ST. MARY’S UNIVERSITY
SCHOOL OF GRADUATE STUDIES
INSTITUTE OF AGRICULTURE AND DEVELOPMENT STUDIES

THE EFFECT OF MANUFACTURING OUTPUT ON ECONOMIC GROWTH IN ETHIOPIA: A VECM TIME SERIES ANALYSIS (1983-2021)

ENDAWEK ABITE DEGEFU

ADDIS ABABA
JANUARY 2024

THE EFFECT OF MANUFACTURING OUTPUT ON ECONOMIC GROWTH IN ETHIOPIA: A VECM TIME SERIES ANALYSIS (1983-2021)

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A THESIS SUBMITTED TO ST. MARY'S UNIVERSITY FOR PARTIAL FULFILLMENT OF MASTERS OF ART DEGREE IN DEVELOPMENT ECONOMICS

ADVISOR: SISAY DEBEBE (PhD)

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DECLARATION

I, the signatories, declare that this study entitled "**The Effect of Manufacturing Output on Economic Growth In Ethiopia: A VECM Time Series Analysis (1983-2021)"** is my own work. I have undertaken the research work independently with the guidance and support of the research advisor. This study has not been submitted for any degree or diploma program in this or any other institutions and all sources of materials used for the thesis have been duly acknowledged.

Declared by

Name: Endaweke Abite

Signature:

Date: January, 2024

Place: Addis Ababa, Ethiopia

ENDORSEMENT

This is to certify that Endaweke Abite has done the study on the topic "**The Effect of Manufacturing Output on Economic Growth In Ethiopia: A VECM Time Series Analysis (1983-2021)".** This study is authentic and has not been done before by any other researcher.

Advisor: Sisay Debebe (PhD)

Signature:___________________________

Date: _________________________

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BY ENDAWEK ABITE

APPROVED BY BOARD OF EXAMINERS

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INTERNAL EXAMINER	SIGNATURE

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LIST OF ACRONYMS (ABBREVIATIONS)

μ_t	Error term at time t
ADF	Augmented Dickey Fuller
ADLI	Agricultural development led industrialization
AIC	Akaike information criterion
GDP	Growth Domestic Product
GTP- I	The Growth and Transformation Plan I
GTP-II	Second Growth and Transformation plan
HQ	Hannan-Quinn criterion
$lgdp_t$	The logarithm function of real growth domestic product (Real GDP) at time t
LIK	Log-Likelihood
$lmva_t$	The logarithm function of manufacturing value added/ output at time t
$lnmva_t$	The logarithm function of the non-manufacturing value added at time t
$lsva_t$	The logarithm function of the service sector value added at time t
MVA	Manufacturing value added
RMS	Root Mean Square Error
SBIC	Schwartcz information criterion
SVA	Service value added
VECM	Vector Error Correction Model

ABSTRACT

Ethiopia's manufacturing sector, comprising only 4.6% of GDP in 2021, faces significant developmental hurdles that hinder its potential as an engine of economic growth. Comparative analyses with neighboring and regional economies underscore Ethiopia's lag in industrial development. For example, Kenya and Tanzania demonstrate higher manufacturing contributions to GDP, highlighting Ethiopia's unrealized potential in the sector. This disparity necessitates strategic interventions to enhance manufacturing competitiveness and economic impact.

While existing literature underscores the transformative role of manufacturing value added (MVA) on economic growth, specific studies focusing on Ethiopia remain scarce. This study addresses these gaps by investigating the dynamics of manufacturing output on Ethiopian economic growth from 1983 to 2021. Utilizing the Vector Error Correction Model (VECM), our analysis reveals a significant and negative long-run equilibrium relationship between MVA and economic growth. Specifically, a one percent increase in MVA correlates with a 0.37 percent decrease in economic growth, highlighting challenges in translating manufacturing growth into broader economic expansion.

Short-run dynamics demonstrate a unidirectional causality from manufacturing value added to GDP, indicating potential immediate economic benefits from targeted sectoral interventions. Moreover, bidirectional short-run causality between manufacturing and service value added underscores complex economic interdependencies within Ethiopia.

These findings challenge conventional beliefs about manufacturing as the primary driver of economic growth in Ethiopia and underscore the need for nuanced policy approaches. Recommendations include short-term interventions to enhance manufacturing productivity and competitiveness, alongside long-term structural adjustments in industrial policies to promote sustainable economic growth and resilience.

Keywords: *Ethiopia, manufacturing output, economic growth, GDP, VECM, long-run relationship, short-run dynamics, policy recommendations.*

CHAPTER ONE

1. INTRODUCTION

This chapter will introduce the background of the study, statement of the problem, research Hypothesis, objectives of the study, limitations and scope of the study and the organization of the study in brief.

1.1. Background of the Study

The manufacturing sector plays a pivotal role in economic development by fostering competitive economic performance through income generation, employment creation, facilitation of international trade, and efficient resource utilization. This sector is widely recognized as a primary driver of economic growth across nations, with its impact varying significantly depending on the country's stage of industrialization and development (UNIDO, 2020).

Industrialization marks a critical phase in a nation's economic trajectory, characterized by the transition from agrarian-based economies to manufacturing-driven growth models. In developed economies, industrial growth signifies advancements in productivity, technological integration, efficient production processes, and environmental sustainability practices. These advancements contribute not only to GDP growth but also to overall societal welfare and quality of life (UNIDO, 2020).

Conversely, for developing economies such as Ethiopia, industrialization represents a strategic shift away from traditional agricultural practices towards modern manufacturing industries fueled by innovation and technological adoption. This transition is instrumental in diversifying the economic base, enhancing productivity, and integrating into global value chains, thereby accelerating economic growth and reducing poverty (UNIDO, 2020).

The manufacturing sector serves as a cornerstone of sustainable economic growth due to several inherent advantages. Studies by Szirmai et al. (2013) underscore the sector's pivotal role through various arguments: higher productivity compared to other sectors, positive correlation with per capita income levels, economies of scale, technological progress, and opportunities for capital accumulation. These factors collectively contribute to the sector's capability to propel overall economic expansion and development.

Moreover, the manufacturing sector exhibits unique characteristics that amplify its impact on economic growth. It is often the fastest-growing sector within economies, surpassing agriculture and services in terms of productivity and growth rates. The sector's ability to specialize and its extensive linkages with other sectors further enhance its economic multiplier effects. Additionally, manufacturing products being tradable offer opportunities to tap into international markets, thereby stimulating demand and enhancing economic resilience (Tunali & Boru, 2019).

Theoretical frameworks such as Nicholas Kaldor's growth model, known as Kaldor's engine of growth hypothesis, provide robust support for the pivotal role of the manufacturing sector in economic development. Kaldor's first law posits a strong positive correlation between manufacturing output growth and overall GDP growth, indicating that as manufacturing output expands, the economy experiences accelerated growth rates. The Kaldor–Verdoorn law further strengthens this relationship by highlighting the deterministic link between manufacturing productivity growth and output expansion, underscoring the sector's catalytic effect on broader economic development (Marconi et al., 2016).

Historical Context: Industrial Development in Ethiopia

Ethiopia's industrialization efforts have evolved significantly over the decades, shaped by historical developments and policy interventions. During the Derg regime (1974-1991), industrial development was a cornerstone of economic policy aimed at reducing dependence on agriculture, achieving self-sufficiency in various sectors, and promoting import substitution through labor-intensive industrialization (Figure 1.1).

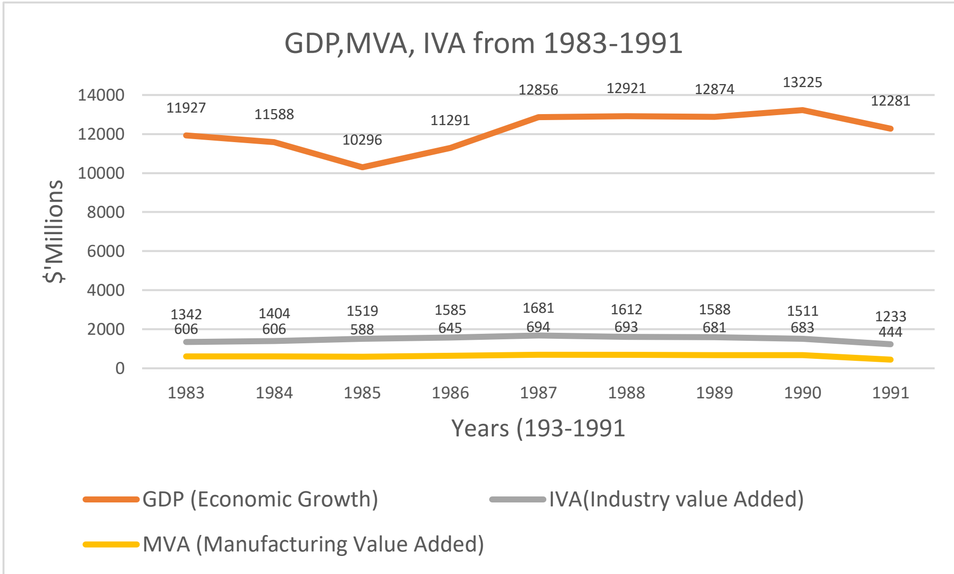

Figure 1.1 GDP, MVA, IVA from 1983 - 1991

However, the industrial sector faced challenges towards the end of the Derg era, leading to economic downturns and declines in manufacturing value added (MVA). Post-Derg, the Ethiopian government introduced the Agricultural Development Led Industrialization (ADLI) strategy in 1993, focusing on strengthening linkages between agriculture and industry to harness the country's human and natural resources effectively.

Subsequent development plans, including the Sustainable Development and Poverty Reduction Program (SDPRP), Plan for Accelerated and Sustained Development to End Poverty (PASDEP), and Growth and Transformation Plans (GTP I & II), continued to prioritize industrial development as a key driver of economic transformation. These efforts aimed to enhance productivity, improve production quality, and stimulate competition within the economy, albeit with varying degrees of success in achieving sustained manufacturing sector growth (Figure 1.2).

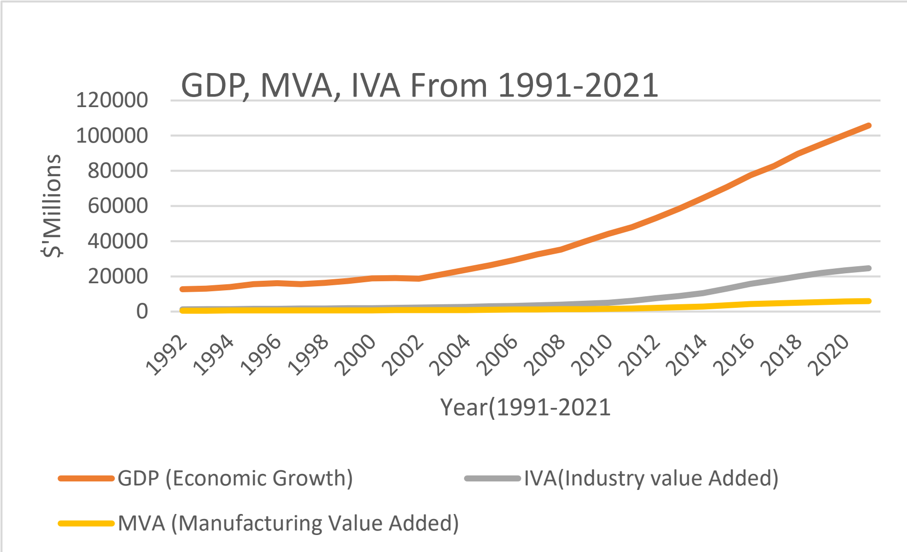

Figure 1.2 Graph showing GDP MVA IVA from 1992-2021 (constant 2015)

Economic Performance Indicators

Analyzing economic performance indicators provides insights into Ethiopia's industrialization progress compared to sub-Saharan African and neighboring countries. Over the years, Ethiopia's GDP has shown positive growth trends, increasing from $13.46 billion in 1991 to $111.27 billion in 2021 (Figure 1.2).

Table 1-1 MVA(%GDP) for Ethiopia sub-Saharan Africa, Kenya, South Africa and Nigeria from 1981-2021

Year	**Ethiopia (MVA % of GDP)**	**Kenya (MVA % of GDP)**	**Nigeria (MVA % of GDP)**	**South Africa (MVA % of GDP)**	**Sub-Saharan Africa (MVA % of GDP)**
1981	4	11	20	25	18
1991	3	10	19	23	16
2001	6	10	14	19	14
2011	4	12	7	13	10
2021	5	7	15	12	12

From Table 1.1: Ethiopia's manufacturing value added (MVA) as a percentage of GDP has shown variability over the years but generally remains below the Sub-Saharan Africa average. In 1981 and 1991, Ethiopia's MVA % of GDP was lower than the Sub-Saharan Africa average, indicating slower industrial development compared to the region. Kenya has maintained a relatively stable MVA % of GDP, slightly higher than Ethiopia's throughout the years, suggesting a comparatively stronger industrial base and consistent industrial policy support. Nigeria has consistently shown a higher MVA % of GDP compared to Ethiopia, indicating a more established industrial sector. South Africa has consistently maintained a significant lead over Ethiopia and other Sub-Saharan African countries, highlighting its advanced industrialization and diversified manufacturing base.

Ethiopia's MVA % of GDP peaked at 6% in 2001, showing improvement, but it has since fluctuated around 4-5%, reflecting challenges in sustaining industrial growth compared to regional peers. Generally, the comparative analysis reveals Ethiopia's lower and fluctuating manufacturing value added as a percentage of GDP, underscoring challenges and opportunities for industrial growth compared to regional counterparts.

Therefore, the aim of this study is to address these research gaps by examining the effect of manufacturing output on economic growth in Ethiopia, exploring both short-run dynamics and long-term equilibrium relationships. The study will provide empirical insights to inform policy decisions aimed at fostering sustainable industrial development and economic transformation in Ethiopia.

1.2. Statement of the Problem

While manufacturing industries have historically burgeoned as engines of growth in developed and emerging economies, Ethiopia's trajectory presents a distinct narrative marked by significant developmental challenges. The manufacturing sector in Ethiopia grapples with a developmental lag, evident in its modest contribution to GDP and annual GDP growth rates. In 2021, manufacturing value added (MVA) accounted for only 4.6% of Ethiopia's GDP, which is notably lower than the Sub-Saharan Africa average (World Bank, 2021). This disparity underscores an unrealized potential compared to global and regional counterparts.

Comparative analysis with neighboring countries such as Kenya and Tanzania further reveal stark differences in manufacturing sector contributions. For instance, Kenya's manufacturing sector contributed 9.2% to GDP in the same year, while Tanzania recorded a 6.8% contribution (World Bank, 2021). Similarly, leading African economies such as South Africa and Nigeria exhibit more robust manufacturing sectors, contributing 13.9% and 8.5% to their respective GDPs (World Bank, 2021). These comparisons underscore Ethiopia's significant lag in industrial development and emphasize the urgent need for strategic interventions to enhance its manufacturing competitiveness and economic impact.

Numerous studies from various economic perspectives underscore the transformative effect of manufacturing value added on economic growth. Teshome Adugna's (2014) Kaldorian approach emphasizes the sector's pivotal role in driving economic development. Assefa, Atsede & Bhatt, Kumar (2017) highlight a direct correlation between manufacturing output growth and overall economic advancement, aligning with Kaldor's first law of economic growth. However, comprehensive studies specifically addressing the dynamics of manufacturing output on Ethiopian economic growth remain limited.

The existing literature inadequately explores the short-run causality and long-run equilibrium dynamics of Ethiopia's manufacturing sector, leaving critical voids in understanding its overall impact on economic growth. Furthermore, the conundrum of whether its long-run impact is positive or negative remains unexplored, thereby challenging the validity of the engine of growth hypothesis. Therefore, this study aims to bridge these gaps, capturing recent dynamics and enriching the knowledge repository.

In essence, this research endeavor is driven by the imperative to uncover the latent dynamics between manufacturing output and economic growth in Ethiopia. The investigation will delve into the sector's short-run causality, long-run equilibrium relationships, and policy implications. Through rigorous analysis, this study seeks to deepen understanding of Ethiopia's economic landscape and provide actionable insights to optimize the manufacturing sector's contribution to sustainable economic development.

1.3. Objective of the study

The main objective of the study is to analyze the effect of manufacturing output on the economic growth of Ethiopia.

Specific Objectives:

- Performance Analysis of the Industry Sector:
    - To conduct an in-depth analysis of the industrial sector's overall performance, with a focused examination of the manufacturing sub-sector within the Ethiopian economic landscape.
- Short-Run Relationship Analysis:
    - To examine the dynamics of the short-run relationship between manufacturing output/manufacturing value added (MVA) and the economic growth of Ethiopia.
- Long-Run Relationship Analysis:
    - To explore the long-run relationship between manufacturing output/ manufacturing value added (MVA) and the economic growth (GDP) of Ethiopia.

1.4. Research hypothesis

This study sets forth hypotheses that encapsulate key assertions to be rigorously tested, serving as crucial benchmarks for the investigation. The hypotheses are structured to unravel the intricate dynamics between manufacturing value added (MVA) and economic growth (GDP) in the Ethiopian context:

Ho_1: Absence of Short-Run Causality

Null Hypothesis: There is no significant short-run causality running from manufacturing value added (MVA) to economic growth (GDP) in Ethiopia.

Rationalization: This hypothesis challenges the existence of a short-term causal link between MVA and GDP, positing that changes in manufacturing value added do not exert immediate influence on the overall economic growth of Ethiopia.

Ho_2: Lack of Long-Run Equilibrium Relationship

Null Hypothesis: There is no significant long-run equilibrium relationship between manufacturing value added (MVA) and economic growth (GDP) in Ethiopia.

Rationalization: This hypothesis questions the presence of a sustained, balanced relationship over the long term between MVA and GDP. It posits that manufacturing value added does not contribute significantly to the enduring equilibrium of Ethiopia's economic growth.

1.5. Significance of the study

The significance of this study extends beyond its immediate focus, promising multifaceted contributions to the realms of academia, policymaking, and industry stakeholders. Firstly, it stands to enrich the existing body of knowledge concerning the intricate dynamics between the manufacturing industry and Ethiopia's economic growth. By shedding light on these relationships, the study provides a nuanced understanding that can inform future research endeavors and theoretical frameworks.

Moreover, this research serves as a critical resource for policymakers, offering insights into the challenges and opportunities that define the landscape of manufacturing sector development in Ethiopia. By pinpointing policy gaps, the study equips decision-makers with valuable information to formulate strategic interventions that foster sustainable growth. This knowledge is instrumental for the government, industrial stakeholders, and scholars alike, fostering informed decision-making and contributing to the formulation of effective policies.

1.6. Limitation and scope of the study

This research relied on thirty-nine years of secondary data meticulously sourced from reputable institutions such as the World Bank, National Bank, Ministry of Finance, and Ministry of Planning and Economic Development. The comprehensive study period, spanning from 1983 to 2021, encompassed crucial development indicators of the Ethiopian economy. Employing a quantitative approach facilitated data analysis through Stata-11, focusing on key variables including manufacturing value added, service value added, and real GDP. Despite the researcher's enthusiasm for a more extensive investigation, certain limitations influenced the study's depth and precision. Factors such as the reliability and validity of the collected data, the selection of a specific set of variables, time constraints, and considerations for maintaining clarity and precision in the face of the dynamic nature of macroeconomics-imposed constraints on the scope and thoroughness of the study. The acknowledgement of these limitations is essential for a nuanced understanding of the study's findings and implications.

1.7. Organization of the study

The structure of this paper unfolds across five comprehensive chapters, each contributing to a holistic understanding of the research. Chapter One sets the stage with an insightful introduction, providing a foundation for the study. Moving forward, Chapter Two delves into a thorough literature review, offering a synthesis of existing knowledge and theoretical frameworks. The research methodology, intricate in its design, is meticulously unveiled in Chapter Three, providing a transparent lens into the study's investigative approach. Chapter Four intricately unveils the research's findings and engages in thoughtful discussions, presenting a comprehensive analysis of the data. The culmination of this intellectual journey unfolds in Chapter Five, where the study concludes with a synthesis of insights and thoughtful recommendations, contributing to the broader discourse within the field. This meticulous organization ensures a seamless flow of information, guiding the reader through the intricacies of the research process and its substantive outcomes.

CHAPTER TWO

2. Literature Review

This chapter delves into the foundational aspects of economic growth and manufacturing, structured into three main sections. Firstly, it defines key terms such as economic growth, GDP, and manufacturing. Secondly, it explores the rich theoretical landscape related to economic growth, encompassing Classical and Neoclassical Growth Theories, Nicholas Kaldor's growth theories, Endogenous Growth Theory, New Growth Theory, Structuralist Growth Theory, and pivotal contributions by economists like Robert Solow and proponents of the Harrod-Domar model. Emphasizing the relevance of these theories to the study, the chapter discusses how they provide a robust framework for understanding the dynamics of economic development. Lastly, the empirical literature on manufacturing and economic growth is critically analyzed, culminating in a gap analysis that identifies avenues for further research.

2.1. Definition of terms and concepts

Economic Growth and GDP

Economic growth embodies the progressive enhancement in the production of goods and services within an entity, such as a country. This upswing generally signifies an augmented standard of living, with individuals and businesses experiencing increased earnings and expenditures, contributing to an overall sense of prosperity. Measuring economic growth accurately poses a challenge, and conventionally, economists have leaned on Gross Domestic Product (GDP) as a pivotal yardstick for gauging an economy's expansion or contraction.

GDP, the monetary value of goods and services produced within a specific timeframe, has earned its status as a premier indicator of a country's economic health. It encompasses the entire economic output, spanning goods and services traded domestically and internationally (McKinsey & Company, 2022). The distinction between nominal and real GDP is crucial. While nominal GDP disregards the impact of inflation, real GDP factors in inflation, rendering it a more precise measure of economic activity.

Influence of Robert Solow

Renowned neoclassical economist Robert Solow identified labor, capital, and technology as paramount factors shaping economic growth. This conceptualization laid the groundwork for understanding the intricate dynamics propelling economic advancement. Subsequent developments by Keynesians expanded this framework by recognizing government expenditure as a pivotal driver, further enriching the comprehension of the multifaceted forces steering economic growth. The integration of these factors provides a holistic view, acknowledging the interplay between labor, capital, technology, and governmental influence in fostering sustained economic development.

Manufacturing Value added (MVA)

Manufacturing, broadly characterized as the physical or chemical transformation of materials into new products, transcends specific processes, locations, or sale methods (UNSTAT, 1991). The United Nations Industrial Development Organization (UNIDO) defines the value added of manufacturing industries as the net output derived from the disparity between gross output and intermediate consumption. Notably, this calculation excludes the deduction of fixed assets' consumption, represented by depreciation in economic accounting concepts.

The aggregate value added of the entire manufacturing sector is the summation of the value added from all manufacturing activities. Manufacturing Value Added (MVA) serves as a comprehensive metric, capturing the exclusive and exhaustive contribution of manufacturing to Gross Domestic Product (GDP). Recognizing the diverse industrial development levels across countries, UNIDO frequently employs MVA as a benchmark.

The pivotal role of manufacturing in economic development is underscored by experiences from various nations. Advanced economies and emerging powerhouses such as India, China, North Korea, Singapore, and Malaysia exemplify a positive correlation between economic growth and the expansion of the manufacturing sector (Banjoko, Iwuji, and Bagshaw, 2012). The manifestation of MVA as a driving force behind GDP underscores the significance of manufacturing in fostering economic vibrancy and development on a global scale.

2.2. Theoretical literature

Role of Manufacturing in Economic Growth

Manufacturing occupies a central role in theories of economic growth, often recognized as a primary catalyst for development. Mohamed (2021) asserts that industrialization correlates positively with per capita income levels in developing countries, positioning manufacturing as a pivotal driver of economic advancement. This sector not only boasts high productivity rates but also serves as a locus for technological innovation, facilitating integration with service sectors and offering avenues for global market penetration. Moreover, manufacturing enables concentrated capital accumulation compared to the dispersed capital in agricultural sectors, thereby playing a crucial role in fostering sustainable growth and development.

Naudé, Szirmai, and Haraguchi (2016) provide a robust framework highlighting manufacturing's uniqueness in economic development. They identify several critical factors: a documented empirical link between manufacturing growth and GDP expansion at lower income levels, higher value added per worker compared to agriculture, opportunities for significant capital accumulation, advantages in economies of scale relative to other sectors, and its pivotal role as a driver of technological progress. These insights underscore manufacturing's multifaceted contributions to economic growth through enhanced productivity, technological diffusion, and international competitiveness.

Economic Growth Theories

Classical Growth Theory

Classical economists such as Adam Smith and David Ricardo laid foundational theories of economic growth, emphasizing capital accumulation and labor productivity as primary drivers. Their frameworks centered on the notion that sustained economic growth hinges upon investments in physical capital and improvements in labor efficiency through specialization and the division of labor.

Neoclassical Growth Theory

Neoclassical Growth Theory builds upon classical foundations by integrating technological progress and productivity growth into its framework. The Solow Growth Model, developed by Robert Solow, exemplifies this approach by incorporating capital accumulation, labor force expansion, and exogenous technological advancements into an aggregate production function ($Y(t) = F[K(t), L(t), A(t)]$). Solow's model elucidates how advancements in capital and technology lead to sustained economic expansion by boosting productivity and output efficiency (Solow, 1956).

The Harrod-Domar Model, in contrast, underscores the critical role of savings, investments, and capital accumulation in driving economic growth. Proposed by Roy Harrod and Evsey Domar, this model posits that the pace of economic growth hinges on the ratio of savings and investments relative to population growth rates. It underscores the necessity of maintaining a balance between saving rates and capital formation to sustain long-term economic development (Harrod, 1939; Domar, 1946).

Kaldorian Growth Theories

Nicholas Kaldor's seminal contributions to growth theory are encapsulated in Kaldor’s First Law, which posits a positive correlation between manufacturing output growth and overall GDP expansion. This principle underscores manufacturing's pivotal role in economic growth through heightened productivity, technological innovation, and export capabilities. Kaldor's insights are particularly relevant in understanding how industrialization stimulates employment, innovation, and economic diversification, thereby propelling economic expansion in developing economies (Kaldor, 1966).

Endogenous Growth Theory

Endogenous Growth Theory diverges from traditional models by shifting focus from exogenous factors like technological progress to internal dynamics such as human capital accumulation, innovation, and institutional frameworks. Advocated by economists like Paul Romer and Robert Lucas Jr., this theory posits that sustained productivity gains derive from investments in education, skills development, and technological innovations. It underscores the pivotal role of governments and private sectors in fostering innovation and creativity through policies supporting research and development (R&D) and intellectual property rights.

New Growth Theory

Building upon Endogenous Growth Theory, the New Growth Theory emphasizes the centrality of knowledge and innovation as primary drivers of economic growth. It argues that advancements in technology and knowledge creation can lead to increasing returns to scale, amplifying economic productivity and competitiveness. Policies supporting innovation, intellectual property rights, and knowledge dissemination are crucial for nurturing long-term economic growth and enhancing global competitiveness (Romer, 1990).

Structuralist Growth Theory

Rooted in the works of economists like Raúl Prebisch and Hans Singer, Structuralist Growth Theory addresses structural imbalances within economies. It advocates for inclusive and sustainable economic growth through policies that reduce dependency on primary commodities, foster industrialization, and promote regional development. This theory underscores the importance of equitable resource allocation and industrial diversification in achieving balanced economic growth (Prebisch, 1950; Singer, 1950).

Relevance to the Study: Choosing the Framework

In the context of studying the manufacturing sector's effect on economic growth in Ethiopia, Neoclassical Growth Theory and the Solow Growth Model offer foundational frameworks. These theories emphasize the significance of capital accumulation, technological progress, and productivity enhancements in assessing the role of manufacturing investments in driving economic expansion. Kaldor's First Law reinforces the hypothesis that manufacturing sectors, through their capacity for innovation and productivity growth, serve as primary engines of economic growth in developing economies like Ethiopia. Additionally, insights from Endogenous Growth Theory, New Growth Theory, and Structuralist Growth Theory provide a comprehensive perspective on fostering sustainable economic growth through human capital development, innovation, and structural transformation.

2.3. Empirical literature review

Numerous studies have explored the intricate relationship between the manufacturing industry and economic growth, providing varied perspectives and insights across different countries.

Mongale and Tafadzwa (2019) in their studies to investigate the relationship between the manufacturing sector and economic growth to test Kaldor's first growth law in South Africa using data from 1980 to 2016 revealed that manufacturing sector proxied by the manufacturing output has a positive and significant coefficient. The results they obtained are in line with Kaldor's first growth law which states that manufacturing is the engine of economic growth and therefore, the 'engine of growth' hypothesis holds true for South Africa.

Szirmai and Verspagen (2011) delved into Manufacturing and Economic Growth in Developing Countries, utilizing a panel dataset for 88 countries from 1950-2005. In their study panel data set with information about the shares of manufacturing and services in GDP for a sample of 88 countries was employed. They used education and income gaps as a control variable in addition to manufacturing and service. The aim of the analysis was to test the hypothesis that manufacturing acted as an engine of growth, which would suggest that expanding the share of manufacturing in GDP is the key to more rapid growth and economic development. Finally, the researchers concluded that there is a positive effect of manufacturing on growth in developing countries with a highly educated workforce.

In a similar vein, Szirmai and Verspagen (2015) explored the correlation between manufacturing value added (MVA) and GDP for 92 countries across different periods. Their analysis revealed that the manufacturing sector functions as a growth engine for low and some middle-income economies, contingent upon an adequate level of manpower.

SALLAM (2021) investigated the role of the manufacturing sector in stimulating economic growth in the Saudi economy using time-series data spanning from the 1980–2018. The researcher used the cointegration and VECM approaches to examine the short-and long-run relationship causality between variables. The results revealed that a two-way causal relationship exists between the manufacturing sector and economic growth and a unidirectional causal relationship exists, running from the manufacturing sector to the services sector. The study recommends that the determinants of the growth of the Saudi manufacturing sector must be investigated. Moreover, the most productive Saudi manufacturing industries must be identified, and the productivity of other sectors must be increased in a way that contributes to economic plans and policies.

Ogundipe (2022) in his study examined the effects of Nigeria's manufacturing sector on economic growth between 1981 and 2018 and found that *manufacturing sector output and economic growth are positively correlated* in Nigeria. The fact that the manufacturing sector of the Nigerian economy is currently one of the country's main driving forces may be responsible for the considerable and favorable impact of manufacturing production on economic growth.

Teshome Adugna's (2014) Kaldorian approach-based study on Ethiopia between 1980-2009 underscored the pivotal role of the manufacturing sector in the country's structural transformation. The study advocated for strengthened efforts in developing the manufacturing sector to secure future economic growth. The future economic growth in the country rests on how well the country's manufacturing sector performs. Hence the government should strengthen its current effort on development of the manufacturing sector in the country.

Contrastingly, Edward, J. J. & Ngasamiaku, W. M (2022) challenged Kaldor's first law in their examination of Tanzania's economic growth using annual time series data from 1985 to 2017. Their study result confirms that it is economic growth that causes manufacturing growth and not manufacturing growth that drives the economy. Thus, the researchers concluded that the result obtained is against the Kaldor's first law for the case of the Tanzanian economy since there exists a unidirectional causation between manufacturing and economic growth as it runs from economic growth to manufacturing growth. This implies that manufacturing growth is not growing at a pace that can largely impact growth significantly.

Evans (2014) studied the Manufacturing industry's impact on economic growth in Kenya using Kaldorian approach for the period of 1971-2013. From his findings the researchers concluded that manufacturing industrial production in Kenya does not lead to increased economic growth in Kenya. This result agrees with the conclusion made by Thirlwall and Wells (2003) from their studies of 45 African countries from 1980-1996 including Kenya where GDP growth is not associated with rapid expansion of manufacturing sector.

Beyond the African context, Rahardja et al. (2012) assessed the contribution of different economic sectors to economic growth in China and India. Each sector was found to have a strong, positive, and significant linear relationship with economic growth in both countries. However, the contribution of economic sectors to economic growth differs in China and India. Manufacturing sector contributes the highest to China's economic growth while services sector is the highest contributor to India's economic growth.

Ilyani Azer et al. (2016) studied the Contribution of Economic Sectors to Malaysian GDP. They examined the three important economic sectors namely agriculture, manufacturing, and service sectors in terms of GDP per capita for the year 2000 until 2010. Their study concluded that the manufacturing and the services sectors are regarded as two main engines of the Malaysian economic growth due to the significant relationship shown by both sectors. A similar study by

Hussin and Ching (2013) examined the contribution of economic sectors to economic growth in Malaysia and China by using time series data from year 1978 until 2007. The study indicated that agriculture sector, manufacturing sector and service sector had positive relationship with GDP per capita in Malaysia and China. Their results also demonstrated that services sector generated the highest contribution to Malaysia's economic growth while manufacturing sector provided the biggest contribution to China's economic growth.

2.4. Conceptual framework of the study

As discussed in the literature review part of this study, the manufacturing sector has a positive and significant effect on economic growth. This is empirically confirmed by Mohamed A. M. Sallam (2021), Mongale and Tafadzwa (2019), Szirmai and Verspagen (2011), Szirmai and Verspagen (2015), Ogundipe (2022), Ilyani Azer et al. (2016). Contrastingly, Edward, J. J. & Ngasamiaku, W. M (2022), Evans (2014) concluded that manufacturing growth is not impacting economic growth significantly. Though, they were not mentioned the impact of manufacturing on economic growth, Hussin and Ching (2013), Rahardja et al. (2012) concludes that Manufacturing sector contributes the highest to China's economic growth. Whereas Rahardja et al. (2012), Hussin and Ching (2013) suggest that services sector is the highest contributor to India's and Malaysia's economic growth.

Gap Analysis

While existing literature provides valuable insights, there remains a notable gap in understanding the nuanced dynamics between the manufacturing sector and economic growth, especially in the context of Ethiopia. The limited studies on Ethiopia fail to comprehensively explain the short-run causality and long-run equilibrium relationship between manufacturing output and economic growth. Furthermore, the varying results across different countries suggest the need for a more contextualized analysis, considering the unique socio-economic factors influencing the manufacturing sector's impact on economic growth in specific regions. Addressing these gaps will contribute to a more nuanced and tailored understanding of the intricate relationships involved, guiding policy recommendations for sustainable economic development in Ethiopia.

CHAPTER THREE

3. RESEARCH METHODOLOGY

This chapter examines the research design, data source and type, model specification, model estimation procedures and definition of variables, measurements, and hypothesis.

3.1. Research design

Crotty (1998) explained that the choice of research design depends on the objectives of the research to answer the research questions. The main objective of the study is to analyze the impact of manufacturing sector on the economic growth of Ethiopia. Analyzing the impact of the derived research hypothesis to examine the short run dynamics and long run relationship of manufacturing value added with economic growth is an issue of concern that needs to be tested. To achieve this, a quantitative research approach is employed, and explanatory research design is used. Explanatory research design is the best approach to test hypotheses and to identify factors that influence the outcome, Creswell (2013). Explanatory research looks for causes and reasons and provides evidence to support or refute an explanation or prediction. It is conducted to discover and report some relationships among different aspects of the phenomenon under study.

3.2. Data types and sources

The study used time series data covering the period from 1983 to 2021. Annual time series data on Economic Growth proxied by Growth Domestic Product which plays the role of the response variable, Manufacturing output proxied by Manufacturing value added, and Service sector proxied by service value added of the Ethiopian economy was used. The time- period chosen for the study is based on the nature of time series data and its availability for the selected variables on Ethiopian economy. The source of data used in this study was from the world development indicators of the World Bank. Moreover, data from the National bank of Ethiopia and Finance ministry of Ethiopia were used.

3.3. Model specifications

Kaldor's first law states that manufacturing industry and economic growth (GDP) have a positive relationship. This can be better explained in terms of GDP growth being faster if the greater the excess of manufacturing growth relative to GDP growth. That is when the share of industry in GDP is rising. Studies show that this law can be tested using the following model:

$$LogGDP_t = \beta_0 + \beta_1 LogMVA_t + \mu_t \qquad 1$$

Where,

- $LogGDP_t$ is the log of real GDP,
- $LogMVA_t$ is the log of manufacturing output.
- μ_t is an error term.
- β_1 is a parameter showing the extent to which manufacturing impacts economic growth and it should be statistically significant and positive in order to validate Kaldor's first law.

On the other hand, the total value added of gross domestic product (GDP) for a country is made up of agriculture, industry, and services excluding financial *intermediary services* indirectly measured (world Bank). Which implies that GDP is a function of industry, agriculture and service sectors. Hence: -

GDP = Function of (Agriculture, Services, Industry) *2*

Where, Manufacturing value added is a subset of industry.

Using equations 1 and 2, the study employed the following model by including the Service sector value added (SVA) in the system. These SVA is added into the system to avoid the problem of spurious feedback relations arising from omitted variables.

$$LogGDP_t = \beta_0 + \beta_1 LogMVA_t + \beta_2 LogSVA_t + \mu_t \qquad 3$$

Where,

- $LogGDP_t$ is the logarithm function of real growth domestic product (Real GDP) at time t,
- $LogMVA_t$ is the logarithm function of manufacturing value added/ output at time t,
- $LogSVA_t$ is the logarithm function of the service sector value added at time t,
- μ_t is an error term time t.
- Logarithms have been used to go away with non-linearities, to fix non-normality and to make possible interpretation of the coefficients as elasticities.

- β_0 is constant and β_1, β_2 are coefficients that explains the extent to which manufacturing, and service sectors impacts the economic growth respectively.

3.4. Model and Estimation procedures

To investigate the relationship between the manufacturing output and economic growth in Ethiopia, the study employed Vector error correction model (VECM) technique. Prior to employing the VECM analysis, the variables are taken through stationarity testing to determine the order of integration using Augmented Dickey-Fuller unit-root test and Philip-Perron unit-root test by Using Stata11.2. After stationarity testing, the cointegration test conducted using Johanson Tests for Cointegration. The optimum lag order was selected from the results of the lag order criterion and the minimum lag order value is selected. After the unit-root, optimum lag selection and cointegration test, the VECM model is used to analyse the presence of long-run and short-run relationship of the variables. Finally, the diagnostic test is done for autocorrelation, normality, and stability of the model.

Unit root testing

The study utilized the Augmented Dickey Fuller (ADF) and Phillip-Perron tests to perform the presence of unit root test and to examine stationarity at what order of integration. The main purpose of this test is to determine the variables order of integration to establish an econometric model and to draw inferences. The unit root test was performed using trend and constant types of regression options.

Optimum lag length selection

There are several criterions for choosing the optimal lag length in a time series: Akaike information criterion (AIC), Schwartcz information criterion (SBIC), Hannan-Quinn criterion (HQ), Root Mean Square Error (RMS), Mean Absolute Error (MAE), Bias proportion (BP), and Log-Likelihood (LIK). The discrimination function differs from one to another criterion. As a rule of thumb, the optimum lag length is selected with the criterion having the lowest value after running the "*varsoc*" command in Stata. This is because the lower the value, the better the model.

Cointegration analysis

Engle and Granger (1987) developed the concept of cointegration which becomes a more robust tool for modelling and testing time series variables. If the variables are found to be cointegrated, that is there exists a linear, stable, and long-run relationship among variables, such that the disequilibrium errors would tend to fluctuate around zero mean. The existence of Co-integration among variables, Johansen (1988), Johansen and Juselius (1990) are used to confirm the presence of potential long run equilibrium relationship between two variables. Therefore, to analyse the long run relationships and short run dynamics among the variables of interest, the model has been tested for the presence of cointegration. Following the unit root test result of Augmented Dickey-Fuller and Phillips-Perron test, if all the variables are stationary on the same order of difference and multivariate, the Johansen tests for cointegration is preferred. The Johanson test for cointegration results uses two test values to determine the number of cointegration vectors in the system, the Trace statistic value, and the Max statistics values. The presence of cointegration shows that there is a long-term relationship between GDP, manufacturing value added, and service value added.

The existence of cointegration implies that there is some mechanism that drives the variables to their long run equilibrium relationship. Once the variables are cointegrated the vector error correction model was run to model the long run relationship and the short run dynamics.

- The null hypothesis, Ho: there is cointegration and
- The alternative hypothesis H1: there is no cointegration.
- If the trace statistic > the 5% critical value, then reject the null hypothesis.

Vector error correction model (VECM)

It can be understood that cointegration indicates the presence of causality among two time series, but it does not detect the direction of the causal relationship. According to Engle and Granger (1987), the presence of cointegration among the variables shows unidirectional or bi-directional Granger causality among those variables. Further, they demonstrate that the cointegration variables can be specified by an Error Correction Mechanism (ECM) that can be estimated by applying standard methods and diagnostic tests. Following the presence of cointegration among the variables, the vector error correction model (VECM) has employed to determine the long run relationship and the short run dynamics. Engle and Granger (1987) assert that the cointegrating variables can be embodied by VECM to identify the short run and long run causality among the variables. In this system, the cointegrating vector is interpreted as a long run equilibrium relationship although the estimates of the short run dynamics symbolise the process of adjustment towards equilibrium. The two elements of the model are calculated simultaneously, and the model is run through a system of equations, eliminating problems with endogeneity, omitted variables and serial correlation. They further claim that estimated coefficients obtained are unbiased and efficient under such specifications. Thus, this study employs causality test in the VECM scheme to know the short run and long run causality between the variables under study.

The VECM equation can be expressed for LogGD, ,LogMVA and LogSVA as follows:

$$\Delta LogGDP_t = \lambda_0 + \sum_{i=1}^{n} \lambda_{1i}\Delta LogGDP_{t-i} + \sum_{i=1}^{n} \lambda_{2i}\Delta LogMVA_{t-i} + \sum_{i=1}^{n} \lambda_{3i}\Delta LogSVA_{t-i} + \alpha_1 ECT_{t-1} + \varepsilon_{1t} \quad 4$$

$$\Delta LogMVA_t = \gamma^0 + \sum_{i=1}^{n} \gamma^1{}_i \Delta LogGDP_t{}^-{}_i + \sum_{i=1}^{n} \gamma^2{}_i \Delta LogMVA_t{}^-{}_i + \sum_{i=1}^{n} \gamma^3{}_i \Delta LogSVA_t{}^-{}_i + \alpha^2 ECT_t{}^{-1} + \varepsilon^2{}_t \quad 5$$

$$\Delta LogSVA_t = \delta^0 + \sum_{i=1}^{n} \delta^1{}_i \Delta LogGDP_t{}^-{}_i + \sum_{i=1}^{n} \delta^2{}_i \Delta LogMVA_t{}^-{}_i + \sum_{i=1}^{n} \delta^3{}_i \Delta LogSVA_t{}^-{}_i + \alpha^3 ECT_t{}^{-1} + \varepsilon^3{}_t \quad 6$$

$$ECT_{t-1} = \beta_1 lgdp_{t-1} - \beta_2 lmva_{t-1} - \beta_3 lsva_{t-1} - \beta_0 \quad 7$$

Where :

- Δ is the first difference operator, and n is the number of lags,
- λ_0 is the constant term and λ_{1i}, λ_{2i}, λ_{3i} are the short run coefficients of the variables in LogGDP as a model equation. equation
- γ_0 is a constant term and γ_{1i} , γ_{2i}, γ_{3i} are the short run coefficients of the variables in LogMVA as a model.
- δ_0 is a constant term and δ_{1i} , δ_{2i}, δ_{3i} are the short run coefficients of the variables in LogSVA as a Model.
- ECT_{t-1} are the error correction terms, the lagged value of the residuals derived from the cointegrating regression of LogGDP , LogMVA and LogSVA.
- α_1, α_2, α_3 are the speed of adjustment from the short run disequilibrium of the error correction term.
- β_0 is constant and β_1, β_2, β_3 are the long run coefficients
- n is the optimum lag length selected using the lag length criterion, in this case AIC.

Diagnosis and tests

After running the VECM, Tests for autocorrelation in the residuals, test for normally distributed disturbance and stability of the model should be conducted.

LM Test for residual autocorrelation

Estimation, inference, and postestimation analysis of VECMs is predicated on the errors not being autocorrelated. The test for residual auto correlation implements the LM test for autocorrelation in the residuals of a VECM discussed in Johansen (1995, 21–22).

The test is performed at lags n = 1, . . . mlag (), is maximum Lag). For each n, the null hypothesis of the test is that there is no autocorrelation at lag n. i.e.,

- The null hypothesis is Ho: no autocorrelation at lag order (n) and
- The alternative hypothesis is H1: there is autocorrelation.

Stability test

Inference after VECM requires that the cointegrating equations be stationary and that the number of cointegrating equations be correctly specified. Although the methods implemented in cointegration test identify the number of stationary cointegrating equations, they assume that the individual variables are I(1). Stability test provides indicators of whether the number of cointegrating equations is mis-specified or whether the cointegrating equations, which are assumed to be stationary, are not stationary. This test uses the coefficient estimates from the previously fitted VECM to back out estimates of the coefficients of the corresponding VAR and then compute the eigenvalues of the companion matrix. If a VECM has K endogenous variables and r cointegrating vectors, there will be $K - r$ unit moduli in the companion matrix.

Test for Normally distributed disturbances test

Test for normally distributed disturbance after VEC computes a series of test statistics of the null hypothesis that the disturbances in a VECM are normally distributed. For each equation and all equations jointly: a skewness statistic, a kurtosis statistic, and the Jarque–Bera statistic. The single-equation results are against the null hypothesis that the disturbance for that equation is normally distributed. The results for all the equations are against the null that all K disturbances have a K-dimensional multivariate normal distribution. Failure to reject the null hypothesis indicates lack of model misspecification. As noted by Johansen (1995, 141), the log likelihood for the VECM is derived assuming the errors are independently and identically distributed normal, though many of the asymptotic properties can be derived under the weaker assumption that the errors are merely independently and identically distributed. Many researchers still prefer to test for normality. Thus, the null hypothesis is Ho: the residuals are normally distributed and; The alternative hypothesis is H1:the residuals are not normally distributed.

3.5. Definitions of variables, measurement, and hypothesis

Definition of variables

Industry value added, IVA.

The industry (including construction), value added (% of GDP) is a measure of the contribution of the industrial sector to the economy. It includes mining, manufacturing, construction, electricity, water, and gas (World Bank). Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (World Bank). Obioma et.al., (2015) in an attempt to explore the impact of industrial output on the economy (GDP) in Nigeria, they concluded that Industrial output has a positive relationship with GDP but was not significant to improve the level of economic growth.

Independent variables

Manufacturing, value added (% of GDP)

Manufacturing refers to industries belonging to ISIC divisions 15-37(World Bank). The value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The contribution of manufacturing output to GDP refers to the percentage of the gross domestic product (GDP) that is generated by the manufacturing sector. Teshome Adugna (2014) purposed an article base on Kaldorian approach to show the manufacturing effect on economic growth in Ethiopia between1980-2009. The result revealed that the manufacturing sector has a major role to play in the structural transformation of the country. On the other hand, Evans (2014) studied the Manufacturing industry and economic growth in Kenya using Kaldorian approach for the period of 1971-2013. From his findings the researcher concluded that manufacturing industrial production in Kenya does not lead to increased economic growth in Kenya.

Services, value added (% of GDP)

Services correspond to ISIC divisions 50-99 and they include value added in wholesale and retail trade (including hotels and restaurants), transport, and government, financial, professional, and personal services such as education, health care, and real estate services. Also included are imputed bank service charges, import duties, and any statistical discrepancies noted by national compilers as well as discrepancies arising from rescaling. The value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. (World Bank). Rahardja *et al.* (2012) analysed the contribution of different economic sectors, namely, agriculture, manufacturing and services sectors to economic growth in China and India. However, they found that service sector contributes the highest to India’s economic growth while manufacturing sector is the highest contributor to China’s economic growth.

Dependent variable

GDP, Gross Domestic Product

Gross Domestic Product (GDP) is defined as the total market value of all final goods and services produced within a country in a given period. It is the most used measure of economic activity and serves as a good indicator to track the economic health of a country. Nominal GDP is GDP at current price which is the GDP unadjusted for the effects of inflation and is at current market prices whereas Real GDP is the GDP at constant price, or the GDP adjusted for the effects of inflation. Economic growth (GDP growth) refers to the percent change in real GDP. The real GDP of Ethiopia is the inflation-adjusted value of all goods and services produced in the country. According to world bank data, for example the nominal GDP (current USD) of Ethiopia for the year 2021 was $111.262B and its real GDP (inflation Adjusted) was $100.435B. here the researcher used the real GDP data (2015 constant price) for the purpose of the study.

Measurement of the variables

Table 3.1. presented summary of the variables measurement and abbreviations used in the study. The "Log" in the variables indicates the logarithm of base (10) of the variables employed in the model specification.

Table 3-1 Summary of the Variables Employed.

Variable Name	Measurement	Abbreviation
Economic Growth	Growth Domestic Product (constant 2015 US$)	LogGDP
Manufacturing Output	Manufacturing value added (constant 2015 US$)	LogMVA
Service sector	service value added (constant 2015 US$)	LogSVA

Hypothesis

The VECM shows the direction of causality between the independent variables and the dependent variables. The significance of the differenced explanatory variables indicates that the short run causality. Thus, the following hypotheses are derived to test the short run causality between the variables.

1. The null hypothesis that manufacturing output doesn't cause economic growth in the short run is:

$$\text{Ho: } \lambda_{21} = \lambda^{22} = \ldots\ldots\ldots = \alpha_{2n} = 0 \qquad 8$$

2. The null hypothesis that the service value added doesn't cause economic growth in the short run is:

$$\text{H0: } \lambda_{31} = \lambda_{32} = \ldots\ldots\ldots = \lambda_{3n} = 0 \qquad 9$$

3. The null hypothesis that economic growth doesn't cause manufacturing output in the short run is:

$$H0: \gamma_{11} = \gamma_{12} = \cdots = \gamma_{1n} = 0 \qquad 10$$

4. The null hypothesis that service value added doesn't cause manufacturing output in the short run is:

$$H0: \gamma_{31} = \gamma_{32} = \ldots = \gamma_{3n} = 0 \qquad 11$$

5. The null hypothesis that economic growth doesn't cause service value added in the short run is:

$$H0: \delta_{11} = \delta_{12} = \cdots = \delta_{1n} = 0 \qquad 12$$

6. The null hypothesis that manufacturing value added doesn't cause service value added in the short run is:

$$H0: \delta_{21} = \delta_{22} = \cdots = \delta_{2n} = 0 \qquad 13$$

Similarly, the following hypothesis are derived to test the long run equilibrium relationship between the dependent and independent variable stated in equations 4, 5,6 & 7:

1. GDP has the long run equilibrium relationship MVA and SVA

   Ho1: LogGDP has long-run equilibrium relationship with LogMVA and LogSVA 14

2. MVA has the long run equilibrium relationship GDP and SVA

   Ho2: LogMVA has long-run equilibrium relationship with LogGDP and LogSVA 15

3. SVA has the long run equilibrium relationship GDP and MVA

   H03: LogSVA has long-run equilibrium relationship with LogGDP and LogMVA 16

CHAPTER FOUR

4. FINDINGS AND DISCUSSIONS

The results of descriptive statistics and econometric tests are presented in this section.

4.1. Performance of industry sector and manufacturing

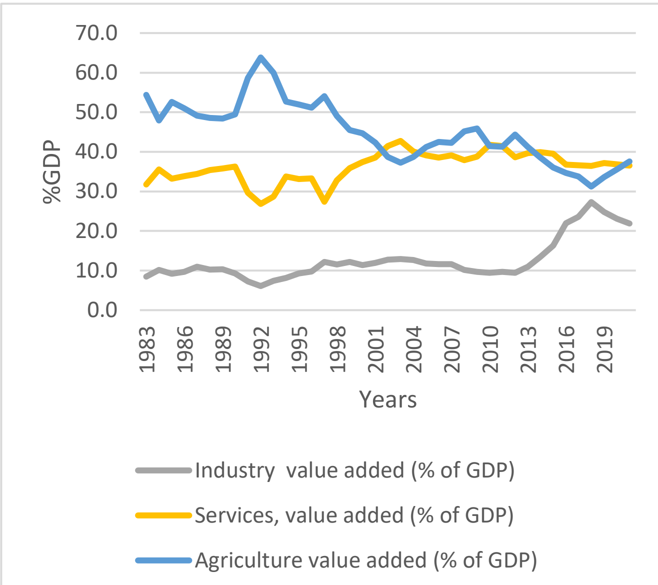

Figure 4.1 Graph showing the sectoral Performance of the economy from 1983-2021

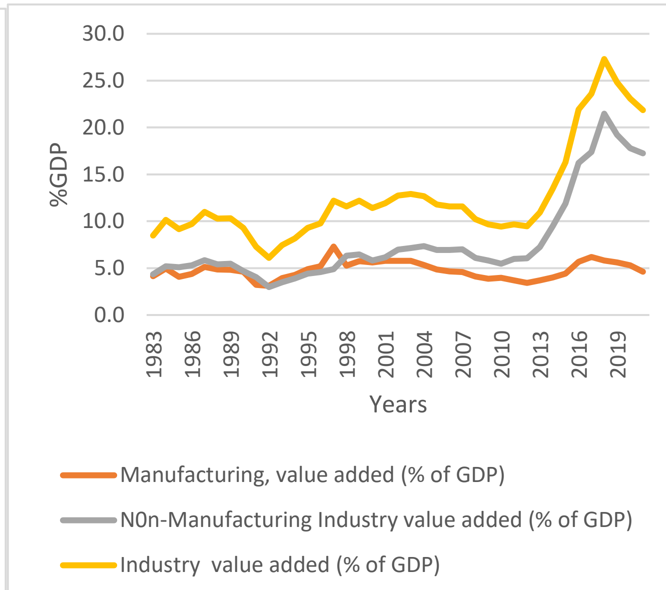

Figure 4.2 Graph showing manufacturing and non-manufacturing performance within the industry sector.

In Figure 4-1, the graph illustrates the percentage contribution of various sectors to the GDP of the economy from 1983 to 2021. Agriculture Value Added (AVA) emerges as the leading sector, contributing 54.4% to GDP, while Service Value Added (SVA) follows with a contribution of 31.8%, and the industry sector contributes 8.5% in 1983. This pattern continues until 1990, with an average contribution of 50.2% GDP for agriculture, 34.5% GDP for services, and 9.8% GDP for the industry sector. In the period from 1991 to 1993, the share of agriculture in GDP rises, while the contributions from other sectors decline. This shift is attributed to political instability during the transitional government. From 2000 to 2021, the average GDP share of agriculture and services is 39.5% and 38.9%, respectively. The industry sector's GDP share increases to an average of 14.9% from 2000 to 2021. Notably, the industry sector's GDP share reaches its peak from 2016 to 2021, averaging 23.8%. However, when examining the manufacturing share (%GDP) of the economy for the same period (2016-2021), it is found to be 5.5%, with non-manufacturing industry contributing 18.3% to GDP (see Figure 4-2). This implies that the upward trend in the industry sector's GDP share is primarily driven by non-manufacturing industry sectors such as construction, mining, electricity, and water, rather than manufacturing. The nuanced analysis distinguishes the specific contributions of various industry components to the overall economic landscape.

4.2. Unit root test results

The results of the unit root tests presented in Tables 4.1 reveal that all the variables exhibit non-stationarity at levels, denoted as I(0). However, upon conducting Dickey-Fuller and Phillips-Perron tests for unit root at the first difference, the variables demonstrate stationarity at I(1). These tests confirm the stationarity of each variable after the first differencing operation, considering both constant and trend options. Consequently, it can be affirmed that all the variables are integrated of order one, denoted as I(1). In simpler terms, they are all stationary at the first difference level, indicating a common order of integration across the variables.

Table 4-1 Unit Root Test Results summary using Dickey-Fuller test and Phillips-Perron test for unit root.

Variable	Test in	Augmented Dickey-Fuller test for unit root					Phillips-Perron test for unit root				
		t-stat.	p-value	Critical Values			t-stat.	p-value	Critical Values		
				1%	5%	10%			1%	5%	10%
LogGDP	Level	-1.855	0.678	-4.27	-3.552	-3.21	-2.025	0.5876	-4.26	-3.55	-3.21
	1st Difference	-5.662	0.000	-4.279	-3.556	-3.21	-4.942	0.0003	-4.27	-3.55	-3.21
LogMVA	Level	-1.519	0.822	-4.27	-3.552	-3.21	-1.143	0.9215	-4.26	-3.55	-3.21
	1st Difference	-4.857	4E-04	-4.279	-3.556	-3.21	-4.177	0.0049	-4.27	-3.55	-3.21
LogSVA	Level	-1.942	0.633	-4.27	-3.552	-3.21	-1.574	0.8024	-4.26	-3.55	-3.21
	1st Difference	-4.007	0.009	-4.279	-3.556	-3.21	-4.152	0.0053	-4.27	-3.55	-3.21

- The p-value for z(t) > 0.05 implies not significant at 5% critical value and hence not stationary at level I(0).
- The p-value for z(t) < 0.05 implies significant at 5% critical value and hence stationary at level I(1).

4.3. Cointegration analysis results

Given that all the variables under consideration are integrated of order one (I(1)), the Johansen cointegration test was executed to ascertain the existence of a long-run relationship among these variables. To determine the most suitable lag length for the cointegration analysis, various lag length selection criteria were applied, and the outcomes are summarized in Table 4.2. The results indicate that the Akaike Information Criterion (AIC) value of (-14.3144*) corresponding to a lag length of two (2) stands as the minimum value among the criteria considered. Consequently, the optimal choice for model adoption is determined by selecting the criterion with the lowest value, and in this case, the AIC criterion supports an optimal lag length of 2.

Table 4-2 Lag length selection-order criteria

lag	LL	LR	FPE	AIC	HQIC	SBIC
0	114.74		3.40E-07	-6.38513	6.33911	-6.25182
1	261.443	293.41	1.30E-10	-14.2539	-14.0698*	-13.7206*
2	271.502	20.117*	1.2e-10*	-14.3144*	-13.9923	-13.3812
3	278.108	13.211	1.50E-10	-14.1776	-13.7174	-12.8444
4	282.476	8.7365	2.00E-10	-13.9129	-13.3146	-12.1798
(implies optimum lag length in each criterion)*						

Table 4-3 Johansen tests result for cointegration

Maximum Rank	LL	Eigenvalue	Statistic			
			trace statistic	5% Critical value	Max Statistic	5% Critical value
0	262.468	.	31.047	29.6	21.1908	20.9
1	270.5634	0.35441	14.8561*	15.41	12.1744	14.07
2	276.6506	0.28038	2.6818	3.76	2.6818	3.76
3	277.9914	0.06992				
(*At most one cointegration vector)						

Analyzing the results summary from Table 4.3 for the Johansen cointegration test, it is evident that the null hypothesis of no cointegration is decisively rejected for rank zero (0). Upon proceeding to the test for rank 1, the null hypothesis, asserting the existence of one cointegration equation, can be accepted based on both the trace and max statistics. The test statistics for both trace and max are found to be below the 5% critical value. The null hypothesis for both trace and max statistics posits that there is no more than one cointegrating vector (refer to Table 4.3). Consequently, the confirmation of cointegration implies that the variables under study have long-run relationships. This robust finding enhances our understanding, indicating that these variables are interconnected and exhibit enduring relationships over time.

4.4. VECM results and interpretations.

4.4.1. Long run relationship analysis

The validity and stability of long-run equilibrium relationships are contingent upon the error correction terms, specifically the adjustment parameters, being both negative and statistically significant. This criterion is emphasized in the work of Burke and Hunter (2005). The rationale behind the necessity for a negative error correction term lies in Johansen's method, which inherently gauges the speed of adjustment towards the steady state. Thus, a negative sign implies convergence, and the magnitude should be less than unity.

Referring to Table 4.4, the error correction term in the LogGDP equation, along with its associated P-value (-0.3537111, *0.000), is not only negative but also statistically significant at the 1% level. This finding provides robust support for the presence of a valid long-run equilibrium relationship with both LogMVA and LogSVA. Similarly, in the LogMVA equation, the error correction term with its P-value (-0.4481135, **0.014) is negative and significant at the 5% level. This result further suggests the existence of a valid long-run equilibrium relationship with LogGDP and LogSVA. However, it's noteworthy that the error correction term in the LogSVA equation, with its P-value (-0.1915149, 0.137), is negative but not statistically significant. While indicating the speed of convergence to the long-run steady state, the lack of statistical significance implies a limited basis for asserting the existence of a long-run equilibrium relationship with LogGDP and LogMVA.

In summary, the empirical evidence from the error correction terms affirms the validity of long-run equilibrium relationships between LogGDP, LogMVA, and LogSVA, provided the conditions of negativity and statistical significance are met.

Table 4-4 Adjustment parameters of Vector error correction Model

Alpha	*Coef. Std.*	*Std. Err.*	*Z*	*P>|z|*
D_LogGDP				
L1. _ce1	*-0.3537111*	*0.0911794*	*-3.88*	**0.000*
D_LogMVA				
L1. _ce1	*-0.4481135*	*0.1828662*	*-2.45*	***0.014*
D_LogSVA				
L1._ce1	*-0.1915149*	*0.1286472*	*-1.49*	*0.137*
* *Implies significant at 1, ** implies significant at 5%*				

Source: authors own computation using Stata 11.2

Table 4-5 Normalized Johanson

Johansen normalization restriction imposed				
Beta	Coef.	Std. Err.	z	P>|z|
_ce1				
LogGDP	1			
LogMVA	0.367482	0.1387262	2.65	*0.008
LogSVA	-1.16737	0.1195741	-9.76	*0.0000
_cons	-2.253586			
**Implies significant at 1 %*				

Source: authors own computation using Stata 11.2

To conclude the long-run relationship, the normalized cointegrating coefficients obtained from the Johansen cointegration analysis are presented in Table 4.5. These coefficients, derived from the estimated cointegrating vectors, signify the enduring influence of Manufacturing Value Added (MVA) and Service Value Added (SVA) on economic growth. The coefficients are incorporated into Equation (7) to elucidate the impact of each variable on economic growth, as outlined in Equation (17). Utilizing the results from Table 4.5, Equation (17) represents the estimated cointegrating equilibrium equation normalized on GDP, constituting a long-run stationary series:

$$ECT_{t-1} = LogGDP_{t-1} + 0.368LogMVA_{t-1} - 1.167LogSVA_{t-1} - 2.254 \qquad 17$$

Referring to Table 4.5 and Equation (17), it is crucial to note that the equilibrium equation is normalized on GDP, necessitating a reversal of the signs on the coefficients for accurate interpretation. Consequently, the results indicate a negative and statistically significant cointegrating relationship between GDP and manufacturing, along with a positive and significant relationship between GDP and service value added in the long run. In simpler terms, manufacturing exerts a significant negative impact on GDP, while service value added has a significant positive effect on GDP in the long run.

Summarizing Equation (17), the long-run findings reveal that a one percent increase in Manufacturing Value Added leads to a significant 0.37 percent decrease in economic growth. Conversely, a one percent increase in Service Value-Added results in a substantial 1.17% increase in economic growth. This outcome contrasts with the findings of Mongale, Itumeleng & Maraswa, Tafadzwa (2019), who identified a positive and significant long-run relationship between Manufacturing output and economic growth in South Africa.

On another note, the cointegration vector characterizes the long-run relationship between the variables. However, in the short run, deviations or errors occur, causing the variables to diverge from their long-run relationship. The correction in short-run errors or deviations is determined by the adjustment coefficient, alpha. From Table 4.4, the adjustment coefficient alpha for LogGDP is -0.354. This implies a one unit increase in the deviation of GDP from its equilibrium results in GDP adjusting back towards its long-run equilibrium with manufacturing and service sector growth at a rate of approximately 35.4% per period. Similarly, Alpha Coefficient (-0.448) for D_LogMVA implies that a one unit increase in the deviation of MVA from its equilibrium leads to MVA adjusting back towards its long-run equilibrium with economic growth and service sector growth at a rate of approximately 44.8% per period.

4.4.2. Short run relationship analysis

Table 4-6 Vector Error correction Model (VECM) results for short run impact coefficients of the lagged differences

	Coef.	Std. Err.	Z	P>z
D_LogGDP				
LD. LogGDP	-0.0172371	0.1905613	-0.09	0.928
LD. LogMVA	0.402904	0.157005	2.57	*0.01
LD. LogSVA	-0.4338974	0.22684	-1.91	***0.056
_cons	-0.0022682	0.0079743	-0.28	0.776
D_LogMVA				
LD. LogGDP	-0.3177678	0.3821829	-0.83	0.406
LD. LogMVA	0.9510605	0.3148836	3.02	*0.003
LD. LogSVA	-0.8796245	0.4549421	-1.93	***0.053
_cons	-0.0026232	0.015993	-0.16	0.87
D_LogSVA				
LD. LogGDP	0.0182615	0.2688675	0.07	0.946
LD. LogMVA	0.4249626	0.2215221	1.92	***0.055
LD. LogSVA	-0.2434835	0.3200539	-0.76	0.447
_cons	0.010327	0.0112512	0.92	0.359
Equation	RMSE	R-sq	chi2	P>chi2
D_LogGDP	0.021367	0.7093	78.07558	0.0000
D_LogMVA	0.042852	0.4856	30.20903	0.0000
D_LogSVA	0.030147	0.6224	52.7534	0.0000
**Implies significant at 1 %, ** *significant at 10%*				

Source: authors own computation using Stata 11.2

In Table 4.6, the logarithm of Manufacturing Value Added (LogMVA) is found to be statistically significant at a 1% level, positively influencing the logarithm of Gross Domestic Product (LogGDP) in the short run. Conversely, the logarithm of Service Value Added (LogSVA) is significant at a 10% level, negatively impacting LogGDP in the short run. Additionally, LogSVA is significant at a 10% level, negatively influencing LogMVA in the short run, while LogMVA is significant at a 10% level, positively affecting LogSVA in the short run.

To assess the short-run causal relationships among LogMVA, LogSVA, and LogGDP, a postestimation linear hypothesis test was conducted, as detailed in Table 4.7. The results indicate the rejection of the null hypothesis (HO) at a 5% significance level, suggesting a unidirectional short-run causality running from Manufacturing Value Added to GDP. Conversely, the null hypothesis regarding short-run causality from GDP to Manufacturing Value Added is accepted, concluding that GDP does not cause or affect MVA in the short run.

Similarly, a unidirectional short-run causality is observed from Service Value Added to GDP. However, a noteworthy bidirectional short-run causality is identified between manufacturing and service value added – a result in contrast to findings in the study by Mohamed A. M. SALLAM (2021), where a bi-directional causality was reported between manufacturing and GDP in the Saudi economy, along with a one-way causal relationship from GDP to service.

These findings provide valuable insights into the intricate dynamics of short-run causal relationships among key economic indicators, shedding light on unique patterns observed in Ethiopia's economic context, distinct from certain international counterparts. Further analysis and consideration of these patterns are essential for a comprehensive understanding of the economic dynamics at play.

Table 4-7: Postestimation linear hypothesis test

The Null Hypothesis	*chi2*	*Prob > chi2*	
[D_LogGDP]LD.LogMVA = 0	*6.59*	**.0103*	*Reject the Null hypothesis, H0 and accept the Alternating hypothesis, HA: MVA causes GDP at 5% significant level*
[D_LogGDP]LD.LogSVA = 0	*3.66*	***0558*	*Reject the Null hypothesis, H0 and accept the Alternating hypothesis, HA: SVA causes GDP at 10% significance level*
[D_LogMVA]LD.LogSVA = 0	*3.74*	***.0532*	*Reject the Null hypothesis, H0 and accept the Alternating hypothesis, HA: SVA causes MVA at 10% significance level*
[D_LogMVA]LD.LogGDP = 0	*0.69*	*0.4057*	*Accept the Null hypothesis, H0: GDP does not cause MVA*
[D_LogSVA]LD.LogGDP = 0	*0.00*	*0.9458*	*Accept the Null hypothesis, H0: GDP does not cause SVA*
[D_LogSVA]LD.LogMVA = 0	*3.68*	***.0551*	*Reject the Null hypothesis, H0 and accept the Alternating hypothesis, HA: MVA causes SVA at 10% significance level*
**Implies significant at 5 %, ** significant at 10%*			
Source: authors own computation using Stata 11.2			

Given the established long-term joint integration relationship among the model variables and the discerned directional influence through causality testing, the Vector Error Correction Model (VECM) can be aptly employed. The VECM serves to estimate and quantify the short-term dynamics between the model variables, offering insights into the transient relationships. Moreover, it provides a measure of the pace at which modifications, corrections, or adaptations occur to restore long-term equilibrium within the dynamic model.

Therefore, leveraging the information presented in Tables 4.4, 4.5, and 4.6, alongside the formulations outlined in equations (4), (5), (6), and (7), the VECM equation for the short-term relationship involving LogGDP, LogMVA, and LogSVA can be succinctly expressed as follows:

$$\Delta LogGDP_t = -0.0023 - 0.01721\Delta LogGDP_{t-i} + 0.4029\Delta LogMVA_{t-i} - 0.43394\Delta LogSVA_{t-i} - 0.354ECT_{t-1} + \varepsilon_{1t} \quad 18$$

$$\Delta LogMVA_t = -0.003 - 0.318\,\Delta LogGDP_{t-i} + 0.951\Delta LogMVA_{t-i} - 0.88\Delta LogSVA_{t-i} - 0.448ECT_t^{-1} + \varepsilon^2{}_t \quad 19$$

$$\Delta LogSVA_t = 0.01 + 0.018\,\Delta LogGDP_{t-i} + 0.425\Delta LogMVA_{t-i} - 0.243\Delta LogSVA_{t-i} - 0.192ECT_{t-1} + \varepsilon_{3t} \quad 20$$

Where, the error correction term, ETC estimated using equation (13) as :

$$ECT_{\,t-1} = LogGDP_{t-1} + 0.368LogMVA_{t-1} - 1.167LogSVA_{t-1} - \ 2.254 \quad 21$$

4.5. VEC diagnosis and tests

4.5.1. LM Test for residual autocorrelation

After fitting the VECM using the variables under study and running the LM test for residual autocorrelation, mlag(4) resulted as presented in Table 4-8.

Table 4-8 Residual autocorrelation test results

Lag	***Chi2***	***Prob>chi2***
1	***10.0041***	*0.35016*
2	***10.2308***	***0.33212***
3	***6.6218***	***0.67643***
4	***6.8261***	***0.65522***
H0: no autocorrelation at lag order		
Source: authors own computation using Stata 11.2		

H0: no autocorrelation at lag order

From the test result of table 4:8, the p-values at lag orders (prob > chi2) is not significant at 5% critical value. This shows that we don’t have sufficent reason to reject the null hypothesis. This implies that there is no serial correlation in the variables. i.e., at the 1%, 5% and 10% level, we cannot reject the null hypothesis that there is no autocorrelation in the residuals for any of the orders tested.

4.5.2. Test for Normally distributed disturbances test

Vecnorm (test for normally distributed disturbance after VEC) computes a series of test statistics of the null hypothesis that the disturbances in a VECM are normally distributed.

Table 4-9: Normally distributed disturbances test result

Equation	Jarque-Bera test		Skewness test		Kurtosis test	
	Chi2	Prob > chi2	Chi2	Prob > chi2	Chi2	Prob > chi2
D_lgdp	0.086	0.958	0.077	0.782	0.009	0.92291
D_lmva	0.195	0.907	0.083	0.773	0.112	0.73768
D_lsva	0.954	0.621	0.544	0.461	0.41	0.52192
All	1.235	0.975	0.704	0.872	0.532	0.91189
The P value is greater than 0.1, accepting the null hypotesis						

Source: authors own computation using Stata 11.2

The findings from Table 4.9 reveal that both the individual-equation and overall equation Jarque–Bera statistics do not provide grounds for rejecting the null hypothesis of normality. The individual-equation skewness test statistics, assessing the null hypothesis that the disturbance term in each equation possesses zero skewness (indicative of normal distribution), are consistent with this observation. The row labelled ALL presents the results of a test assessing whether the disturbances in all equations jointly exhibit zero skewness. Notably, the skewness results do not indicate nonnormality. Moreover, the kurtosis statistics in the table evaluate the null hypothesis that the disturbance terms' kurtosis aligns with normality. The outcomes of these tests similarly do not warrant rejection of the null hypothesis. In summary, the P-values associated with all variables in the Jarque-Bera test, skewness test, and kurtosis test results exceed the 5% significance level. This indicates a lack of substantial evidence to reject the null hypothesis (Ho) that the residuals follow a normal distribution. Consequently, it can be inferred that the residuals are, indeed, normally distributed.

4.5.3. Stability test

After fitting the model and using vecstable, check stability condition of VECM estimates to analyse the eigenvalues of the companion matrix of the corresponding var. The output in table 4:10 showing the eigenvalues of the companion matrix and their associated moduli. The table 4:10 footer reminds us that the specified VECM imposes two-unit moduli on the companion matrix. As the VECM in this study has 3 endogenous variables and 1 cointegrating vectors the presence of 2-unit moduli (3-1) confirms the stability of the VECM estimates.

Table 4-10 Stability condition Test result

Eigenvalue stability condition	
Eigenvalue	*Modulus*
1	*1*
1	*1*
0.8283369	*0.828337*
0.1985654 + .3812815i	*0.429888*
0.1985654 + .3812815i	*0.429888*
0.1700561	*0.170056*
The VECM specification imposes 2 unit moduli.	

Source: authors own computation using Stata 11.2

The Results from Roots of Characteristic Polynomial stability condition (Fig. 4.3) showed that the

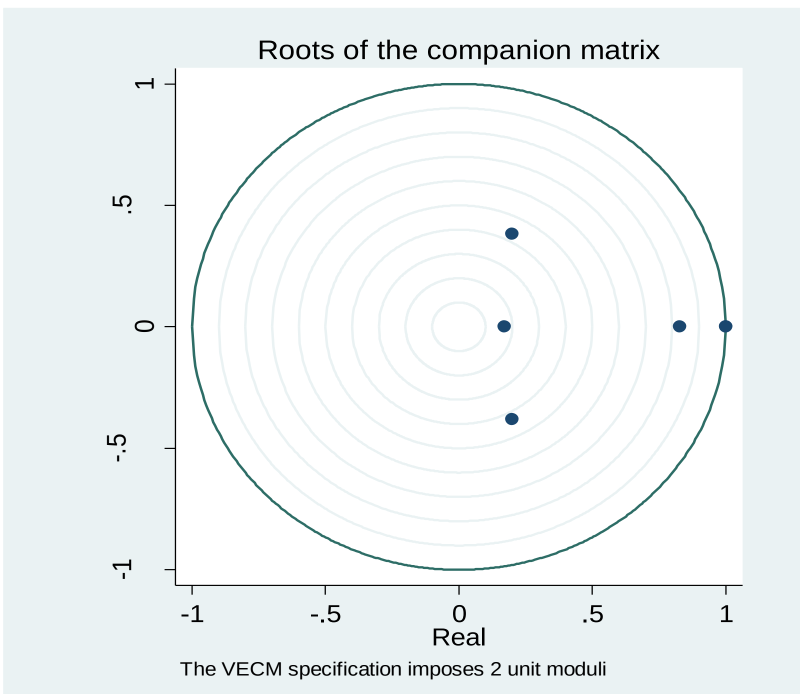

Figure 4.3 Stability Graph for VECM

VECM model satisfies stability conditions since all the roots lie inside the unit circle.

CHAPTER FIVE

5. SUMMARY, CONCLUSION AND RECOMMENDATION

5.1. Summary

The primary objective of this study was to explore the long-run and short-run relationship between manufacturing output and Gross Domestic Product (GDP) in Ethiopia. Utilizing annual time series data spanning from 1983 to 2021 obtained from the World Bank, various statistical tests were applied to discern the dynamics of the variables. The examination involved unit root tests, cointegration analysis, the Johansen cointegration test, and the vector error correction model. The stability of the model, presence of serial correlations, and normality of disturbance distribution were also assessed. The findings confirmed the presence of a single cointegrating vector, indicating a long-term relationship between GDP, manufacturing value added, and service value added. The Vector Error Correction Model facilitated the estimation of the speed of adjustment and short-run causality. Stability tests were conducted to ensure the reliability of the model.

5.2. Conclusion

The study provides significant insights into the relationship between economic growth and the manufacturing sector in Ethiopia. Manufacturing Value Added (MVA) shows a substantial and negative long-run association with economic growth, indicating that a one percent increase in MVA leads to a 0.37 percent decrease in economic growth. This suggests that while manufacturing contributes to the economy, its growth has not proportionately translated into broader economic expansion.

In contrast, Service Value Added (SVA) demonstrates a significant and positive long-term relationship, with a one percent increase resulting in a 1.17% increase in economic growth. These findings challenge conventional beliefs about manufacturing as the primary engine of economic growth in Ethiopia, highlighting the need for a balanced approach to economic development across sectors.

This result contrasts with that of Mongale, Itumeleng & Maraswa (2019), who find a positive and significant long-run relationship between Manufacturing output and economic growth in South

Africa. This contrast underscores the unique economic dynamics observed in Ethiopia compared to other regions, emphasizing the distinctiveness of the study's findings.

Short-run causality analysis reveals a unidirectional causality from manufacturing value added to GDP and bidirectional causality between manufacturing and service value added, further illustrating Ethiopia's unique economic dynamics. These insights imply that enhancing manufacturing output could stimulate immediate economic activity, underscoring the importance of targeted interventions in the manufacturing sector.

5.3. Recommendations

1. **Short-Run Policy Interventions:** The unidirectional short-run causality from manufacturing value added to GDP indicates that targeted interventions in the manufacturing sector could yield immediate economic benefits. Policies aimed at enhancing manufacturing productivity, efficiency, and competitiveness are crucial to stimulating short-term economic growth.
2. **Long-Term Structural Adjustments:** To address the negative long-run relationship between manufacturing value added and economic growth, structural adjustments in industrial policies are necessary. This includes incentivizing technological innovation, improving infrastructure, enhancing human capital, and promoting value-added manufacturing activities. Long-term strategies should focus on sustainable growth and economic resilience.

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Annexes

Annex I: Data from 1983-2021

YEAR	GDP(Real)	MVA	SVA	LogGDP	LogMVA	LogSVA
1983	11,926,862,664.37	605,445,307.21	2,771,599,948.33	10.0765	8.7821	9.4427
1984	11,587,183,057.11	605,798,922.40	2,941,555,038.57	10.0640	8.7823	9.4686
1985	10,295,866,477.03	587,668,770.94	3,099,196,667.91	10.0127	8.7691	9.4912
1986	11,290,613,185.27	644,929,421.08	3,127,446,101.75	10.0527	8.8095	9.4952
1987	12,855,416,570.24	693,581,946.39	3,461,500,002.92	10.1091	8.8411	9.5393
1988	12,920,166,074.13	692,081,475.91	3,619,866,760.62	10.1113	8.8402	9.5587
1989	12,873,518,566.50	680,273,975.23	3,599,279,713.57	10.1097	8.8327	9.5562
1990	13,224,508,842.96	682,199,935.40	3,698,192,323.60	10.1214	8.8339	9.5680
1991	12,280,612,208.83	443,971,967.09	2,978,528,118.75	10.0892	8.6474	9.4740
1992	11,215,578,552.98	364,649,285.27	2,480,508,967.72	10.0498	8.5619	9.3945
1993	12,689,623,421.71	473,031,534.73	3,023,149,874.16	10.1034	8.6749	9.4805
1994	13,094,417,914.47	526,213,434.18	3,314,298,361.25	10.1171	8.7212	9.5204
1995	13,896,779,866.75	572,969,477.17	3,665,148,144.38	10.1429	8.7581	9.5641
1996	15,623,617,882.46	591,452,811.03	3,921,463,748.84	10.1938	8.7719	9.5934
1997	16,113,247,513.63	608,990,858.46	4,093,884,223.65	10.2072	8.7846	9.6121
1998	15,556,028,995.65	611,328,566.39	4,359,317,337.25	10.1919	8.7863	9.6394
1999	16,359,053,896.37	664,549,999.37	4,712,996,024.56	10.2138	8.8225	9.6733
2000	17,352,574,817.10	708,789,103.51	5,225,978,529.96	10.2394	8.8505	9.7182
2001	18,793,065,207.17	735,776,806.67	5,463,259,969.31	10.2740	8.8667	9.7375
2002	19,077,728,596.86	749,088,739.80	5,771,243,793.75	10.2805	8.8745	9.7613
2003	18,665,390,255.09	758,123,311.17	6,259,926,282.91	10.2710	8.8797	9.7966
2004	21,198,769,598.36	813,203,673.74	6,577,874,650.56	10.3263	8.9102	9.8181
2005	23,704,202,560.76	919,204,156.80	7,388,052,448.98	10.3748	8.9634	9.8685
2006	26,272,488,211.36	1,013,887,055.59	8,337,041,179.21	10.4195	9.0060	9.9210
2007	29,282,308,335.91	1,114,568,620.80	9,650,677,198.63	10.4666	9.0471	9.9846
2008	32,441,436,520.71	1,217,798,219.64	11,233,426,719.26	10.5111	9.0856	10.0505
2009	35,297,111,228.58	1,322,833,126.49	12,882,732,979.31	10.5477	9.1215	10.1100
2010	39,727,088,708.33	1,444,635,515.98	15,038,967,465.69	10.5991	9.1598	10.1772
2011	44,167,900,366.58	1,578,096,623.57	16,994,361,529.86	10.6451	9.1981	10.2303
2012	47,987,457,192.70	1,764,382,594.84	18,678,306,967.93	10.6811	9.2466	10.2713
2013	53,065,619,502.13	2,063,155,680.95	20,368,740,289.60	10.7248	9.3145	10.3090
2014	58,508,821,687.27	2,406,403,599.28	22,989,291,588.92	10.7672	9.3814	10.3615
2015	64,589,329,344.69	2,844,913,961.91	25,542,308,327.50	10.8102	9.4541	10.4073
2016	70,682,352,527.24	3,496,417,162.50	28,406,648,345.38	10.8493	9.5436	10.4534
2017	77,442,546,767.05	4,358,466,745.54	30,546,567,634.38	10.8890	9.6393	10.4850
2018	82,721,145,212.31	4,655,772,621.23	33,138,364,081.37	10.9176	9.6680	10.5203
2019	89,640,012,689.13	5,014,135,281.21	36,864,965,244.05	10.9525	9.7002	10.5666
2020	95,071,776,944.63	5,390,816,288.91	38,814,208,687.39	10.9781	9.7317	10.5890
2021	100,435,280,444.53	5,665,734,383.20	41,247,756,555.92	11.0019	9.7533	10.6154

Source: From world development indicators (world bank, 2023) and own computation

Annex II: Figures

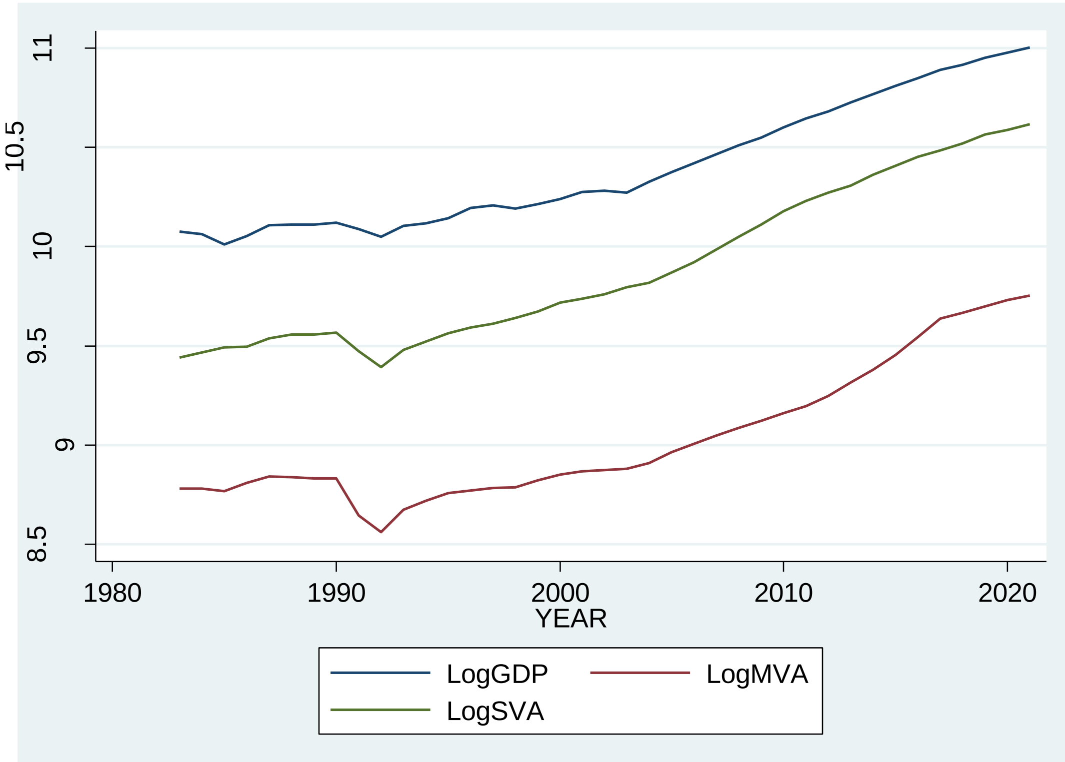

Figure -1. Line graph of the variables showing an increasing Trend

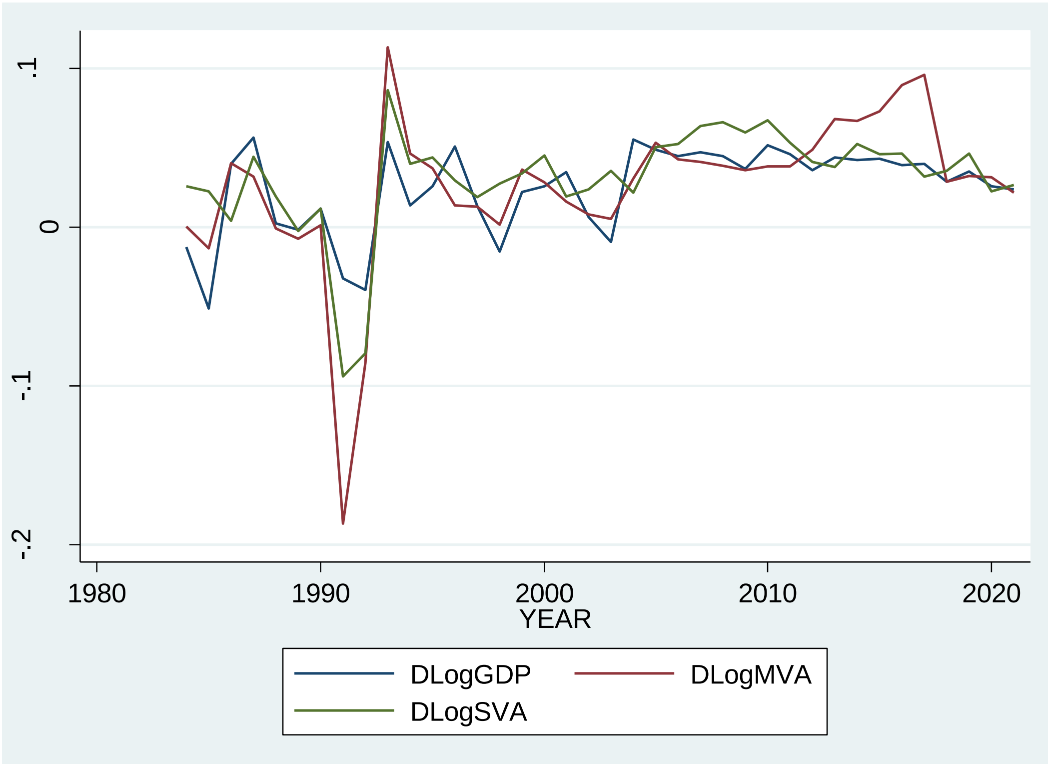

Figure -2. Line graph of the first difference of the variables showing stationarity

Annex III: Tables

Table-1: lag-length selection criteria

```
. varsoc LogGDP LogMVA LogSVA

   Selection-order criteria
   Sample:  1987 - 2021                         Number of obs      =        35
```

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	114.734				3.4e-07	-6.38478	-6.33876	-6.25147
1	261.454	293.44	9	0.000	1.3e-10	-14.2545	-14.0704*	-13.7213*
2	271.514	20.12*	9	0.017	1.2e-10*	-14.3151*	-13.993	-13.3819
3	278.12	13.212	9	0.153	1.5e-10	-14.1783	-13.7181	-12.8451
4	282.492	8.7446	9	0.461	2.0e-10	-13.9138	-13.3156	-12.1807

```
   Endogenous:  LogGDP LogMVA LogSVA
    Exogenous:  _cons
```