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L'intitulé du Mémoire **:**

THE IMPACT OF COFFEE EXPORTS ON UGANDA'S ECONOMIC GROWTH FROM 1986 TO 2022

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Dedications

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Abstract

This dissertation investigates the impact of coffee exports on Uganda's economic growth from 1986 to 2022. Grounded in the export-led growth theory, the study utilises time series data from reputable sources like the World Bank, UCDA, UBOS, and IMF, employing an Autoregressive Distributed Lag (ARDL) model to analyse the long-run relationship between coffee exports and GDP growth. The empirical analysis reveals a statistically significant positive impact of coffee exports on Uganda's economic growth. The study finds that a 1% increase in coffee export values leads to a 0.75% increase in GDP in the long run. The research also highlights the significant positive influence of foreign direct investment on economic growth, while revealing a complex interplay with inflation and exchange rates. Diagnostic tests confirm the validity and reliability of the ARDL model, strengthening the robustness of the findings. The study underscores the crucial role of coffee exports as a driver of economic growth in Uganda, supporting the export-led growth theory. Based on the empirical findings, this dissertation recommends policy interventions focused on enhancing coffee productivity, attracting foreign direct investment, managing inflation, and mitigating climate change risks. These strategies can foster a more sustainable and thriving coffee sector, contributing significantly to the long-term economic development of Uganda. This research provides valuable empirical evidence and policy insights for policymakers, industry stakeholders, and development practitioners seeking to promote a robust and resilient coffee industry in Uganda. The findings have significant implications for shaping a more prosperous future for both coffee farmers and the broader Ugandan economy.

French version of the abstract

Résumé

Ce mémoire examine l'impact des exportations de café sur la croissance économique de l'Ouganda de 1986 à 2022. Fondée sur la théorie de la croissance tirée par les exportations, l'étude utilise des données de séries temporelles provenant de sources réputées telles que la Banque mondiale, l'UCDA, l'UBOS et le FMI. Autoregressive Distributed Lag (ARDL) est utilisé pour analyser la relation à long terme entre les exportations de café et la croissance du PIB. L'analyse empirique révèle un impact positif statistiquement significatif des exportations de café sur la croissance économique de l'Ouganda. Cette étude révèle qu'une augmentation de 1 % de la valeur des exportations de café entraîne une augmentation de 0,75 % du PIB à long terme. La recherche souligne également l'influence positive significative des investissements directs étrangers sur la croissance économique, tout en révélant une interaction complexe avec l'inflation et les taux de change. Des tests de diagnostic confirment la validité et la fiabilité du modèle ARDL, renforçant la robustesse des résultats. L'étude souligne le rôle crucial des exportations de café en tant que moteur de la croissance économique en Ouganda, soutenant la théorie de la croissance tirée par les exportations. Sur la base des résultats empiriques, la thèse recommande des interventions politiques axées sur l'amélioration de la productivité du café, l'attraction des investissements directs étrangers, la gestion de l'inflation et l'atténuation des risques liés au changement climatique. Ces stratégies peuvent favoriser un secteur du café plus durable et plus prospère, contribuant de manière significative au développement économique à long terme de l'Ouganda. Cette recherche fournit des preuves empiriques précieuses et des informations politiques pour les décideurs, les acteurs du secteur et les praticiens du développement qui cherchent à promouvoir une industrie du café robuste et résiliente en Ouganda. Les conclusions ont des implications importantes pour façonner un avenir plus prospère pour les producteurs de café et l'économie ougandaise dans son ensemble.

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List of Abbreviations and Acronyms

ADF: Augmented Dickey-Fuller (test)

AIC: Akaike Information Criterion

AGOA: African Growth and Opportunity Act

ARDL: Autoregressive Distributed Lag (model)

CE: Coffee Exports

CUSUM: Cumulative Sum (of recursive residuals test)

CUSUMSQ: Cumulative Sum of Squares (of recursive residuals test)

ECM: Error Correction Model

EXR: Exchange Rate

FDI: Foreign Direct Investment

GDP: Gross Domestic Product

HDI: Human Development Index

ICO: International Coffee Organization

ILO: International Labour Organisation

IMF: International Monetary Fund

INF: Inflation Rate

LM: Lagrange Multiplier (test)

OEC: Observatory of Economic Complexity

UCDA: Uganda Coffee Development Authority

UBOS: Uganda Bureau of Statistics

UGX: Ugandan Shilling

UNDP: United Nations Development Programme

UNCTAD: United Nations Conference on Trade and Development

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General Introduction

Introduction

Coffee in Uganda holds a unique position as both a culturally significant beverage and a cornerstone of the nation's economy. This crucial agricultural commodity has shaped Uganda's economic landscape for decades, impacting livelihoods, trade, and national development. This study delves into the intricate relationship between coffee exports and Uganda's economic trajectory, exploring how the industry has navigated challenges and opportunities over time.

First, this introductory chapter establishes the background of the study by analysing Uganda's economic journey, tracing its growth patterns and identifying key factors that have influenced its trajectory. Understanding this historical context is crucial for comprehending the intertwined relationship between coffee and the nation's economic prosperity.

After establishing the context, the chapter dives into a comprehensive overview of Uganda's coffee industry. It explores the historical roots and evolution of coffee production, highlighting its emergence as a vital export commodity. The intricate coffee value chain, encompassing all stages from cultivation to exportation, is also examined. This section identifies and analyses the various stakeholders, including smallholder farmers, exporters, and policymakers, who contribute to the industry's vibrancy and resilience.

With a clear understanding of the context, the chapter presents well-defined research questions, which will guide the subsequent analysis. Aligned with these questions, specific objectives and hypotheses are outlined to provide a roadmap for the study. Additionally, the geographical, content, and time scopes are established to ensure clarity and consistency.

Finally, to offer a roadmap for the reader, the chapter concludes by outlining the organisation of the study, providing a glimpse into the organisation of the following chapters and the flow of the research journey.

1.1 Background of the study

Uganda's economic journey from the 1960s to the present day has been marked by a series of highs and lows, with coffee playing a central role in shaping the nation's development trajectory. The 1960s saw Uganda experiencing significant economic expansion, with an average annual GDP growth rate of around 5.5% (World Bank). This growth coincided with a global surge in coffee prices, positioning Uganda as a major Robusta coffee producer and leading to a notable rise in foreign exchange earnings. However, this period of prosperity was short-lived. Political instability and economic mismanagement in the late 1970s and 1980s led to a sharp decline in both coffee production and economic growth. GDP growth plummeted below 1% in some years during this period, as reported by the International Monetary Fund (IMF). In the coffee season 1994-1995, coffee exports accounted for 64% of total export earnings, however in 1999-1900 this share had fallen to 14.1%, with total export earnings themselves 71% higher.

Since the late 1990s, Uganda has embarked on a journey of economic recovery and diversification. Government-implemented reforms aimed to stabilise the economy and attract foreign investment, laying the groundwork for growth. Efforts to diversify the economy beyond coffee gained traction, with sectors like tourism, manufacturing, and services receiving increased attention. The early 2000s witnessed a coffee-induced economic boom, fuelled by a global surge in prices. This period saw significant growth in Uganda's GDP and coffee exports. Coffee exports reached a peak of $41 million in 2004-2005, contributing between 20-30% of the nation's foreign exchange earnings (UCDA, 2009). This coffee-driven surge culminated in 2013, with Real GDP growth reaching 5.6%, compared to just 2.8% in 2012 (UBOS, 2014). However, challenges like under-execution of public investment and depressed exports due to a global slowdown hindered sustained growth.

The period between 2014 and 2019, Uganda's economy experienced a period of generally positive growth, averaging 5.6% annually (UBOS, 2022). This growth coincided with positive trends in coffee exports (UCDA report, 2023). The years 2020 to 2022 presented a more challenging scenario. The global trade disruptions caused by the COVID-19 pandemic in 2020 resulted in a temporary decline in economic growth. Economic activity largely stalled dropping as low as 2.95% representing a 3.49% decline from the previous year (macro trends) with sectors like tourism and manufacturing experiencing significant setbacks. However, the agricultural sector, including coffee production, demonstrated relative resilience. In 2022, coffee exports reached an all-time

high of USD 883.24 million (UCDA,2023). Understanding the intricate relationship between coffee and economic performance is crucial for analysing the nation's current economic landscape and identifying strategies for sustainable and inclusive growth in the future.

1.2 An overview of Uganda's coffee industry

Uganda's coffee industry holds a strong position on both the African and global stages with a deep-rooted historical legacy and a focus on Robusta coffee. Coffee has been a significant part of Uganda's economic and cultural landscape since its introduction in the late 19th century. Production escalated in the early 20th century, driven by government incentives and a favourable international market.

However, the political and economic instability of the 1970s and 1980s saw a dramatic decline in the industry. In the 1970s, the government under President Idi Amin implemented nationalisation policies that led to the decline of the coffee sector, resulting in reduced production and exports (Oxfam, 1980). This era was marked by political instability and economic mismanagement, which adversely affected Uganda's coffee industry and overall economy.

During the 1980s, coffee remained Uganda's most important cash crop. Despite economic challenges and security issues, coffee production persisted. Farmers planted approximately 191,700 hectares of Robusta coffee in southeastern Uganda and about 33,000 hectares of Arabica coffee in high-altitude areas (Wikipedia, coffee production in Uganda). Since the late 1990s, Uganda has experienced a coffee renaissance, with a government focus on smallholder farmers as the backbone of production. This revitalisation has solidified Uganda's position as Africa's second-largest coffee producer after Ethiopia, and it currently ranks seventh globally (ICO, 2023).

Coffee is Uganda's top-earning export crop, contributing nearly a third of the country's export earnings. The cultivation of coffee involves over 1.8 million households in Uganda. Robusta coffee grows natively in the Lake Victoria Crescent in the districts of Bugiri, Mityana, Mukono, Busia, Kayunga and Buikwe, while Arabica coffee thrives around the slopes of Mount Elgon highlands (Kapchorwa, Mbale), the Rwenzori Mountains (Kasese), and Mount Muhabura (Kisoro).

The Ugandan coffee value chain is a dynamic process involving multiple interconnected stakeholders. Smallholder farmers, often owning less than 2 hectares of land, form the foundation

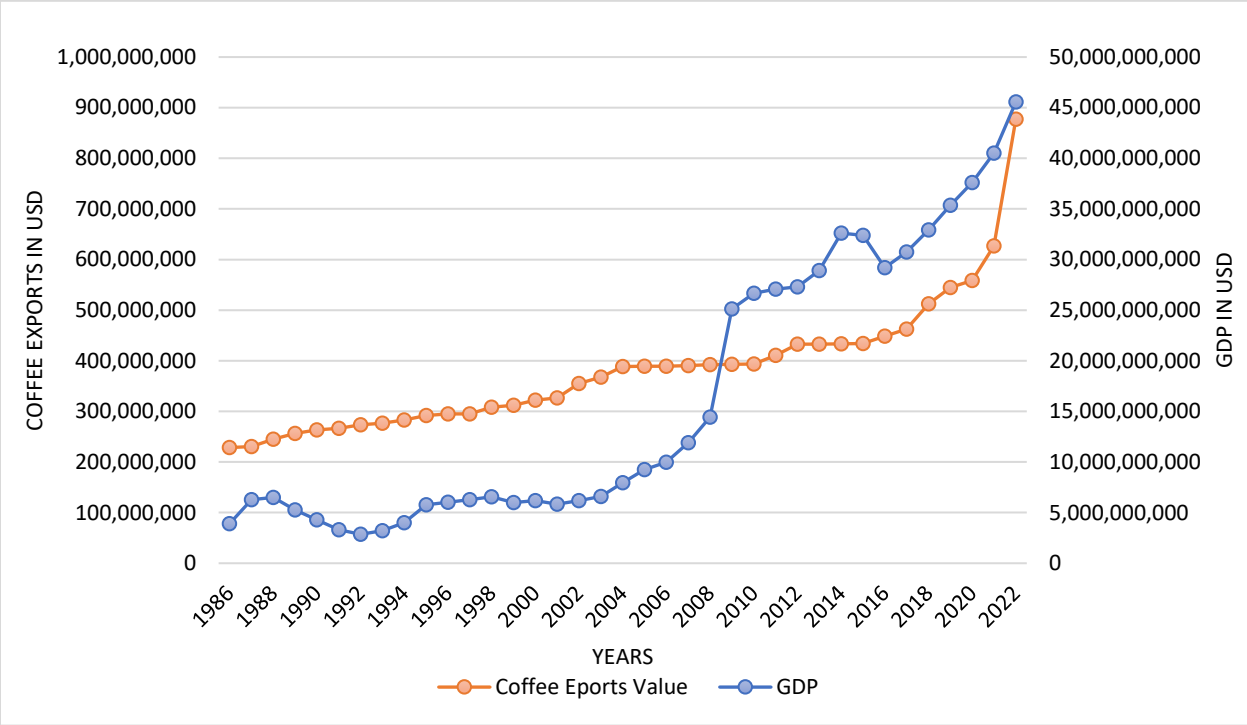
by cultivating, managing, and harvesting coffee. Cooperative societies and producer organisations play a crucial role in supporting these farmers, providing access to financing, training on best agricultural practices, and assistance with marketing and processing. Coffee processors then step in, responsible for the essential tasks of washing, pulping, drying, and hulling the coffee cherries to obtain exportable coffee beans. Exporters bridge the gap between Uganda and the global market by purchasing, grading, sorting, and exporting these beans in accordance with international standards. Finally, policymakers play a pivotal role in regulating the industry, investing in infrastructure, and supporting research and development initiatives to improve coffee quality and increase productivity.

Coffee production in Uganda has exhibited a generally upward trend over the past several years. The Uganda Coffee Development Authority (UCDA) reports that the country produced 8.4 million 60kg bags of coffee in the 2021/2022 coffee year of which 5.8 million 60kg bags were exported, representing a significant increase from previous years (UCDA, 2023). This upward trend underscores the industry's growing importance within the Ugandan economy.

Uganda's coffee export landscape is dominated by a handful of key players. Leading the pack is Kyagalanyi Coffee Ltd. with a market share of 16.39%, followed closely by Louis Dreyfus Company Uganda Ltd. at 14.01% (UCDA, 2023). Established players like Ugacof (U) Limited and Ideal Quality Commodities Limited still hold significant market share, contributing 13.00% and 10.30%, respectively. Other notable companies include Olam Uganda Limited (9.54%), Touton Uganda Limited (6.35%), and Ibero (U) Ltd. (5.73%), all contributing to the diverse range of exporters within the Ugandan coffee industry (UCDA Monthly Report, December 2021).

The majority of Ugandan coffee finds its way onto the global market. Between November 2021 and October 2022, Uganda exported 5.83 million 60kg bags of coffee, with a total value of US$883.24 million (UCDA, 2023). Europe stands as the primary destination for Ugandan coffee exports. Italy leads the pack, purchasing US$178 million worth of coffee in 2021. Germany follows closely with imports valued at US$100 million (Coffee Geography Magazine, January 2024). Other major European importers include Spain ($32.8 million) and Belgium ($27 million). Outside of Europe, the United States ($53 million) and Morocco ($30.6 million) are also notable consumers of Ugandan coffee (OEC World, 2023).

Figure 1: **Trend of Uganda's GDP alongside coffee exports from 1986 to 2022**



Source: Author using data from the World Bank and UCDA (2023)

1.3 Statement of the problem

Uganda boasts a rich agricultural landscape with coffee playing a historic and substantial role in its economic development. As the second-largest coffee producer in Africa, coffee exports serve as a significant source of foreign exchange, alongside tourism and, more recently, gold exports. However, despite its established position in the global market, a closer examination of Uganda's coffee sector reveals a complex scenario. While the industry has contributed significantly to national economic growth, many coffee farmers continue to face challenges, including low productivity, limited access to markets, and vulnerability to price fluctuations. This complexity is further amplified by the unpredictable nature of the global coffee market, where price fluctuations and shifting consumer preferences pose significant risks to Uganda's economic stability. This complex scenario presents policymakers with a challenging dilemma: how to promote coffee export growth while simultaneously ensuring sustainable agricultural practices, equitable distribution of benefits, and improved livelihoods for coffee farmers.

While agriculture, including coffee farming, forms the backbone of Uganda's economy, contributing 24.01% to its GDP in 2022 and employing an estimated 68% of the workforce (UBOS,

2023), the sector faces substantial challenges. These challenges are characterised by rudimentary farming practices, insufficient market information, limited technological advancements, and inadequate infrastructure. These issues, coupled with outdated cultivation methods and inefficiencies within the coffee value chain, hamper the overall economic contribution of this vital sector.

Although numerous studies have explored the Ugandan economy and its agricultural landscape, a knowledge gap exists regarding the specific impact of coffee exports on Uganda's long-term economic growth. This study aims to bridge this gap by providing a comprehensive understanding of the impact of coffee exports on Uganda's economic growth, specifically focusing on the period from 1986 to 2022. This will help shed light on potential avenues for sustainable development within the coffee and agricultural sector hence boosting the country's economy.

1.3.1 Research Question:

What has been the impact of coffee exports on the economic growth of Uganda from 1986 to 2022?

1.4 Purpose and significance of the study

This study delves into the relationship between coffee exports and Uganda's economic growth from 1986 to 2022, employing empirical analysis to gain an objective and evidence-based understanding. Utilising quantitative data analysis techniques, the study will examine the impact of coffee exports on economic growth. By analysing this data, the study aims to bridge a knowledge gap concerning the specific influence of coffee exports on Uganda's long-term economic growth.

This research holds significant value for its potential to inform decision-making by policymakers, industry stakeholders, and development practitioners. The findings can shed light on key factors influencing the relationship between coffee exports and economic growth, allowing for more informed strategies. This, in turn, can lead to the identification of potential areas for policy intervention and the development of sustainable development strategies within the coffee and agricultural sectors, ultimately contributing to a more robust and thriving Ugandan economy.

1.4.1 Objectives of the study

- This study aims to comprehensively analyse the impact of coffee exports on Uganda's economic growth from 1986 to 2022.

- By addressing the knowledge gap, the study seeks to identify sustainable development avenues within the coffee and agricultural sector, ultimately bolstering Uganda's economy.

1.4.2 Research hypotheses

H1: There is a long run relationship between coffee exports and economic growth in Uganda.

H2: There is a positive and statistically significant relationship between coffee exports and economic growth in Uganda.

1.4.3 Methodology of the study

This study employs a quantitative approach to investigate the relationship between coffee exports and Uganda's economic growth from 1986 to 2022. The analysis utilises time series data from reputable sources, including the World Bank, UCDA, UBOS, and IMF. The core methodological framework is grounded in the Autoregressive Distributed Lag (ARDL) model, a powerful econometric tool suitable for analysing the long-run and short-run dynamics of relationships between variables that might be integrated of different orders. The study further employs unit root testing, cointegration analysis, and a battery of diagnostic tests to ensure the validity and reliability of the findings.

1.5 Geographical, content, and time scope of the Study

The study was conducted on Uganda using times series data from reliable sources including the World Bank, UCDA, UBOS, IMF and Macrotrends over a 37-year period, from 1986 to 2022. This timeframe is particularly relevant as it encompasses a period of significant economic transformation in Uganda, marked by both liberalisation policies and fluctuations in the global coffee market. This period witnessed several coffee boom and bust cycles, allowing us to examine the impact of price volatility on Uganda's economic growth trajectory. Additionally, this timeframe was chosen due to the availability of reliable data on coffee exports and economic indicators, allowing for a comprehensive and robust analysis. By examining this crucial period, the study seeks to shed light on potential avenues for sustainable development within the coffee and agricultural sector, ultimately bolstering the country's economy.

Although Uganda exports more than 20 commodities (products) including non-agricultural products, the study was limited to coffee. The selection of this item was based on being one of the

top exports from the country; this means the study considers the overall impact of exports on economic growth.

1.6 Organisation of the study

This study investigates the relationship between coffee exports and economic growth in Uganda and is organised in three chapters with the general introduction and the general conclusion. The general introduction provides context on the Ugandan coffee market and the role of coffee in Uganda's economy, highlighting its contribution to rural livelihoods, employment, and foreign exchange earnings. Chapter one reviews relevant economic theories and empirical evidence from past research on coffee and economic development, identifying a gap in understanding the specific impact of coffee exports on Uganda's growth. Chapter two details the methodological approach, outlining the data sources, variables, and econometric models used to analyse the relationship. Chapter three presents and interprets the findings of the econometric analysis, drawing connections to the theoretical framework and previous research. Finally, the general conclusion summarises the study, highlighting the key findings and their implications. It then proposes policy recommendations to enhance the positive contributions of coffee exports to Uganda's economy. It concludes by identifying areas for future research and acknowledging the limitations of the study.

Chapter One

Literature Review

Introduction

This literature review provides a comprehensive examination of key concepts and empirical findings relevant to the relationship between coffee exports and economic growth. This chapter will explore the following key themes: the notion of economic growth from various perspectives, the of measures economic growth, factors influencing economic growth, and a theoretical framework grounded in the export-led growth theory. Additionally, this chapter delves into the multifaceted nature of coffee exportation, exploring its perspectives and challenges, with a particular focus on factors that influence the relationship between coffee exports and economic growth. Finally, the chapter synthesises and evaluates existing empirical literature examining the link between coffee exports and overall economic growth, highlighting key trends and identifying the specific knowledge gap this study aims to address.

2.1 The notion of economic growth

Economic growth, a central concept in economics, is traditionally measured by the increase in the production of goods and services within an economy, typically reflected in changes in Gross Domestic Product (GDP), as highlighted by economists like Simon Kuznets (1930's) and Robert Solow (1956). However, this narrow focus on GDP growth does not fully capture the potential impact of a key sector like coffee exports on a developing country like Uganda. A more nuanced understanding of economic growth emerges when we consider alternative definitions that encompass broader societal well-being.

Amartya Sen (1999) and Martha Nussbaum (2000) argue that economic growth should be viewed through the lens of human well-being, emphasising factors like poverty reduction, improved access to healthcare and education, and reduced income inequality. In the context of Uganda's coffee sector, this perspective raises crucial questions about whether increased coffee exports translate into tangible improvements in the livelihoods of smallholder farmers and contribute to poverty reduction.

Similarly, the concept of inclusive growth, championed by the World Bank (1990s onwards) and the International Labour Organisation (founded in 1919), stresses that economic growth should

benefit all segments of society. Applying this to Uganda's coffee industry, it underscores the importance of ensuring that the benefits of coffee exports are distributed equitably, reaching not only large exporters but also smallholder farmers and rural communities. This focus on inclusivity is essential to prevent widening income inequality and create a more sustainable and equitable path for economic development.

Finally, the Human Development Index (HDI) approach developed by Mahbub ul Haq (1980s) for the United Nations Development Programme (UNDP) founded in 1965, acknowledges that economic growth is just one component of broader human development, incorporating factors like life expectancy, education levels, and standard of living. In the context of Uganda, the HDI approach prompts us to consider whether growth driven by coffee exports leads to improvements in these crucial human development indicators, ultimately contributing to a more holistic understanding of the sector's impact on overall societal well-being.

This review of various perspectives reveals that while economic growth, often measured by GDP, is a vital component of development, it is essential to adopt a broader perspective. When examining the impact of a key sub-sector like coffee exports, we must consider its influence on human well-being, inclusivity, and broader human development to gain a comprehensive understanding of its role in driving sustainable and equitable economic growth in Uganda.

2.1.1 Measuring economic growth; key indicators

While economic growth is a multifaceted concept, it is most commonly measured using quantitative indicators that provide insights into a country's economic performance. This study will focus on four key measures particularly relevant for assessing the impact of coffee exports on Uganda's economy:

- **Gross Domestic Product (GDP):** GDP represents the total monetary value of all goods and services produced within a country's borders over a specific period, typically a year. It serves as a primary indicator of the overall size and health of an economy. It is calculated using three approaches: production or output approach, income approach, and expenditure approach. It can be calculated in nominal terms (current prices) or real terms (adjusted for inflation). By analysing changes in Uganda's GDP over time, we can assess the impact of coffee exports on the country's overall economic expansion.

- **Real GDP Growth Rate**: This measure captures the percentage change in GDP adjusted for inflation. It provides a more accurate representation of economic growth by accounting for changes in the price level, allowing us to isolate the impact of coffee exports on real output.
- **GDP per Capita**: This indicator divides the total GDP by the population, providing an average income level per person. It is useful for assessing the standard of living and economic well-being of the population, allowing us to examine whether growth driven by coffee exports translates into improvements in individual incomes.
- **Human Development Index (HDI)**: The HDI, developed by the United Nations Development Programme (UNDP), offers a broader perspective on development by considering factors beyond just income. It combines measures of life expectancy, education, and income to provide a more holistic picture of a country's progress. In the context of Uganda's coffee sector, analysing the HDI alongside economic growth measures will allow us to examine whether growth driven by coffee exports translates into broader improvements in human development outcomes. This is particularly relevant as the coffee sector significantly impacts rural livelihoods, and improvements in the HDI can reflect positive spillover effects from coffee export revenues into areas like education and healthcare.

By examining these three measures, this study aims to provide a comprehensive assessment of the impact of coffee exports on Uganda's economic performance, considering both overall economic growth and its potential for improving individual livelihoods.

2.1.2 Factors Influencing Economic Growth in Uganda: A Focus on Coffee Exports

Numerous factors can influence a country's economic growth. However, considering the focus of this study, the factors most relevant to Uganda's context and the potential impact of coffee exports are highlighted and these include:

- **Human Capital**: Investment in education and training for coffee farmers can enhance productivity, leading to higher coffee yields and quality, ultimately boosting export earnings.
- **Technological Progress**: Adopting new technologies in coffee farming, processing, and marketing can improve efficiency, reduce costs, and enhance the competitiveness of Ugandan coffee in the global market.

- **Trade and Globalisation**: Access to international markets and favourable trade policies are crucial for coffee exports. Trade liberalisation and participation in global value chains can expand market opportunities for Ugandan coffee and stimulate economic growth.
- **Institutional Framework**: A stable and transparent institutional environment, including secure property rights, efficient contract enforcement, and effective regulation, is essential for attracting investment in the coffee sector and fostering sustainable growth.
- **Natural Resources**: Uganda's climate and fertile land are conducive to coffee cultivation. Sustainable management of these resources is essential for ensuring the long-term viability of the coffee sector and its contribution to economic growth.

This study will examine how these factors interact with coffee exports to influence Uganda's economic growth. By understanding these dynamics, potential areas for policy intervention can be identified to enhance the positive contributions of the coffee sector to Uganda's development.

2.2 Theoretical Framework Review: Export-Led Growth Theory and its Applicability to Uganda's Coffee Sector

This study is grounded in the Export-Led Growth Theory, which posits that expanding exports can serve as a key engine of economic growth. This theory finds its roots in classical and neoclassical economic theories that emphasise the role of international trade in driving economic development. Economists like Bela Balassa (1978) and Anne Krueger (1998) have been prominent proponents of this theory, providing both theoretical arguments and empirical evidence to support its validity.

Balassa, in his seminal work Exports and Economic Growth: Further Evidence (1978), demonstrated that countries specialising in exporting goods and services could achieve higher levels of productivity and economic efficiency. He argued that "export expansion leads to increased specialisation, exploitation of economies of scale, and enhanced competitiveness, ultimately fostering economic growth" (Balassa, 1978, p. 97). Krueger, in her influential paper Trade Policy and Economic Development: How We Learn (1998), further emphasised the importance of open trade policies and export-oriented strategies, particularly for developing countries. She asserted that "for many developing countries, promoting exports is the most effective means of achieving sustained economic growth" (Krueger, 1998, p. 15).

The relevance of this theory to Uganda's coffee sector is evident in several ways. First, coffee exports bring in substantial foreign currency, which can be used to import essential machinery,

technology, and intermediate goods, thereby improving the efficiency of domestic production. Second, a thriving coffee export sector can attract foreign direct investment (FDI) seeking to capitalise on Uganda's comparative advantage in coffee production. This FDI can contribute to technology transfer, infrastructure development, and the creation of higher-paying jobs. Third, increased export demand for Ugandan coffee can lead to economies of scale, allowing producers to reduce costs and become more competitive in the global market.

While the Export-Led Growth Theory has been influential in explaining the rapid economic growth of countries like South Korea and Taiwan, some critics, such as Dani Rodrik (1992), argue that it may be less relevant in today's globalised economy. They point to factors like the rise of global value chains and the increasing importance of services in international trade, suggesting that the relationship between exports and growth may be more complex than previously thought. Rodrik, in his article Trade Policy Reform as Institutional Reform (1992), argues that "the success of export-oriented strategies depends on a range of institutional factors that go beyond simply promoting exports" (Rodrik, 1992, p. 14).

However, for developing countries like Uganda, which rely heavily on primary commodity exports like coffee, the Export-Led Growth Theory remains highly pertinent. Coffee exports continue to be a major source of foreign exchange earnings for Uganda, and the sector plays a crucial role in supporting rural livelihoods and driving overall economic activity.

This study recognises the potential limitations of relying solely on export-led growth, but it acknowledges that for Uganda, expanding coffee exports can provide a crucial pathway for economic development. By examining the historical relationship between coffee exports and economic growth in Uganda, this study will contribute to a more nuanced understanding of the theory's applicability in the context of a developing country heavily reliant on a key agricultural export commodity.

2.3 Coffee Exportation: Perspectives and Challenges

2.3.1 Historical and Socioeconomic Perspectives

The significance of coffee exportation and its intricate relationship with socioeconomic development have been extensively studied. Robert H. Smith (1998), in his insightful essay "Coffee Production and Exportation: Rethinking the Dependency Paradigm," challenges

conventional wisdom surrounding the industry. He argues that scholars have often overlooked the crucial roles of intermediaries and the negative consequences of coffee monoculture specialisation, including environmental degradation, resource depletion, and social inequalities. Smith's work encourages a critical re-evaluation of established notions and emphasises the need to consider the multifaceted impact of coffee exportation on producing countries.

2.3.2 Production and Investment Dynamics

Complementing Smith's socioeconomic perspective, Romer and Lane (2001) delve into the practical aspects of coffee production, highlighting the importance of participation, management, joint ventures, and technology transfer. They argue that successful coffee cultivation hinges on networks of expertise and collaboration. Blomstrom (1989), further refining our understanding of investment dynamics, emphasises the distinct role of direct investment in shaping the coffee industry. He classifies coffee production into three categories:

- Horizontal Coffee Production: Expanding within the same industry or market segment.
- Platform Coffee Production: Leveraging existing infrastructure and networks to enter new markets.
- Vertical Coffee Production: Integrating processes from cultivation to retail, aiming to control the entire value chain.

Understanding these diverse investment strategies is crucial for understanding the evolving structure and dynamics of the coffee industry.

2.3.3 The Challenges of Coffee Export Dependence

While coffee exports can contribute significantly to economic growth, over-reliance on a single commodity can create vulnerabilities. Research by Hauge and Øygard (2005) in Tanzania highlights the risks of coffee export dependence, emphasising that price volatility in the global market can undermine economic stability. Their study cautions against neglecting diversification efforts and emphasises the need for strategies to mitigate the negative impacts of external shocks.

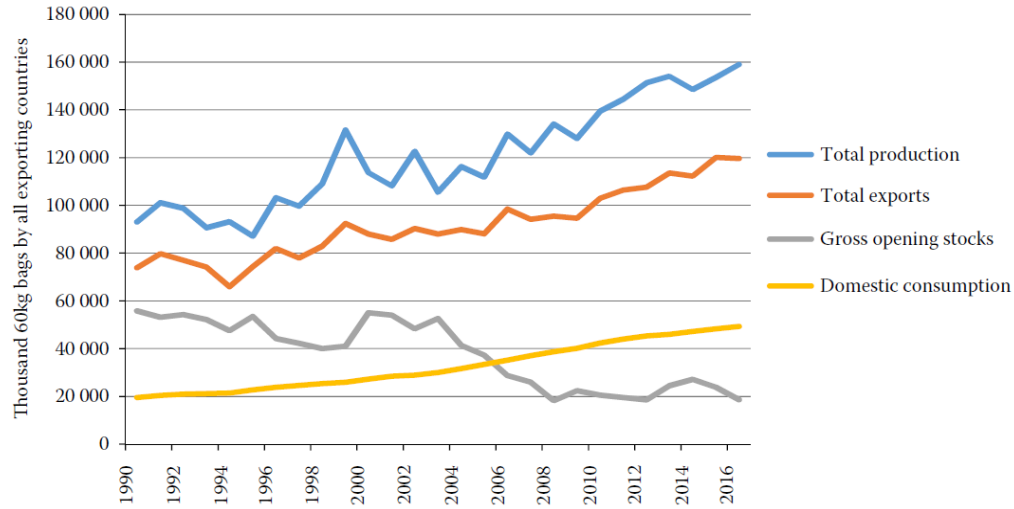
2.3.4 Empirical Evidence on Coffee Exports and Growth

Empirical studies on the relationship between coffee exports and economic growth have yielded mixed results. Giuliano and Zachariassen (2014) found a positive correlation between coffee exports and economic expansion in Brazil, while Aoki-Suzuki et al. (2018) reached similar

conclusions in their study of Ethiopia. Gómez-Restrepo and Ramírez-Giraldo (2019) also observed a positive association between coffee exports and growth in Colombia, suggesting that coffee exports can stimulate investment and long-term development.

These diverse findings underscore the complex and context-dependent nature of the relationship between coffee exports and economic growth. Further research is needed to explore the specific factors that influence this relationship and to develop strategies for maximising the positive contributions of coffee exports while mitigating potential risks.

Figure 2: **Change of coffee production, consumption and exportation in all exporting countries from 1990 to 2016**



Source: International Coffee Organization (ICO 2018)

2.3.5 Factors Influencing the Relationship between Coffee Exports and Economic Growth: The Case of Uganda

The impact of coffee exports on economic growth is not uniform across all countries. It is shaped by a complex interplay of various factors. In the context of Uganda, the following factors are particularly relevant:

Table 1: **Factors influencing the relationship between coffee exports and Economic growth in Uganda**

Factor	Description	Relevance to Uganda
Global Coffee Prices	Fluctuations in international coffee prices, driven by global supply and demand, directly impact export earnings and overall economic performance.	Uganda, as a major coffee exporter, is highly susceptible to global price volatility, which can significantly influence its economic growth trajectory.
Domestic Production & Productivity	The quantity and quality of coffee produced domestically determine export volumes and influence global market share. Factors like agricultural practices, technology adoption, and investment in the coffee sector play a crucial role.	Uganda faces challenges in improving coffee productivity due to factors like aging coffee trees, limited access to inputs and technology, and climate change. Enhancing productivity is crucial for increasing export volumes and maximising the economic benefits of coffee.
Value Addition & Processing	Adding value to coffee through processing and product diversification (e.g., roasted beans, instant coffee) can capture higher value in the global market, generating more revenue.	Uganda has traditionally exported primarily unprocessed green coffee beans, limiting its potential earnings. Investing in processing facilities and developing a diverse product portfolio can enhance Uganda's competitiveness and

		contribute to higher export revenues.
Market Access & Trade Policies	Favourable trade agreements, reduced tariff barriers, and access to key export markets are essential for maximising coffee export earnings and boosting economic growth.	Uganda benefits from trade agreements like the African Growth and Opportunity Act (AGOA) but faces challenges in meeting quality standards and navigating complex international trade regulations. Strengthening trade relationships and ensuring compliance with international standards can enhance Uganda's access to lucrative markets.
Institutional Framework	A stable and transparent institutional environment, including strong property rights, contract enforcement, and effective regulation, fosters investment, encourages entrepreneurship, and promotes sustainable growth in the coffee sector.	Uganda has made progress in improving its institutional framework, but challenges remain in terms of corruption, bureaucratic inefficiencies, and lack of access to credit for smallholder farmers. Strengthening institutions is vital for fostering a conducive environment for coffee production and export growth.

Environmental Sustainability	Sustainable coffee production practices, environmental conservation efforts, and certification schemes enhance the long-term viability of the coffee sector and its attractiveness to environmentally conscious consumers.	Climate change poses a significant threat to coffee production in Uganda. Investing in climate-resilient coffee varieties, promoting sustainable farming practices, and ensuring environmental conservation is crucial for safeguarding the future of the coffee sector and its contribution to the economy.

Source: Author

2.4 Empirical Literature Review: Examining the Coffee-Growth Nexus

The empirical literature on the relationship between coffee exports and economic growth offers a mixed picture, highlighting the complexity and context-dependent nature of this relationship. This review synthesises key findings, grouping studies based on their primary conclusions:

2.4.1 Evidence Supporting a Positive Relationship

A number of studies have found evidence suggesting a positive relationship between coffee exports and economic growth. Giuliano and Zachariassen (2014), in their analysis of Brazil, found that coffee exports had a significant positive impact on economic expansion. Similarly, Aoki-Suzuki et al. (2018), focusing on Ethiopia, concluded that coffee exports contributed to economic growth, particularly by stimulating investment and creating employment opportunities. Gómez-Restrepo and Ramírez-Giraldo (2019), examining the Colombian coffee sector, also observed a positive correlation between coffee exports and growth, highlighting the potential for long-term development benefits. Roy et al. (2006), utilising a simultaneous equation model with time-series data, found that coffee exports had a positive and significant impact on the U.S. economy's expansion between 1970 and 2001.

2.4.2 Mixed and Context-Dependent Results

Other studies have yielded more mixed or context-dependent results. Nair-Reichert (2000), using panel from Brazil between 1971 and 1995, found that the impact of coffee exports on growth varied significantly across countries. They concluded that open economies, those more integrated into global trade, tended to benefit more from coffee exports. Carcovic and Levine (2002), using a large dataset and advanced econometric techniques, reached similar conclusions, finding that the effect of coffee exports on growth was heterogeneous and influenced by various country-specific factors.

2.4.3 Debates over Foreign Direct Investment in Coffee Production

The impact of foreign direct investment (FDI) in coffee production on host countries has also been a subject of debate. Dalgard and Dreher (1992) argue that FDI in coffee production can bring substantial benefits, including capital investment, technology transfer, and the creation of linkages with local businesses. However, Hanson (2001) suggests that the evidence for positive spillovers from FDI in coffee production is weak, and Gorg and Strobl (2002), using micro-level data, found that spillovers from foreign-owned to locally owned companies were predominantly negative.

2.4.4 Knowledge Gap and Contribution of this Study

Despite the extensive literature on coffee exports and economic growth, a significant knowledge gap remains regarding the long-term impact of coffee exports on Uganda's economic development, particularly in the context of recent economic reforms and liberalisation policies. This study aims to address this gap by conducting an empirical analysis of the relationship between coffee exports and economic growth in Uganda from 1986 to 2022, a period marked by significant economic transformations. By employing the Autoregressive Distributed Lag (ARDL) model, this study will provide a more nuanced assessment of the long-term effects of coffee exports on Uganda's economic trajectory, taking into account various factors influencing this relationship, including global coffee prices, domestic production, investment dynamics, and trade policies. This study will contribute to the existing literature by providing valuable insights for policymakers and stakeholders seeking to foster sustainable and inclusive growth within Uganda's coffee sector.

Conclusion

This chapter has explored a range of perspectives on economic growth, from traditional measures like GDP to more holistic views emphasising human well-being and sustainable development. The examination of factors influencing economic growth, particularly in the context of Uganda's coffee sector, has highlighted the complex interplay of human capital, technological progress, trade dynamics, institutional frameworks, and natural resource management. A detailed analysis of the Export-Led Growth Theory, considering its strengths, criticisms, and applicability to developing economies reliant on primary commodity exports, has provided a solid theoretical foundation for this study.

While the empirical literature on the relationship between coffee exports and economic growth offers valuable insights, it also reveals inconsistencies and a significant knowledge gap. Studies focusing on various countries and time periods have produced mixed results, highlighting the context-dependent nature of this relationship. Existing research often fails to adequately account for the specific challenges and opportunities faced by developing countries like Uganda, where coffee production plays a crucial role in supporting rural livelihoods and driving overall economic activity. This underscores the need for further investigation into the long-term impact of coffee exports on Uganda's economic development, particularly in the context of recent economic reforms and liberalisation policies.

Chapter Two

Methodology of the study

Introduction

This chapter lays the groundwork for an empirical investigation into the influence of coffee exports on Uganda's economic growth. It provides a comprehensive and transparent account of the research design and analytical tools employed. The chapter commences by outlining the guiding research philosophy and the specific research type adopted. It then justifies the selected time frame for the study and explains the rationale behind the choice of data sources. Next, the chapter delves into a detailed explanation of each variable included in the analysis, and justifying their relevance to the research question. The chapter then introduces the chosen econometric model, providing a clear rationale for its selection and offering a detailed explanation of its application in addressing the study's objectives. By establishing a clear and comprehensive understanding of these methodological choices, this chapter aims to equip the reader to critically evaluate the statistical relationship between coffee exports and economic growth in Uganda, paving the way for robust and reliable findings.

3.1 Research design

3.1.1 Research Philosophy

This study adopts a positivist philosophy, aiming to identify objective and measurable relationships between economic variables. Positivism, as defined by sociologist Emile Durkheim, emphasises the scientific method and objective data analysis to understand the social world (Durkheim, 1895). This approach is well-suited for investigating the impact of coffee exports on Uganda's economic growth because it emphasises the use of quantitative data, statistical analysis, and econometric modelling to test hypotheses and draw generalisable conclusions. By adhering to the principles of positivism, this study seeks to establish empirical evidence that can contribute to a more comprehensive understanding of the causal relationship between coffee exports and economic growth in Uganda, informing policy decisions and economic development strategies.

3.1.2 Research type

This research employs a deductive and quantitative approach. As economics student Robert S. Pindyck defines, the deductive approach involves "using general economic theories and then applying them to specific situations" (Pindyck & Rubinfeld, 2013, p. 12). This study specifically draws upon the export-led growth theory, which posits that export expansion can stimulate economic growth through various channels, such as increased foreign exchange earnings, economies of scale, and technological advancements. The theory is applied to the specific case of Uganda, examining the impact of coffee exports on its economic growth. This deductive reasoning is coupled with a quantitative approach, utilising numerical data and statistical analysis to investigate the relationship between coffee exports and Uganda's GDP. By employing econometric models and statistical tests, the study aims to quantify the direction and strength of this relationship, providing objective and generalisable insights for policymakers and stakeholders in Uganda's coffee sector.

3.1.3 Time scope

This study analyses data spanning a 37-year period, from 1986 to 2022. This timeframe was deliberately chosen to capture the long-term impact of coffee exports on Uganda's economic growth, recognising that economic growth is often a gradual process. Analysing data over several decades allows for a more comprehensive assessment of the relationship between coffee exports and economic development, taking into account potential cyclical fluctuations, structural changes in the economy, and the evolving role of coffee in Uganda's export portfolio. This extended time scope provides a more robust basis for drawing meaningful conclusions about the long-term influence of coffee exports on Uganda's economic trajectory.

3.1.4 Data collection

This study relies on secondary data analysis, utilising existing datasets from reputable sources, offering advantages such as cost-effectiveness, access to large datasets covering an extended timeframe, and established reliability of data from reputable institutions. Secondary data for this research was sourced from institutions like the Uganda Coffee development Authority (UCDA), the World Bank, International Monetary Fund (IMF), and Macro trends. To ensure the stability of variance and meet the assumptions of the econometric model, variables were transformed using natural logarithms. Specifically, GDP, coffee exports and FDI were converted to their logarithmic

values. This transformation helps to address potential issues of heteroscedasticity and improves the interpretation of coefficients as elasticities. The datasets obtained were for the following variables;

Table 2: **Identification of variables, their abbreviations and expected signs**

Variable	Abbreviation	Source of Data	Expected Sign
Real Gross Domestic Product (US$)	GDP	World Bank Databank	-
Coffee Exports (US$)	CE	Uganda Coffee development Authority (UCDA)	Positive (+)
Foreign Direct Investment (US$)	FDI	Macrotrends	Positive (+)
Inflation Rate (Percentage)	INF	World Bank Databank	Negative (-)
Exchange Rate (Ugandan Shilling) compared to US Dollar	EXR	International Monetary Fund (IMF)	Positive/Negative (+/-)

Source: Author

a. Gross Domestic Product (GDP) – Dependent variable

Uganda's Real Gross Domestic Product serves as the dependent variable in this study. GDP, defined as "the monetary value of all final goods and services produced in a country in a given year" (IMF, 2023, Understanding National Accounts), is a fundamental indicator of a nation's economic well-being. Real GDP is therefore GDP adjusted for price changes(inflation). This research specifically analyses changes in Uganda's Real GDP over time to assess the impact of coffee exports, foreign direct investment, inflation, and exchange rates on the country's overall economic growth. By examining the relationship between these independent variables and GDP, the study aims to gain a deeper understanding of the key factors driving Uganda's economic performance

b. Coffee exports (CE)

Coffee exports (CE) are the central independent variable in this study. As economist Jeffrey Sachs emphasises, "coffee remains a critical cash crop for many developing countries" (Sachs, 2008, p. 232), and Uganda is no exception. The study analyses the total value of coffee beans exported from Uganda during the period from 1986 to 2022, recognising that coffee is a vital source of foreign exchange earnings for the country. A thriving coffee sector can also stimulate broader economic activity through job creation in production, processing, and transportation. By examining the relationship between coffee exports and GDP, this research aims to assess the extent to which coffee contributes to Uganda's economic growth, considering its direct impact on export earnings as well as its broader influence on overall economic activity.

c. Foreign Direct Investment (FDI)

Foreign direct investment is another key independent variable in this study. FDI, defined by the United Nations Conference on Trade and Development (UNCTAD) as "an investment made by a company or individual in one country into a business in another country, in which the investor has control or a significant influence in management decisions" (UNCTAD, 2023, International Investment Definitions and Statistics), plays a crucial role in economic growth, particularly in developing countries. As the World Bank highlights, FDI can provide "much-needed capital, technology, and skills" (World Bank, 2023, Foreign Direct Investment). This study analyses the value of FDI inflows into Uganda from 1986 to 2022, investigating how these investments contribute to the country's overall economic growth. The analysis will consider the potential channels through which FDI can impact GDP, including increased job creation, technology transfer, and infrastructure development.

d. Inflation Rate (INF)

Inflation rate is a crucial independent variable in this study, as it can significantly impact economic growth. Inflation, defined as the sustained rise in the general price level of goods and services in an economy over time, can distort investment decisions, reduce purchasing power, and create uncertainty for businesses and consumers, as highlighted by economist Michael Woodford (2003). This study analyses inflation data from 1986 to 2022, examining its interaction with coffee exports, FDI, and the exchange rate to understand its influence on Uganda's economic growth trajectory.

By incorporating inflation into the analysis, this research aims to provide a more nuanced understanding of the factors driving economic performance in Uganda.

e. Exchange rate (EXR)

The exchange rate is another important independent variable considered in this study. Defined by economist Jeffrey A. Frankel as "the price of one currency in terms of another" (Frankel, 2023, p. 10), fluctuations in the exchange rate can significantly impact Uganda's economic growth. A weaker Ugandan shilling (UGX) relative to foreign currencies can make Ugandan exports more competitive, potentially boosting export earnings and stimulating economic activity. Conversely, a stronger UGX can make imports more expensive, potentially contributing to inflation and dampening economic growth. As the World Bank emphasises, a stable exchange rate "can create a more predictable environment for businesses and investors," potentially encouraging foreign direct investment and fostering economic expansion (World Bank, 2023, Exchange Rates and Economic Growth). This study analyses exchange rate data from 1986 to 2022, examining its relationship with GDP to understand how changes in the value of the UGX affect Uganda's economic growth.

3.2 Empirical estimation technique

This section outlines the econometric approach employed to assess the relationship between coffee exports and Uganda's economic growth. The analysis is conducted using EViews 12 software, a widely recognised econometric package specifically designed for time series analysis. EViews offers robust features for unit root testing, model estimation, diagnostic testing, and result presentation, making it a suitable choice for this research.

To explore the relationship between economic growth and the selected variables, a general functional form for the model is established. This function represents Uganda's Real Gross Domestic Product at time t (GDP_t) as a function of the independent variables:

General Functional Form:

$$GDP_t = f(CE_t, FDI_t, INF_t, EXR_t) \quad (1)$$

where:

GDP_t: Real Gross Domestic Product of Uganda at time t

CE_t: Coffee Exports from Uganda at time t

FDI_t: Foreign Direct Investment in Uganda at time t

INF_t: Inflation Rate in Uganda at time t

EXR_t: Exchange Rate in UGX at time t

The general functional form is then expanded into a linear regression equation, using the natural logarithms of GDP, coffee exports and FDI to stabilise variance and improve the interpretation of coefficients

Linear Regression Equation:

$$lnGDP_t = \beta 0 + \beta 1 lnCE_t + \beta 2 lnFDI_t + \beta 3 INF_t + \beta 4 EXR_t + \varepsilon_t \quad (2)$$

Here:

$\beta 0$: The constant term

βi (i = 1 to 4): Represent the coefficients of the respective independent variables

ε_t: Represents the error term

3.2.1 Descriptive summary of the data

Descriptive summary was presented to provide a concise overview of the key characteristics of the dataset. This summary is essential for understanding the overall distribution of the data and identifying any potential outliers or inconsistencies before proceeding to the analysis. By summarising the data descriptively, a foundational understanding of the information is gained, allowing for informed decisions about the most appropriate statistical methods for further exploration. These descriptive statistics will be presented in form of descriptive statistics, time trends of graphs and the correlation matrix of the variables.

3.2.2 Unit Root Tests

To determine the order of integration of the variables ($lnGDP$, $lnCE$, $lnFDI$, INF and EXR) the Augmented Dickey-Fuller (ADF) unit root test was employed. The ADF test, developed by Dickey and Fuller (1979, 1981), is a widely used test for stationarity in time series data. It helps determine whether a time series has a unit root, implying non-stationarity, or not.

The general form of the ADF test equation is:

$$\Delta Y_t = \alpha + \beta_t + \delta Y_{t-1} + \sum \gamma i \, \Delta Y_{t-i} + \varepsilon_t \quad (3)$$

where:

ΔY_t: The first difference of the variable Y at time t (i.e., Y_t - Y_{t-i})

α: The constant term

β_t: The time trend term (included in some specifications)

δ: The coefficient of the lagged dependent variable (Y_{t-1})

γi: The coefficients of additional lagged difference terms (ΔY_{t-i})

ε_t: The error term at time t

i: The number of lagged difference terms (determined by model selection criteria, such as the Akaike Information Criterion or Bayesian Information Criterion)

The ADF test involves testing the null hypothesis (H0) against the alternative hypothesis (H1):

H0: The data has a unit root (non-stationary). This implies that the current value of the series is highly dependent on its past value, and shocks (changes) tend to persist over time.

H1: The data does not have a unit root (stationary). This suggests that the series has a constant mean and variance over time, and shocks eventually die out.

If the null hypothesis is rejected, it implies that the time series is stationary. If the null hypothesis cannot be rejected, then the time series is considered non-stationary. The results of the ADF tests, including test statistics and p-values, will be presented in tables 5 and 6 to determine the order of integration for each variable.

3.3 Model Selection and Specification

Following the determination of the order of integration of the variables using unit root tests, the Autoregressive Distributed Lag (ARDL) model was selected to analyse the relationship between coffee exports and Uganda's economic growth. The ARDL model is particularly suitable for time series analysis, especially when dealing with variables that may be integrated of different orders. It offers several advantages, including:

- Flexibility: ARDL can accommodate both stationary (I(0)) and non-stationary (I(1)) variables, making it appropriate for a wider range of data characteristics.

- Cointegration Analysis: ARDL allows for testing for cointegration – a long-run equilibrium relationship between variables – even when the variables are integrated of different orders.
- Small Sample Performance: ARDL has been shown to perform well in small and finite samples, making it robust for datasets that are not very large.

3.3.1 Bounds Test for Cointegration

A bounds test was conducted to assess the presence of cointegration between the variables. The bounds test, developed by Pesaran et al. (2001), uses the Wald test (F-statistic) to compare the estimated coefficients of the lagged levels of the variables. The computed F-statistic was then compared with critical values provided by Pesaran et al. (2001), which account for the number of variables and the sample size.

Null Hypothesis (H0): No cointegration exists between the variables.

Alternative Hypothesis (H1): Cointegration exists between the variables.

If the calculated F-statistic exceeds the upper bound critical value, the null hypothesis of no cointegration is rejected, providing evidence of a long-run relationship between the variables.

3.3.2 ARDL Model Specification

Once cointegration was established, the ARDL model was specified. The general form of the ARDL(p, q, r, s, t) model, where p, q, r, s, and t represent the lag lengths for $lnGDP$, $lnCE$, $lnFDI$, INF, and EXR respectively, is:

$$\Delta lnGDP_t = \alpha 0 + \sum \beta_i \, \Delta lnGDP_{t-i} + \sum \gamma_i \, \Delta lnCE_{t-j} + \sum \delta_k \, \Delta lnFDI_{t-k} + \sum \varepsilon_l \, \Delta INF_{t-l} + \sum \mu_m \, \Delta EXR_{t-m} + \omega 1 lnGDP_{t-1} + \omega 2 lnCE_{t-1} + \omega 3 lnFDI_{t-1} + \omega 4 INF_{t-1} + \omega 5 EXR_{t-1} + \varepsilon_t \quad (4)$$

where:

Δ: Represents the first difference operator (e.g., $\Delta lnGDP_t = lnGDP_t - lnGDP_{t-1}$)

$\alpha 0$: The constant term

β_i, γ_i, δ_k, μ_m: The coefficients of the lagged difference terms for the respective variables

$\omega 1$, $\omega 2$, $\omega 3$, $\omega 4$, $\omega 5$: The long-run coefficients of the variables in levels

ε_t: The error term at time t

The optimal lag lengths (p, q, r, s, t) were selected using the Akaike Information Criterion (AIC).

3.3.3 Error Correction Model (ECM)

The ARDL model can also be expressed as an Error Correction Model (ECM), which highlights the short-run dynamics and the adjustment towards the long-run equilibrium:

$$\Delta lnGDP_t = \alpha 0 + \sum \beta_i \Delta lnGDP_{t-i} + \sum \gamma_j \Delta lnCE_{t-j} + \sum \delta_k \Delta lnFDI_{t-k} + \sum \varepsilon_l \Delta INF_{t-l} + \sum \mu_m \Delta EXR_{t-m} + \lambda ECT_{t-1} + \varepsilon_t \quad (5)$$

where:

ECT_{t-1}: The lagged error correction term, derived from the long-run relationship between the variables. It captures the speed of adjustment from short-run deviations back to the long-run equilibrium.

λ: The coefficient of the error correction term, representing the speed of adjustment.

3.3.4 Diagnostic Tests and Model Validation

After estimating the ARDL model, a series of diagnostic tests were performed to evaluate the model's validity and ensure the reliability of the findings. These tests assess the key assumptions of the ARDL model and identify potential issues that could affect the results.

The following diagnostic tests were conducted:

- **Normality of Residuals**: The Jarque-Bera test was employed to assess the normality of the residuals. This test evaluates both the skewness and kurtosis of the residuals, checking for deviations from a normal distribution.
- **Serial correlation**: The Breusch-Godfrey Lagrange Multiplier (LM) test was used to detect the presence of autocorrelation (serial correlation) in the residuals. Autocorrelation violates the assumption of independent errors, which can lead to biased and inefficient coefficient estimates.
- **Heteroscedasticity**: The Breusch-Pagan-Godfrey test was performed to assess the presence of heteroscedasticity – unequal variances in the residuals. Heteroscedasticity can also affect the efficiency of the coefficient estimates and lead to incorrect standard errors.

- **Model Stability**: The cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) tests were applied to examine the stability of the ARDL model over time. These tests help identify structural breaks or shifts in the model's parameters, which could affect the reliability of the long-run relationship.

The results of these diagnostic tests are presented in the next chapter. By carefully conducting and reporting the results of these diagnostic tests, the validity and reliability of the ARDL model are ensured, providing a strong foundation for the analysis of the relationship between coffee exports and Uganda's economic growth.

Conclusion

This chapter has outlined the methods used to study the impact of coffee exports on Uganda's economic growth. A positivist philosophy and a deductive, quantitative approach guided the choice of data and analytical tools. Data from 1986 to 2022, collected from reliable sources, was analysed using the Autoregressive Distributed Lag (ARDL) model. This model is suitable for handling variables integration of I(0) and I(1) and works well with smaller datasets. A bounds test was used to confirm cointegration, and the ARDL model was then specified, including variables like GDP, coffee exports, FDI, inflation, and exchange rate. Diagnostic tests were performed to ensure the model's accuracy and reliability. These test results are discussed in the next chapter, providing a complete analysis of both the short-term and long-term connections between coffee exports and economic growth in Uganda.

Chapter Three

Empirical data analysis

Introduction

This chapter moves from theory to practice, employing statistical analysis to understand the connection between coffee exports and Uganda's economic growth from 1986 to 2022. Using EViews12 software, this chapter examines the collected data to uncover the real impact of coffee exports on Uganda's economy. First, a clear summary of the data is presented, highlighting important trends and characteristics. Next, unit root tests are employed to check if the data is suitable for analysis. Then, a long-term stable relationship between coffee exports and economic growth is examined using cointegration analysis. The core of this chapter lies in using the Autoregressive Distributed Lag (ARDL) model. This model helps in understanding both the immediate and long-term effects of coffee exports on Uganda's economic growth, considering factors like foreign direct investment, inflation, and exchange rates. This detailed data analysis aims to definitively answer the question: What has been the impact of coffee exports on Uganda's economic growth from 1986 to 2022? By providing clear and concrete evidence, this chapter offers valuable insights for policymakers and stakeholders to develop effective strategies for Uganda's coffee sector and the country's overall economic well-being.

4.1.1 Descriptive summary of the data

A descriptive summary of data in the table below provides a concise overview of its characteristics.

Table 3: **Descriptive summary of the data**

	lnGDP	lnCE	lnFDI	INF	EXR
Mean	23.24528	19.48354	19.39169	0.137697	2093.621
Median	23.02385	19.60448	20.11423	0.057800	1810.300
Maximum	24.54230	20.59245	21.14853	1.961200	3727.070
Minimum	21.77409	18.24558	13.81551	-0.002900	106.1400
Std. Dev.	0.884264	0.629466	1.771799	0.341115	1017.862
Skewness	-0.015506	-0.407956	-1.709993	4.877382	0.294389
Kurtosis	1.492474	2.353659	5.527520	26.37734	2.081297
Jarque-Bera	3.126193	1.489770	24.86641	882.2762	1.637178
Probability	0.209486	0.474789	0.000004	0.000000	0.441054
Sum	767.0943	642.9569	639.9257	4.544000	69089.50
Sum Sq. Dev.	25.02154	12.67929	100.4567	3.723511	33153384
Observations	33	33	33	33	33

Source: Author Using Eviews12

Note: *The original dataset contained 37 observations. However, due to the logarithmic transformation of the variables lnGDP, lnCE, and lnFDI, the effective sample size for these variables is reduced to 33 observations. This is because logarithmic transformations are undefined for values of zero or less, and any such observations were necessarily excluded.*

According to **Table 2**, Uganda's Gross Domestic Product, represented by its natural logarithm (lnGDP), exhibits an average value of 23.25, reflecting a generally positive growth trajectory over the study period. The standard deviation of 0.88 indicates moderate variability in GDP growth. The distribution of lnGDP is relatively symmetrical, as evidenced by skewness and kurtosis values close to zero, suggesting a pattern close to a normal distribution.

Coffee exports, expressed as lnCE, show an average value of 19.48, indicating a generally positive trend in coffee export values over time. With a standard deviation of 0.63, lnCE exhibits less variability compared to lnGDP, suggesting a relatively more stable stream of export earnings. However, a negative skewness of -0.41 suggests a longer tail on the left side of the distribution, indicating some periods of significantly lower coffee export values that warrant further investigation.

The natural logarithm of foreign direct investment (lnFDI) presents an average value of 19.39 but displays considerable volatility, as evidenced by a large standard deviation of 1.77. This suggests substantial fluctuations in FDI inflows over the study period. Furthermore, lnFDI exhibits a highly negative skewness (-1.71) and a high kurtosis value (5.53), suggesting a distribution heavily skewed to the left with a sharp peak and a long tail. This pattern indicates a few periods with exceptionally high FDI inflows, which might represent outliers requiring closer examination during the analysis.

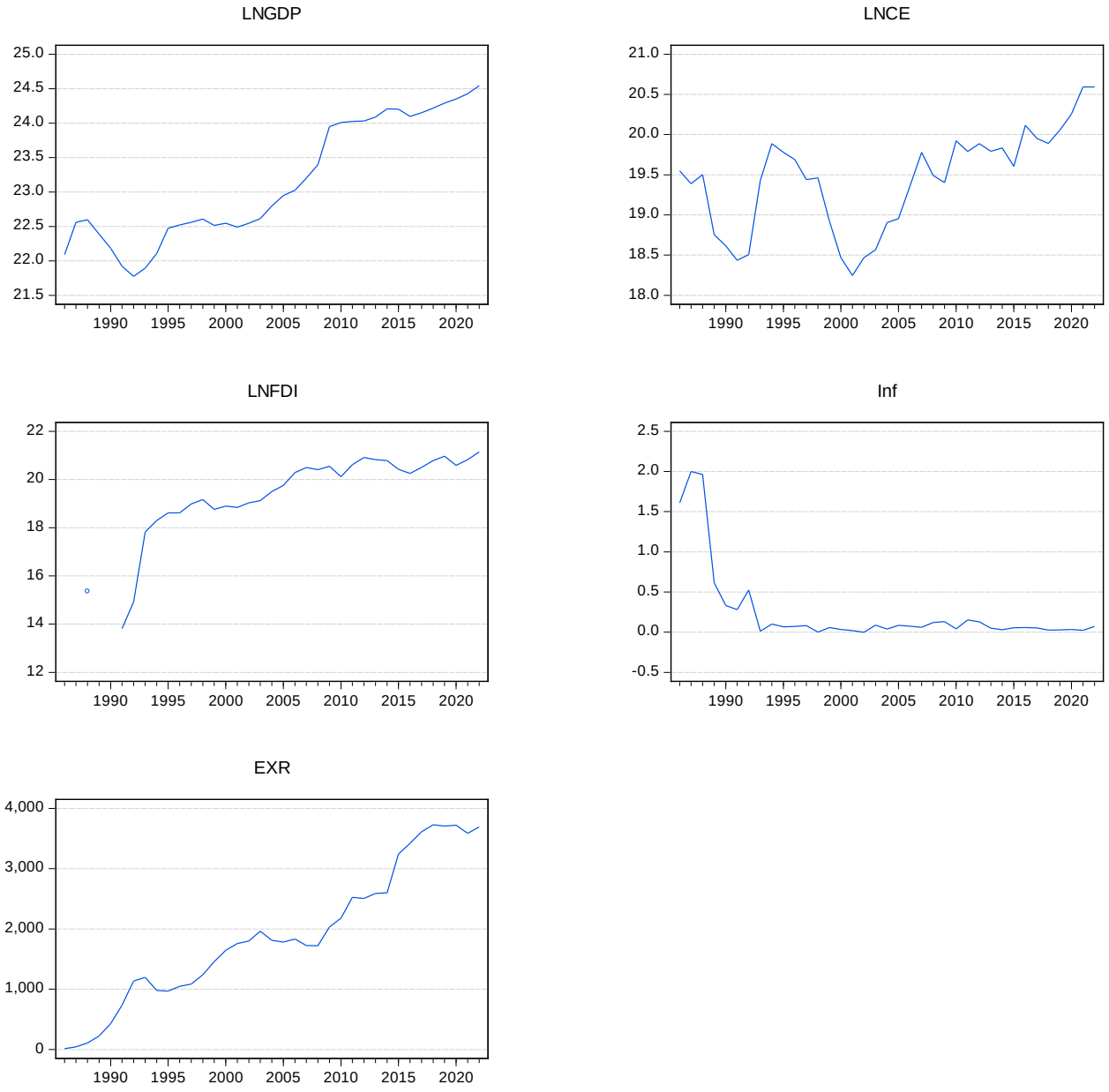
The average inflation rate over the study period is 13.77%, a relatively high figure for a developing economy. The large standard deviation of 34.11, coupled with extremely high positive skewness (4.88) and kurtosis (26.38), indicates substantial variation in inflation rates and a distribution heavily skewed to the right. This suggests the presence of periods with very high inflation, potentially exerting significant pressure on Uganda's economy.

The average exchange rate, measured as Ugandan shillings (UGX) per unit of a US dollar, is 2093.62. The substantial standard deviation of 1017.86 indicates considerable fluctuations in the exchange rate over the study period, reflecting potential volatility in Uganda's foreign exchange market. The positive skewness of 0.29 suggests a slight rightward skew in the distribution, indicating a higher likelihood of periods with a relatively weaker Ugandan shilling compared to the foreign currency.

The Jarque-Bera test for normality indicates that lnGDP, lnCE, and EXR do not show a statistically significant departure from a normal distribution. However, both lnFDI and INF exhibit strong deviations from normality, as evidenced by their very low p-values. The non-normality of lnFDI is likely due to the highly skewed nature of the data, while the non-normality of INF is expected given its extreme skewness and kurtosis values. These deviations highlight the potential influence of outliers or extreme values, which warrant careful consideration during subsequent analyses.

4.1.2 Visualisation of time trends of the variables

Figure 3: **Graphs showing the time trends of the variables**



Source: Author using Eviews12

Figure 3 above shows the trend of the variables used in this study for the period under study (1986-2022). lnGDP, lnCE, lnFDI, EXR show a general upward trend which is due to the growth experienced in different sectors of the economy during this period. INF shows a downward and then stable trend due to the economic policies put in place by the government during this period to stabilise the economy.

4.1.3 Correlation of Variables

This section examines the correlations between the variables to understand the strength and direction of their linear relationships. The correlation matrix presented below provides insights into potential associations between GDP growth, coffee exports, foreign direct investment, inflation, and exchange rates. Identifying strong correlations can help anticipate potential multicollinearity issues in later regression analysis and provide a preliminary understanding of the interconnectedness between these economic factors.

Table 4: **Table of correlation matrix of variables**

	lnGDP	lnCE	lnFDI	INF	EXR
lnGDP	1	0.7288	0.7975	-0.2185	0.8848
lnCE	**0.7288**	1	0.5826	-0.0829	0.5840
lnFDI	**0.7975**	0.5826	1	-0.5566	0.7425
INF	-0.2185	-0.0829	-0.5566	1	-0.4201
EXR	**0.8848**	0.5840	**0.7425**	-0.4201	1

Source: Author using Eviews12

Table 3 reveals relationships between the variables under study. Notably, a strong positive correlation exists between Uganda's economic growth (lnGDP) and coffee exports (lnCE), with a correlation coefficient of 0.72. This finding suggests that higher coffee export values tend to be associated with stronger economic growth, supporting the notion that coffee exports play a significant role in driving Uganda's economic activity.

Further solidifying this observation, lnGDP exhibits a very high positive correlation (0.79) with lnFDI, implying that foreign direct investment contributes significantly to Uganda's economic expansion. The strong positive correlation (0.88) between lnGDP and the exchange rate (EXR) is also significant. A weaker Ugandan Shilling (higher EXR value) likely makes exports, including coffee, more competitive in international markets, boosting export revenues and contributing to economic growth.

The strong positive correlation (0.74) between lnFDI and EXR suggests that foreign investors might be attracted to Uganda during periods of a weaker shilling, potentially due to lower investment costs and higher potential returns in foreign currency terms.

4.2 Results of the Unit Root Tests

The Augmented Dickey-Fuller (ADF) test helps determine whether a time series is stationary meaning its statistical properties like mean and variance remain constant over time or non-stationary. This is crucial for selecting the appropriate econometric model. The ADF test examines two hypotheses:

- **H0**: The data has a unit root (non-stationary). This means the series is influenced by past values and shocks persist over time.
- **H1**: The data does not have a unit root (stationary). This implies a constant mean and variance, with shocks eventually disappearing.

The aim is to reject the null hypothesis (H0) to establish stationarity. A variable is considered stationary at levels (denoted I(0)) if the null hypothesis is rejected at its original form. If stationarity is achieved only after differencing the variable once (denoted I(1)), it indicates the presence of a trend that needed removal.

4.2.1 ADF test results at levels

Table 5 below presents the ADF test results at levels, providing insights into the stationarity properties of each variable and guiding the model selection process.

Table 5: **ADF test results at levels**

Model / Variable	Trend and Intercept	Critical value at 5% level of significance	P-Value	Intercept	Critical value at 5% level of significance	P-Value	Decision
lnGDP	-4.2494	-3.5442	0.0099	-0.0515	-2.9458	0.9472	Reject the null hypothesis
lnCE	-2.2087	-3.5403	0.4706	-1.0348	-2.9458	0.7302	Do not reject the null hypothesis
lnFDI	-5.43371	-3.5628	0.0006	-5.4444	-2.9604	0.0001	Reject the null hypothesis
INF	-2.5635	-3.5403	0.2981	-2.9893	-2.9458	0.0454	Do not reject the null hypothesis
EXR	-1.9398	-3.5403	0.6132	-0.5545	-2.9458	0.8684	Do not reject the null hypothesis

Source: Author using Eviews12

Table 5 presents the results of the Augmented Dickey-Fuller (ADF) test conducted at levels for each variable to assess the presence of a unit root, which would indicate non-stationarity.

The ADF test results for lnGDP reveal a nuanced pattern: while the test incorporating both a trend and intercept indicates no unit root (p-value: 0.00), suggesting stationarity at levels (I(0)), the intercept-only test suggests the presence of a unit root (p-value:0.94). Given the importance of accounting for potential trends, the analysis prioritises the more general trend & intercept result and considers lnGDP stationary at levels (I(0)).

Both the trend & intercept and intercept-only ADF tests for lnCE indicate the presence of a unit root (p-values: 0.47 and 0.73, respectively), suggesting that lnCE is non-stationary at levels. Conversely, the ADF test for lnFDI rejects the null hypothesis of a unit root in both specifications (p-values: 0.00 and 0.00, respectively), indicating that lnFDI is stationary at levels (I(0)).

The trend & intercept ADF test for INF suggests a unit root (p-value: 0.29), while the intercept-only test suggests no unit root (p-value: 0.04), leading to the conclusion that INF is non-stationary at levels, prioritising the more general test. Finally, the ADF test results for EXR consistently indicate the presence of a unit root in both specifications (p-values: 0.61 and 0.86, respectively), confirming that EXR is non-stationary at levels.

These findings highlight the diverse stationarity properties of the variables, setting the stage for further investigation of their time series properties by examining the ADF test results after differencing the non-stationary variables to determine their order of integration.

4.2.2 Achieving Stationarity: ADF Test Results at First Difference

The ADF test results at levels (Table 5) revealed that some variables exhibited non-stationarity. To address this and prepare the data for further analysis, these variables were differenced. Differencing involves subtracting the previous period's value from the current period's value, effectively capturing the change in the variable over time. This transformation helps stabilise the mean and variance, making the series stationary.

Table 6 presents the ADF test results at first difference for the variables identified as non-stationary at levels (lnCE, INF, and EXR). This information is crucial for confirming the order of integration of each variable, paving the way for the cointegration analysis and the application of the ARDL model.

Table 6: **ADF Test Results at First Difference**

Model / Variable	Trend and Intercept	Critical value at 5% level of significance	P-Value	Intercept	Critical value at 5% level of significance	P-Value	Decision
lnCE	-4.8912	-3.5442	0.0019	-4.8514	-2.9484	0.0004	Reject the null hypothesis
INF	-6.0068	-3.5484	0.0001	-4.9509	-2.9511	0.0003	Reject the null hypothesis
EXR	-4.6052	-3.5442	0.0040	-4.6686	-2.9484	0.0006	Reject the null hypothesis

Source: Author using Eviews12

Table 6 presents the ADF test results at first difference for the variables identified as non-stationary at levels: lnCE, INF, and EXR. The results show that all three variables achieve stationarity after undergoing this transformation. Both the trend & intercept and intercept-only specifications of the ADF test for lnCE, INF, and EXR reject the null hypothesis of a unit root since all their respective p-values are less than 5%, indicating that the changes in these variables over time are stationary.

These findings demonstrate that all variables in the analysis are either stationary at levels or become stationary after first differencing. This establishes that all variables are integrated of order one, denoted I(1), or of order zero, denoted I(0). This confirmation of the order of integration is crucial for conducting the cointegration analysis and employing the ARDL model to investigate the long-run relationship between coffee exports and economic growth in Uganda.

4.3Estimation of the ARDL Model

Having established the stationarity properties of the variables, the analysis now proceeds to estimate the Autoregressive Distributed Lag (ARDL) model to investigate the relationship between coffee exports and Uganda's economic growth. This process begins with the optimal lag length selection and then the bounds test for cointegration to determine whether a long-run equilibrium relationship exists between the variables. Following confirmation of cointegration, the ARDL model will be specified, the error correction model (ECM) will be derived, diagnostic testing will

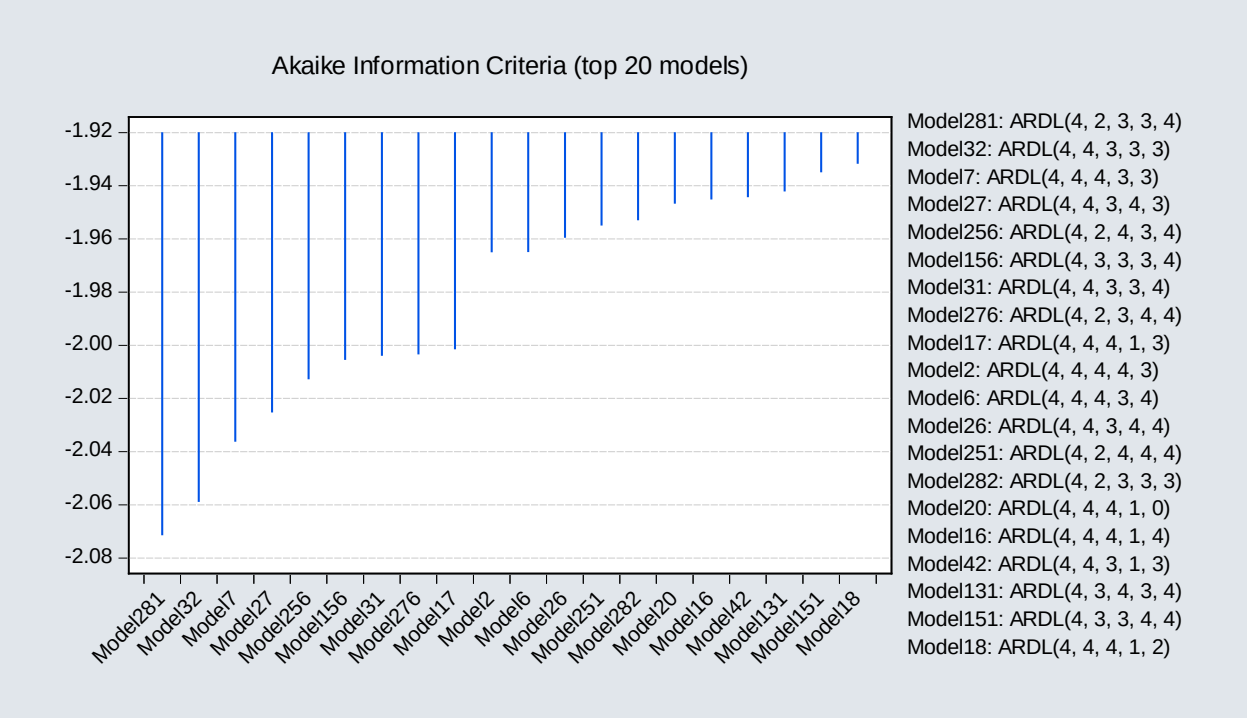
be conducted, and finally, a detailed interpretation of the model results will be provided within the context of the research question and existing economic literature.

4.3.1 Selecting the optimal lag length

Determining the appropriate lag length for the ARDL model is crucial for ensuring accurate and reliable results. In this study, the Akaike Information Criterion (AIC) was employed to select the optimal lag structure. The AIC is a widely used statistical measure that balances model fit with model complexity, aiming to prevent overfitting.

Figure 4 illustrates the AIC values for different lag lengths, with the optimal lag length being the one associated with the lowest AIC value. This selection process ensures that the ARDL model captures the essential dynamics of the relationship between coffee exports and economic growth without introducing unnecessary complexity or spurious correlations.

Figure 4: **Akaike Information Criteria**



Source: Author using Eviews12

Figure 4 displays the AIC values for various ARDL model specifications, evaluated to determine the optimal lag structure. Based on the AIC, which balances model fit with complexity, the

ARDL(4, 2, 3, 3, 4) model emerges as the most suitable choice, exhibiting the lowest AIC value. This indicates that a lag length of 4 for lnGDP, 2 for lnCE, 3 for lnFDI, 3 for INF, and 4 for EXR provides the best balance between capturing the dynamics of the relationship and avoiding overfitting. The selection process was conducted automatically using EViews12 software, ensuring a systematic and unbiased approach to identifying the optimal lag structure.

4.3.2 Bounds test for cointegration

Before estimating the ARDL model, it is essential to determine whether a long-run equilibrium relationship exists between the variables under study. This long-run relationship, known as cointegration, implies that the variables move together over time, and any short-term deviations from this equilibrium are eventually corrected. Establishing cointegration is crucial because a valid ARDL model requires the presence of a cointegrating set of variables.

To test for cointegration, the bounds test approach developed by Pesaran et al. (2001) is employed. This method offers the advantage of testing for cointegration even when the variables are integrated of different orders, which is relevant in this analysis given the presence of both I(0) and I(1) variables. The bounds test will provide insights into whether a long-run relationship exists between coffee exports and Uganda's economic growth, considering the influence of foreign direct investment, inflation, and exchange rates. This confirmation of cointegration will lay the foundation for a robust ARDL model capable of capturing both the short- and long-run dynamics within this multivariate framework.

Table 7: **F-Bounds Test**

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	5.986817	10%	1.9	3.01
k	4	5%	2.26	3.48
		2.5%	2.62	3.9
		1%	3.07	4.44

Source: Author using Eviews12

Table 7 presents the results of the bounds test for cointegration. The computed F-statistic is 5.98, which exceeds the upper bound critical value of 3.48 at the 5% significance level. This result

provides strong evidence to reject the null hypothesis of no cointegration, indicating the presence of a long-run relationship between the variables. This finding confirms the suitability of the ARDL model for analysing the relationship between coffee exports and Uganda's economic growth, allowing for the estimation of both short-run and long-run dynamics within an econometric framework.

4.3.3 Long run estimations

Following confirmation of cointegration and the determination of the optimal lag structure, the analysis now focuses on the long-run estimations derived from the ARDL model. This section presents and interprets the long-run coefficients, revealing the magnitude and direction of the impact of coffee exports and other variables on Uganda's economic performance over the long term.

Table 8: **Long run Regression**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
lnCE	0.750815	0.070880	10.59274	0.0000
lnFDI	0.449830	0.068953	6.523767	0.0001
INF	7.266017	2.543421	2.856790	0.0189
EXR	-0.000124	4.98E-05	-2.486941	0.0346
EC = lnGDP - (0.7508*lnCE + 0.4498*lnFDI + 7.2660*INF -0.0001*EXR)				

Source: Author using Eviews12

The long run equation of the model is expressed as follows;

$$lnGDP_t = 0.75lnCE_t + 0.45lnFDI_t + 7.27INF_t - 0.0001EXR_t \quad (6)$$

Table 8 presents the long-run coefficients estimated from the ARDL model, revealing the equilibrium relationship between coffee exports and Uganda's economic growth. Notably, all independent variables are statistically significant at the 5% level, indicating their substantial influence on long-term economic performance.

Coffee exports (lnCE) exert a positive and economically significant impact on Uganda's GDP, with a coefficient of 0.75. This implies that a 1% increase in coffee exports leads to a 0.75% increase in GDP in the long run, highlighting the importance of the coffee sector for driving economic growth. Similarly, foreign direct investment (lnFDI) demonstrates a positive and

significant impact on lnGDP, with a coefficient of 0.45, signifying that a 1% increase in FDI contributes to a 0.45% increase in GDP in the long run. This finding underscores the role of FDI in fostering economic expansion in Uganda.

The coefficient for inflation (INF) is 7.26, indicating a strong positive relationship with lnGDP in the long run. This suggests that higher inflation is associated with higher GDP levels. However, this finding requires careful interpretation, as high inflation can also have detrimental effects on an economy. Further analysis is needed to fully understand this relationship. On the other hand, the coefficient for the exchange rate (EXR) is -0.000124, suggesting a negligible negative impact on lnGDP. This implies that fluctuations in the exchange rate have minimal long-term effects on Uganda's economic growth. The error correction term (EC) equation presented at the end of Table 8, represents the deviation of lnGDP from its long-run equilibrium relationship with the independent variables. This term will be crucial for understanding the short-run dynamics and the speed of adjustment back to equilibrium, as discussed in the following section.

Overall, the long-run estimations reveal a strong positive relationship between coffee exports and Uganda's economic growth, reinforcing the importance of this sector for the country's long-term economic development. Foreign direct investment also plays a significant role in boosting GDP, while the exchange rate exhibits minimal long-term influence. The positive coefficient for inflation warrants further investigation to fully understand its implications. The error correction term sets the stage for exploring the short-run dynamics in the next section.

4.3.4 Short run estimations

Table 9: **ECM Regression**

ECM Regression Case 1: No Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(lnGDP(-1))	0.061966	0.153996	0.402389	0.6968
D(lnGDP(-2))	-0.082152	0.221001	-0.371728	0.7187
D(lnGDP(-3))	-1.116494	0.231175	-4.829657	0.0009
D(lnCE)	0.703858	0.120878	5.822879	0.0003
D(lnCE(-1))	-0.337705	0.099745	-3.385674	0.0081
D(lnFDI)	-0.113028	0.089120	-1.268262	0.2365
D(lnFDI(-1))	-0.296986	0.075950	-3.910276	0.0036
D(lnFDI(-2))	-0.421070	0.110821	-3.799541	0.0042
D(INF)	2.975599	0.598009	4.975843	0.0008
D(INF(-1))	-1.000180	0.453302	-2.206433	0.0548
D(INF(-2))	-1.240032	0.394031	-3.147044	0.0118
D(EXR)	-0.000175	0.000131	-1.339663	0.2132
D(EXR(-1))	-0.000568	0.000131	-4.323224	0.0019
D(EXR(-2))	0.000705	0.000155	4.556334	0.0014
D(EXR(-3))	0.000228	0.000107	2.137458	0.0613
CointEq(-1)*	**-0.675151**	**0.102676**	**-6.575570**	**0.0001**
R-squared	**0.887539**	Mean dependent var		0.091367
Adjusted R-squared	**0.757777**	S.D. dependent var		0.129708
S.E. of regression	0.063837	Akaike info criterion		-2.363862
Sum squared resid	0.052977	Schwarz criterion		-1.609492
Log likelihood	50.27600	Hannan-Quinn criter.		-2.127603
Durbin-Watson stat	2.279319			

Source: Author using Eviews12

Table 9 presents the short-run dynamics estimated from the ARDL model, revealing how deviations from the long-run equilibrium are corrected over time. Several lagged variables demonstrate statistical significance, highlighting the complex interplay between past changes and current economic growth in Uganda.

The coefficient for the error correction term (ECT) is -0.67 and is highly statistically significant (p-value: 0.0001). This negative and significant coefficient confirms the presence of a long-run relationship and indicates a relatively fast adjustment process. Specifically, the coefficient suggests that approximately 67.5% of the deviation from the long-run equilibrium is corrected within a

single period. This highlights the strong tendency of the model to converge back to the long-run equilibrium after experiencing shocks or short-term fluctuations.

Examining the short-run coefficients, several lagged values of lnGDP are statistically significant. The coefficient for D(lnGDP(-3)) is -1.116 (p-value: 0.0009), suggesting a negative impact of changes three periods ago on the current GDP. This lagged effect highlights the potential for cyclical adjustments in economic growth. The coefficients for D(lnCE) and D(lnCE(-1)) are 0.70 (p-value: 0.0003) and -0.33 (p-value: 0.0081) respectively, suggesting a positive impact of current coffee export changes and a negative impact of changes one period ago on current GDP growth. This points to a dynamic relationship between coffee export fluctuations and short-term economic performance.

The lagged values of lnFDI, D(lnFDI(-1)) and D(lnFDI(-2)), exhibit significant negative coefficients (-0.29 and -0.42, with p-values of 0.0036 and 0.0042, respectively). This suggests that 1% increases in FDI one and two periods ago can negatively affect current GDP growth, indicating potential time lags in the realisation of FDI benefits. Similarly, the lagged values of INF, D(INF) and D(INF(-2)), show statistically significant coefficients (2.97 and -1.24, with p-values of 0.0008 and 0.0118 respectively), further emphasising the complex and potentially volatile relationship between inflation and short-term economic fluctuations.

While most lagged values of the exchange rate (EXR) are not statistically significant, the coefficient for D(EXR(-1)) is -0.0005 (p-value: 0.0019). This suggests a small but significant negative effect of the previous period's exchange rate changes on current GDP growth. The relatively small magnitude of this coefficient aligns with the long-run estimation results, highlighting the limited influence of exchange rate fluctuations on Uganda's economy.

The R-squared value of 0.887 indicates that the model explains approximately 88.7% of the variations in lnGDP, while the adjusted R-squared of 0.75 accounts for the number of variables included in the model. These values suggest a good overall fit for the ARDL model in capturing the short-run dynamics of Uganda's economic growth.

Overall, the short-run analysis reveals a complex interplay of factors influencing Uganda's economic growth, with lagged effects of GDP, coffee exports, FDI, and inflation playing

significant roles. The statistically significant and negative coefficient of the ECT confirms the presence of a long-run equilibrium relationship, and its magnitude suggests a rapid adjustment back to equilibrium after short-term disturbances.

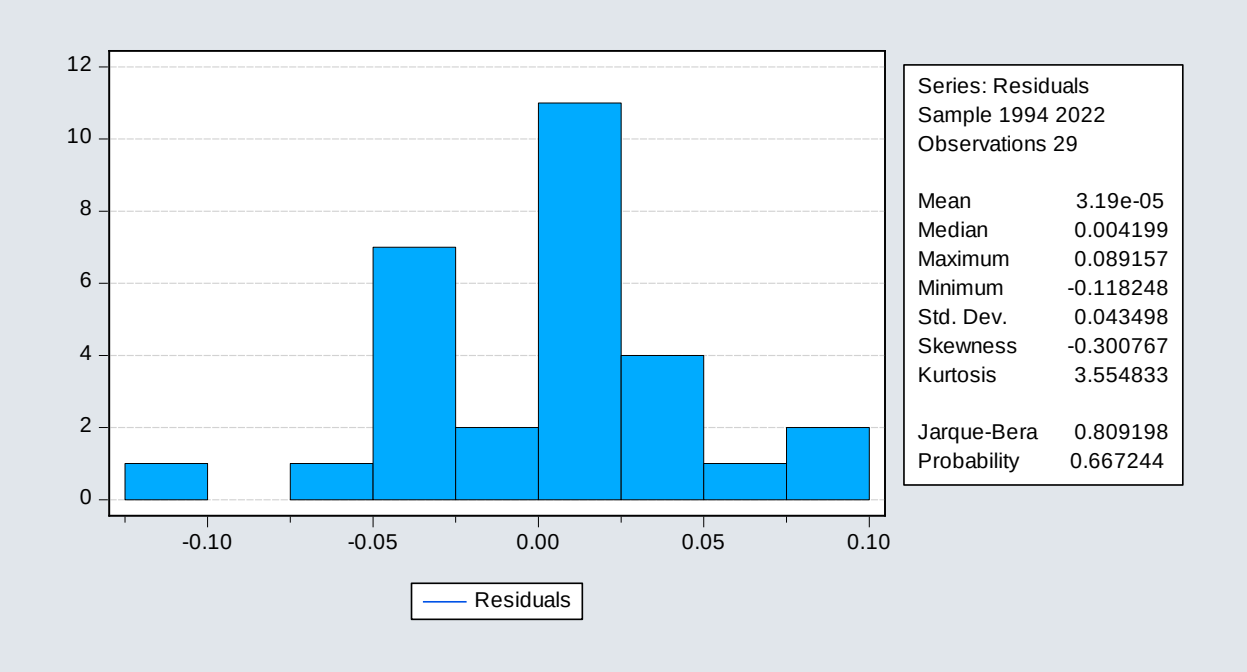
4.4 Diagnostic tests results

Following the estimation of the ARDL model and the analysis of its long-run and short-run dynamics, it is crucial to conduct diagnostic tests to evaluate the model's validity and ensure the reliability of the findings. This section presents the results of several diagnostic tests, including the Breusch-Godfrey serial correlation LM test, Jarque-Bera normality test, Breusch-Pagan-Godfrey heteroscedasticity test, and recursive stability tests. These tests assess the key assumptions of the ARDL model and provide insights into whether the model meets the necessary econometric properties for reliable inference from time series data.

4.4.1 Normality test for residuals

The ARDL model assumes normally distributed residuals for reliable statistical inference. To assess this assumption, the Jarque-Bera test is employed. This test compares the skewness and kurtosis of the model's residuals to those of a normal distribution. A statistically significant Jarque-Bera statistic would indicate a violation of the normality assumption, potentially impacting the reliability of p-values and confidence intervals associated with the ARDL model.

Figure 5: **Jarque-Bera normality test**



Source: Author using Eviews12

Figure 5 presents the histogram of the residuals from the ARDL model along with the Jarque-Bera test statistic for assessing normality. The Jarque-Bera statistic is 0.80, with a corresponding probability value of 0.66. This high probability value indicates that we fail to reject the null hypothesis of normality. Visually, the histogram appears reasonably symmetrical and bell-shaped, further supporting the conclusion that the residuals are normally distributed. Therefore, this key assumption of the ARDL model is met, strengthening the validity of the model's results.

4.4.2 Serial correlation test for residuals

After conducting the normality test for the residuals, a serial correlation test was performed to assess the validity of a key assumption: that the error terms are independent. The presence of serial correlation, where error terms are correlated over time, would violate this assumption and could lead to biased and inefficient estimates. **Table 10** presents the results of the Breusch-Godfrey Lagrange Multiplier (LM) test, which evaluates the presence of serial correlation in the residuals of the model. These results will help determine whether the model satisfies the assumption of independent errors, ensuring the reliability of the findings.

Table 10: **Breusch-Godfrey Serial Correlation LM Test:**

Breusch-Godfrey Serial Correlation LM Test:			
Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	0.251176	Prob. F(2,7)	0.7846
Obs*R-squared	1.941815	Prob. Chi-Square(2)	0.3787

Source: Author using Eviews12

The Breusch-Godfrey Lagrange Multiplier (LM) test for serial correlation, as presented in **Table 10**, indicates that there is no evidence of serial correlation in the residuals of the estimated ARDL model. This conclusion is supported by both the F-statistic (0.25) with a p-value of 0.78 and the Obs*R-squared statistic (1.94) with a p-value of 0.37. As both p-values are significantly greater than the significance level of 0.05, we fail to reject the null hypothesis of no serial correlation. This suggests that the assumption of independent errors is met, strengthening the validity and reliability of the ARDL model.

4.4.3 Heteroscedasticity test for residuals

Following the assessment of normality and independence of the residuals, the analysis now focuses on another crucial assumption of the ARDL model: homoscedasticity. Homoscedasticity implies that the variance of the error terms remains constant across all observations. Violation of this assumption, termed heteroscedasticity, can lead to inefficient coefficient estimates and inaccurate standard errors, potentially affecting the reliability of hypothesis testing. To evaluate the presence of heteroscedasticity, the Breusch-Pagan-Godfrey test is employed. **Table 11** presents the results of this test, offering further insights into the validity of the ARDL model and the robustness of the findings.

Table 11: **Heteroscedasticity Test: Breusch-Pagan-Godfrey**

Heteroscedasticity Test: Breusch-Pagan-Godfrey			
Null hypothesis: Homoscedasticity			
F-statistic	0.731544	Prob. F(20,8)	0.7305
Obs*R-squared	18.74852	Prob. Chi-Square(20)	0.5382
Scaled explained SS	2.305875	Prob. Chi-Square(20)	1.0000

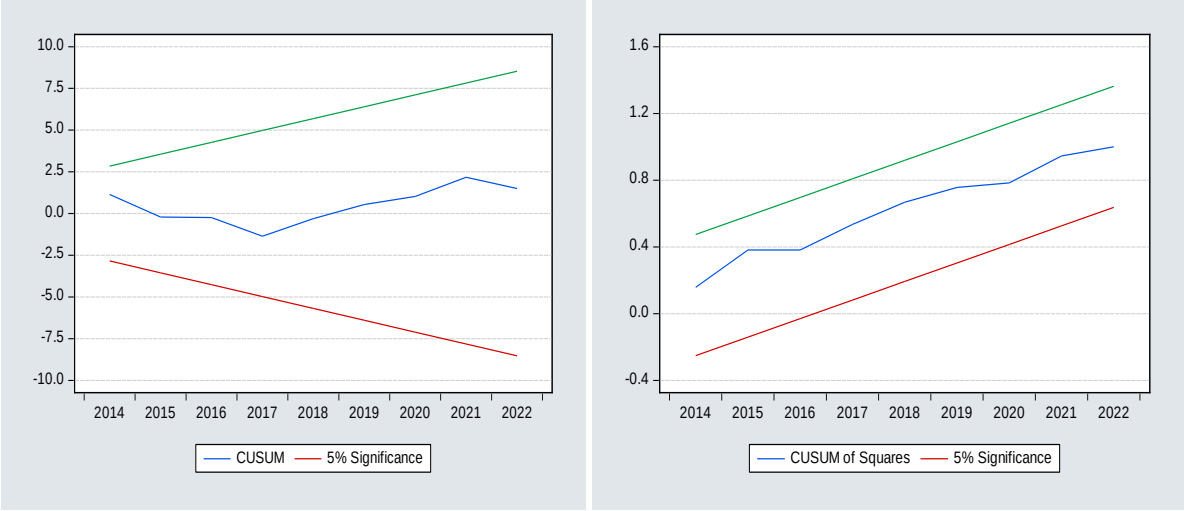
Source: Author using Eviews12

The Breusch-Pagan-Godfrey test for heteroscedasticity, as presented in **Table 11**, indicates no evidence of heteroscedasticity in the residuals of the estimated ARDL model. This conclusion is based on the F-statistic (0.73) with a corresponding p-value of 0.73 and the ObsR-squared statistic (18.74) with a p-value of 0.53. Both p-values are considerably higher than the 0.05 significance level, leading to the failure to reject the null hypothesis of homoscedasticity. The consistency of the F-statistic and ObsR-squared results supports the conclusion of homoscedasticity. This suggests that the assumption of constant variance in the error terms holds true, further bolstering the validity and reliability of the ARDL model.

4.4.4 Stability tests of the model

To ensure the reliability of the ARDL model over time, recursive tests were conducted, visually examining the graphs of recursive parameter estimates. This approach allows for identifying potential instabilities or structural breaks in the model's parameters that might affect the validity of the estimated relationships. Visual inspection of these graphs provides insights into the consistency and stability of the model's coefficients across the study period, further strengthening the robustness of the findings.

Figure 6: **CUSUM and CUSUM of squares tests**



Source: Author using Eviews12

Figure 6 presents the results of the CUSUM and CUSUM of squares tests, which provide a visual assessment of the ARDL model's stability over time. Both graphs clearly demonstrate that the model is stable throughout the study period. The CUSUM line, representing the cumulative sum

of recursive residuals, remains well within the confidence bounds in both tests. This indicates an absence of structural breaks or parameter instability. These findings reinforce the reliability of the estimated ARDL model and provide further confidence in the validity of the results.

4.5 Discussion of ARDL Model Results

This section interprets the ARDL model results, connecting the empirical findings to the research objectives, hypotheses, and research questions laid out in the general introduction.

4.5.1 Addressing the Research Question

The primary research question guiding this study was: "What has been the impact of coffee exports on the economic growth of Uganda from 1986 to 2022?" The ARDL model results reveal a positive and statistically significant relationship between coffee exports and economic growth. The long-run coefficient of 0.75 indicates that a 1% increase in coffee export values leads to a 0.75% increase in GDP in the long run, on average. This suggests that coffee exports play a crucial role in driving Uganda's long-term economic growth, aligning with the theoretical framework of export-led growth established in Chapter 1.

Several studies cited in the literature review support this finding. For example, Giuliano and Zachariassen (2014), studying Brazil, found a positive correlation between coffee exports and economic expansion. Similarly, Aoki-Suzuki et al. (2018) observed a positive link between coffee exports and economic growth in Ethiopia. These findings highlight the consistent influence of coffee exports in stimulating economic activity in various coffee-producing countries.

The secondary research questions further inquired about the existence of a long-run relationship between coffee exports and economic growth and the factors influencing this relationship. The cointegration analysis conducted in Section 3.1 of this chapter confirms the existence of a long-run equilibrium relationship between these variables, consistent with the bounds test showing significance at the 5% level. This finding supports the notion of a long-run, stable relationship between coffee exports and Uganda's economic performance, as proposed by the export-led growth theory.

Furthermore, the ARDL model reveals that, besides coffee exports, factors such as foreign direct investment (FDI), exchange rate, and inflation play a role in explaining Uganda's economic growth

over the study period. FDI demonstrates a positive and statistically significant long-run impact, which aligns with the arguments of Dalgard and Dreher (1992) who emphasise the potential benefits of FDI in terms of capital investment, technology transfer, and linkages with local businesses. However, the mixed findings from the literature on FDI's overall impact (Hanson, 2001; Gorg and Strobl, 2002) highlight the need for careful consideration of the context and specific channels through which FDI influences economic growth.

Inflation also positively impacts economic growth in the long run. This finding requires careful interpretation, as high inflation can have detrimental effects on an economy, as discussed by economist Michael Woodford (2003). Further research is needed to fully understand the complex relationship between inflation and economic growth in Uganda.

The exchange rate shows a negative, albeit very small, long-run coefficient (-0.000124), suggesting a weak inverse relationship with economic growth. This aligns with concerns raised by Hauge and Øygard (2005) regarding the potential risks of over-reliance on a single commodity export, where exchange rate fluctuations can undermine economic stability.

4.5.2 Hypothesis Testing

The study proposed two hypotheses:

H1: There is a long-run relationship between coffee exports and economic growth in Uganda.

The bounds test results support this hypothesis, providing evidence of a statistically significant long-run relationship between the variables at the 5% significance level.

H2: There is a positive and statistically significant relationship between coffee exports and economic growth in Uganda.

The ARDL model results strongly support this hypothesis. The coefficient for coffee exports (lnCE) is positive (0.75) and statistically significant, suggesting a positive impact of coffee exports on Uganda's long-term economic growth.

4.5.3 Fulfilling Research Objectives

This study aimed to achieve two main objectives:

- To comprehensively analyse the impact of coffee exports on Uganda's economic growth from 1986 to 2022.

This objective has been fulfilled through the ARDL model estimation and interpretation. The analysis revealed a positive and statistically significant impact of coffee exports on Uganda's long-term economic growth, alongside the influence of FDI, exchange rates, and inflation.

- To identify sustainable development avenues within the coffee and agricultural sector, ultimately bolstering Uganda's economy.

The findings suggest that promoting sustainable development within Uganda's coffee sector can significantly contribute to the country's economic growth. Policies focused on increasing coffee export volumes, attracting foreign direct investment, and managing inflation effectively can contribute to a more robust and thriving coffee sector, aligning with the need for strategies to mitigate the challenges of coffee export dependence highlighted in the literature review (Hauge and Øygard, 2005).

Conclusion

This chapter embarked on an empirical investigation into the relationship between coffee exports and Uganda's economic growth from 1986 to 2022. Leveraging the Autoregressive Distributed Lag (ARDL) model, the analysis revealed a statistically significant positive impact of coffee exports on long-term economic growth. The findings confirm that a 1% increase in coffee export values leads to a 0.75% increase in GDP in the long run, underscoring the vital role of the coffee sector in driving economic activity in Uganda. Furthermore, the study highlighted the positive contributions of foreign direct investment and a complex interplay with inflation and exchange rates in shaping Uganda's economic performance. The results of this empirical investigation offer valuable insights for policymakers and stakeholders in Uganda's coffee sector. Prioritising policies that enhance productivity, attract foreign investment, and manage macroeconomic factors like inflation and exchange rates effectively can contribute to a more robust and resilient coffee industry. Ultimately, a thriving coffee sector can serve as a powerful engine for sustainable economic growth and development, benefiting both coffee farmers and the broader Ugandan economy.

General Conclusion

5.1 Summary of the study

This study examined the relationship between coffee exports and Uganda's economic growth from 1986 to 2022. The general introduction established the historical context of Uganda's economic journey, highlighting coffee's crucial role in shaping the nation's development trajectory and providing an overview of Uganda's coffee industry, emphasising its significance for livelihoods, trade, and national development.

Chapter one delved into the export-led growth theory, exploring its relevance to Uganda's coffee sector and highlighting the potential for coffee exports to stimulate economic growth through increased foreign exchange earnings, attraction of FDI, and enhanced competitiveness. However, the review also acknowledged the challenges of dependence on primary commodity exports, particularly the vulnerability to price fluctuations in the global market.

Chapter two meticulously outlined the research methodology, detailing the study's positivist philosophy, deductive and quantitative approach, and the selection of the Autoregressive Distributed Lag (ARDL) model for analysing the time series data.

Chapter three presented the empirical findings, demonstrating a statistically significant positive long-run impact of coffee exports on economic growth in Uganda. The estimated ARDL model revealed that a 1% increase in coffee export values leads to a 0.75% increase in GDP in the long run. The analysis also identified foreign direct investment, inflation, and exchange rates as significant factors influencing Uganda's economic performance. Robust diagnostic tests confirmed the model's validity and reliability, ensuring the robustness of the findings.

Finally, the general conclusion provided a synthesis of the study's key findings, outlining policy recommendations to enhance the positive impact of coffee exports on Uganda's economy. The chapter acknowledges data limitations inherent in researching developing economies and suggests areas for future research, particularly concerning climate change and value addition within the coffee sector. Ultimately, this concluding chapter aims to provide stakeholders with valuable insights to foster a more sustainable and prosperous future for Uganda's coffee industry.

This study contributes to a deeper understanding of the coffee-growth nexus in Uganda, providing evidence to support the export-led growth theory and emphasising the importance of coffee exports as a driver of long-term economic growth and development.

5.2 Policy Recommendations

Based on the empirical findings of this study, several policy recommendations emerge to enhance the positive contributions of coffee exports to Uganda's economic growth and foster sustainable development within the sector.

Firstly, policymakers should prioritise investments aimed at boosting coffee productivity. This includes promoting the adoption of modern agricultural practices, providing access to improved coffee varieties, and facilitating the dissemination of relevant knowledge and skills to coffee farmers. Enhanced productivity can lead to increased export volumes, generating higher foreign exchange earnings and driving economic growth.

Secondly, attracting foreign direct investment (FDI) into the coffee sector is crucial. Policies aimed at creating a stable and predictable investment climate, streamlining regulatory processes, and providing incentives for foreign investors can encourage FDI inflows. FDI can contribute to technology transfer, infrastructure development, and the creation of higher-paying jobs, further bolstering the coffee sector's contribution to the economy.

Regarding macroeconomic management, effective control of inflation is vital to ensuring a stable economic environment. High inflation can erode purchasing power, distort investment decisions, and create uncertainty, potentially hindering economic growth. Policy measures to control inflation, such as prudent fiscal policies and effective monetary management, can create a more stable and conducive environment for businesses and investors.

Finally, while the exchange rate was found to have a minimal long-run impact on economic growth, policymakers should remain vigilant in monitoring exchange rate fluctuations and their potential short-term effects on the coffee sector. Excessive volatility in the exchange rate can create uncertainty for exporters and discourage foreign investment. Appropriate policy interventions, such as managing foreign exchange reserves and implementing prudent monetary policies, can help mitigate exchange rate risks and promote stability in the coffee sector.

By implementing these policy recommendations, policymakers can contribute to a thriving and sustainable coffee sector in Uganda, maximising its potential as a driver of economic growth, job creation, and poverty reduction. These efforts can ultimately contribute to a more prosperous and resilient Ugandan economy.

5.3 Areas of Future research

This study has established the crucial role of coffee exports in driving Uganda's economic growth. However, to maximise the sector's potential and ensure its long-term sustainability, two key areas require further investigation.

Firstly, research is needed to assess the impact of climate change on Uganda's coffee production. This work should evaluate the sector's vulnerability to changing weather patterns and identify effective adaptation strategies to mitigate potential risks to production, farmer livelihoods, and export earnings.

Equally important is exploring the economic viability and benefits of value addition and diversification within Uganda's coffee sector. Research should focus on identifying profitable value-added activities, such as roasting, grinding, and specialty coffee production, to enable Uganda to capture a greater share of the global coffee market and enhance export revenues.

By addressing these critical areas, future research can contribute to a more resilient and prosperous coffee sector, solidifying its role as a key engine of economic growth and development in Uganda.

5.4 Limitations of the study

This study acknowledges the inherent challenges of conducting empirical research in developing countries. The reliance on secondary data, while providing a valuable historical perspective, presented limitations regarding data availability and reliability. Data gaps and potential inconsistencies in reporting, common in developing economies, might have influenced the analysis. Despite these challenges, this research employed rigorous econometric techniques and robust diagnostic tests to ensure the validity and reliability of the findings within the available data constraints.

5.5 Conclusion

The empirical analysis conducted in this study has unequivocally established the significant and positive impact of coffee exports on Uganda's long-term economic growth. This finding strongly supports the validity of export-led growth theory within the Ugandan context, underscoring the crucial role of the coffee sector in driving economic development.

However, to fully harness the potential of coffee exports for sustainable and inclusive growth, continued policy support is essential. Prioritising investments in productivity enhancement, attracting foreign direct investment, ensuring macroeconomic stability, and mitigating climate change risks are crucial for a thriving coffee industry. By addressing these key areas, Uganda can leverage its position as a major coffee producer to foster economic prosperity for both coffee farmers and the broader Ugandan economy. This research provides valuable empirical evidence and policy insights to guide stakeholders in navigating the complexities of the global coffee market and shaping a more resilient and prosperous future for Uganda's coffee sector.

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Appendices

Appendix 1: Data

YEAR	GDP	CE	FDI	INF	EXR
1986	$3,920,000,000.00	$308,594,658.00	$0.00	160.98%	UGX 14.00
1987	$6,270,000,000.00	$263,239,573.00	$0.00	200.03%	UGX 42.84
1988	$6,510,000,000.00	$294,867,882.00	$4,700,000.00	196.12%	UGX 106.14
1989	$5,280,000,000.00	$139,566,731.00	-$1,760,000.00	61.44%	UGX 223.09
1990	$4,300,000,000.00	$121,343,113.00	-$5,910,000.00	33.12%	UGX 428.85
1991	$3,320,000,000.00	$101,442,768.00	$1,000,000.00	28.07%	UGX 734.01
1992	$2,860,000,000.00	$108,873,991.00	$3,000,000.00	52.44%	UGX 1,133.83
1993	$3,220,000,000.00	$273,658,850.00	$54,600,000.00	1.16%	UGX 1,195.02
1994	$3,990,000,000.00	$432,651,034.00	$88,200,000.00	10.04%	UGX 979.45
1995	$5,760,000,000.00	$388,916,157.00	$121,200,000.00	6.55%	UGX 968.92
1996	$6,040,000,000.00	$355,126,641.00	$121,000,000.00	7.19%	UGX 1,046.08
1997	$6,270,000,000.00	$276,476,134.00	$175,000,000.00	8.17%	UGX 1,083.01
1998	$6,580,000,000.00	$282,995,511.00	$210,000,000.00	0.07%	UGX 1,240.31
1999	$6,000,000,000.00	$164,763,789.32	$140,200,000.00	5.78%	UGX 1,454.83
2000	$6,190,000,000.00	$104,776,424.00	$160,700,000.00	3.39%	UGX 1,644.48
2001	$5,840,000,000.00	$83,936,951.00	$151,496,151.00	1.87%	UGX 1,755.66
2002	$6,180,000,000.00	$104,787,094.00	$184,648,059.00	-0.29%	UGX 1,797.55
2003	$6,610,000,000.00	$115,705,844.00	$202,192,594.00	8.68%	UGX 1,963.72
2004	$7,940,000,000.00	$162,078,550.00	$295,416,480.00	3.72%	UGX 1,810.30
2005	$9,240,000,000.00	$170,343,586.56	$379,808,341.00	8.45%	UGX 1,780.54
2006	$9,980,000,000.00	$256,580,844.00	$644,262,500.00	7.31%	UGX 1,831.45
2007	$11,900,000,000.00	$388,398,200.00	$792,305,781.00	6.14%	UGX 1,723.49
2008	$14,440,000,000.00	$291,743,882.00	$728,860,901.00	12.05%	UGX 1,720.44
2009	$25,130,000,000.00	$266,673,061.00	$841,570,803.00	13.02%	UGX 2,030.49
2010	$26,670,000,000.00	$448,890,669.00	$543,872,727.00	3.98%	UGX 2,177.56
2011	$27,087,000,000.00	$392,698,138.00	$894,293,858.00	15.13%	UGX 2,522.80
2012	$27,310,000,000.00	$432,694,059.00	$1,210,000,000.00	12.68%	UGX 2,504.56
2013	$28,920,000,000.00	$393,922,335.00	$1,100,000,000.00	4.90%	UGX 2,586.89
2014	$32,610,000,000.00	$410,564,121.00	$1,060,000,000.00	3.07%	UGX 2,599.79
2015	$32,390,000,000.00	$326,676,251.00	$737,652,140.00	5.59%	UGX 3,240.62
2016	$29,200,000,000.00	$544,587,628.00	$625,704,362.00	5.71%	UGX 3,420.10
2017	$30,740,000,000.00	$462,828,907.00	$802,704,141.00	5.21%	UGX 3,611.22
2018	$32,930,000,000.00	$433,964,268.76	$1,060,000,000.00	2.62%	UGX 3,727.07
2019	$35,350,000,000.00	$512,333,404.05	$1,270,000,000.00	2.87%	UGX 3,704.05
2020	$37,610,000,000.00	$627,184,756.10	$873,769,790.00	3.31%	UGX 3,718.25
2021	$40,510,000,000.00	$877,382,409.00	$1,100,000,000.00	2.20%	UGX 3,587.05
2022	$45,560,000,000.00	$877,382,409.00	$1,530,000,000.00	7.20%	UGX 3,689.82

Appendix 2: Unit Root Tests

UNIT ROOT TEST RESULTS TABLE (ADF)
Null Hypothesis: the variable has a unit root

		GDP	CE	FDI	INF	EXR
	At Level					
With Constant	t-Statistic	1.7044	-0.0613	-0.2080	-2.9894	-0.5545
	Prob.	***0.9995***	***0.9462***	***0.9285***	***0.0454***	***0.8684***
		n0	n0	n0	**	n0
With Constant & Trend	t-Statistic	-1.0161	-1.5367	-2.9318	-2.5636	-1.9398
	Prob.	***0.9290***	***0.7977***	***0.1650***	***0.2981***	***0.6132***
		n0	n0	n0	n0	n0
Without Constant & Trend	t-Statistic	3.5774	0.8394	0.9291	-15.2776	2.7101
	Prob.	***0.9998***	***0.8879***	***0.9025***	***0.0000***	***0.9978***
		n0	n0	n0	***	n0
	At First Difference					
		d(GDP)	d(CE)	d(FDI)	d(INF)	d(EXR)
With Constant	t-Statistic	-3.8506	-5.7425	-5.1158	-4.9509	-4.6687
	Prob.	***0.0057***	***0.0000***	***0.0002***	***0.0003***	***0.0006***
		***	***	***	***	***
With Constant & Trend	t-Statistic	-4.5493	-6.0703	-5.3172	-6.0068	-4.6053
	Prob.	***0.0047***	***0.0001***	***0.0006***	***0.0001***	***0.0040***
		***	***	***	***	***
Without Constant & Trend	t-Statistic	-3.2475	-5.6414	-5.0406	-4.6985	-3.6502
	Prob.	***0.0019***	***0.0000***	***0.0000***	***0.0000***	***0.0006***
		***	***	***	***	***

Notes:
a: (*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1% and (no) Not Significant
b: Lag Length based on SIC
c: Probability based on MacKinnon (1996) one-sided p-values.

Appendix 3: ARDL Long Run Form and Bounds Test

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LNGDP)
Selected Model: ARDL(4, 2, 3, 3, 4)
Case 1: No Constant and No Trend
Date: 05/23/24 Time: 15:07
Sample: 1986 2022
Included observations: 29

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDP(-1)*	-0.675151	0.196875	-3.429339	0.0075
LNCE(-1)	0.506913	0.153513	3.302092	0.0092
LNFDI(-1)	0.303703	0.102086	2.974977	0.0156
INF(-1)	4.905658	1.305358	3.758094	0.0045
EXR(-1)	-8.36E-05	4.26E-05	-1.964955	0.0810
D(LNGDP(-1))	0.061966	0.231327	0.267873	0.7948
D(LNGDP(-2))	-0.082152	0.295702	-0.277821	0.7874
D(LNGDP(-3))	-1.116494	0.331696	-3.366016	0.0083
D(LNCE)	0.703858	0.212426	3.313425	0.0090
D(LNCE(-1))	-0.337705	0.139382	-2.422865	0.0384
D(LNFDI)	-0.113028	0.153430	-0.736671	0.4801
D(LNFDI(-1))	-0.296986	0.101154	-2.935993	0.0166
D(LNFDI(-2))	-0.421070	0.173537	-2.426407	0.0382
D(INF)	2.975599	0.848063	3.508701	0.0066
D(INF(-1))	-1.000180	0.558475	-1.790914	0.1069
D(INF(-2))	-1.240032	0.501217	-2.474039	0.0353
D(EXR)	-0.000175	0.000171	-1.022914	0.3331
D(EXR(-1))	-0.000568	0.000197	-2.885430	0.0180
D(EXR(-2))	0.000705	0.000269	2.619671	0.0278
D(EXR(-3))	0.000228	0.000200	1.140507	0.2835

* p-value incompatible with t-Bounds distribution.

Levels Equation
Case 1: No Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCE	0.750815	0.070880	10.59274	0.0000
LNFDI	0.449830	0.068953	6.523767	0.0001
INF	7.266017	2.543421	2.856790	0.0189
EXR	-0.000124	4.98E-05	-2.486941	0.0346

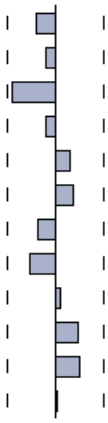
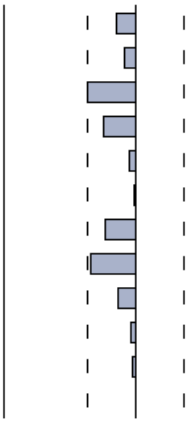
EC = LNGDP - (0.7508*LNCE + 0.4498*LNFDI + 7.2660*INF -0.0001*EXR)

F-Bounds Test Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	5.986817	10%	1.9	3.01
K	4	5%	2.26	3.48
		2.5%	2.62	3.9
		1%	3.07	4.44
			Finite Sample: n=35	
Actual Sample Size	29			
		10%	-1	-1
		5%	-1	-1
		1%	-1	-1
			Finite Sample: n=30	
		10%	-1	-1
		5%	-1	-1
		1%	-1	-1
t-Bounds Test			Null Hypothesis: No levels relationship	
Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-3.429339	10%	-1.62	-3.26
		5%	-1.95	-3.6
		2.5%	-2.24	-3.89
		1%	-2.58	-4.23

Appendix 4: Correlogram of Residuals

Date: 05/23/24 Time: 15:14
Sample (adjusted): 1994 2022
Q-statistic probabilities adjusted for 4 dynamic regressors

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
		1	-0.153	-0.153	0.7474	0.387
		2	-0.071	-0.097	0.9152	0.633
		3	-0.338	-0.377	4.8599	0.182
		4	-0.073	-0.253	5.0506	0.282
		5	0.120	-0.050	5.5868	0.349
		6	0.147	-0.009	6.4272	0.377
		7	-0.133	-0.244	7.1475	0.414
		8	-0.201	-0.348	8.8723	0.353
		9	0.037	-0.145	8.9326	0.444
		10	0.175	-0.041	10.379	0.408
		11	0.185	-0.029	12.084	0.357
		12	0.010	0.007	12.089	0.439

Appendix 5: Diagnostic Ramsey test

Ramsey RESET Test

Equation: UNTITLED

Omitted Variables: Squares of fitted values

Specification: LNGDP LNGDP(-1) LNGDP(-2) LNGDP(-3) LNGDP(-4) LNCE LNCE(-1) LNCE(-2) LNFDI LNFDI(-1) LNFDI(-2) LNFDI(-3) INF INF(-1) INF(-2) INF(-3) EXR EXR(-1) EXR(-2) EXR(-3) EXR(-4)

	Value	df	Probability
t-statistic	0.796240	8	0.4489
F-statistic	0.633999	(1, 8)	0.4489
Likelihood ratio	2.211720	1	0.1370

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.003890	1	0.003890
Restricted SSR	0.052977	9	0.005886
Unrestricted SSR	0.049087	8	0.006136

LR test summary:

	Value
Restricted LogL	50.27600
Unrestricted LogL	51.38186