industries in Bangladesh. Their results confirmed a positive correlation between productivity and the degree of skills and the working environment though it was a weak correlation; R&D had a strong positive correlation with productivity in Bangladesh.

Heshmati and Rashidghalam (2016) studied the determinants of labor productivity in manufacturing and service sectors in Kenya using the World Bank Enterprise Survey database for 2013. Their findings confirmed a positive effect of capital intensity and wage on labor productivity while female participation reduced productivity in these sectors. Nagler and Naudé (2014) examined the factors determining labor productivity of non-farm enterprises in rural sub-Saharan Africa in Ethiopia, Nigeria, Uganda, and Malawi using the

World Bank's LSMS-ISA database. They found that rural enterprises were less productive than urban enterprises. By estimating Heckman selection and panel data models their study confirmed that education and credit availability induced labor productivity in the enterprises.

Samuel and Aram (2016) investigated the main factors that helped or hindered the realization of industrial productivity in Africa and concluded that financial development, economic development, the labor market's flexibility, and the real effective exchange rate were clear determinants of industrialization in the entire region. Otalu and Anderu (2015) examined the determinants of industrial sector growth in Nigeria by using the cointegration and error correction model (ECM). Their results showed that both labor and capital had significant effects. The exchange rate showed a positive and significant impact signifying that currency appreciation might be detrimental to the growth of the industrial sector. In addition, they found that these factors had a more permanent and not a transitory effect on industrial output.

In literature on energy, the contribution of energy use to productivity in practice is controversial with some studies claiming that energy use is a fundamental pillar of productivity growth while others argue that energy has little effect on productivity growth (Chen et al., 2012; Murillo-Zamorano, 2005). In studies on labor productivity energy seems to be missing as a major determinant factor for explaining labor productivity. There is little focus on investigating the explicit role of energy on labor productivity from the manufacturing industry perspective. Yet, most growth theories fail to include energy use as a productivity pillar or as one argument for the differences among nations. Thus, this study empirically investigates this relationship using panel data for manufacturing industry's groups in Ethiopia.

6.3. Model specification and estimation

6.3.1. Model specification

Productivity is a fundamental indicator for assessing economic performance (OECD, 2008). In general terms, productivity can be defined as a ratio of total output produced to inputs used. There are different measures of productivity which can be classified as multifactor productivity measures and single factor measures of productivity (OECD, 2001). The former relate output to a bundle of inputs while the latter measure the ratio of output to a single input (OECD, 2008). For instance, labor productivity is defined as the ratio of the quantity index of gross output to the quantity index of labor input (OECD, 2001). Among other factors, energy is a key driver of economic growth and industrialization as it enhances the productivity of labor, capital, and other factors of production as well. In fact, energy use has received considerable attention as a pillar of productivity in literature on energy economics but with mixed empirical results for different countries on the causal relationship between the two (Al-Iriani, 2005; Mahadevan and Asafu-Adjaye ,2007; Alaali et al., 2015).

This study empirically investigates the relationship between energy use and labor productivity in Ethiopian manufacturing industries. Like labor and capital production factors, energy is seen as an essential factor for economic development (Alaali et al., 2015). The production function is a useful tool for analyzing the technological relationship between labor, capital, other inputs, and the output produced (Hajkova and Hurnik, 2007). The production function which relates output to the vector of inputs is mostly used for analyzing productivity (Van Beven, 2010; Del Gatto et al., 2011). Accordingly, the production function (Cobb and Douglas, 1928) is used for estimating the productivity of labor in the manufacturing sector in Ethiopia. The Cobb-Douglas type of production function with two inputs in its basic form (Murthy, 2002: Zellner et al., 1966) is represented as:

$$(eq. 6.1). \quad Y = AL^{\alpha}K^{\beta}$$

In Equation (6.1) Y denotes quantity of production or output or its value, L represents labor or its value, and K stands for the value of capital. α and β are parameters of the inputs of labor and capital respectively and A is technology. This standard production function can be generalized to include more inputs such as energy and other material inputs:

$$(eq. 6.2). \quad Y = AL^{\alpha}K^{\beta}E^{\gamma}$$

In Equation (6.2), other variables are defined in the same manner as in Equation 6.1 while E stands for energy inputs in the production process with γ denoting a parameter to be estimated as a coefficient for energy input. We can linearize the production function by log transformation as:

$$(eq. 6.3). \quad LogY = \log A + \alpha \log L + \beta \log K + \gamma \log E + U$$

$$(eq. 6.4). \quad \begin{aligned} &if \alpha + \beta + \gamma > 1, IRS \\ &if \alpha + \beta + \gamma \prec 1, DRS \\ &if \alpha + \beta + \gamma = 1, CRS \end{aligned}$$

In Equation (6.4), α, β, and γ stand for elasticities of production with respect to labor, capital, and energy respectively. Equation (6.3) is the first model to be estimated to decide the return to scale of the production in manufacturing industries in Ethiopia. The sum of the parameters will give us a measure of the returns to scale from a proportional increase in inputs. If the sum of the parameters is greater than one we have increasing returns to scale (IRS), if the sum is less than one we get decreasing returns to scale (DRS), and if the sum is one then the returns to scale are constant (CRT).

As labor productivity shows how effectively labor inputs are converted into outputs (Eldridge and Price, 2016), we take production or output per employee to measure labor productivity in our case. There are two ways of doing this. First, if one is interested in the scale effects of energy and capital use on labor productivity, then we take the right-hand side to include all inputs in the original form per labor, while the left side is measured as productivity, that is, output is divided by labor. In this case labor on the right-hand side represents the scale of production as:

$(eq.6.5)$. $Y/_L = AL^{\alpha}K^{\beta}E^{\gamma}/_L$
$(eq.6.5a)$. $Y/L = AL^{\alpha-1}K^{\beta}E^{\gamma}$
$(eq.6.5b)$. $Log\,Y/L_{it} = logA_{it} + (\alpha-1)\text{log}L_{it} + \beta\text{log}K_{it} + \gamma\text{log}E_{it} + U_{it}$
$(eq.6.5c)$. $\rho = \alpha - 1; then, \alpha = \rho + 1$
$(eq.6.5d)$. $L\,og\,Y/L_{it} = \lambda + \rho\text{log}L_{it} + \beta\text{log}K_{it} + \gamma\text{log}E_{it} + TT_i + U_{it}$

In Equation (6.5 to 6.5d), the dependent variable is labor productivity which measures the scale effect of the factors on labor productivity. Value of energy is used for manufacturing industries as a major variable of interest. Labor is a control variable that represents the scale of production and is defined as the number of employees in the industry group. The second key control variable is capital which is defined as the value of the fixed assets of industry groups. All variables are in logarithm form so that the coefficients are defined elasticities. T represents trend included to capture the technical change effect. U represents the error term of the panel model and subscripts i and t represent industry sector and time period respectively. U contains unobservable sector- and time-specific effects. The β's are unknown coefficients of the explanatory variables where λ is the constant term.

Equation 6.6 and 6.6a represents the third model which measures the intensity effect of factors on labor productivity. The other way of specifying the model is by dividing the right-hand side variables (L, K, E) with labor to express energy and capital in the form of capital intensity and energy intensity respectively, while the L ratio will end up in the intercept. Thus, the third model to be estimated is written as:

$(eq.6.6)$. $Y/_L = (A/_L)(L/_L)^{\alpha}(K/_L)^{\beta}(E/_L)^{\gamma}$
$(eq.6.6\text{a})$ $Y/_L = (A/_L)(K/_L)^{\beta}(E/_L)^{\gamma};\ (L/_L)^{\alpha} = 1^{\alpha} = 1$

For all three models to be estimated an error term is included and the models are linearized and transformed into logarithm forms before estimation. The third model to be estimated (eq6.7) measures the energy and capital intensity and their effect on labor productivity in manufacturing industrial groups in Ethiopia as:

$(eq.6.7)$. $Log(Y/L)_{it} = \mu + \beta\text{log}k_{it} + \gamma\text{log}e_{it} + TT_i + u_{it}$
$(eq.6.7a)$. $LogMLP_{it} = \alpha + \beta logCapital\ Intensity_{it} + \gamma logEnergy\ Intensity_{it} + \lambda Time\ trend_i + U_{it}$

In Equation (6.7), manufacturing labor productivity is the dependent variable defined as manufacturing output of an industry group per employee. μ is the intercept, β is a slope coefficient for capital intensity, γ is a slope coefficient for energy intensity, while t stands for time trend to represent a shift in the production function over time and thus λ is the rate of technological change. U is the error term in the model with i and t representing industry group and time respectively. It follows an error component structure consisting of industry effects and random error components.

6.3.2. Model estimation

Panel data models can be static or dynamic. Static panel data models can be estimated using pooled OLS, fixed effects (FE), and random effects (RE) models but these models do not take the problems of heteroscedasticity, serial correlation, and the endogeneity of explanatory variables into account (Faustino and Leitão, 2007; Hummels and Levinsohn, 1995; Zhang et al., 2005). The pooled OLS ignores fixed industry and time effects. In FE these are fixed correlated with the inputs, while they are assumed not correlated with inputs in the RE model. In all the models' the time effects are captured by the trend. In the FE model, we estimate the effects in the form of industry intercepts, while in RE we estimate the parameters of the distribution of the industry effect which is assumed to have mean zero and constant variance (Faustino and Leitão, 2007).

To solve the estimation problems related to a static panel formulation we use the dynamic panel model of difference GMM and system GMM estimators as proposed by Arellano and Bond (1991) and Arellano and Bover (1995) respectively. The difference GMM and system GMM are dynamic panel estimators designed for large N and small T, many groups/individuals, and a few time periods, linear functional relationship, one left hand side that is dynamic depending on its own past realization and designed for independent variables that are not strictly exogenous (Roodman, 2009). System GMM contains both level and first difference equation parts and it uses instruments in levels for equations in first difference and uses instruments in first difference for equations in levels (Faustino and Leitão, 2007). After estimating the dynamic panel data models, tests for serial correlation of the residuals and over identification are done using Hausman or Sargan tests and the AR (2) test respectively (Arellano, and Bond, 1991; Arellano and Bover, 1995).

6.4. The Data

6.4.1. Data and variables

All data used in this study is taken from the Ethiopian Central Statistical Authority (CSA). The period 2005-16 is chosen since the latest information on all variables is available only up to 2016. A two-digit industry sector level is the most disaggregated data level available for this specific case. The number of observations for industry groups (industrial sectors) is 15 where for every industrial group the relevant variables available are included. Table 6.1 provides a list of the industrial groups. The medium and large manufacturing industries in Ethiopia are categorized into 15 industrial groups.

Table 6-1: List of Industry groups

Industry Code	Industrial Group (sector)
1	Food Products and Beverages Industry
2	Tobacco Products Industry
3	Textiles Industry
4	Wearing Apparel, Except Fur Apparel Industry
5	Tanning and Dressing of Leather; Footwear, Luggage and Handbags Industry

6	Wood and of Products of Wood and Cork, Except Furniture Industry
7	Paper, Paper Products and Printing Industry
8	Chemicals and Chemical Products Industry
9	Rubber and Plastic Products Industry
10	Other Non-Metallic Mineral Products Industry
11	Basic Iron and Steel Industry
12	Fabricated Metal products except machinery and Equipment Industry
13	Machinery and Equipment Industry
14	Motor Vehicles, Trailers and Semi-Trailer Industry
15	Furniture; Manufacturing Industry

Source: CSA.

Table 6.2 gives the list of variables used in this study and their definitions. To define labor productivity, we need information on production and employment. Production in our case is defined as gross value of production by industrial group. Employment is defined as the number of employees by industrial group. Accordingly, labor productivity is defined as the ratio of production to employment by industry group or per capita employed production labeled in literature as labor productivity. Energy is defined as the ratio of value of energy consumed by the industrial groups. Capital is defined as total value of fixed assets by industrial groups. Table 6.2 also shows the expected effects of the variables in the model on labor productivity. Labor productivity is the dependent variable and the explanatory variables consisting of energy use, employment, capital, and trend are expected to be statistically significant in the empirical estimation. The expected sign for employment is positive as the industries in Ethiopia are more labor intensive adding more labor will be expected to increase production. Similarly, the expected signs of the parameters for energy, capital, and technical change are expected to be positive. It is assumed that energy use and capital will increase labor's productivity in the manufacturing industries in Ethiopia. [55]The increase in wage and salary is expected to positively affect labor productivity and higher wages per capita reflect the labor's skills and education levels.

Table 6-2: List of variables and coefficient signs

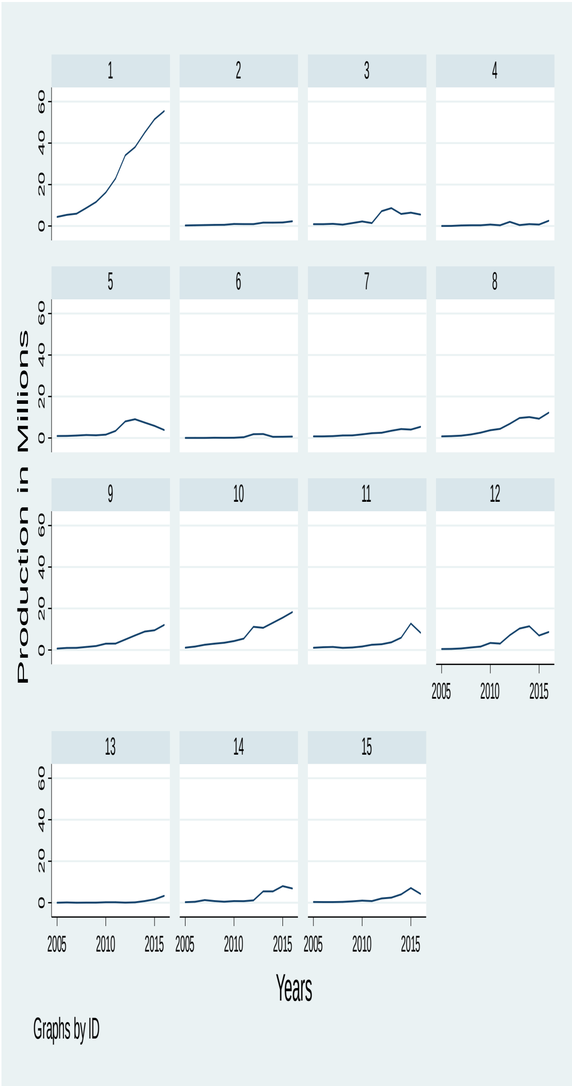
Variables	Variable definitions	Expected effect
Labor Productivity	Dependent variable: Ratio of gross value of production to number of employees	-
	Independent variables:	
Production	Gross value of production by industrial group (in 000 birr)	-

[55] The wage and salary were included as a proxy for human capital but due to high correlation are excluded from the estimation.

Employment	Number of employees by industrial group	positive
Energy	Ratio of value of energy consumed to total industrial expenditure by industrial group	positive
Capital	Total value of fixed assets by industrial group (in 000 birr)	positive
Time trend	Is a proxy for technical change and is included in the model as a control variable	positive

6.4.2. The variables' development over time

Figure 6.1 gives the trend for production of the 15 industries included in this study. The industry classification is standard as provided by the Statistics Authority in Ethiopia. A list of the 15 industry sectors is reported in Table 6.1. Based on that, the food and beverage industry (industry code 1) shows an increasing trend for 10 years (2005-16). Similarly, the other non-metallic mineral products industry (industry code 10) and the motor vehicle and trailer industry (industry code 14) show an increase in the recent years of the study period. However, the remaining industries have a constant trend in their respective production. Thus, the outcome of policies in the form of industrial development effect are heterogeneous across industrial sectors. Figure 6.2 presents the trend of energy use across the industrial groups. Except the wood products industry (code 6) and the non-metallic mineral industry (code 10) the overall trend of energy use throughout the decade, on average, shows steady growth. However, the two industries are relatively more energy intensive and very recently a decline in energy use has been witnessed in both these industries.



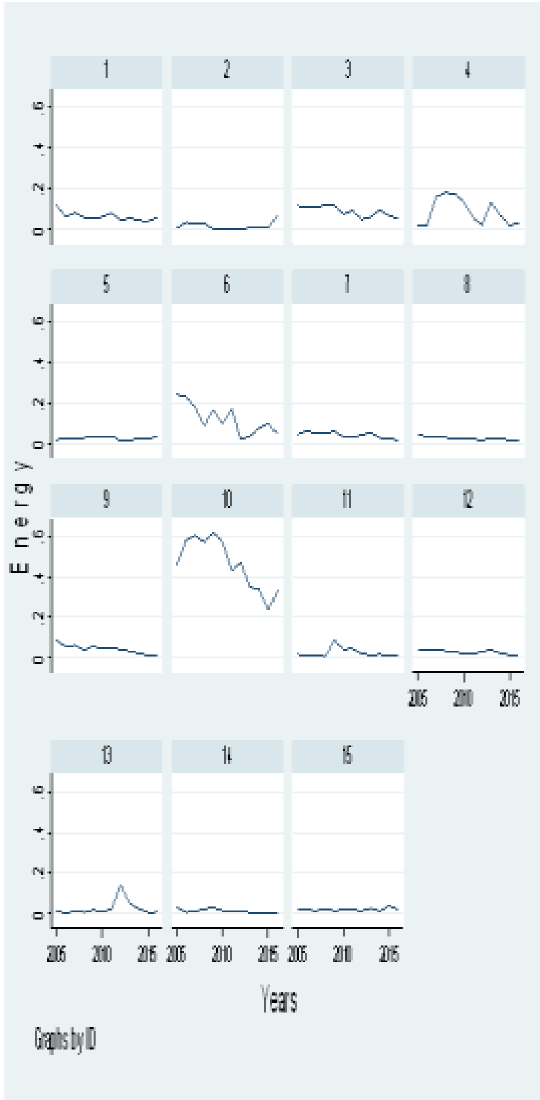
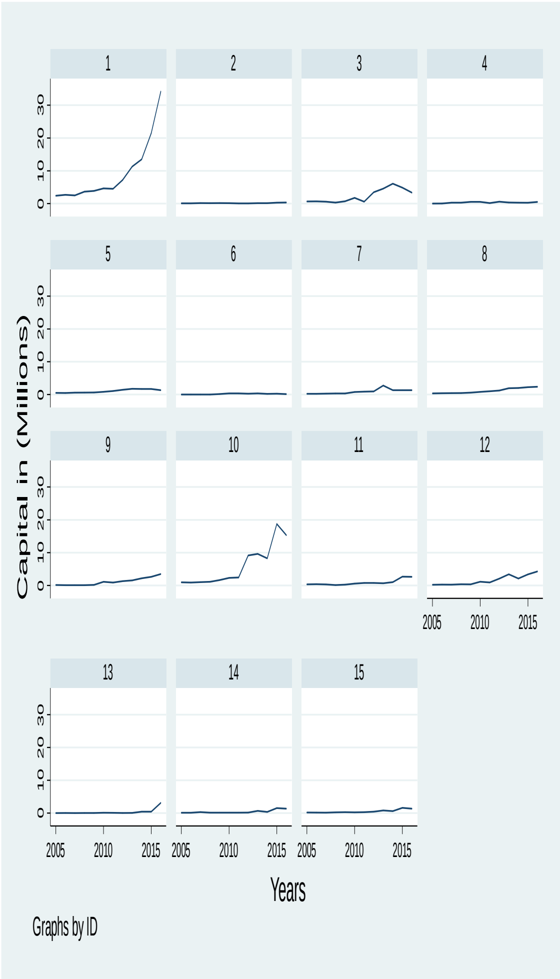


Figure 6-1: Production trend by industrial groups Figure 6-2: Energy use trend by industrial groups

Figures 6.3 and 6.4 give the trends of capital and employment in the 15 industrial groups in the study period. The use of capital increased over time for the food and beverage industry (code 1) and non-metallic minerals (code 10) compared to the other industrial groups. Employment in the food and beverage industry (code 1) as well as the textile industry (code 3), on average, showed an upward trend throughout while both rubber and plastic industry (code 9) and the metallic industry (code 12) had huge employment in the second half of the study period but overall had a flatter upward trend over time. In the remaining industrial groups, the overall employment trend was steady.



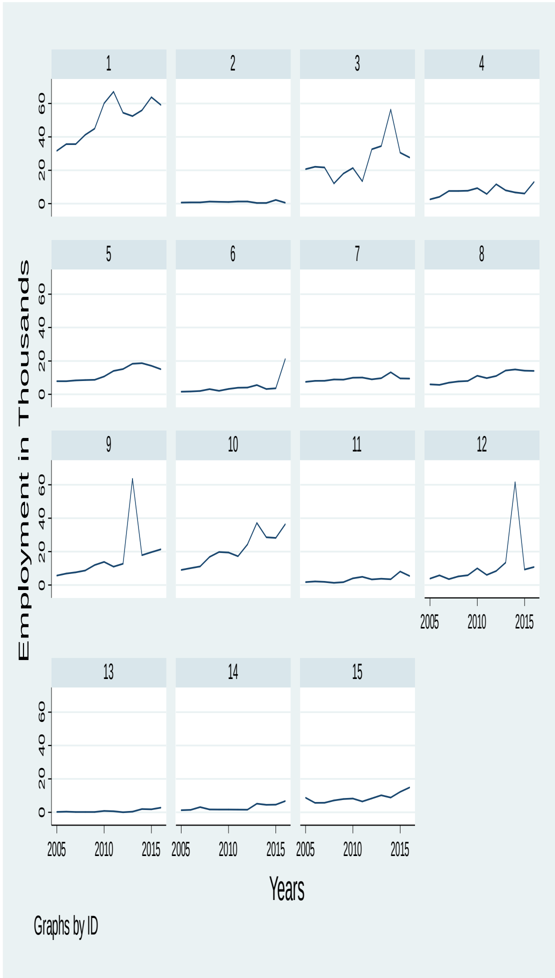
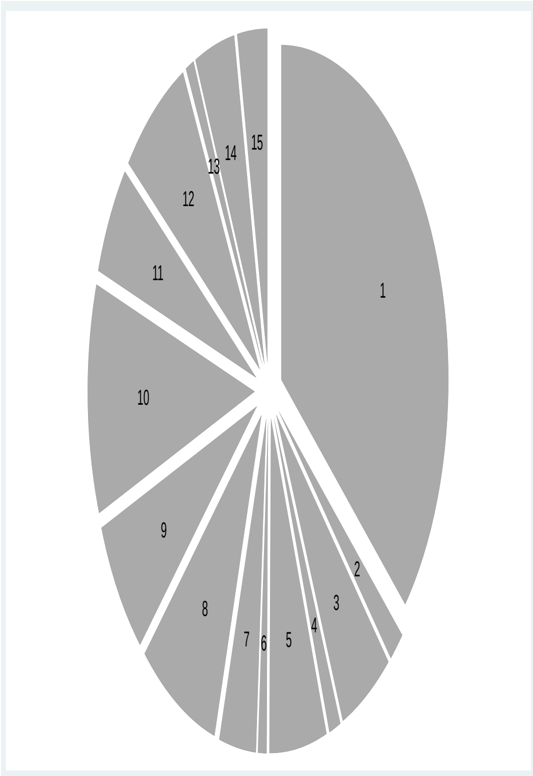


Figure 6-3: Capital trend by industrial groups Figure 6-4: Employment trend by industrial groups

Figures 6.5 and 6.6 show the share of production and energy use by the manufacturing industrial groups respectively. In the 15 industries, the food and beverage industry (code 1) had the lion's share in terms of production followed by the non-metallic mineral products industry (code 10). The apparel industry (code 4), wood industry (code 6), and machinery industry (code 13) had the least share compared to the other industrial groups. Energy use was huge in the metallic industry (code 10) followed by the wood industry (code 6), the apparel industry (code 4), and the textile industry (code 3).



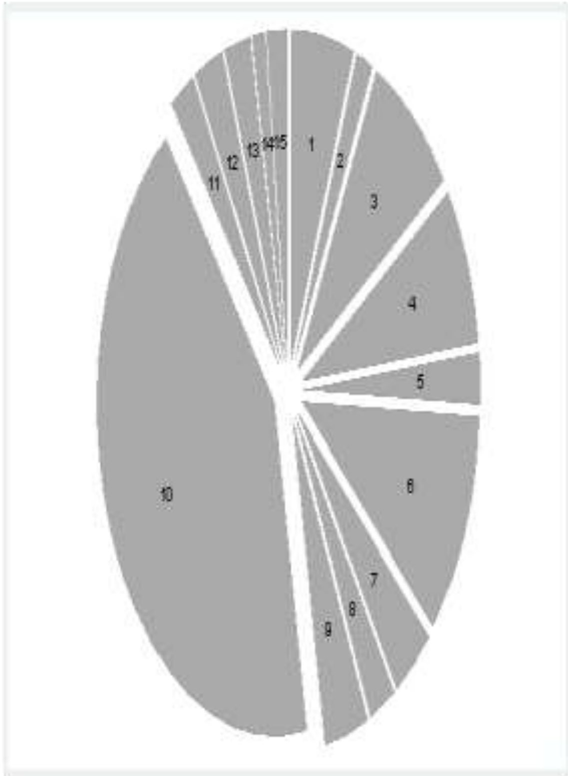


Figure 6-5: Gross value of production by industrial groups Figure 6-6: Energy use across the industrial groups

6.5. Empirical Results and Discussion

6.5.1. Descriptive Statistics

Table 6.3 gives the summary statistics of our variables of interest. It gives information about the overall, between, and within variations in terms of mean and standard deviations together with the minimum and maximum value of the variables. The total sample is 180 observations: a product of 15 industry groups and 12-years of data from 2005 till 2016. In the summary, we have variables such as industry production, employment, and labor productivity defined as a ratio of production per employee in the industry groups, capital proxied by fixed assets, value of energy and human capital proxied by wages and salaries. Accordingly, for variables such as production per employment and value of energy the within variations are found to be higher than the between variations while the within variations of labor and capital are found to be higher than the between variations. The minimum and maximum values of each variables are also given in Table 6.3.

Table 6-3: Summary Statistics of the Variables of Interest

Variable	Variations	Mean	Std. Dev.	Min	Max	Observations
	Overall	453240	8002421	13673	5.54e+07	NT=180
Production	Between		5985648	551875.1	2.50e+07	N=15
	Within		5514752	-1.60e+07	3.50e+07	T=12
Employment	Overall	12512.6	14497.45	48	67072	NT=180
	Between		12699.86	813	50190.67	N=15
	Within		7668.181	-5985.011	62091.91	T=12
	Overall	428.838	563.5947	19.6428	4078.363	NT=180
Productivity	Between		364.3505	85.9931	1470.145	N=15
	Within		439.3695	-587.8283	3037.057	T=12
	Overall	175329	3860281	4686	3.42e+07	NT=180
Capital	Between		2541552	160494.1	9332244	N=15
	Within		2973086	-5173360	2.66e+07	T=12
	Overall	0.0730	0.11774	0.0010	0.6210	NT=180
Energy	Between		0.11285	0.0132	0.4650	N=15
	Within		0.04369	-0.1539	0.2290	T=12
	Overall	275439	488709.7	1329	4023882	NT=180
Cost of	Between		351034.5	30176.83	1466912	N=15
Labor	Within		350976.4	-867761	2832410	T=12

Source: Author's computation using Stata.

6.5.2. Regression Results and Analysis

In this section static and dynamic panel data models are estimated for the industrial panel data available from 2005 till 2016. The data contains 15 industries listed in Table 1 and all of them are included in the analysis. Thus, the data includes the entire population of the industry groups. The estimated models are pooled OLS, fixed effects (FE), and random effects (RE) models from the static panel estimators while difference GMM and system GMM are presented as dynamic estimators. Three different model specifications are used in the estimation. In the first model, industry group production is the dependent variable while energy, labor, and capital are explanatory variables. In this model, the returns to scale of production are calculated based on the sum of the coefficients for the three input variables. In the second model, manufacturing labor productivity is specified as employment (labor), capital (fixed assets), value of energy, and time trend (technology) as explanatory variables. In this model, the coefficients measure the scale effect of the explanatory variables on labor productivity of the industry groups and labor represents scale effect. In the third model, labor productivity of the manufacturing sector is explained by energy and capital measuring intensities respectively. In all the three model specifications, a trend is included to capture a shift in the labor productivity function or rate of technological change. All variables (trend excepted) are transformed into logarithmic form so that the coefficients are interpreted as input elasticities.

Accordingly, Table 6.4 shows the results of the pooled OLS for the three model specifications. In the first model, labor, capital, energy, and technology are found to be statistically significant and positive which are among the key factors for explaining the manufacturing industry's production growth. The elasticity of output with respect to capital is higher than the corresponding figures for labor and energy in these industries. The returns to scale of the production process is 1.06 implying increasing returns to scale in this specification coinciding with predictions in the literature (Kaldor 1966; Rodrik.2013). In the second model, labor is significant and positive at the 1 percent significance level. However, here we do not interpret the coefficient of labor as it is instead based on Equation (6.5c) we find the value of α by adding one to the estimated coefficient in our model which is ρ. Then α in our case will be positive indicating the positive effect of labor on productivity in the manufacturing industries. This can be attributed to the increasing return to scale of production and the type of existing industries which are dominated by labor intensive industries. In this model, capital is significant and positive for labor productivity which is a boost to the industry groups. Energy use also positively affects productivity. In the third model, capital and energy intensities are significant and positive to explain labor productivity in the manufacturing industries. The results confirm that labor productivity is high and more elastic for energy intensity than for capital for the Ethiopian manufacturing industries. The models show that adjusted R^2 is high and the probability of F-statistics is significant confirming the appropriateness of the model's specifications (see Table 6.4).

Table 6-4: Pooled OLS Estimation Results for the Three Models

Variables	Model 1		Model 2		Model 3	
	Coef.	Robust Std. Err	Coef.	Robust Std. Err	Coef.	Robust Std. Err
Labor (log)	0.2730***	(0.0755)	-0.7269***	(0.0755)	-	-
Capital (log)	0.7029***	(0.0544)	0.7027***	(0.0544)	0.0014***	0.0004
Energy (log)	0.0895***	(0.0146)	0.0895***	(0.0146)	0.1082***	0.0127
Time trend	0.0226***	(0.0502)	0.0226***	(0.0050)	0.0374***	0.0088
Constant	0.7930***	(0.1996)	0.7930***	(0.1996)	1.7272***	0.0541
RTS	1.0655					
AdjR2	0.8979		0.8285		0.6074	
F-statistics (p-value)	0.0000		0.0000		0.0000	

Notes: ***, **, and * denote the statistical significance levels at 1%, 5% and 10% levels respectively.

*Model 1: Output is the dependent variable

*Model 2: Labor productivity is the dependent variable (scale effect)

*Model 3: Labor productivity is the dependent variable (input intensity effect)

It should be noted that the pooled OLS model ignores industry effects which may generate biased results. However, it serves well to establish the model's specifications. Table 5 presents the static panel data model estimation results. In this section only the second and third models are estimated using fixed effects (FE) and random effects (RE) estimation methods. The fixed effects allow the industry effects and inputs to be correlated while the random effects model assumes that these are not correlated. The fixed effects model is consistent and unbiased regardless of the correlated effects, but the random effects are valid and efficient. In this case since the industry groups are made up of the population of industries, fixed effects are a better choice. For a comparison, we estimate the models using both estimation methods.

In the fixed effect model, labor is statistically significant and is a positive factor explaining the variations in manufacturing productivity in Ethiopia. This is expected based on theoretical predictions as more labor employment induce labor productivity. The fixed effects estimation results confirm that energy, capital, and technology positively affect labor productivity, and all are statistically significant at 1 percent level of significance. The input intensity model based on the fixed effects estimation shows that capital intensity and energy intensity are statistically significant factors to explain labor productivity in the Ethiopian manufacturing industries. But, in this case productivity is more elastic to capital intensity than energy intensity. In the random effects model, energy, capital, and technology are positive and statistically significant in explaining the industry groups' labor productivity while the coefficient for labor is negative but based on Equation (6.5c) α is found by adding one on the coefficient which gives us positive coefficient with a value of 0.45. For the intensity model, the random effects estimation approach confirms the significance of energy and capital intensities positively affecting labor productivity. Like the fixed effects model's results, productivity is less elastic to energy intensity than capital intensity. In all the models, the coefficients for trends are positive and significant implying a positive shift in labor productivity because of technological changes in Ethiopian manufacturing industries during the study period.

Table 6-5: Static Panel Estimation Results for Models 2 and 3

	Fixed Effects		Random Effects	
Variables	Model 2 Coef.	Model 3 Coef.	Model 2 Coef.	Model 3 Coef.
Log Labor	-0.5541^{***}	-	-0.5748^{***}	-
	(0.1287)	-	(0.1311)	-
Log Capital	0.3545^{***}	0.3807^{***}	0.4205^{***}	0.4513^{***}
	(0.0420)	(0.0475)	(0.0449)	(0.0562)
Log Energy	0.0405^{**}	0.0335^{***}	0.0474^{***}	0.0487^{***}
	(0.0209)	(0.0113)	(0.0201)	(0.0182)
Time Trend	0.0552^{***}	0.0454^{***}	0.0486^{***}	0.0400^{***}
	(0.0075)	(0.0045)	(0.0065)	(0.0046)
Constant	2.0353^{***}	1.3045^{***}	1.7624^{***}	1.1679^{***}
	(0.5567)	(0.0822)	(0.4978)	(0.1056)
Test	H_0 & H_1	Appropriate Model	Prob of chi2 & chibar2	Decision
Breusch and Pagan LM Test	Ho H1	Pooled OLS Random Effects	0.000	reject H_0

Hausman test	H0	Random Effects	0.000	reject H_0
	H1	Fixed Effects		

Notes: ***, **, and * denote the statistical significance levels at the 1%, 5%, and 10% levels respectively.
*Model 2: Labor productivity as the dependent variable (scale effect)
*Model 3: Labor productivity as the dependent variable (intensity effect)

The models give different results for some of the explanatory variables so we cannot take the results of all the models. Instead we must select a model which explains the data using different tests and base the analysis on the optimal model specifications. To choose between pooled and random effects models we used the Breusch and Pagan LM tests with the null hypothesis that pooled OLS is an appropriate model that explains the data better relative to the random effects model. The Hausman test compares the random effects model with the fixed effects model and the null hypothesis for the Hausman test shows that the random effects model is not appropriate for representing the data relative to the fixed effects model. Accordingly, in both cases the p-value of the chi2 and chibar2 forces us to reject the null hypothesis. Therefore, the fixed effects model is preferred to the pooled OLS model and the fixed effects model is preferred to the random effects model to represent our data. To control for the heteroscedasticity problem standard errors reported in all the models are robust standard errors.

Table 6 6 gives the dynamic panel model's estimation results of both difference GMM and system GMM. Unlike the static panel models these models include lag of the dependent variable as an explanatory variable in addition to the other variables. In the dynamic models, problems of heteroscedasticity and autocorrelation are considered. In both the scale effects (Model 2) and the inputs intensity models (Model 3), lagged labor productivity is found to be significant and positive in explaining changes in the manufacturing industry's labor productivity in Ethiopia. This shows that the previous year's productivity increases current productivity which in our case is labor productivity. An increase in employment for the industry groups has a positive and significant effect which is attributed to the increasing return to scale and the labor-intensive nature of manufacturing industries in both the cases. In both the difference GMM and system GMM model's energy induces labor productivity. However, in the inputs intensity model (Model 3) the elasticity productivity for energy intensity is higher than capital intensity while the opposite holds for the system GMM model. Capital is positive and significant in all the models for increasing labor productivity. The coefficient for time trend has a positive sign in all the models indicating technological progress with an expected positive effect on productivity in the industries (see Table 6.6).

Table 6-6: Dynamic Panel Estimation Results for Models 2 and 3

	Difference GMM		System GMM	
Variables	Model 2	Model 3	Model 2	Model 3
	Coef.	Coef.	Coef.	Coef.
Productivity_L1	0.1443 (0.1286)	0.1210 (0.1667)	0.1342** (0.0592)	0.0990 (0.1004)

Log Labor	-0.6557***	-	-0.5997***	-
	(0.1155)	-	(0.0549)	-
Log Capital	0.5438***	0.0007***	0.5276***	0.5391***
	(0.0516)	(0.0002)	(0.0442)	(0.0373)
Log Energy	0.0393***	0.0221	0.0357***	0.0311***
	(0.0188)	(0.0153)	(0.0098)	(0.0071)
Time trend	0.0263***	0.0451***	0.0255***	0.0251***
	(0.0091)	(0.0157)	(0.0039)	(0.0086)
Constant	1.1946***	1.6935***	1.0919***	0.8973***
	(0.4445)	(0.3551)	(0.2333)	(0.2006)
AR(2)			0.499	0.520
Test for autocorrelation			0.1958	0.1287
Number of instruments			5	4
Number of groups			15	15

Notes: ***, **, and * denote the statistical significance levels at 1%, 5%, and 10% levels respectively.

*Model 2: Labor productivity as the dependent variable (scale effect)

*Model 3: Labor productivity as the dependent variable (input intensity effect)

Table 6.7 discusses the result for the system GMM dynamic estimator including dummies to trend. Results indicate that in both model's energy in magnitude and energy intensity is statistically significant and positive factor to increase labor productivity in the manufacturing industry groups coinciding with (Ejaz et al., 2016; Toman and Cabraal et al., 2005; Jemelkova, 2003). Besides, capital in magnitude and capital intensity are positive factors for labor productivity. In both models, time dummies are positive throughout. The results show that there is no cyclical effect rather through time labor productivity increases in both cases which this can be attributed to technical change which increases labor productivity.

Table 6-7: System GMM Dynamic Panel with Time Dummies for Models 2 and 3

	System GMM Dynamic Panel (With Time Dummies)			
	Scale Effect Model (Model 2)		Intensity Effect Model (Model 3)	
	Coff.	Std.Err	Coff.	Std.Err
Productivity_L1	0.1653*	(0.0877)	0.1660*	(0.0874)
Log Labor	-0.6872***	(0.0607)	-	-
Log Capital	0.6784***	(0.0545)	0.7145***	(0.0481)
Log Energy	0.0954***	(0.0171)	0.0947***	(0.0108)
D.trend(2)	0.7977***	(0.1921)	0.0709	(0.0805)
D.trend(3)	0.8422***	(0.1929)	0.1068**	(0.0805)
D.trend(4)	0.8978***	(0.1933)	0.1632	(0.0805)
D.trend(5)	0.8448***	(0.1982)	0.1036	(0.0807)
D.trend(6)	0.8115***	(0.2085)	0.0744	(0.0817)
D.trend(7)	0.9268***	(0.2058)	0.1885**	(0.0814)
D.trend(8)	0.9867***	(0.2121)	0.2669***	(0.0832)

D.trend(9)	1.0325^{***}	(0.2178)	0.2701^{***}	(0.0835)
D.trend(10)	1.0505^{***}	(0.2191)	0.2948^{***}	(0.0832)
D.trend(11)	0.9460^{***}	(0.2271)	0.1892^{**}	(0.0858)
D.trend(12)	0.9808^{***}	(0.2277)	0.2142^{**}	(0.0857)
AR(2)	0.853		0.779	
Test for Autocorrelation	0.1200		0.1287	
Number of Instruments	15[56]		14	
Number of groups	15		15	

Notes: ***, **, and * denote the statistical significance levels at 1%, 5%, and 10% levels respectively.
*Model 2: Labor productivity as the dependent variable (scale effect)
*Model 3: Labor productivity as the dependent variable (input intensity effect)

One major objective of this study was checking if an empirical relationship between energy and labor productivity in Ethiopian industries exists along with investigating whether it positively affects productivity or limits it. The results of all the models confirm that energy related parameter is significant and positive showing that an increase in energy consumption enhances labor productivity in Ethiopian manufacturing industrial groups. This result coincides with related empirical studies of (Alaali et al., 2015; Fallahi et al., 2010; Soytas and Sari, 2003). But, in our case the empirical validation is at industry level not at national level which this is one contribution of this study differentiating it from others. In the case of labor input, it is significant and positive in the scale effect models (Model 2). This means, an increase in employment of labor will increase labor productivity which is straight forward due to increasing return and the labor-intensive nature of the industries. Finally, the diagnostic tests for serial correlation and heteroscedasticity are reported. The AR(2) test validates the model free from the serial correlation problem. The number of instruments used are less than the groups in both the dynamic panel estimation approaches.

6.6.Conclusion and Policy Implications

This study investigated the effect of energy on manufacturing labor's productivity in Ethiopia using a panel data of manufacturing industry groups. Fifteen industries were included in the study covering 12 years of data from 2005 till 2016. The number of industry groups and the period was determined by data availability. The data was obtained from the Central Statistical Authority (CSA) in Ethiopia. We used both descriptive and econometric approaches for examining the empirical relationships among the variables of interest conditional on some other variables and characteristics. This study had two specific objectives: examining the existence of an empirical relationship between energy and labor productivity in manufacturing industries and estimating the elasticity effect of energy on labor productivity.

[56] Instruments in the second model is not equal with the third one as in the intensity model labor is omitted from the estimation procedure.

Three models were estimated. The first model is a conventional production function with labor, capital, and energy as the explanatory variables along with a time trend to proxy for capturing technological changes. The second model measures the scale effect of energy with control variables labor, capital, and technology. The third model measures the intensity effect of energy and capital on labor productivity in Ethiopian manufacturing industries. Accordingly, static and dynamic panel data models were estimated; pooled OLS, fixed effect, and random effect static panel estimators along with difference and system GMM dynamic panel models.

The data for industrial groups showed that the overall trend for the production was steady over the study period except for the food and beverage industry (code 1). On average, the energy use trend increased in the food and beverage industry (code 1) as well as the textile industry (code 3) among others. The share of production across the 15 industry groups was dominated by the food and beverage industry (code 1) followed by the non-metallic mineral industry (code 10). The non-metallic mineral industry was found to be more energy intensive than the others.

In the first model, the manufacturing production function was estimated with labor, capital, and energy as the inputs in the production process. Time trend was included to capture technological change. In this model energy, capital, and labor were statically significant and positive in augmenting manufacturing production in Ethiopia which is similar with other empirical results by (Alaali et al. ,2015; Fallahi et al., 2010; Soytas and Sari, 2003). Technology was also significant and a positive factor for industrial growth in Ethiopia. In this model, the sample average returns to scale of production was 1.07 implying increasing return to scale of the manufacturing industries. Labor and capital were statistically significant in all the models at the 1 percent level of significance.

Across the models some variables had different significance levels which led us to selecting an appropriate model that fit the data best. Both static and dynamic model estimation methods were considered, and we got different coefficient results. For its limitations in considering endogeneity, omitted variable bias, autocorrelation, and a heteroscedasticity problem the dynamic panel model estimator was selected over the static panel estimator. The system GMM estimator was chosen over the difference GMM model based on the diagnostic tests and to overcome the limitations of missing observations in the difference GMM model.

In all models, increase in employment induces labor productivity due to increasing return to scale and labor-intensive nature of the industries. Yet, energy positively explains labor productivity in manufacturing industries in Ethiopia. This means an increase in the use of energy will enhance the productivity of labor in the industry groups. Capital intensity use will boost labor productivity which is consistent with theoretical predictions. In addition, a system GMM model is estimated including time dummies for the scale effect and input intensity models respectively. In both cases, labor productivity increases through time signifying the positive effect of technical change on manufacturing labor productivity in Ethiopia. Across the different approaches used, the role of energy use and energy intensity are consistent being significant and positive factor explaining labor productivity change in Ethiopian manufacturing industries.

This study showed that energy induces labor productivity in the manufacturing industry groups in Ethiopia showing that an efficient use of energy increases industrial growth. It also empirically identified labor and capital as essential determinant factors of productivity in the manufacturing industries in Ethiopia complemented by technological change effects. This indicates a need to organize resources in a way that they can boost the growth of the industries. Energy and capital should also be efficiently used as the results show that productivity is elastic to a change in energy and capital input intensities in the manufacturing industries in Ethiopia. Yet, the positive role of energy on productivity is empirically validated in Ethiopia in the case of manufacturing industries.

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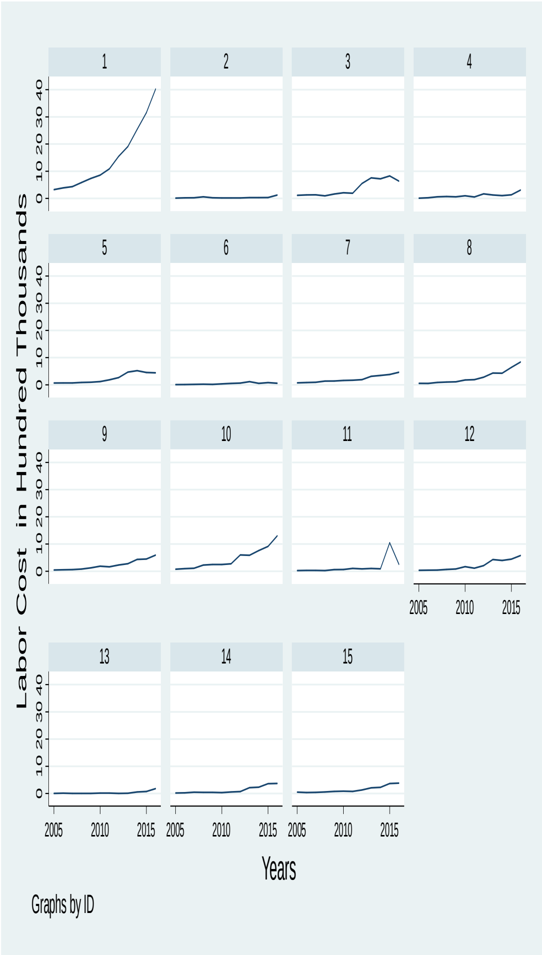
Appendix A3



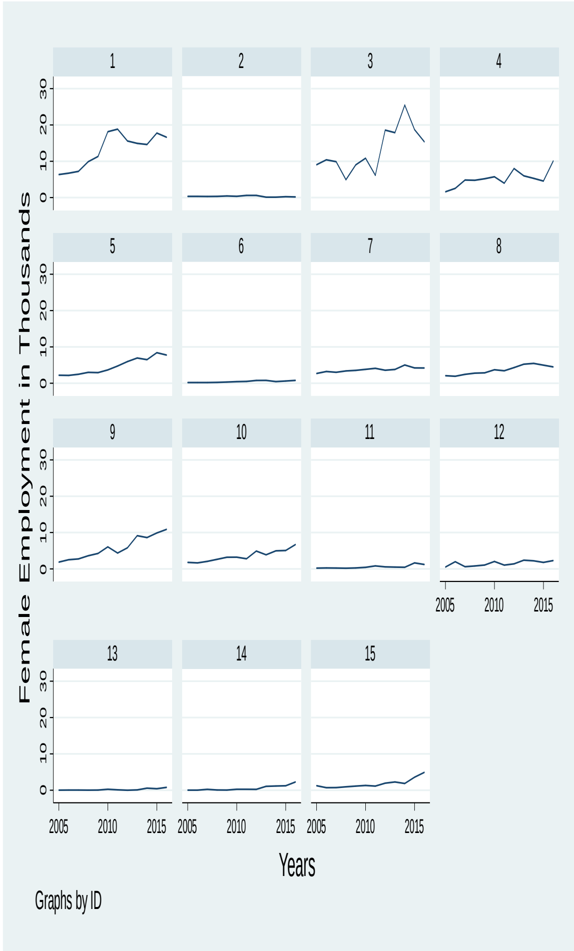


Figure 6-7[57]: Labor cost trend by industrial groups Figure 6-8[58]: Female employment trend by industrial group

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[57] Figures 6.7 the trends of labor cost across the 15 industrial groups for the study period. Labor costs in the food and beverage industry show an increasing trend through time relative to other industries as this is a labor-intensive manufacturing industry. The cost of labor in other industries, on average, shows steady growth.

[58] Figures 6.8 give the trends for female participation across female participation on average, has an increasing trend in the food and beverage industry (code 1), textile industry (code 3), and the rubber and plastic industry (code 9). In the remaining industries the participationrate is steady.

Appendix A4

VEC Granger Causality/Block Exogeneity Wald Tests
Date: 06/28/20 Time: 13:33
Sample: 1961 2014
Included observations: 51

Dependent variable: D(GDP)

Excluded	Chi-sq	df	Prob.
D(MVA)	6.917950	2	0.0315
All	6.917950	2	0.0315

Dependent variable: D(MVA)

Excluded	Chi-sq	df	Prob.
D(GDP)	7.407847	2	0.0246
All	7.407847	2	0.0246

VEC Granger Causality/Block Exogeneity Wald Tests
Date: 06/28/20 Time: 13:41
Sample: 1961 2014
Included observations: 51

Dependent variable: D(NMVA)

Excluded	Chi-sq	df	Prob.
D(MVA)	8.876714	2	0.0118
All	8.876714	2	0.0118

Dependent variable: D(MVA)

Excluded	Chi-sq	df	Prob.
D(NMVA)	4.080840	2	0.1300
All	4.080840	2	0.1300