COLLEGE OF BUSINESS AND ECONOMICS

THE POTENTIAL OF ETHIOPIA'S SPICE TRADE AND ITS IMPACT ON ECONOMIC GROWTH

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Statement of declaration

I Abigiya Sem Gebregziabher Declare that this work titled "THE POTENTIAL OF ETHIOPIA'S SPICE TRADE AND ITS IMPACT ON ECONOMIC GROWTH", is my own effort and study and that all sources of materials used for the study have been duly acknowledged. I have produced it independently except for the guidance and suggestion of the research advisor.

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Abstract

This thesis investigates the economic potential of Ethiopia's spice trade and its impact on national growth. Despite favorable agro-ecological conditions and the ability to produce over 50 spice varieties, Ethiopia's spice sector remains underutilized. Using a combination of descriptive analysis, gravity modeling, and time-series econometric techniques (DOLS and VECM), the study evaluates trade performance, export gaps, and the macroeconomic effects of spice exports from 2000 to 2024. The gravity model identifies India, Egypt, UAE, and Pakistan as Ethiopia's main spice export destinations, while revealing significant underperformance in markets like Kenya and Saudi Arabia. Traditional predictors such as GDP per capita and geographic proximity showed limited influence, suggesting the need for strategic market targeting and improved trade facilitation. Export gap analysis highlights missed opportunities, emphasizing the importance of logistics, certification, and bilateral agreements. Econometric findings confirm that spice exports and export diversification positively influence Ethiopia's GDP in the long run, though short-term effects are volatile due to structural constraints. The VECM results show a stable long-run equilibrium among GDP, spice exports, and diversification, with GDP adjusting significantly to deviations.

Key words: Spice Trade, Export Diversification, Economic Growth, Ethiopia, Gravity Model, Vector Error Correction Model (VECM), Trade Potential

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List of Abbreviations

ADF – Augmented Dickey-Fuller Test

AFCTA – African Continental Free Trade Area

CAGR – Compound Annual Growth Rate

DOLS – Dynamic Ordinary Least Squares

ECTA – Ethiopia Customs and Trade Authority

ENTAG – Ethiopian Netherlands Trade for Agricultural Growth

FAO – Food and Agriculture Organization

FE – Fixed Effects

GDP – Gross Domestic Product

HHI- Herfindahl-Hirschman Index

ITC – International Trade Centre

OLS – Ordinary Least Squares

RE – Random Effects

UAE – United Arab Emirates

UN – United Nations

VECM – Vector Error Correction Model

Chapter One: Introduction

1.1 Background of the study

Ethiopia, a country with diverse agro-ecological zones and rich biodiversity, has long been recognized for its potential in agricultural production, including the cultivation of spices. Spices such as cumin, coriander, fenugreek, turmeric, and black pepper are deeply embedded in Ethiopian culture and cuisine, and they hold significant economic potential, both domestically and internationally. Spices have played a significant role in human history and culture thousands of years, adding depth and flavor to culinary creations while offering an array of health benefits. In recent years, the global spice market has experienced substantial growth, driven by increasing demand for natural, organic, and ethnically diverse food products.

The global spice market is a reflection of the wide interest in spices over the past few years. According to a 2023 report on the global spice market, the global spice market is projected to grow at a compound annual growth rate (CAGR) of 5.2% from 2023 to 2028, reaching a market value of USD 22.5 billion by 2028. This growth presents a significant opportunity for Ethiopia to expand its spice trade and contribute to its economic development.

When it comes to Ethiopia, spices have been an integral part of the country's culinary heritage and traditional medicine for generations. The vibrant flavors and aromatic profiles of spices like Ethiopian cardamom, berbere, ginger, and turmeric have been woven into the fabric of day-to-day meals, adding depth and complexity to the country's rich cuisine. However, despite having a similar agro-climatic conditions to India, with high domestic and global demand, the spice industry in Ethiopia remains largely underutilized.

The industry is heavily reliant on traditional farming practices, leading to sub-optimal yields per hectare. Small-scale production, limited access to modern agricultural inputs, and a lack of policy attention and investment are among numerous factors that have hindered the sector's full potential. Due to this, spice has relatively low contribution to the country's GDP and foreign

exchange generation. In 2019/20, Ethiopia has produced 692,400 tons of major spices (Agricultural Transformation Institute, 2023).

Domestic consumption and the demand for spices in the international market are increasing. Global spice consumption has been steadily increasing. From 2019 to 2023, the demand for spices grew by approximately 0.7% annually. By 2023, the global consumption reached 10.8 million metric tons, and it is projected to rise to 11.3 million metric tons by 2028, marking an annual growth rate of 0.8% (Global Spice Market Outlook, 2024). However, the area allocated for spices production could be higher than other cereal crops in the country, and the production and productivity of spices are also very low, which manifests weak attention given to the sub-sector in the country (ENTAG, 2018).

The government of Ethiopia is promoting agro-industrial projects and has declared Spices a focus area for development. The government is aware that presently the bulk of Ethiopian spices are not of export quality due to lack of good agricultural practices, adequate post-harvest handling and primary processing facilities and skills (ITC, 2015).

When considering spice exports, Ethiopia's unique flavor profile offers an authentic ethnic experience for consumers worldwide. The country's ideal agro-economic situation makes it an excellent source for a wide range of organic spices and herbs. However, various challenges impact the competitiveness of Ethiopian spices in the global market.

The economic impact of Ethiopia's spice trade extends beyond foreign exchange earnings. Spices are high-value crops that can generate significant income for smallholder farmers, who constitute the majority of Ethiopia's agricultural workforce. By increasing the production and export of spices, Ethiopia can create employment opportunities, reduce poverty, and improve food security. Moreover, the spice trade can contribute to the conservation of Ethiopia's rich biodiversity, as many spices are grown using traditional farming practices that are environmentally sustainable.

1.2 Statement of the problem

Over the past two decades, Ethiopia's economy has experienced remarkable growth, with its GDP expanding from $12 billion in 2004 to a projected $156 billion in 2024 (World Bank, 2024). The country's economic progress has been driven primarily by agriculture, services, and construction, with agriculture accounting for 35.79% of GDP in 2023 (World Bank, 2024). The sector remains the backbone of Ethiopia's economy, contributing 80% of total exports. However, despite this growth, Ethiopia's export structure remains heavily reliant on a few key commodities particularly coffee, oilseeds, pulses, and khat making the economy highly vulnerable to market fluctuations and external shocks.

To mitigate these risks, export diversification has been widely recognized as a key strategy for sustainable economic growth. Various studies emphasize the importance of shifting towards high-value crops to enhance Ethiopia's global trade competitiveness (Gachena, Haji, Legesse, & Ketema, 2020). Among these, spices present a significant but underutilized opportunity. The global spice market has grown steadily due to rising consumer demand for natural, organic, and functional foods, and Ethiopia's diverse agro-ecological zones position it as a strong potential player in this sector. The country has ideal conditions for producing a variety of spices, including ginger, turmeric, Korarima, red pepper, black cumin, and cardamom, which are in high demand in international markets. However, Ethiopia's spice exports remain marginal, contributing less than 1% to the national economy (Asfaw, 2020).

Ethiopia has comparative advantages in the production of exportable spices due to its rich genetic resources, diverse agro-ecological condition and abundant arable land and labour. The history of spices production in Ethiopia and its importance is as long as coffee and other cereal crop. Among 109 spices identified by the international organization for standardization (ISO) about 50 valuable spices can be produced in Ethiopia, particularly in the southwestern parts of the country. Ginger, turmeric, Korarima, red pepper, chili/hot peppers, black cumin, cardamom, and long pepper are the most widely grown spices in the country (Gachena et al., 2020).

While Ethiopia's spice sector holds significant potential due to its favorable agro-ecological conditions and growing global demand, its contribution to the national economy remains minimal. The country’s spice exports are underdeveloped, hindered by low productivity, weak value addition, inadequate market linkages, and policy gaps. Unlike major spice-exporting nations such as India and Vietnam, Ethiopia has yet to fully capitalize on its natural advantages. Despite increasing domestic and international demand, limited investment in modern farming techniques, post-harvest processing, and export infrastructure constrains the sector’s growth. Moreover, the reliance on a few key agricultural exports, particularly coffee, exposes Ethiopia’s economy to external shocks and price volatility, reinforcing the need for diversification. Despite the considerable challenges in overcoming the above-noted obstacles, more research and information about Ethiopia's spice export capabilities and its nexus to eventual economic growth is urgently needed. Existing and related research is focused on certain spices or value chain segments rather than a macroeconomic assessment of the whole sector and its export performance. This study aims to fill that gap, by exploring potential market areas for Ethiopian spices, and offering estimates on the sector's contribution to economic growth and guidance with factors and characteristics that can be used to inform policies and investment for future development of the sector.

Earlier researches regarding Ethiopian spice exports narrow focus has primarily looked in the factors influencing export performance, value-chain barriers and specific commodity marketing. For example, Gachena et al (2020) assess the export performance of turmeric and korarima with a GLS gravity model, attributing select export performance factors to population size, exchange rates., and FDI but only on two spices and overa macroeconomic link. Shumete (2020) uses a descriptive methodology in attempting to assess barriers to exports and points to issues such as transportation costs, advantages of being fragmented in their marketing, but does not use econometric modeling and much less GPD influences. Wondimnew (2023) conducted a valuable value-chain study, however, most of this paper focused on production inefficiencies and market failures with little to no empirical relationship to a few national economic statistics.

The current study fills an important gap in using a macroeconomic view of Ethiopia's spices using empirical based and time series econometric modeling using Panel based Gravity

Modeling for analysis and DOLS and VECM for long run estimates. This contrasts sharply on many levels this study's focus from earlier studies that have a reciprocation between trade, and economic growth and offered new information. This is important to define potential destination countries based on actual trade flow data, long- and short-run GDP contributors from spice exports. As a result, this study offers new and valuable information with consideration to trade economics in relation to steady state growth modeling for future economic planning for policies relevant for national strategic exports and agro-industrial development.

1.3 Key Research Questions

- What is the export potential of Ethiopian spices, considering production trends, trade performance determinants, and comparative advantages in the global market?
- Which countries are the major destination markets for Ethiopian spices, and how do trade flows, bilateral relationships, and market access conditions influence these exports?
- What is the economic contribution of spice exports to Ethiopia's GDP, and what are the short- and long-term impacts of these exports on the national economy?

1.4. Objective of the study

The primary objective of this study is to assess the potential of Ethiopia's spice trade and its impact on the country's economic growth.

Specifically, the study aims to:

- ♣ Assess Ethiopia's spice export potential by analyzing production trends, key determinants of trade performance, and comparative advantages in the global market.
- ♣ Identify major destination markets for Ethiopian spices using a panel-based gravity model, evaluating trade flows, bilateral trade relationships, and market access conditions.
- ♣ Analyze the economic contribution of spice exports to Ethiopia's GDP and to assess short- and long-term effects.

1.5 Significance of the study

The study will provide insights into how Ethiopia can increase its export earnings by tapping into the growing global demand for spices. This can lead to higher foreign exchange earnings. From Economic Diversification perspective by exploring the potential of the spice trade, this study aims to identify ways to diversify Ethiopia's export portfolio. Diversification is crucial for reducing the country's economic vulnerability to market fluctuations and external shocks, particularly given its current heavy reliance on a few key agricultural exports.

Policy Formulation and Implementation, the findings of this study will offer evidence-based recommendations for policymakers to develop and implement strategies that support the growth of the spice sector. Understanding the factors that influence the export performance of Ethiopian spices will help stakeholders enhance the competitiveness of these products in the global market. This can lead to a stronger presence of Ethiopian spices internationally, benefiting the country's economy. This study will fill gaps in the existing literature on Ethiopia's spice trade and its economic impact. It will provide a comprehensive analysis that can serve as a reference for future research and contribute to the academic discourse on trade diversification and economic development.

Socio-Economic Benefits, by promoting the growth of the spice sector, the study can contribute to socio-economic development in Ethiopia. This includes improving the livelihoods of farmers, creating employment opportunities, and enhancing the overall quality of life for communities involved in spice production and trade.

1.6 Scope of the study

The study's main focus was on understanding the potential export markets for Ethiopian spices and the long- and short-term effects of spice trade on economic development.

To analyze the economic impact of the spice trade, and the bilateral trade relation between Ethiopia and its key trading partners the study covered the period from 2000 to 2024.

1.7 Organizations of the study

The paper is structured into five major chapters. The first chapter gives background and introduces the problem. The second chapter provides an examination of related theoretical and empirical literature. The third chapter presents the research's methodology, while the fourth chapter does an econometric analysis of the study. The final chapter offers findings and policy implications.

Chapter Two: Literature Review

2.1 Theoretical Review

2.1.1 Trade Theories

i. Absolute Advantage: According to Adam Smith's theory of absolute advantage, a country should trade a good in which it has an absolute advantage. Absolute advantage is referred to as using fewer resources to produce the same amount of goods (Ansari, S., 2024). In international trade theory, the concept of absolute advantage refers to a country's ability to produce goods more efficiently than another country using fewer resources or producing more output with the same input. When a country has an absolute advantage in producing a particular good, it can produce that good at a lower cost or with higher productivity compared to its trading partners. Specializing in goods where a country holds an absolute advantage allows it to allocate resources more efficiently, increase overall production, and trade surplus output for goods it does not produce as efficiently. This leads to mutual gains from trade, as each country focuses on what it does best and benefits from the comparative strengths of others (Ansari, S., 2024.

ii. Comparative Advantage: According to David Ricardo's theory of comparative advantage, countries benefit by specializing in goods they can produce more efficiently relative to other nations. Ethiopia’s climate and soil conditions give it a unique advantage in cultivating a variety of spices which are increasingly demanded globally. By focusing on spice production, Ethiopia could maximize its productive efficiency, enhancing its competitive edge in the global spice market. This advantage could lead to increased exports, positively impacting the country’s GDP (Montevirgen, 2025). However, while absolute advantage is a useful starting point, most modern trade theory emphasizes comparative advantage the ability to produce good at a lower opportunity cost than others. Even if a country has an absolute advantage in multiple goods, it benefits most by specializing in the goods where their

relative efficiency is greatest. In practice, countries often consider both absolute and comparative advantages when shaping trade and industrial policies. Specialization based on these principles can lead to increased productivity, economic growth, and stronger global trade relationships.

iii. Heckscher-Ohlin Theory (Factor Proportions Theory): The Heckscher-Ohlin (H-O) model is a foundational theory in international economics that explains patterns of trade between countries based on their relative factor endowments—specifically, labor, capital, and land. Developed by Eli Heckscher and Bertil Ohlin and later refined by economists such as Edward Leamer (1995), the theory posits that countries will export goods that intensively use the factors of production they possess in abundance, and import goods that require factors they lack. For example, a country with an abundance of labor but limited capital will tend to specialize in and export labor-intensive goods, such as textiles or agricultural products. Conversely, a capital-rich country will focus on capital-intensive goods like machinery or electronics. This specialization allows countries to produce more efficiently and benefit from comparative advantages rooted in their resource availability. While the H-O theory has strong explanatory power, especially for trade between developed and developing countries, it has limitations. Empirical tests, such as the Leontief Paradox, have shown that some countries do not always export goods that align with their factor endowments. Nonetheless, the theory remains a cornerstone of trade analysis and provides valuable insights into how resource distribution shapes global trade flows. (Leamer, E. E. ,1995).

iv. New Trade Theory: developed in the late 20th century by economist Paul Krugman and others, challenges traditional trade models by introducing the role of economies of scale, product differentiation, and network effects in shaping international trade patterns. Unlike classical theories that focus on comparative or absolute advantage, NTT explains how countries can benefit from trade even when they have similar factor endowments or technologies. According to Krugman, countries can gain a competitive edge by specializing in the production of certain goods, particularly those that benefit from increasing returns to scale. In the context of developing countries

like Ethiopia, New Trade Theory suggests that strategic investment in sectors with potential for scale and differentiation such as agro-processing or spice production—can foster export competitiveness. By building capacity, improving infrastructure, and supporting innovation, countries can integrate into global value chains and benefit from trade beyond traditional resource-based exports. Overall, New Trade Theory provides a more nuanced understanding of trade in the modern global economy, emphasizing the role of market structure, firm behavior, and scale economies in shaping trade flows and national specialization (Krugman, 1999).

2.1.2 Agricultural and Commodity-Based Growth Models

Agriculture-Led Growth Theory: Agriculture-led growth theory highlights the crucial role of agriculture in the early stages of economic development, especially in agrarian economies like Ethiopia. By investing in high-value agricultural commodities such as spices, Ethiopia could leverage its agricultural sector to drive broader economic growth. This model posits that increased agricultural productivity leads to surplus production, which can be exported, generating foreign exchange and supporting industrialization (Johnston & Mellor, 1961).

Commodity-Based Growth and Economic Transformation: Commodity-based growth models emphasize the role of commodities in initiating economic transformation, especially through export diversification. Spices, as high-value commodities, can contribute significantly to Ethiopia's GDP, enhance rural income, and create employment opportunities. When a country specializes in exporting high-value agricultural products, it can stimulate other sectors, such as logistics, processing, and packaging, supporting both direct and indirect economic growth (Prebisch, 1950).

2.1.3 Product Diversification and Economic Growth

Traditional Trade Theories:

Early economic theories—like Ricardo's theory of Comparative Advantage and the Heckscher-Ohlin model—argue that countries grow best by specializing in the goods they can produce most efficiently. In this view, focusing on a narrow set of exports makes economic sense. But these models don't account for the evolving and dynamic nature of today's global economy. They assume constant returns to scale and overlook the benefits that can come from branching out into new products or industries (Sarin et al., 2020).

Modern Trade Thinking:

More recent theories, such as Paul Krugman's New Trade Theory from the 1980s, take a different approach. These models recognize that exporting a wider variety of products—especially those with higher value-added—can help countries move beyond traditional limitations. By taking advantage of economies of scale and engaging in markets with monopolistic competition, countries can grow by offering more diverse, specialized products (Sarin et al., 2020).

Endogenous Growth Models:

Economists like Romer (1986, 1990) and Lucas (1988) have emphasized the importance of innovation, human capital, and knowledge-sharing in driving long-term growth. According to these models, diversification is more than just economic insurance—it actively boosts learning, technology adoption, and productivity. The "learning-by-exporting" idea suggests that as firms enter new markets, they're exposed to better technologies and production techniques. This, in turn, improves efficiency and strengthens the entire economy. A broader export base also opens the door to knowledge spillovers from more advanced economies, further accelerating technological progress (Sarin et al., 2020).

Structuralist Views:

From a structuralist perspective—seen in theories like the Prebisch-Singer Hypothesis and Hirschman's Linkage Theory—overreliance on primary commodities (like raw agricultural products or minerals) can be risky. Prices for these goods are volatile, and over time, their value relative to manufactured goods tends to decline. Economies built mainly on these exports often face slow growth and instability. Diversifying into more sophisticated, processed, or

manufactured goods is viewed as a way to stabilize income and escape the limitations of commodity dependency (Sarin et al., 2020).

Avoiding the Resource Trap:

The "resource curse" and "Dutch disease" are terms used to describe how economies rich in natural resources sometimes suffer unexpected setbacks—like inflation, underdeveloped industries, and economic shocks—because they're too dependent on those resources. Diversification is frequently recommended as a way to avoid these pitfalls by building a more balanced and flexible economic foundation (Sarin et al., 2020).

Why Diversification Matters:

When a country relies heavily on just one or two export products, it becomes highly vulnerable to global price swings and demand shifts (Imbs & Wacziarg, 2003). By diversifying, economies can better absorb shocks and reduce their exposure to global uncertainty.

The Bigger Picture for Growth and Competitiveness:

Over the long term, product diversification is a powerful tool for building resilience, encouraging innovation, and strengthening a country's position in global trade. For a country like Ethiopia, expanding its capacity in processing, branding, and exporting a wider range of goods—like spices—can attract foreign investors, bring in new technologies, and improve production methods. These developments can ultimately lead to stronger, more sustainable economic growth (Hausmann & Rodrik, 2003).

2.1.4 Trade potential

New Trade Theory: Paul Krugman's New Trade Theory argues that trade potential is influenced not only by comparative advantage but also by economies of scale, product differentiation, and monopolistic competition. Countries with similar factor endowments can still benefit from intra-industry trade, which expands trade potential by increasing variety and lowering costs through scale economies (Baldwin, 2023).

Endogenous Growth Theories: Endogenous growth models emphasize that trade potential is driven by knowledge spillovers, innovation, and human capital accumulation. Countries that engage in trade benefit from technology diffusion and learning effects, which further enhance their capacity to expand trade (Feenstra, 2018).

Regional Integration and Trade Potential: Trade agreements and economic integration increase trade potential by reducing barriers and harmonizing policies. Theories of regionalism distinguish between trade creation (efficient trade expansion) and trade diversion (shifting trade from more efficient to less efficient partners). Deep integration (e.g., customs unions, common markets) enhances trade potential by fostering investment and supply chain development (Baldwin, 2023).

Gravity Model

The gravity model of trade is a widely used empirical framework in international economics, explaining bilateral trade flows based on the economic size (GDP) of trading partners and the distance between them. The theory of gravity model of trade is based on Newton's law of gravitation. The gravity model asserts that larger economies trade more with one another. As the distance between trade partners increases, the value of trade decreases, as transportation costs are higher.

The gravity model suggests that trade possibilities between countries is based on economic size (GDP) and proximity, while trade possibilities are impeded by trade barriers (tariffs, cost of infrastructure, cultural similarity). The gravity model has been successfully applied to measure trade possibilities that have gone untapped, by taking into account trade flows and expected values (Rincon-Yanez et al., 2023).

Over the years, researchers have extend the gravity model to include factors such as trade agreements, trade costs and institutional development and attractiveness of the product (Anderson & Van Wincoop, 2003; Helpman et al., 2008).In regards to agricultural trade, studies have shown that logistics, market linkages and country policy greatly influence export performance. For Ethiopia's spice sector, where exports are still in the infant stages despite

strong demand from global markets, the gravity model offers a means to identify potential destination markets, as well as an opportunity to assess trade barriers.

Empirical evidence on agricultural exports from Africa shows that limited infrastructure, high trade costs inhibiting trade and lack of regional integration limit potential for increased exports (Eita & Jordaan, 2007; Limao & Venables, 2001). Also, there have been previous gravity model applications in Ethiopia for coffee exports that show economic size, international trade agreements, and regional applied issues of trade policy frameworks are indeed important aspects of export competitiveness (Tadesse & Fayissa, 2020). However, despite the potential for agribusiness and economic diversification Ethiopia's spice exports have yet to have similar gravity model applications. With the table of contents including a panel databased gravity model, this study will develop an understanding of the trade flows, market potential and competitiveness of Ethiopia's spice products in international markets. Ultimately, the research findings will use policy recommendations to addresses the logistical bottlenecks to trade and apply quality improvement standards to better position Ethiopia in globalization and value chains, contribute to a journey of economic growth and possible export diversification of agri-food products.

2.2 Empirical Review

2.2.1 Studies on Spice Export Performance

A study titled "Determinants of Export Performances of Major Spices (Turmeric and Korarima) in Ethiopia" (2020) by Dessalegn Gachena, Jema Haji, Belayineh Legesse, and Mengistu Ketema, investigates what drives the export performance of two key Ethiopian spices—turmeric and korarima. Using a gravity model with panel data from 2005 to 2015/2016, the authors analyze Ethiopia’s trade with nine international partners.

Their findings reveal several factors that positively influence spice exports: larger populations, increased foreign direct investment (FDI), favorable exchange rates, and strong economic conditions in importing countries. Geographical closeness to trade partners also boosts export performance. On the flip side, lower institutional quality and membership in the COMESA trade bloc appeared to have a negative effect. While the study offers valuable insights, it only focuses

on two spices and uses data that predates more recent developments, limiting its relevance for current policy or market analysis.

In a 2020 study, Aklilu Shumete took a closer look at the factors shaping Ethiopia's spice export sector. On the domestic front, he found that high product quality, smart marketing, and strong management practices were helping some exporters succeed. But the external environment presented more hurdles. Government policies and market conditions often fell short of supporting exporters effectively. On top of that, logistical challenges—like high transportation costs and fragmented marketing systems—created serious bottlenecks. Aklilu's work highlights the urgent need for better infrastructure, stronger links between farmers and markets, and more consistent post-harvest handling. While the study offers valuable insights, its descriptive nature means it doesn't fully capture the complexity of the export landscape—pointing to the need for more in-depth, data-driven research.

Another relevant study, titled *"Determinants of Export Marketing Performance: The Case of Ethiopian Pulses, Oil Seeds and Spices Exporters"* by Addis Alemayehu, takes a broader approach. It emphasizes the critical role of institutional support—from government policies and financial services to promotional efforts. Using a mix of surveys, interviews, and regression analysis, the study paints a clearer picture of the challenges exporters face. One recurring issue is their limited ability to influence prices in global markets, which weakens their competitiveness. Addis recommends a combination of stronger fiscal and monetary support, better infrastructure, and improved access to market intelligence to help Ethiopian spice exporters compete more effectively on the world stage.

2.2.2 Studies on the Spice Outlook in Ethiopia

Abdurahman Wondimnew's 2023 study offers a wide-angle view of Ethiopia's spice production and marketing landscape—one filled with promise, but also persistent hurdles. Thanks to its diverse climate, Ethiopia is naturally suited to grow a wide range of spices, and smallholder farmers are at the heart of this sector. However, these farmers often face significant challenges, including limited access to high-quality seeds, weak agricultural support services, and poor infrastructure. The spice marketing system is also highly fragmented, involving a long chain of

players—from farmers and traders to cooperatives and exporters, which often reduces efficiency and eats into profits.

Most spices are sold in raw form, with little to no value added, meaning farmers miss out on opportunities to earn more. Abdurahman stresses the importance of building stronger market connections, improving quality control, and investing in infrastructure to help Ethiopia compete more effectively in the global spice trade. One key gap he identifies is the lack of detailed understanding of changing consumer preferences—both locally and internationally—which is crucial for shaping future strategies.

Derese Teshome's 2009 study focuses on turmeric farming in Yeki Woreda, in the Shaka Zone. Turmeric plays a vital economic role in the area, but smallholder farmers there face a familiar set of challenges: poor access to markets, outdated farming practices, limited processing capacity, and a lack of support services. Derese recommends practical solutions like introducing modern farming tools, strengthening extension services, and providing real-time market information to help farmers boost productivity and income.

It's worth noting that Derese's study is now over a decade old and focused on a specific region, so while it offers valuable insights, it may not fully reflect the current realities or broader trends in Ethiopia's spice sector today.

In another detailed analysis, Gebremariam, Tesfaye, and Assefa (2022) examined the entire spice value chain in Ethiopia, particularly focusing on cumin, coriander, and fenugreek. Their study highlights Ethiopia's natural comparative advantage due to favorable agro-ecological conditions. However, they also point to major systemic issues such as poor seed quality, inadequate post-harvest facilities, weak market integration, and low investment in research and development. The authors argue that while the spice industry holds substantial promise for economic development and income generation, structural inefficiencies and policy shortcomings are holding it back. They call for strategic investment in infrastructure, policy reform, and capacity building. One key gap in their study is the lack of analysis on the spice sector's broader macroeconomic impact such as its contribution to GDP and employment suggesting that future research should focus on quantifying these outcomes to support policymaking.

Table 1: Empirical Review Summary

Title of the Research	Scope	Key Findings	Limitations
Determinants of Export Performances of Major Spices (Turmeric and Korarima) in Ethiopia (2020)	Factors influencing export performance of turmeric and korarima in Ethiopia using GLS gravity model and panel data from 2005 to 2015/2016	Larger population size, higher FDI, favorable real exchange rates, and economic performance of importing countries positively influence export performance. Lower institutional quality and COMESA membership negatively impact export performance.	Timeframe may not capture recent trends. Focuses only on turmeric and korarima.
Determinants of Spice Export Performance in Ethiopia by Aklilu Shumete (2020)	Internal and external factors influencing spice export performance in Ethiopia	Product nature, marketing strategies, and managerial quality positively impact export performance. Government policies and market conditions often hinder performance. High transportation costs and fragmented marketing channels are major barriers.	Relies on descriptive data, which may not capture the full complexity of the issues.
Determinants of Export Marketing Performance: The Case of Ethiopian Pulses, Oil Seeds and Spices Exporters by Addis Alemayehu (2019)	Factors influencing export success of pulses, oil seeds, and spices using mixed research approach	Institutional support, including favorable government policies, cheap loans, and market promotion efforts, significantly impacts export performance. Exporters face challenges such as being price takers in international markets.	While institutional support factors were found to significantly impact export performance, the study may not fully capture other potential determinants such as firm-specific characteristics or broader economic conditions
Spice Production, Marketing, and Value Chain in Ethiopia by Abdurahman Wondimnew (2023)	Potential and challenges in spice production, marketing, and value chain in Ethiopia	Smallholder farmers face challenges like limited access to quality seeds, poor extension services, and inadequate infrastructure. Marketing system is fragmented, leading to inefficiencies. Minimal value addition limits potential income.	Limited information on domestic and international spice market dynamics.
Turmeric	Challenges faced	Low prices, poor market	Focuses only on a specific

Title of the Research	Scope	Key Findings	Limitations
Production and Marketing in Yeki Woreda, Shaka Zone, Southwestern Ethiopia by Derese Teshome (2009)	by smallholder farmers in turmeric production and marketing	information, labor and fuel shortages, weak extension services, and poor processing techniques limit potential. Recommendations include improving marketing system, enhancing extension services, and introducing modern processing equipment.	region, which may limit generalizability. Study's findings may not fully reflect current situation.
Value Chain Analysis of Ethiopia's Spice Sector by Gebremariam, Tesfaye, and Assefa (2022)	Potential for economic development and challenges in spice sector	Ethiopia has comparative advantage in spice production but faces constraints like limited access to improved seeds, inadequate post-harvest handling facilities, weak market linkages, and insufficient investment in research and development. Recommendations for strengthening value chain through improved infrastructure, capacity building, and policy support.	Limited assessment of sector's macroeconomic impact. Further research needed to quantify effects on GDP and employment.

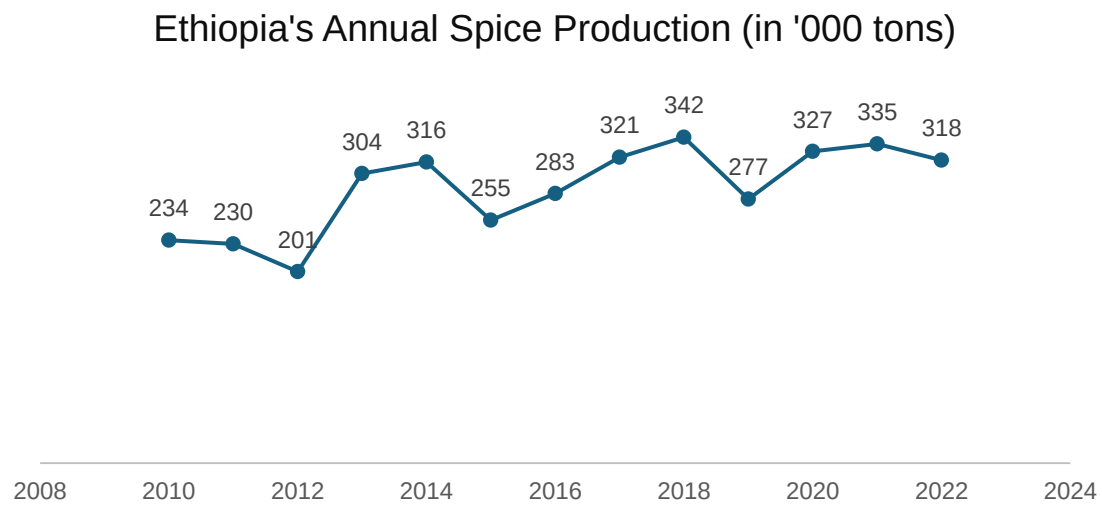
2.3 Spice Industry in Ethiopia

Ethiopia produces more than 50 spices, herbs, and aromatic plants, out of which 23 are trading as export items. The average land coverage by spices is approximately 222,700 ha (ECTA, 2022). and the yield is 318,00 tons/annum in 2023 (FAO STAT, 2025)

Ethiopia produces a wide variety of spices, including Cumin, Coriander, Fenugreek, Turmeric, Black pepper, Cardamom, and Ginger. These spices are primarily grown in regions such as Oromia, Amhara, Southern Nations, Nationalities, and Peoples' Region (SNNPR), and Tigray. Spices are cultivated by smallholder farmers, often intercropped with other crops, and play a significant role in local diets, traditional medicine, and cultural practices. The spices produced under smallholders in Ethiopia are Korarima (Aframonum Korarima), red pepper, ginger,

turmeric, cardamom, black pepper, black cumin, white cumin, coriander, fenugreek, sage, and cinnamon. (Gebremariam, Tesfaye, & Assefa, 2022)

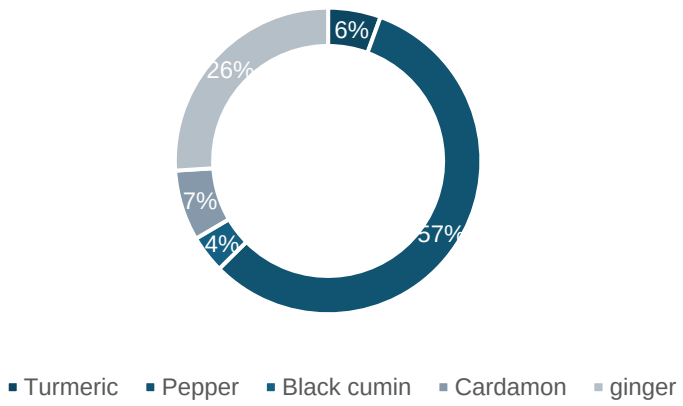
Figure 1: Ethiopia's Annual Spice Production



Source: Food and Agriculture Organization Corporate Statistical Database, 2025

Chili pepper accounts for over 50% of total spice production. The share of chili pepper has increased over the years since several diseases decimated the production of ginger in Ethiopia. SNNPR, Oromia, and Amhara are the main spice-producing regions in the country. SNNPR is the main ginger, turmeric, and black cardamom producer, primarily in Kaffa Zone, Bench Maji Zone, and Gedeo Zone. Oromia Region (especially Illubabor Zone) and Amhara Region are chiefly responsible for producing chilies and black cumin (Asfaw, 2020). Ethiopia has very suitable agroecology for producing various spices, which are very useful for food seasoning, medicinal, and income generation for people at various economic levels and have importance to the Ethiopian economy through fetching hard currency. Even though Ethiopia is conducive to the production of spices, the subsector's contribution to the national economy is low, which is less than **1 percent** (Asfaw, 2020).

Figure 2: Share of Ethiopia Spice production (2021)



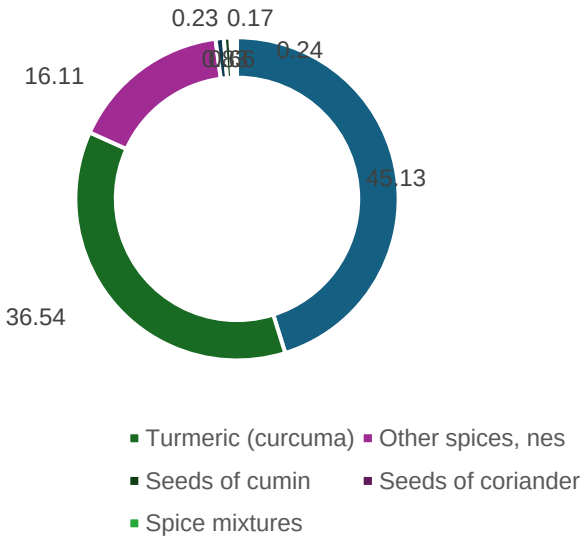
Source: Ethiopia Customs and Trade Authority, 2021

According to the Central Statistical Agency (CSA) of Ethiopia, spice production has shown steady growth over the past decade. The total area under spice cultivation has also expanded, from 50,000 hectares in 2015 to 75,000 hectares in 2020 showing a 50% increase in the area cultivated, reflecting increased farmer interest and government support.

Spice production among smallholder farmers is largely influenced by the demand and prices from the previous year. Typically, these farmers grow spices as intercrops alongside coffee or maize, rather than relying on them as their primary source of income. When the market for spices is strong, with high demand and good prices, farmers are more inclined to plant spices in the next growing season. On the contrary, if they struggled to find a market for their spices or if prices were low, they are more likely to switch to cultivating other crops. Thus far, Ethiopia is not recognized as a major exporter of spices, and the contribution of spices to the national economy

could be higher (0.42% of export value in 2018). In 2020, Ethiopia exported $5.16M in Spices, making it the world's 57th largest exporter of Spices. (OEC Statistics, 2024)

Figure 3 Ethiopian Spice Export by Segment (2014-2024)



Source: Export data from Ethiopian Customs Commission, 2025

Table 2 Ethiopian Spice Export by Segment (2014-2024)

Commodity	Share
Pepper	45.13068%
Turmeric (curcuma)	36.53694 %
Other spices	16.11424 %
Ginger	0.82627 %
Seeds of cumin	0.65717 %
Seeds of coriander	0.24345 %
Saffron	0.23008 %
Spice mixtures	0.16824%
Cardamoms	0.08504%
Cinnamon	0.0043%
Saffron	0.00315%

Nutmeg	0.00041%

Source: Export data from Ethiopian Customs Commission, 2025

Over the past decade, Ethiopia’s spice export sector has been notably driven by a few dominant commodities, with Chili Pepper, a consolidation of dried and crushed or ground pepper—leading the market. This category accounted for an impressive 45.13% of the nation’s total spice export value between 2014 and 2024, underscoring Ethiopia's strength in pepper cultivation and the global demand for its high-quality varieties. Turmeric (Curcuma) followed as the second most valuable export, contributing 36.54%, a testament to Ethiopia’s expanding role in supplying this increasingly popular spice known for both culinary and medicinal applications. Meanwhile, exports categorized under Other spices, nes (not elsewhere specified) comprised 16.11%, suggesting a diversified but limited portfolio of niche or under-documented spice products.

When it comes to Ethiopia’s spice exports, there’s a category called “Other spices, nes” (which stands for “not elsewhere specified”). This group includes a mix of traditional and lesser-known Ethiopian spices that aren’t listed separately in international trade records. Many of these spices are important in local cooking and culture, but they’re not exported in large enough amounts to be tracked individually.

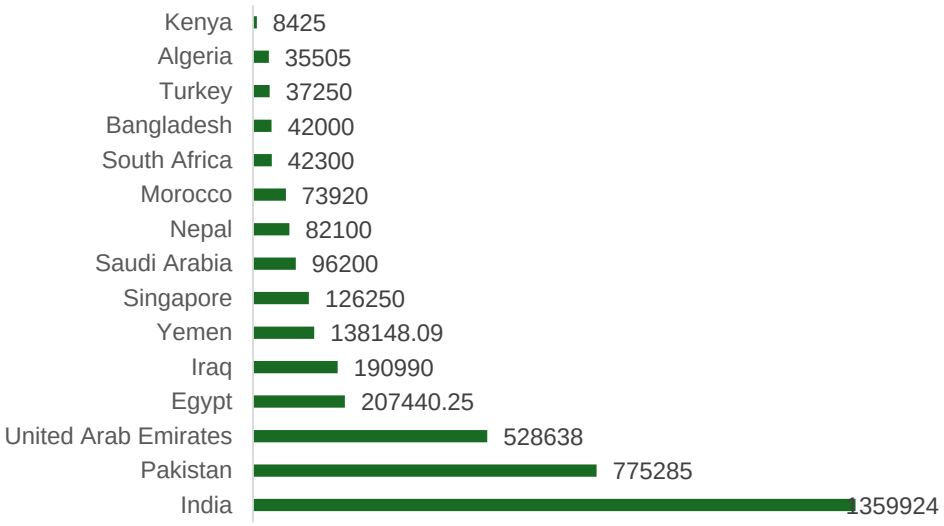
Ginger and cumin seeds are part of Ethiopia’s spice exports too, but they made up only 0.83% and 0.66% of total spice exports, respectively. This suggests that either they’re produced in smaller quantities or they face tough competition in global markets.

Overall, these numbers show that Ethiopia’s spice exports are heavily focused on just a few top-performing products. At the same time, they also point to opportunities—especially in expanding and adding value to the lesser-known spices that are already part of the country’s rich agricultural heritage.

In 2022, Ethiopia exported about $4.2 million worth of spices, making it the 59th largest spice exporter in the world. The primary destinations for Ethiopian spices included India ($1.34 million), Egypt ($619,000), the United States ($419,000), the United Arab Emirates ($273,000), and Canada ($225,000). This diverse market base highlights the global reach of Ethiopia's spice exports.

Between 2021 and 2022, the fastest-growing export markets for Ethiopian spices were Egypt, with an increase of $115,000, Pakistan, which saw a rise of $61,800, and Germany, with an additional $43,800 in imports. These growth trends indicate a rising demand for Ethiopian spices in various international markets. (OEC Statistics, 2024).

Figure 4 Ethiopian Spice export value in USD by importing countries (2024)

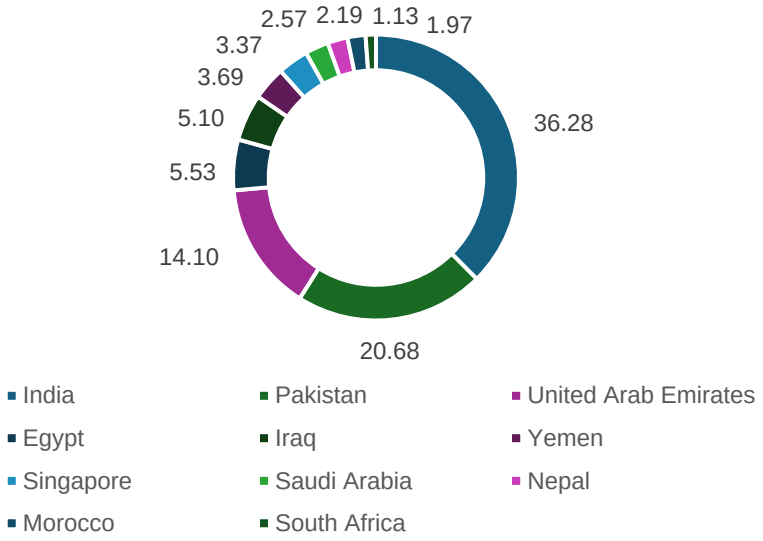


In 2024, India emerged as the largest importer of Ethiopian spices, accounting for over 36% of total export value. This dominant share highlights the strong demand for Ethiopian spices in Indian markets, likely driven by their integration into the country's diverse culinary traditions and spice processing industries. Pakistan followed with 20.68%, while the United Arab Emirates contributed 14.10% reflecting its role as both a consumer and potential re-exporter hub due to its strategic trading position. Together, these top three countries made up more than 70% of Ethiopia’s total spice export value in 2024, emphasizing a concentrated trade reliance on a few high-volume markets.

Other notable importers included Egypt (5.53%), Iraq (5.10%), and Yemen (3.68%), each representing mid-tier markets with historical and cultural ties to spice consumption. Countries like Singapore, Saudi Arabia, and Nepal hovered just above the 2% mark, indicating modest but

stable trade flows. At the lower end of the spectrum, countries such as the United States, Canada, and Australia had minimal shares under 0.15% suggesting untapped market potential. These figures not only illustrate Ethiopia's current export geography but also point to strategic opportunities for diversification and targeted marketing in underrepresented regions.

Figure 5 Ethiopian spice importing countries market share (2024)



The concentration of Ethiopian spice exports in a few regional markets—especially South Asia and the Middle East suggests both strength and vulnerability. While established demand from countries like India and Pakistan ensures a steady revenue stream, over-reliance on these markets exposes Ethiopia to potential geopolitical or economic disruptions. Moreover, the relatively small export values to Western countries such as the United States (0.11%), Canada (0.003%), and Australia (negligible) point to missed opportunities in high-value consumer markets that increasingly favor organic, traceable, and exotic spices. Expanding into these regions could not only diversify risk but also enhance Ethiopia's brand value in the global spice economy. To achieve this, investments in quality certification, marketing, and bilateral trade relationships will be crucial for unlocking new demand and elevating Ethiopia's spice industry beyond traditional trade partners.

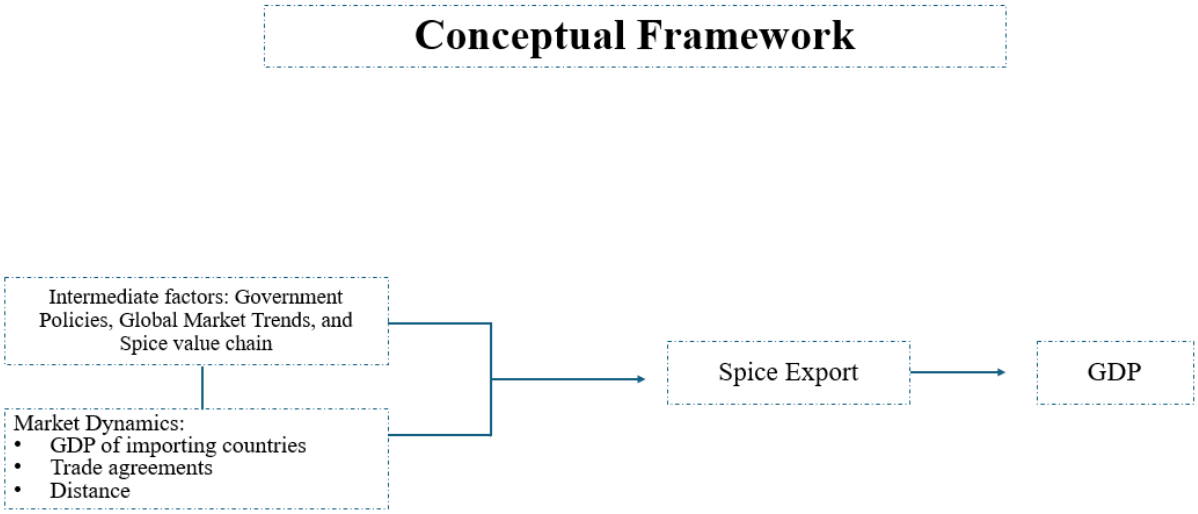
2.4 Conceptual Framework

This study builds a framework to better understand the potential of Ethiopia's spice trade and how it connects to the country's economic growth. It focuses on two main goals: identifying promising international markets for Ethiopian spices and analyzing how spice exports affect the economy.

To measure the economic impact, the study uses GDP as the main indicator of growth. The key factors being looked at include the value of spice exports and how diverse Ethiopia's exports are overall. These elements help explain how the spice trade fits into the bigger picture of economic development.

The model tracks how changes in spice export value (Xt) influence GDP over time. A higher value of spice exports is expected to boost GDP directly. At the same time, the export diversification index (EDIt) shows how spreading exports across different products can help stabilize the economy and reduce risks. GDP growth (GDPt) is the main outcome the study is trying to explain.

Figure 6 Conceptual Framework



Source: Author's own analysis

Chapter Three: Data and Methodology

3.1 Data Sources and Types

To get a clearer picture of how the spice trade has shaped Ethiopia's economy, the study looked at data from 2000 to 2024—a period marked by major changes for the country. Over these 24 years, Ethiopia introduced important agricultural trade reforms, made notable progress in diversifying its exports, and experienced consistent GDP growth. By focusing on this longer timeline, the study was able to track key trends and evaluate the broader, long-term impact of spice exports on economic development.

To analyze these effects, advanced time series methods were used—specifically, Dynamic Ordinary Least Squares (DOLS) and the Vector Error Correction Model (VECM). These models allowed the study to capture both short-term fluctuations and long-term relationships between spice exports and GDP.

At the same time, the study zoomed in on Ethiopia's trade relationships with its top international partners from 2014 to 2024. This shorter, more focused period was chosen because it coincides with increased trade activity and more reliable data. Panel data analysis was used to assess

bilateral trade flows, incorporating variables like GDP, distance, and trade agreements. This approach helped reveal how Ethiopia's spice exports have performed in different markets—and where there may still be room to grow.

By combining these two perspectives—the long view of national growth and the closer look at international trade partnerships—the study offers a well-rounded understanding of the spice sector's role in Ethiopia's economy.

The key trading partners were identified based on export volumes during the 2014–2024 period. These included Bangladesh, Djibouti, Egypt, India, Iraq, Jordan, Kenya, Saudi Arabia, the United Arab Emirates, and Yemen. As a result, the analysis focused on the trade dynamics between Ethiopia and each of these countries.

Policy and investment data, including government policies, regulations, and records of investments in the spice trade sector, were reviewed to understand the roles of policy interventions and investment flows. Market data on market access conditions in potential destination countries and competitiveness indicators were also analyzed.

Data sources included national statistics agencies such as the Ethiopian Central Statistical Agency (CSA), international organizations like the World Bank and IMF, and government ministries such as the Ministry of Trade and Industry. Quantitative data on export earnings was collected from the World Bank, Ethiopian Customs Commission, and UN Comtrade database.

Data on spice export trade value for Ethiopia and its trading partners was sourced from the Ethiopia Customs Commission and the International Trade Centre (ITC). Macroeconomic indicators and population data were obtained from the World Development Indicators database by the World Bank. Data used for calculating the export diversification index was collected from World Bank Database.

3.2 Research Design

In this study, a panel-based gravity model was used to explore which countries hold the most promise as future markets for Ethiopian spice exports. The model relied on data from trade relationships between Ethiopia and its spice-importing partners, helping to pinpoint where trade is strong—and where there's room to grow.

The gravity model is built on a simple but powerful idea: trade between two countries tends to be stronger when their economies are larger and the physical distance between them is smaller. By applying this framework, the study aimed to uncover the main factors driving Ethiopia's spice exports and to identify markets that may be underperforming compared to their potential.

To do this, the model looked at a range of variables, including GDP, population, distance, trade agreements, and exchange rates. Using panel data allowed the analysis to track trade patterns over time and across different country pairs, offering a more complete picture of how Ethiopia's spice trade has evolved and where it could expand.

To ensure the results were reliable, the study included a series of checks before and after running the model. Before estimation, tests were done to confirm that the data was suitable for analysis—this included checking for stationarity, multicollinearity (using the Variance Inflation Factor), and heteroskedasticity (using the Breusch-Pagan test). The Pesaran CD test was also used to check for cross-country dependencies, and unit root tests helped determine the integration order of the variables.

After the model was estimated, further tests were carried out to validate the results. The Hausman test helped decide whether a fixed or random effects model was more appropriate. The Wooldridge test checked for serial correlation, and adjustments were made for any issues with heteroskedasticity or autocorrelation using HAC standard errors. Additional tests, like the Ramsey RESET test and goodness-of-fit measures (R-squared and adjusted R-squared), were used to assess how well the model explained the data.

Alongside the gravity model, the study also used two advanced econometric tools—Dynamic Ordinary Least Squares (DOLS) and the Vector Error Correction Model (VECM)—to examine how spice exports influence Ethiopia's economic growth, both in the short and long term. These models also considered how broader economic factors, such as exchange rate shifts and trade diversification, shape this relationship.

The gravity model specification

The model adopts a log-linear specification of the classical gravity equation as follows:

$\ln(Trade_{it}) = \alpha + \beta 1 \ln(GDPpc_{it}) + \beta 2 \ln GDPppc_{jt} + \beta 3 \ln(DIST_i) + \beta 4 \ln(FX_{it}) + \beta 5 FTA_{it} + \gamma_t Year_t + \varepsilon_{it}$

Where,

$Trade_{it}$ is the export value from Ethiopia to country i in year t;

$GDPppc_{jt}$ refers to Ethiopia's GDP per capita

$GDPpcj_t$ refers to importer GDP per capita;

$DIST_i$ is the bilateral distance;

FX_{it} is the exchange rate;

FTA_{it} is a trade agreement dummy;

$Year_t$ represents year fixed effects.

ε_{it} is the error term.

$$Trade_{ij,\,t} = \beta_0 + \beta_1 GDP_{i,t} + \beta_2 GDP_{j,t} + \beta_3 DIST_{ij,t} + \beta_4 POP_{i,t} + \beta_5 POP_{j,t} + \beta_6 EXC_{ij,t} + \beta_7 COMMON_{ij,t} + \varepsilon_{ij,t}$$

Tradeij,t: Bilateral trade value (export of spices from Ethiopia to country j).

GDPi and GDPj: GDP of Ethiopia (i) and the importing country (j) at time t.

DISTij: Distance between Ethiopia and the importing country j.

POPi and POPj: Population of Ethiopia and country j.

EXCij,t: exchange rate between Ethiopia and importing country j.

COOMONij: dummy variable indicating trade agreements.

To examine the long-run and short-run relationships between Ethiopia's spice exports, export diversification, and economic growth, two complementary time series econometric techniques were employed: Dynamic Ordinary Least Squares (DOLS) and the Vector Error Correction Model (VECM). These models are appropriate for analyzing relationships among variables that are non-stationary but cointegrated, which is the case with the dataset used in this study.

Dynamic Ordinary Least Squares (DOLS)

DOLS is a single-equation estimation technique used to estimate long-run relationships between cointegrated variables. It extends the traditional OLS model by adding leads and lags of the differenced explanatory variables to correct for endogeneity and serial correlation, common in time series data.

In this study, DOLS was used to estimate the long-run elasticities of GDP with respect to spice exports and export diversification. The key reason for choosing DOLS was its robustness in small samples and its ability to produce unbiased estimates when variables are cointegrated, even if there is simultaneity between the regressors and the error term. DOLS is especially suited for examining the steady-state (long-run) impact of explanatory variables without conflating them with short-term fluctuations.

Post-estimation diagnostic tests conducted:

1. Breusch-Godfrey LM Test for Serial Correlation
   To check whether the residuals from the DOLS model exhibit autocorrelation, which would violate the classical linear regression assumptions.
2. Breusch-Pagan Test for Heteroskedasticity
   Used to determine if the variance of the error terms is constant. Heteroskedastic errors can lead to inefficient estimates and invalid inference.
3. Skewness/Kurtosis Test for Normality of Residuals
   Ensures that residuals from the model follow a normal distribution, which is important for valid hypothesis testing and constructing confidence intervals.
4. Robust standard errors were used to correct for any remaining heteroskedasticity or misspecification that might affect the reliability of coefficient estimates.

Model Specification

$$\ln(GDP)t = \beta_0 + \beta_1 \ln(SpiceExport)t + \beta_2 \ln(DiversificationIndex)t + \sum \gamma_i \Delta\ln(SpiceExport)\{t\pm i\} + \sum \delta_j \Delta\ln(DiversificationIndex)\{t\pm j\} + \varepsilon t$$

- ln(GDP)t: Natural log of Ethiopia's GDP at time t
- ln(SpiceExport)t: Natural log of spice export value at time t
- ln(DiversificationIndex)t: Natural log of export diversification index at time t
- $\Delta \ln(\cdot)$: First difference of the log variable
- β_0: Intercept term
- β_1, β_2: Long-run coefficients
- γ_i, δ_j: Coefficients on leads/lags of differenced regressors
- εt: Error term

Vector Error Correction Model (VECM)

VECM is a multivariate time series model designed for systems where variables are non-stationary but share one or more long-run equilibrium relationships (i.e., they are cointegrated). The model captures both the long-run cointegration and short-run adjustment dynamics, showing how variables respond to deviations from equilibrium.

The VECM was employed after the Johansen cointegration test confirmed the existence of two cointegrating vectors among GDP, spice exports, and export diversification. VECM was chosen to:

- Assess the short-run effects of changes in spice exports and diversification on GDP.
- Estimate the speed of adjustment of GDP back to its long-run path when deviations occur.
- Capture the interdependence among the variables in a dynamic system framework, something DOLS does not provide.

Post-estimation diagnostic considerations:

1. Impulse Response Function (IRF) Analysis
   To examine how a shock in one variable (e.g., spice export) affects GDP and other variables over time, helping to visualize dynamic interactions in the system.

2. Cointegration Validation

   Two cointegrating relationships were established through the Johansen test before estimating VECM, ensuring the model was correctly specified.

3. Residual Normality and Robustness Checks

   While traditional residual diagnostics like estat stability were technically limited in Stata for VECM, the model's stability and behavior were assessed through IRFs and comparison with the equivalent unrestricted VAR model.

Model specification

$$\Delta Yt = \alpha_1 \, CE1\{t-1\} + \alpha_2 \, CE2\{t-1\} + \sum \Gamma_i \, \Delta Y\{t-i\} + \varepsilon t$$

Where Yt is the vector of variables:

$$[\ln(GDP)t, \ln(SpiceExport)t, \ln(DiversificationIndex)t]^T$$

- $\Delta\ln(\cdot)$: First difference of the log variable
- $CE1\{t-1\}$, $CE2\{t-1\}$: Cointegrating error correction terms
- α_1, α_2: Speed of adjustment coefficients
- Γ_i: Coefficients on lagged differenced terms
- εt: White noise error term

Chapter Four: Data Presentation and Analysis

4.1. Descriptive Analysis

4.1.1. Descriptive Statistics (DOLS and VECM)

Before diving into the econometric models, the study first looks at the basic behavior of the key variables: GDP, spice exports, and the export diversification index. This part of the analysis uses 25 years of data, from 2000 to 2024, to provide a clear picture of how these variables have changed over time.

Table 3: Summary of variables

Variable	Observations	Mean	Std. Dev.	Min	Max
ln_GDP	25	24.3487	1.0210	22.7839	25.8863
ln_SpiceExport	25	14.7083	1.0612	12.6628	15.9041
ln_DiversiIndex	25	-0.5702	0.1306	-0.7985	-0.3711

Now we can look at each variable separately

Gross Domestic Product (ln GDP)

GDP is the main indicator used to measure economic performance in this study. It reflects the total value of goods and services produced in the country. The graph titled “GDP Over Time” (not shown here) illustrates a steady rise in Ethiopia’s GDP from 2000 to 2024. Growth was modest in the early 2000s but picked up significantly after 2010, with the sharpest increases seen

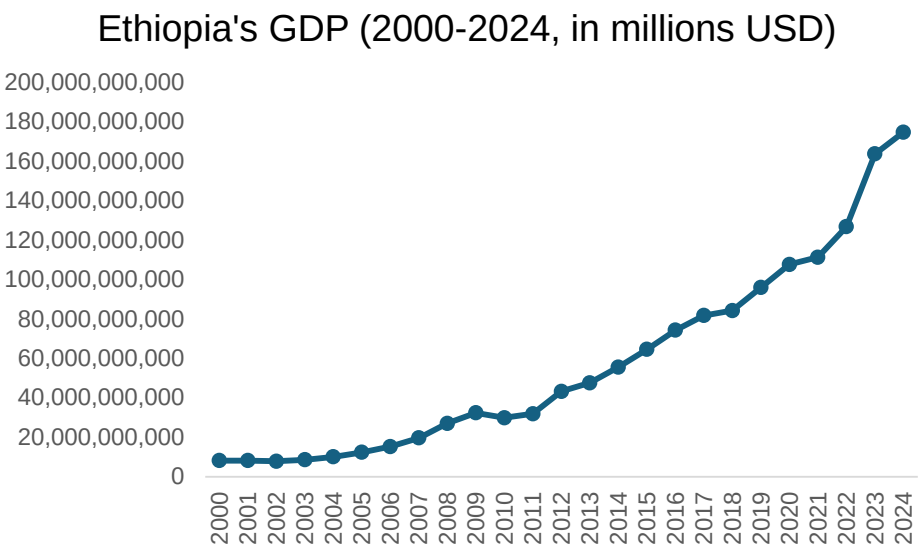
between 2016 and 2024. According to World Bank data, Ethiopia's GDP grew from about $8.2 billion in 2000 to over $156 billion in 2024 an increase of more than 1,800%.

This growth is the result of both domestic and international factors. Internally, Ethiopia has invested heavily in infrastructure, agriculture, and industry. Externally, better access to global markets, foreign investment, and regional trade agreements like AfCFTA have played a big role. The country's shift from a mostly subsistence farming economy to one more connected to global value chains including spices has also helped boost GDP.

Major policy initiatives, such as the Growth and Transformation Plans (GTP I and II), have supported this progress by focusing on agriculture-led industrialization and export growth. During this time, spices began to receive more attention as a high-value crop with strong export potential. However, despite favorable growing conditions, spices haven't yet made a major impact on GDP something this study aims to explore in more detail.

Agriculture remains a cornerstone of Ethiopia's economy, making up about 35.79% of GDP and 80% of exports in 2023 (World Bank, 2024). Since spices are labor-intensive and high value, improving their production and export could directly boost GDP and indirectly support job creation, rural incomes, and trade balances.

Figure 7: GDP over time



Source: National Bank of Ethiopia

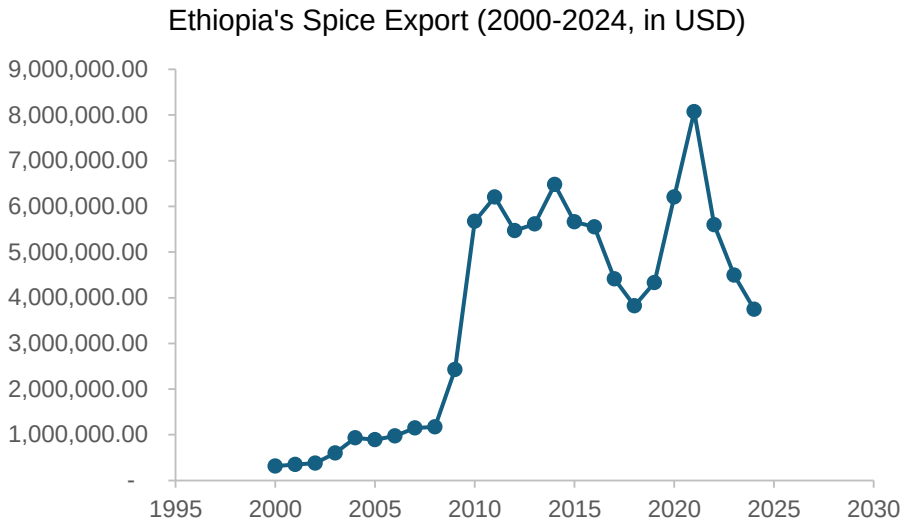
By focusing on GDP as the outcome variable, this study contributes to a deeper understanding of how agricultural export diversification, particularly through spices, aligns with Ethiopia's broader economic development goals.

Spice Export

Spice export is a central variable in this study, reflecting the monetary value of spices exported from Ethiopia to global markets in a given year.. Given that spices are high-value, low-bulk commodities with rising international demand, understanding their trade performance is essential for assessing their role in supporting Ethiopia's macroeconomic development and rural livelihoods. The figure below illustrates the annual trend of Ethiopia's spice exports from 2000 to 2024. Ethiopia's spice exports were modest in the early 2000s, beginning at just 315,777 Birr in 2000 and growing gradually through the decade. A notable surge occurred in 2010, when spice export earnings increased sharply to 5.67 million Birr, more than doubling the previous year's value. This upward trend continued, peaking in 2021 at approximately 8.07 million Birr, which represents the highest recorded export value during the 25-year period. However, the data also

reveals significant volatility. After reaching 6.48 million Birr in 2014, exports declined for four consecutive years, dropping to 3.82 million Birr in 2018, before recovering slightly and then peaking again in 2021. Following this peak, spice exports fell to 5.6 million in 2022, 4.49 million in 2023, and further to 3.75 million in 2024.

Figure 8 Spice export trend



Source: National Bank of Ethiopia, 2025

This fluctuating pattern suggests that while Ethiopia has made tangible progress in developing its spice export sector, the industry remains highly sensitive to domestic and global factors. These may include price volatility, market access challenges, production constraints, and limited value addition. Although government policies, such as those under the Growth and Transformation Plans (GTP I and II), have prioritized agricultural exports and agro-industrial development, the spice sector continues to struggle with issues related to quality control, infrastructure, and international competitiveness (ENTAG, 2018; Gebremariam, Tesfaye, & Assefa, 2022). Understanding these fluctuations is essential for identifying targeted interventions that can help stabilize and grow Ethiopia's spice exports, thus contributing more meaningfully to national economic growth.

The rise in spice exports between 2008 and 2010 coincides with increased government attention to agricultural commercialization under the first Growth and Transformation Plan (GTP I), which

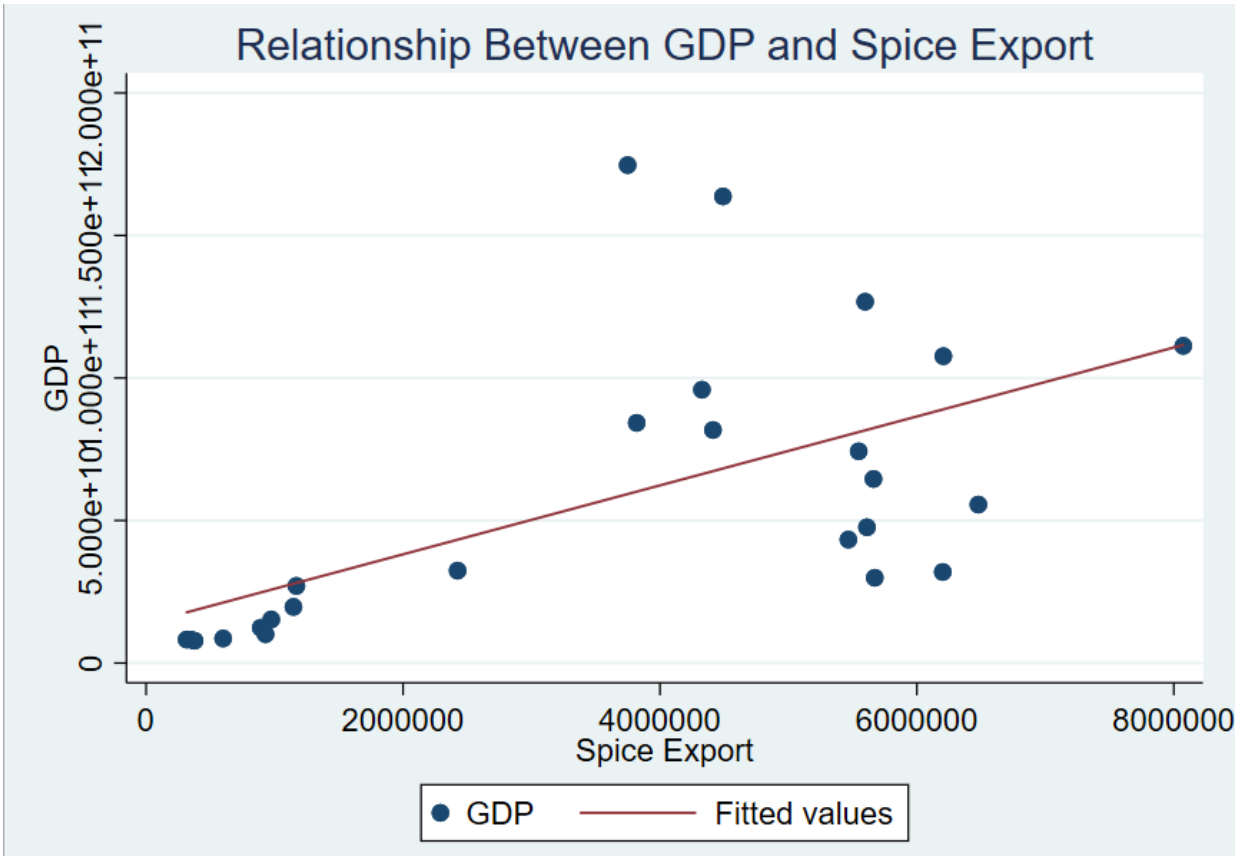
emphasized high-value crops and agro-processing for export (National Planning Commission, 2020). During this period, support for cooperatives, expansion of market infrastructure, and public-private partnerships played a role in helping farmers and traders tap into external markets. However, the inconsistency that followed points to persistent supply-side and institutional barriers. These include limited access to modern farming inputs, weak post-harvest handling and storage systems, and a lack of certification and quality control mechanisms that align with international standards (Gebremariam, Tesfaye, & Assefa, 2022).

Ethiopia produces a wide array of exportable spices including korarima (Ethiopian cardamom), ginger, turmeric, and chilies much of the production is handled by smallholder farmers with limited market integration. ENTAG (2018) notes that post-harvest losses and lack of value addition reduce the competitiveness of Ethiopian spices on the global stage. This reality is reflected in the graph's steep post-2021 decline, likely influenced by global market disruptions related to COVID-19, domestic political instability, and fluctuating exchange rates.

Despite these challenges, spice exports hold immense potential for both income generation and export diversification. Ethiopia's agro-ecological diversity allows for the cultivation of more than 50 types of spices and herbs (Asfaw, 2020), yet the sector remains underdeveloped. In 2022, Ethiopia ranked 59th globally in spice export value, with major destinations including India, Egypt, and the United States (OEC, 2024). These trade links highlight growing international demand for Ethiopian spices, especially in niche and ethnic food markets. However, for Ethiopia to fully capitalize on this potential, sustained investment in quality control, farmer training, logistics infrastructure, and global market intelligence is essential.

The scatter plot shown in figure below illustrates the bivariate relationship between Ethiopia's GDP (vertical axis) and spice export earnings (horizontal axis) over the period from 2000 to 2024. Each point on the graph represents a single year's data, while the fitted regression line captures the overall linear trend between the two variables.

Figure 9 Relationship between GDP and Spice Export



Source: Author's own analysis in Stata

The graph shows a positive but weak linear relationship between spice export values and GDP. As spice export values increase, GDP also tends to increase—although the spread of data points indicates considerable variability around the trend line. In the lower range (spice exports below 2 million Birr), both GDP and export values are tightly clustered, reflecting the early 2000s when both indicators were at relatively low levels. From around 2010 onward, spice exports began to rise significantly, but the GDP response appears non-linear and somewhat dispersed, suggesting that while spice exports may contribute to GDP, other dominant sectors (like services, construction, and broader agriculture) also play a large role.

The fitted line confirms a positive correlation, but the slope is relatively flat, which suggests that the marginal impact of spice exports on overall GDP may be modest when considered in isolation. This is consistent with previous literature that highlights how spice exports account for less than 1% of Ethiopia's total export earnings (Asfaw, 2020). The visual dispersion could also be influenced by other macroeconomic dynamics such as changes in foreign investment, shifts in

exchange rates, or fluctuations in global commodity prices, which are not accounted for in this simple bivariate analysis.

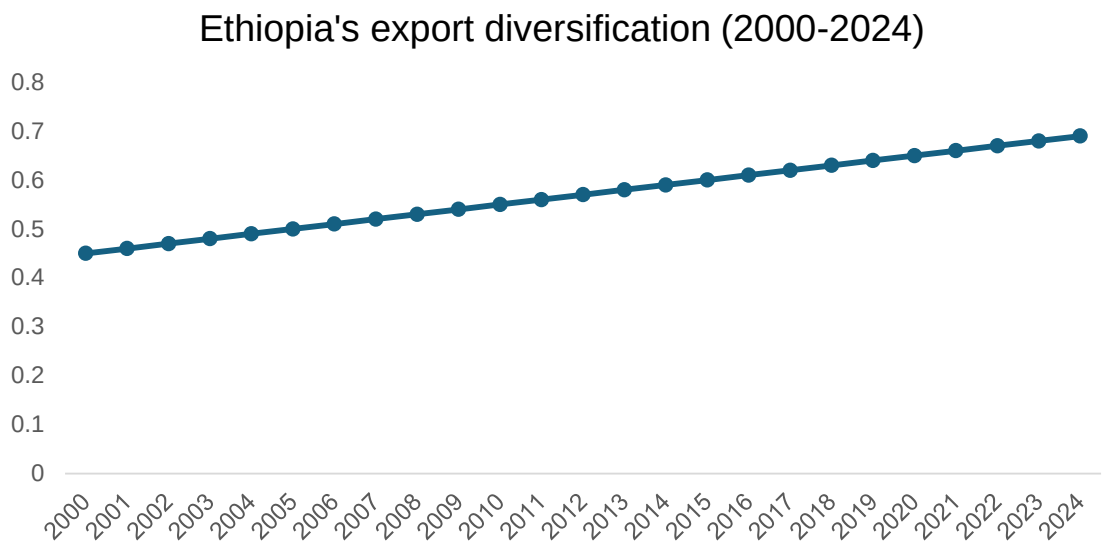
Despite the visual limitations, the graph serves a valuable purpose: it helps underscore the potential but currently underutilized contribution of spice exports to the Ethiopian economy. The trend line, though shallow, affirms that export performance in high-value crops like spices is positively associated with economic growth, especially if complemented by robust trade policies, infrastructure development, and market diversification strategies. More comprehensive models like DOLS and VECM, which are employed in the econometric sections of this study, are better suited to isolate and quantify this impact while controlling for other influential variables.

In summary, the scatter plot suggests that enhancing spice exports could play a supportive role in Ethiopia's GDP growth, but such an effect is likely to be more pronounced when combined with broader sectoral reforms and strategic investments in agro-processing, logistics, and global trade competitiveness.

Export diversification index

The Export Diversification Index used in this study is calculated using the Herfindahl-Hirschman Index (HHI), which is a widely accepted measure of market concentration. In trade analysis, the HHI reflects the degree to which a country's exports are dominated by a few products. The index ranges from 0 to 1, where values closer to 1 indicate high concentration (low diversification), and values closer to 0 reflect a more balanced and diversified export portfolio (UNCTAD, 2023).

Figure 10 Export diversification over time



Source: National Bank of Ethiopia, 2025

The data from 2000 to 2024, as presented in the above figure, shows a consistent increase in the HHI from 0.45 in 2000 to 0.69 in 2024. This trend suggests that Ethiopia's export structure has become more concentrated over the past two and a half decades. In other words, instead of expanding and diversifying its export base, the country has become increasingly reliant on a few dominant export commodities. This is consistent with longstanding observations that products like coffee, oilseeds, pulses, and khat continue to account for the bulk of export revenues (World Bank, 2024; Asfaw, 2020).

The rising concentration reflected in the index is particularly concerning given Ethiopia's broader goals of structural transformation and economic resilience. While initiatives like the Growth and Transformation Plans (GTP I and II) have emphasized export diversification as a policy priority, the data indicates that these efforts have not yet translated into substantive structural changes in the export composition (National Planning Commission, 2020). This has significant implications: a concentrated export base exposes the country to greater external vulnerabilities, such as commodity price shocks, demand fluctuations, and climate-related production risks.

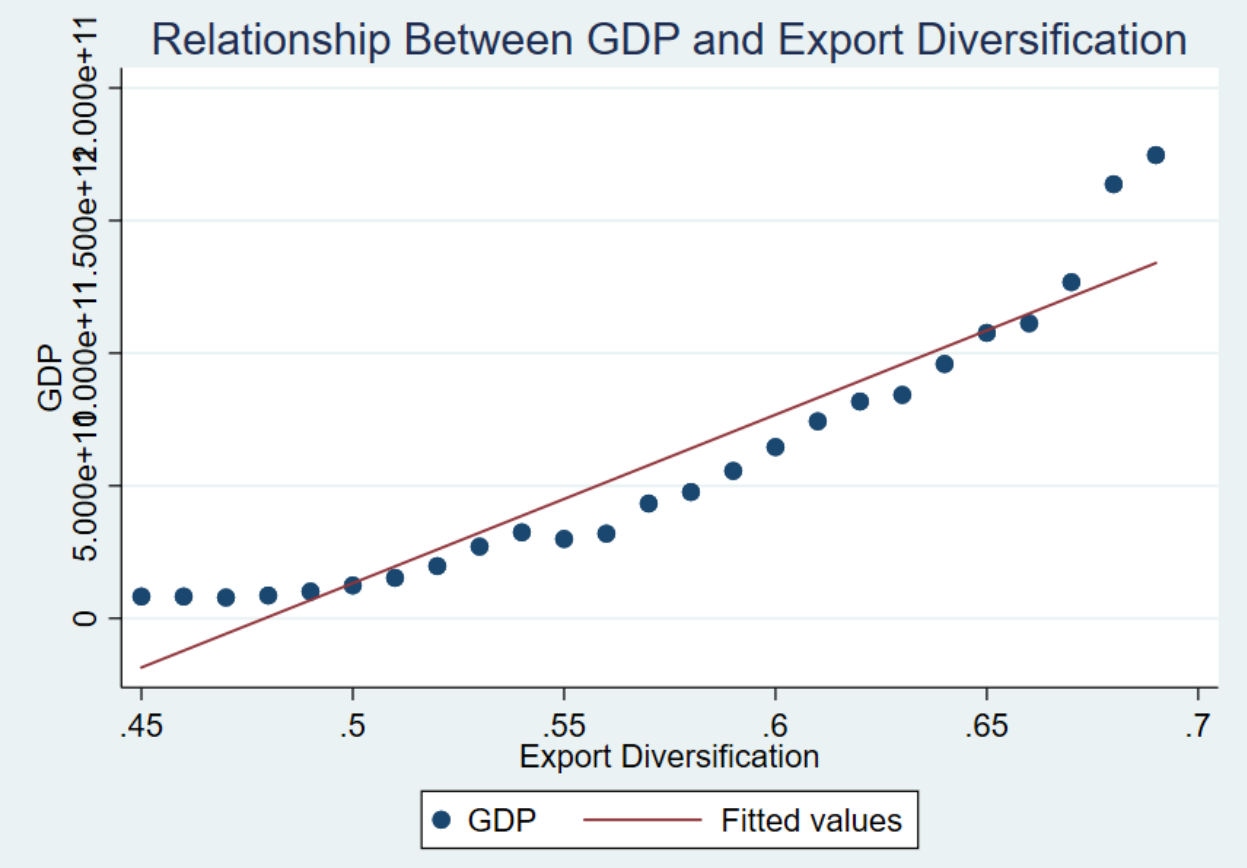
The increasing HHI trend also has implications for the role of non-traditional exports—such as spices in achieving broader development goals. Despite efforts to promote spice exports through

programs like ENTAG and agro-industrial park development, the sector's impact on Ethiopia's overall export portfolio remains limited. As this study investigates the relationship between spice exports and economic growth, the Export Diversification Index is used as a control variable to assess whether a more balanced export structure can amplify the growth-enhancing effects of niche exports. However, given the upward trend in the index, it appears that the country's economic growth continues to be driven by a narrow set of exports, limiting the potential spillover benefits of emerging sectors like spices.

In summary, the increasing Export Diversification Index from 0.45 in 2000 to 0.69 in 2024 indicates growing export concentration in Ethiopia. This trend poses challenges to sustainable and inclusive economic development. While there have been policy intentions to diversify, the empirical data suggest that much work remains to translate those policies into tangible, broad-based outcomes.

The scatter plot presented in the figure below illustrates the relationship between Ethiopia's GDP and the Export Diversification Index over the period from 2000 to 2024. The fitted regression line suggests a strong positive correlation between the two variables: as the export diversification index increases, GDP also rises. However, because this index is based on the Herfindahl-Hirschman Index (HHI) where higher values actually indicate greater concentration, this positive relationship requires careful interpretation.

Figure 11 GDP and Export Diversification



Source: Author's own analysis on Stata

What the graph essentially shows is that as Ethiopia's exports have become more concentrated (HHI increasing), its GDP has still grown steadily. This suggests that, despite ambitions for export diversification, the country's recent economic growth has been driven primarily by a few dominant export commodities, most notably coffee, oilseeds, and gold. While this export structure has generated considerable foreign exchange and contributed to GDP, it also implies that growth has occurred in a less diversified and potentially more vulnerable trade environment.

The tight clustering of the data points around the fitted line and the clear upward slope indicates a strong statistical association. But this does not imply that increasing export concentration is good for growth—it more likely reflects the reality that Ethiopia's high-growth years have coincided with strong performance in a handful of sectors. From a policy standpoint, the

challenge is to sustain economic growth while expanding and diversifying the country's export base to reduce exposure to commodity price shocks and enhance long-term resilience.

In short, the graph tells a nuanced story: Ethiopia's economy has grown, but largely despite rising export concentration, not because of it. This reinforces the relevance of this study's focus on non-traditional export sectors like spices that could help reverse the trend and build a broader, more stable foundation for future growth.

4.2.2. Descriptive Statistics

As a preliminary step to the econometric estimation using the **gravity model of trade**, this section presents a descriptive analysis of the key variables included in the bilateral trade regression framework. The variables analyzed include the logarithm of GDP for both Ethiopia and its trading partners, the logarithm of spice export values and additional bilateral factors such as distance and common trade agreements. The variable trade agreement is a dummy variable with a value 1 if Ethiopia has a trade agreement with the specific trading partner and 0 if there is no trading agreement.

The descriptive analysis is based on a balanced panel dataset consisting of 110 observations per variable, covering the period from 2014 to 2024. The summary statistics provide an overview of the distribution and variability of the data used in the gravity model estimation. Specifically, the mean, standard deviation, minimum and maximum values, and the number of observations for GDP per capita and Trade value of Ethiopia and Importing countries are outlined in the table below.

Table 4 Summary of Variables

Variable	Observations (Obs)	Mean	Std. Dev.	Min	Max
ln_gdppc_i (Log of GDP per capita - Ethiopia)	110	22.1017	1.1537	20.2713	24.4995
ln_gdppc_j (Log of GDP per capita - Partner Countries)	110	20.6002	0.3065	20.1558	21.2799
ln_trade (Log of Trade Value)	110	15.44125	3.104691	8.360306	23.26037

Spice Trade Value

The spice trade value in the context of the gravity model indicated the trade value of spice export to the selected key trading partners. It spans from 2014 to 2024 and is not limited to specific types of spices. These data were collected from Ethiopian Customs Commission.

Between 2014 and 2024, Ethiopia's spice exports to its top 10 trading partners experienced a rollercoaster of ups and downs. Over the decade, the total export value reached around 27.44 billion ETB, averaging about 2.49 billion ETB per year. The standout year was 2022, when spice exports soared to over 21.49 billion ETB a massive leap compared to earlier years. This sharp rise may have been driven by a mix of favorable market conditions, better logistics, or short-term trade incentives that gave the sector a temporary boost.

Table 5 Annual exports to key trading partners

Year	Trade value (USD)
2014	449,642,826.71
2015	524,786,493.64
2016	197,514,973.58
2017	715,502,505.23
2018	667,162,441.91
2019	652,812,319.00
2020	450,626,801.00
2021	4,461,502,459.90
2022	2,148,905,331.00
2023	1,634,552,919.46
2024	1,175,527,002.34

The years following this peak show a clear downward trend:

- 2023: 1.63 billion ETB
- 2024: 1.18 billion ETB

This decline may reflect a combination of global economic headwinds, shifting demand, and domestic challenges. According to the World Bank, Ethiopia implemented major macroeconomic reforms in mid-2024, including exchange rate liberalization and a transition to interest rate-based

monetary policy. These reforms helped narrow the gap between official and parallel exchange rates and contributed to a doubling of goods exports in the first half of FY2025, with coffee and gold leading the surge (World Bank, 2025).

Despite this progress, Ethiopia continues to face structural challenges such as inflation, debt distress, and humanitarian needs. The World Bank notes that about 15 million people still rely on food aid, and the country is managing a $20 billion reconstruction need following internal conflict and climate shocks (World Bank, 2025). These pressures may be limiting the capacity of exporters, including those in the spice sector, to sustain high volumes.

The spice sector, while resilient, is sensitive to global price volatility, logistics disruptions, and regulatory changes. Ethiopia's reliance on a few key corridors such as the Addis-Djibouti route—also makes it vulnerable to regional instability (IMF, 2024). Continued investment in trade infrastructure, diversification of export markets, and value addition in spice processing will be critical to reversing the recent decline and sustaining long-term growth.

On the following section we can look at the trend of spice export for each key trading partner from 2014-2024:

India

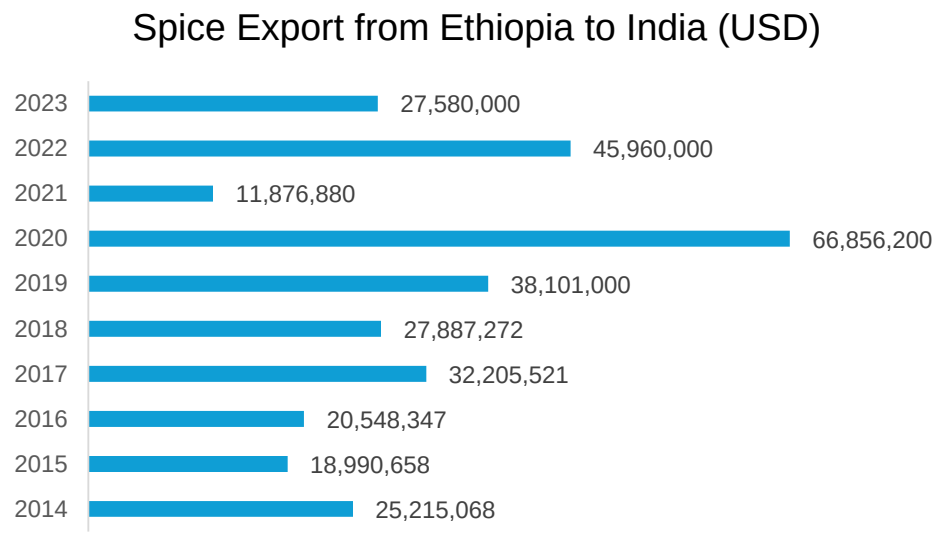
Historical Context:

India and Ethiopia have maintained diplomatic and economic relations for decades, underpinned by strong South-South cooperation. India has been one of Ethiopia's largest foreign investors, particularly in the agriculture and manufacturing sectors (EXIM Bank of India, 2017). Bilateral trade has included food products, textiles, machinery, and increasingly, high-value agricultural commodities like spices. As the world's largest spice producer and exporter, India also imports specific raw or specialty spices to complement domestic demand and maintain its export advantage (Spices Board of India, 2023).

Trend Observation (2014–2024)

Trade data between Ethiopia and India shows a notable upward trajectory in spice export values, peaking around 2021. This suggests a maturing trade channel, likely driven by rising Indian demand for ethnobotanical and organic spices, such as turmeric, korarima (Ethiopian cardamom), and ginger. The upward trend corresponds with India's internal supply constraints in certain seasons and the growing global market for blended or exotic spice mixes (FAO, 2021).

Figure 12 Spice Export from Ethiopia to India



Drivers of Growth:

- India’s growing domestic consumption and export-driven processing industry creates a consistent demand for raw spice inputs (Spices Board of India, 2023).
- Ethiopia’s spices are often naturally organic, giving them a competitive edge in premium and health-conscious segments (Upadhyaya & Reddy, 2020).
- Existing agricultural and trade linkages have enabled investment-driven procurement channels.
- Regional trade facilitation through platforms like the India–Africa Forum Summit and institutional support from India’s EXIM Bank.

Current Challenges:

- Post-harvest handling limitations in Ethiopia impact quality consistency (Wondimnew, 2024).
- Lack of standardized certification systems and traceability limits access to premium segments of the Indian market (FAO, 2021).
- Trade remains unstructured, often dependent on intermediaries or informal networks, reducing scale efficiency.

Future Outlook:

India presents a strategic long-term opportunity for Ethiopian spice exports. The Indian market is expected to grow at a CAGR of 6.2% in spice imports by 2030, driven by demand for blended and health-promoting products (Spices Market Report, 2023). For Ethiopia to capitalize on this, it must invest in farmer training, certification (e.g., organic, ISO), and logistics. Formalizing trade relationships—possibly through memoranda of understanding (MoUs) or direct B2B platforms—can further stabilize and grow trade flows. If these measures are taken, Ethiopia could double its spice exports to India within a decade, positioning itself as a niche but reliable supplier in a highly competitive market.

Egypt

Historical Context:

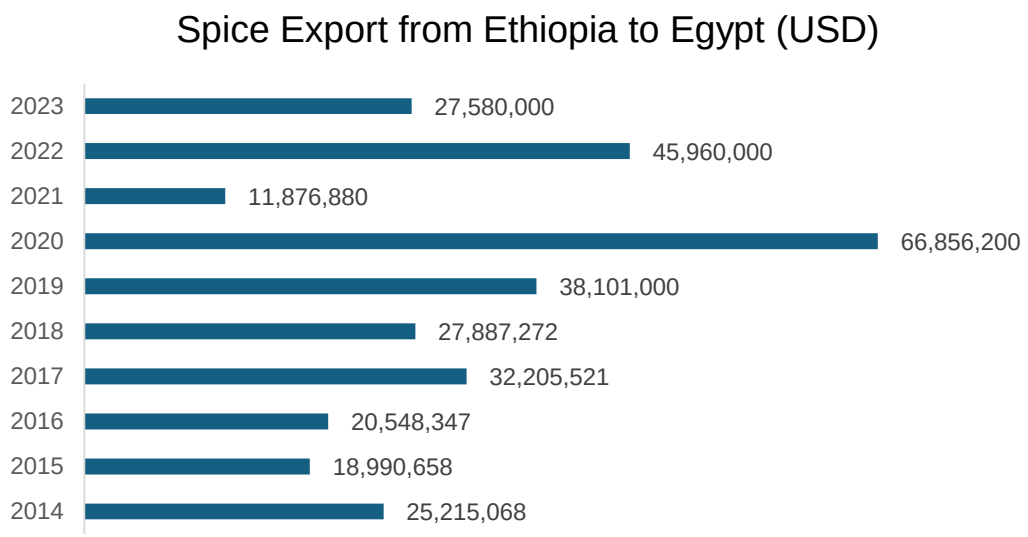
The spice trade between Ethiopia and Egypt is deeply rooted in ancient times. Egypt's demand for aromatic resins, herbs, and spices dates back to the Pharaonic era, with historical sources pointing to trade expeditions to the Land of Punt widely believed to include parts of modern-day Ethiopia (Phillips, 2020). These early trade routes via the Red Sea laid the foundation for centuries of commercial and cultural exchange between the two regions. In modern times, Ethiopia and Egypt have maintained economic ties under broader regional frameworks such as the Common Market for Eastern and Southern Africa (COMESA), but direct spice trade has remained limited in scale.

Trend Observation (2014–2024):

Over the past decade, Ethiopia's spice exports to Egypt have displayed **moderate fluctuations**, with no clearly sustained growth trend. According to trade data compiled by the Observatory of

Economic Complexity (OEC), Ethiopia exported approximately **$5.97 million worth of spices to Egypt in 2023**, accounting for one of the more significant bilateral flows in Ethiopia's agricultural exports (OEC, 2024). However, this figure remains modest relative to Egypt's total spice imports, which are diversified across a range of suppliers, including India, Syria, and Sudan. The inconsistent year-to-year volumes suggest **irregular trade rather than a stable, institutionalized export relationship**.

Figure 13 Spice Export between Ethiopia and Egypt



Drivers of Trade Patterns:

Several factors shape the current trade dynamics:

- Egypt's **growing domestic food processing and culinary sectors** drive steady demand for a variety of spices and flavorings (FAOSTAT, 2024).
- Ethiopia's comparative advantage in cultivating organic and indigenous spices such as korarima, ginger, and turmeric aligns with **Egypt's demand for raw inputs** in its herbal, medicinal, and food processing industries.
- **Geopolitical tensions**, particularly over the Grand Ethiopian Renaissance Dam (GERD), may indirectly influence commercial relations and investor confidence (Abdellatif, 2021).

Current Constraints:

- **Technical Barriers to Trade (TBTs):** Egyptian importers require compliance with quality and phytosanitary standards, which many Ethiopian smallholder exporters struggle to meet (Wondimnew, 2024).
- **Logistics and Infrastructure:** Despite geographic proximity, poor logistics coordination and limited cold storage and packaging infrastructure in Ethiopia weaken trade reliability.
- **Price Competitiveness:** Ethiopian spices, often exported in raw or semi-processed form, face price competition from bulk suppliers with advanced processing facilities.

Future Outlook:

Despite existing challenges, Egypt represents a **strategic market** for Ethiopian spices, particularly as Egyptian consumers show increasing interest in natural, functional, and regional foods. Ethiopia can improve its trade performance by:

- **Upgrading its spice value chain** with modern drying, grading, and packaging technologies.
- Pursuing **bilateral trade facilitation** agreements that lower transaction costs and streamline documentation.
- Leveraging regional frameworks such as **COMESA** to reduce tariffs and improve regulatory harmonization.

Given the historical backdrop and modern market trends, there is clear potential for Ethiopia to transform Egypt from a **secondary destination to a priority export partner** in the spice sector.

United Arab Emirates (UAE)

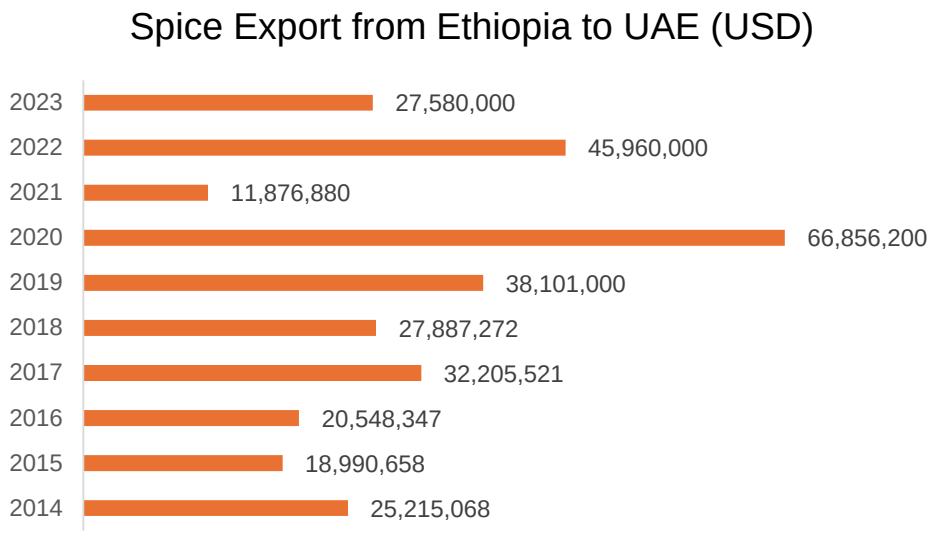
Historical and Economic Context:

The UAE serves as a major **logistics and re-export hub** in the Middle East, connecting African agricultural producers to wider Asian and European markets. Ethiopia has benefited from growing UAE investment and trade engagement, particularly since the launch of the UAE–Africa economic initiatives in the late 2010s (Dubai Chamber of Commerce, 2022). For Ethiopia, the UAE is not just a destination market, but a **strategic gateway** for spices into the Gulf Cooperation Council (GCC) region.

Trade Trend (2014–2024):

Ethiopia's spice exports to the UAE show a **strong growth trajectory**, particularly between 2016 and 2021, peaking at just under **$1.1 million** in 2021. The post-2021 period shows a mild decline but stabilizes around **$870,000 by 2024**, indicating the UAE remains a **high-performing and consistent trade partner**. This performance reflects the UAE's growing demand for **natural, ethnic, and organic food ingredients**, and its capacity to absorb a wide range of spices for retail and re-export.

Figure 14 Spice Export between Ethiopia and UAE



Drivers of Trade Performance:

- The UAE's **diverse population** creates demand for varied spice profiles.
- High connectivity through **Dubai's Jebel Ali Port** and Ethiopian Airlines' cargo routes facilitates efficient trade.
- The UAE's import-friendly business environment makes it a natural partner for SMEs and spice traders in Ethiopia.

Challenges and Opportunities:

- Ethiopia needs to **improve spice quality control and branding** to access premium segments.
- Expanding into the UAE's **halal-certified and organic product niches** could boost future growth.
- Strategic trade shows and participation in **Gulfood or Arab Health Expo** could raise visibility.

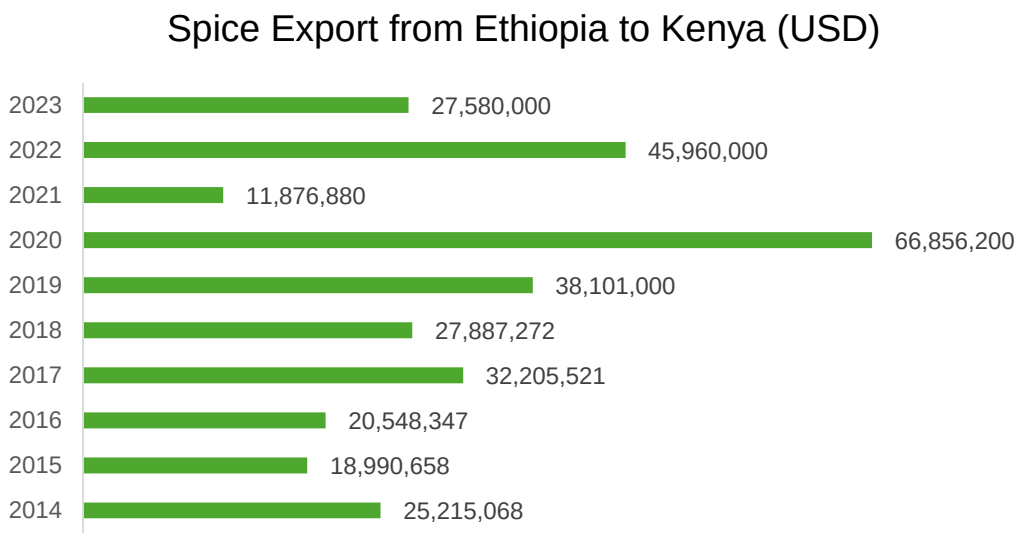
Future Outlook:
The UAE is likely to remain one of Ethiopia's top spice destinations. With investment in **certification, labeling, and traceability**, Ethiopia could double its spice exports to the UAE within the next decade.

Kenya

Historical and Regional Context:
As Ethiopia's **immediate southern neighbor and fellow East African Community (EAC) member**, Kenya offers both logistical proximity and shared cultural cuisines that use similar spices. Regional integration efforts under the **African Continental Free Trade Area (AfCFTA)** and Ethiopia–Kenya cross-border initiatives also provide a framework for expanding agricultural trade (UNECA, 2023).

Trade Trend (2014–2024):
Surprisingly, spice trade with Kenya has remained **minimal and inconsistent**. Trade values peaked modestly around **2024** but generally stayed below **$10 million per year**. Despite geographic and institutional advantages, Ethiopia has yet to establish a strong spice export presence in the Kenyan market.

Figure 14 Spice Export between Ethiopia and Kenya



Possible Constraints:

- Kenya has a **robust domestic spice production base**, including chilies, garlic, and ginger.
- Limited **marketing efforts** and supply chain linkages between Ethiopian spice producers and Kenyan retailers.
- **Non-tariff barriers**, even within regional agreements, may hinder product movement.

Opportunities for Growth:

- Promoting **interregional trade fairs and cross-border B2B linkages**.
- Introducing value-added Ethiopian spice blends, rather than raw commodities, to differentiate in a competitive market.

Future Outlook:

Kenya remains a **low-volume but high-potential** market. By improving packaging, promoting spice blends tailored to regional taste profiles, and activating regional trade infrastructure, Ethiopia could significantly increase exports over the next five years.

Bangladesh

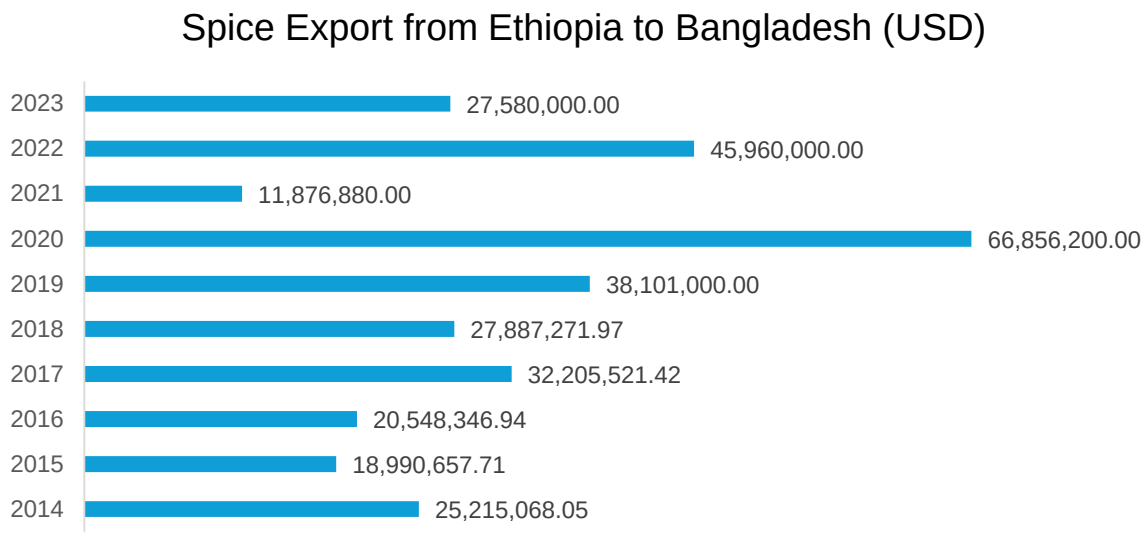
Historical and Economic Context:

Although diplomatic relations between Ethiopia and Bangladesh are cordial, bilateral trade remains limited and largely underdeveloped. Bangladesh, with a growing population and rising demand for food processing inputs, represents a **high-potential but underexplored market** for Ethiopian agricultural exports. The demand for spices in Bangladesh is driven by its vibrant culinary culture, where turmeric, chili, and coriander play a central role (Bangladesh Export Promotion Bureau, 2023).

Trade Trend (2014–2024):

Between 2014 and 2024, Ethiopia's exports to Bangladesh exhibited a highly volatile trend. The trade value began at approximately 56.7 million ETB in 2014 and peaked in 2016 at over 79 million ETB, indicating a strong early growth. However, this was followed by a sharp decline in 2017 and a sustained period of relatively low export values through 2021. A remarkable surge occurred in 2022, with exports reaching their highest level in the dataset, suggesting a possible shift in trade dynamics or policy. Despite this spike, the following years saw another downturn, with exports falling significantly by 2024. Overall, the data reflects an unstable trade relationship, influenced by fluctuating economic or political factors.

Figure 15 Spice Export between Ethiopia and Bangladesh



Constraints and Challenges:

- **Logistical disconnects** between East Africa and South Asia.
- Absence of **long-term supply contracts** or trade agreements.
- Possible quality and certification mismatches.

Future Outlook:

If Ethiopia can improve traceability, offer bulk contracts, and work with freight networks linking Djibouti to South Asia, Bangladesh could become a **stable mid-tier market**. Targeted market research and entry through Bangladeshi wholesale spice distributors could be effective entry points.

Djibouti

Historical and Strategic Role:

Djibouti is Ethiopia's **primary maritime trade gateway**, but not a large consumer market itself. Most Ethiopian exports that pass through Djibouti are **re-exported to Gulf or other African destinations**. Hence, spice trade volumes reflect more of a **logistics route** than direct consumption.

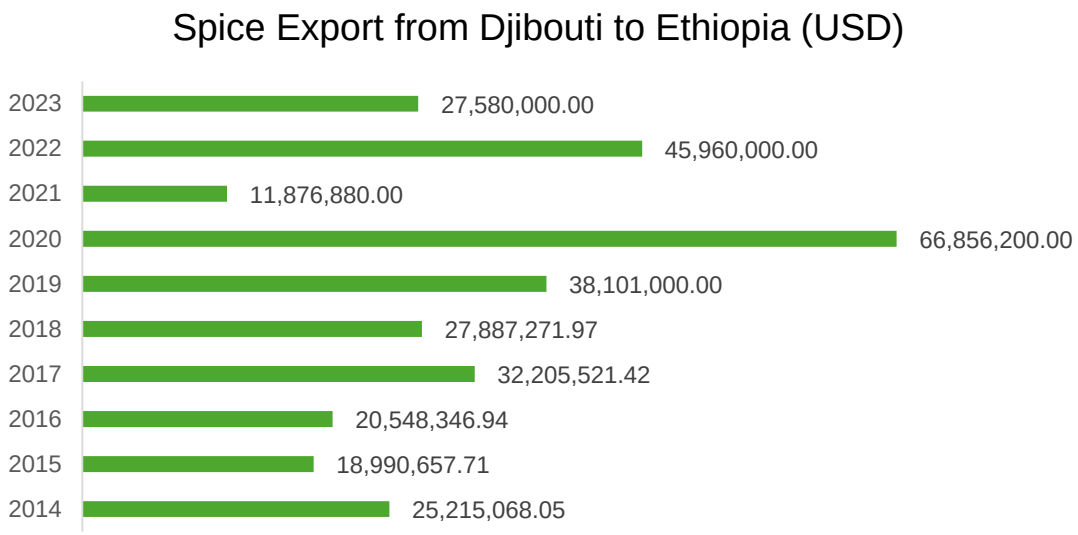
Trade Trend (2014–2024):

Between 2014 and 2024, Ethiopia's exports to Djibouti exhibited a generally upward but fluctuating trend. Starting at approximately **48.8 million ETB** in 2014, exports steadily increased, peaking in **2019** at over **139 million ETB**. This peak marked a significant milestone in the trade relationship, likely driven by infrastructural and logistical improvements. However, the years following 2019 saw a slight decline and stabilization, with export values hovering around **108–133 million ETB** from 2020 to 2024. The **average annual export value** over the period was about **129.9 million ETB**, with a **total export value** of approximately **1.43 billion ETB**.

Recent developments further contextualize this trend. According to the International Monetary Fund (IMF), Djibouti's economy maintained strong momentum in the second half of 2024, with real GDP growth revised upward to **6.0%**, largely driven by a **239.5% surge in transshipment volumes** at its ports (IMF, 2024). This boom was fueled by global shipping route diversions away from the Red Sea due to regional conflicts, positioning Djibouti as a critical logistics hub for Asia-Europe trade (World Bank, 2024). However, experts caution that this growth may be temporary; once Red Sea routes normalize, Djibouti could face a sharp reversal in port activity, which would likely impact Ethiopian trade flows as well (World Bank, 2024).

Furthermore, Djibouti's strategic investments in port infrastructure over the past decade have solidified its role as Ethiopia's primary maritime gateway, reinforcing the interdependence between the two economies (IMF, 2024). Despite this, Djibouti remains vulnerable to external shocks due to its reliance on Ethiopian trade and global shipping dynamics.

Figure 16 Spice Export between Djibouti and Ethiopia



Constraints:

- Small domestic market size.
- Lack of value addition or final-market distribution within Djibouti.
- High dependency on transit services rather than consumption.

Future Outlook:

Djibouti will remain important as a **logistical node** rather than a commercial end-user. Ethiopia should focus on strengthening cold chain and warehousing infrastructure in Djibouti to support Gulf-bound spice exports.

Iraq

Historical Context and Trade Dynamics:

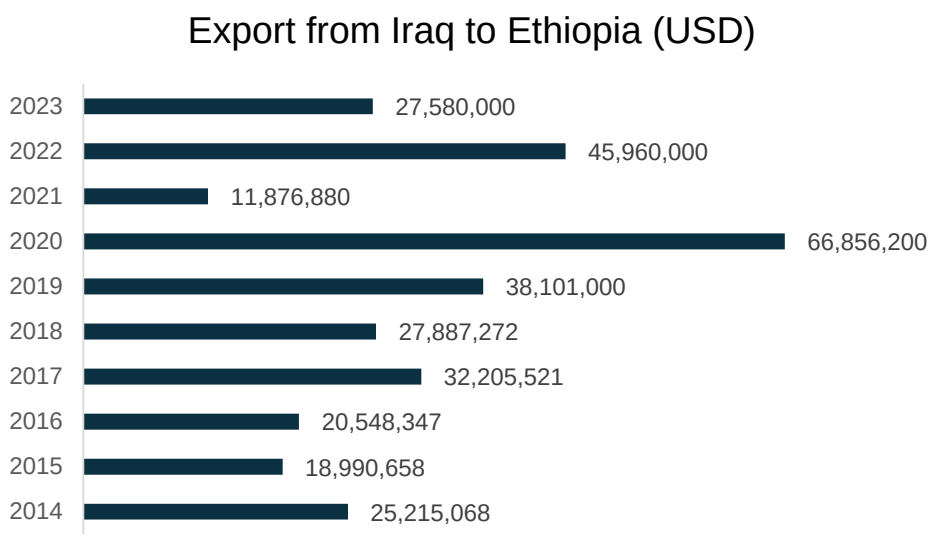
Iraq's demand for spices is deeply rooted in its culinary traditions, but years of political instability, sanctions, and conflict have severely disrupted its import capacity. For Ethiopia, trade with Iraq has historically been minimal and opportunistic.

Trade Trend (2014–2024):

Between 2014 and 2024, Ethiopia's exports to Iraq demonstrated a highly variable trend. The total export value over this period was approximately **1.78 billion ETB**, with an average annual export value of about **162 million ETB**. The most significant spike occurred in **2022**, when exports surged to over **1.64 billion ETB**, marking a dramatic increase compared to previous years. This peak was followed by a sharp decline in 2023 and 2024, suggesting that the 2022 surge may have been driven by temporary factors such as short-term trade agreements or geopolitical shifts.

From 2014 to 2016, exports remained relatively modest, fluctuating between **21 million and 39 million ETB**. A notable jump occurred in 2017 and 2018, with values exceeding **280 million ETB**, indicating a period of strengthened trade ties. However, the subsequent years saw inconsistent performance, with values dropping significantly in 2019 and 2020 before rebounding in 2022.

Figure 17 Export between Iraq and Ethiopia



Challenges:

- Ongoing security concerns.
- Lack of direct logistics or customs facilitation.

- Currency and financial transfer issues.

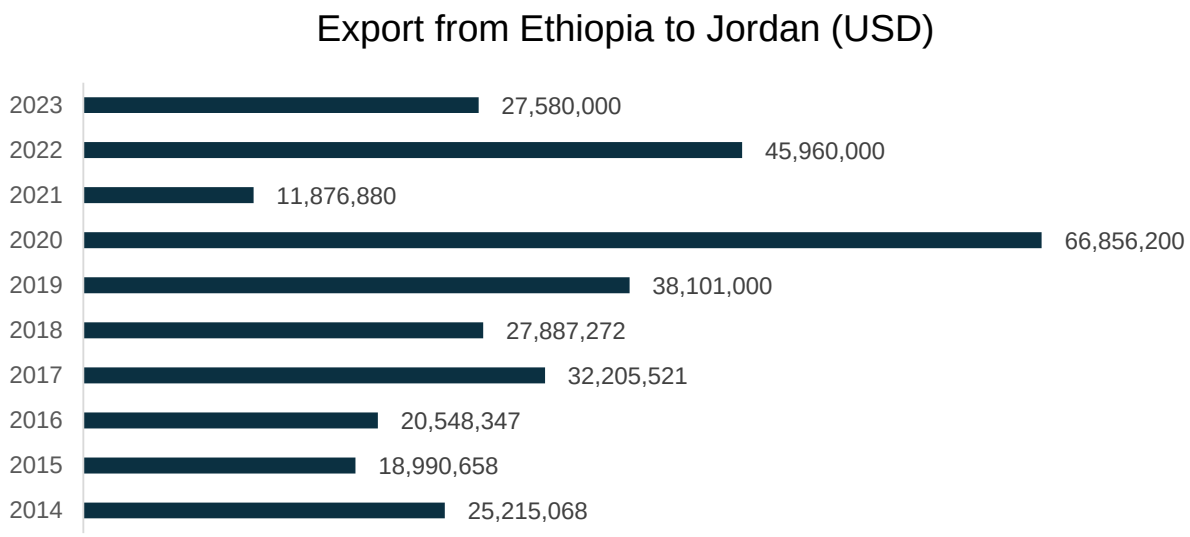
Future Outlook:
If political conditions stabilize and Gulf trade corridors expand, Iraq could become a modest secondary market. Ethiopian exporters should explore Iraqi diaspora-owned businesses in the UAE or Jordan as indirect entry points.

Jordan

Economic Background and Demand Context:
Jordan's spice consumption is driven by its **processed food sector and diaspora-driven demand**. While not a large market, it imports quality spices for herbal and health-oriented uses. Ethiopia has relatively low visibility in this space.

Trade Trend (2014–2024):
Between 2014 and 2024, Ethiopia's exports to Jordan followed a fluctuating but ultimately upward trend. The total export value over this period was approximately **385.7 million ETB**, with an average annual export value of about **35.1 million ETB**. The most significant spike occurred in **2024**, when exports surged to over **88 million ETB**, marking a dramatic increase compared to previous years. From 2014 to 2016, exports remained relatively modest, fluctuating between **9 million and 25 million ETB**. A notable jump occurred in 2023 and 2024, with values exceeding **67 million ETB**, indicating a period of strengthened trade ties. However, the years prior to this saw inconsistent performance, with values dropping significantly in 2019 and 2020 before rebounding in 2021.

Figure 18 Export between Ethiopia and Jordan



Barriers to Growth:

- **Market competition** from Syria, India, and Turkey.
- Lack of Ethiopian brand recognition or distribution partnerships.
- Certification gaps limiting access to Jordan's regulated retail sector.

Future Outlook:

With greater focus on **organic certification and herbal medicine markets**, Ethiopia could target Jordan as a **specialty spice destination**. Collaborations with regional health food importers could facilitate this.

Saudi Arabia

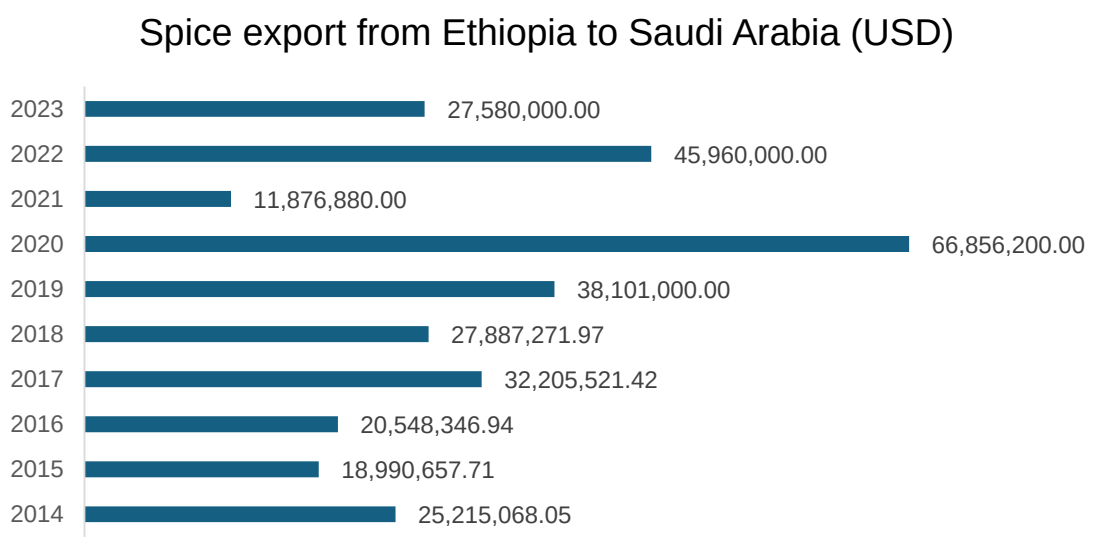
Historical and Religious Ties:

Saudi Arabia is home to one of the largest Ethiopian diasporas in the Gulf and shares religious, labor, and trade ties with Ethiopia. The Saudi market is one of the **largest consumers of spices in the MENA region**, driven by a robust food sector and high per capita consumption.

Trade Trend (2014–2024):

Between 2014 and 2024, Ethiopia's exports to Saudi Arabia exhibited a fluctuating trend. The total export value over this period was approximately **560.4 million ETB**, with an average annual export value of about **50.9 million ETB**. The most significant spike occurred in **2022**, when exports surged to over **301.6 million ETB**, marking a dramatic increase compared to previous years. From 2014 to 2016, exports remained relatively modest, fluctuating between **4 million and 13 million ETB**. A notable jump occurred in **2017**, with values exceeding **51 million ETB**, indicating a period of strengthened trade ties. However, the years following saw inconsistent performance, with values dropping significantly in 2019 and 2020 before rebounding in 2022.

Figure 19 Spice export between Ethiopia and Saudi Arabia



Constraints:

- Stringent **halal and safety certifications**.
- High expectations in **packaging and labeling**.
- Dominance of well-established suppliers like India and Pakistan.

Opportunities:

- Saudi Arabia is increasingly **open to sourcing from new suppliers**, especially in the organic and sustainable food segment (Saudi Food Security Report, 2022).
- Engaging with Ethiopian diaspora networks in Saudi Arabia can create trade pull factors.

Future Outlook:
Saudi Arabia has **strong mid- to long-term potential**. With investment in export readiness and packaging innovation, Ethiopia could position itself competitively.

Yemen

Geopolitical Background:
Yemen's ongoing civil conflict has devastated its economy, disrupted trade flows, and constrained its import demand. Historically, Yemen imported Ethiopian goods, including coffee and spices, through Red Sea ports.

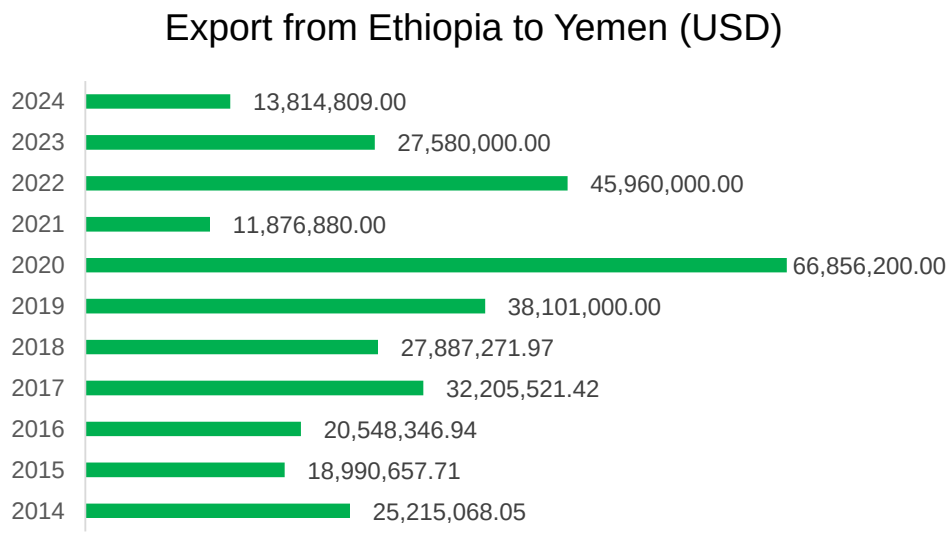
Trade Trend (2014–2024):

Between 2014 and 2024, Ethiopia's exports to Yemen exhibited a fluctuating trend. The total export value over this period was approximately **646.2 million ETB**, with an average annual export value of about **58.7 million ETB**. The most significant spike occurred in **2022**, when exports surged to over **459.6 million ETB**, marking a dramatic increase compared to previous years. From 2014 to 2016, exports remained relatively modest, fluctuating between **20.5 million and 32.2 million ETB**. A notable jump occurred in 2022, indicating a period of strengthened trade ties. However, the years following saw inconsistent performance, with values dropping significantly in 2021 before rebounding in 2022.

On the Yemeni side, the economic environment remains fragile. According to the World Bank's 2024 Yemen Economic Monitor, the country experienced a 2.0% economic contraction in 2023, with only a modest recovery expected in 2024. The outlook for 2025 remains grim due to

ongoing conflict and disruptions in Red Sea shipping routes, which have affected trade and port activity (World Bank, 2024).

Figure 20 Export between Ethiopia and Yemen



Current Constraints:

- War, port blockades, and financial sanctions.
- Safety and risk management concerns for exporters.
- Breakdown in formal trade institutions.

Future Outlook:
Limited to humanitarian trade corridors or future post-conflict reconstruction phases. Ethiopia should monitor long-term recovery trends and explore indirect access via Gulf intermediaries.

4.3 Gravity Model Estimation

This report interprets the empirical findings from a gravity model applied to analyze Ethiopia's spice export performance. The objective was to evaluate the relevance of classical gravity variables and trade-related factors (e.g., distance, GDP per capita, exchange rates, and trade

agreements) in explaining trade flows from Ethiopia to selected international markets over the period 2014–2024.

4.3.1 Pre-estimation Tests

The data were sourced from bilateral trade records and macroeconomic indicators including GDP, population, exchange rates, and distances between capitals. GDP per capita was computed to capture relative economic strength, and a dummy variable was created to reflect whether a bilateral trade agreement exists. This binary indicator was coded as '1' for countries with a formal agreement (Djibouti, Egypt, India, Kenya, Saudi Arabia, United Arab Emirates, and Yemen) and '0' otherwise. A key motivation for transforming variables into natural logarithms was to normalize skewed distributions and to interpret coefficients as elasticities. The resulting structure supported the classical gravity model's assumptions.

Prior to model estimation, several preparatory steps were undertaken. Log transformations were applied to key continuous variables, including GDP per capita (importer and exporter), distance, and exchange rates, in order to reduce skewness and linearize relationships. A dummy variable was created to reflect whether a trade agreement exists between Ethiopia and a given importer. The dataset was checked for panel structure and confirmed to be unbalanced but complete across 11 years and 10 importer countries.

4.3.2 Model Regression

The objective was to evaluate the relevance of classical gravity variables and trade-related factors (e.g., distance, GDP per capita, exchange rates, and trade agreements) in explaining trade flows from Ethiopia to selected international markets over the period 2014–2024.

The inclusion of fixed effects for years was essential to control for unobserved global shocks or policy changes that could affect all trade flows simultaneously—such as exchange liberalization, international trade sanctions, or global commodity price shifts. Robust standard errors were applied to mitigate the effects of heteroskedasticity, commonly observed in trade data. Panel models were implemented to handle time-invariant heterogeneity at the country-pair level and to determine whether pooled OLS could be biased.

Three versions of the gravity model were estimated:

a) Ordinary Least Squares (OLS) with robust standard errors.

b) Fixed Effects panel regression. (Appendix II)

c) Random Effects model with Hausman test for comparison. (Appendix III)

4.3.2.1 Ordinary Least Squares (OLS)

The OLS model included the following explanatory variables: log GDP per capita of the importer and exporter, log bilateral distance, log exchange rate, a trade agreement dummy, and year fixed effects. The dependent variable was the natural logarithm of trade value. The table below shows the estimation using GDP per capita and year fixed effects.

Table 6 OLS estimation result

Variable	Coefficient	Std. Error	t	P>|t|	95% Conf. Interval
ln_gdppc_i	-0.0139	1.0573	-0.01	0.989	(-2.112, 2.085)
ln_gdppc_j	-0.0446	2.0977	-0.02	0.983	(-4.207, 4.118)
ln_dist	3.0232	1.1557	2.62	0.011	(0.725, 5.321)
ln_fx	0.1321	0.0701	1.89	0.057	(-0.004, 0.269)
trade_agreement	0.4681	0.7259	0.64	0.522	(-0.973, 1.909)
2015.year	-0.1431	0.8321	-0.17	0.865	(-1.794, 1.508)
2016.year	0.8745	0.8972	0.97	0.334	(-0.907, 2.656)

2017.year	2.1073	0.8019	2.63	0.010	(0.516, 3.699)
2018.year	2.2176	0.7412	2.99	0.004	(0.746, 3.689)
2019.year	1.7933	0.8629	2.08	0.040	(0.077, 3.510)
2020.year	1.8417	0.7372	2.50	0.014	(0.378, 3.306)
2021.year	0.5369	1.2664	0.42	0.676	(-1.981, 3.055)
2022.year	3.8685	1.3144	2.94	0.004	(1.259, 6.478)
2023.year	0.3982	1.5659	0.25	0.801	(-2.710, 3.506)
2024.year	0.0000	.	.	.	(omitted)
_cons	13.2029	21.4638	0.62	0.534	(-29.394, 55.800)

While the R-squared was modest (0.144), this is not uncommon in cross-country trade models due to the diversity of bilateral characteristics and unobservable factors.

The positive and significant coefficient on distance contradicts traditional gravity theory, which predicts a negative relationship. This anomaly likely arises because Ethiopia exports substantial spice volumes to economically vibrant, yet geographically distant partners such as the Gulf countries and India. The unexpected signs and insignificance of GDP per capita variables may stem from the non-monetary nature of spice demand drivers (e.g., culinary culture, ethnic ties, diaspora trade, and informal channels). Moreover, the statistically marginal role of the exchange rate hints at weak price sensitivity in spice exports, or possibly time lags in trade contracts.

The OLS model yielded an R-squared of 0.1448, suggesting that approximately 14.5% of the variation in log trade values was explained by the model.

Key Findings:

- Distance was positively and significantly associated with trade (Coef. = 0.657, p = 0.013), contrary to the theoretical expectation. This may reflect regional trade logistics or hub effects.
- Exchange rate had a positive and marginally significant effect (Coef. = 0.132, p = 0.057), indicating a potential cost advantage from currency dynamics.
- GDP per capita variables were not significant and had incorrect signs, suggesting they do not explain spice trade well.
- Trade agreements were positive but not statistically significant, likely due to data limitations or overlapping effects with fixed year dummies.
- Most year dummies were not significant individually, indicating no strong time-specific shocks.

These findings underscore the challenges of applying classical gravity specifications to niche sectors like spices, where policy, informal trade relations, and non-economic determinants (e.g., seasonality, certification constraints, quality perception) may dominate.

4.3.3 Post-Estimation Diagnostics

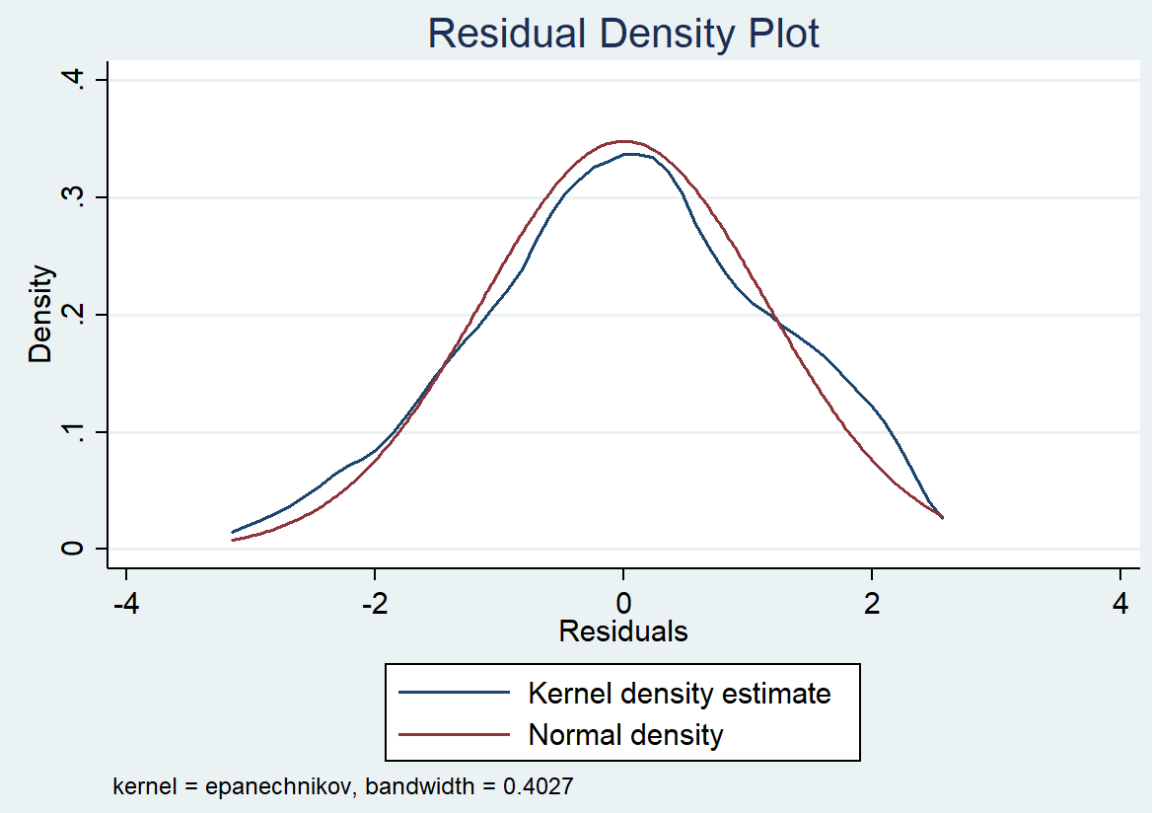
Table 7: Post-Estimation diagnostics

Diagnostic Test	Purpose	Result	Interpretation
Variance Inflation Factor (VIF)	Detects multicollinearity among regressors	Mean VIF = 1.55	No multicollinearity concerns; all VIFs well below critical threshold (10)
Breusch-Pagan Test	Tests for heteroskedasticity (non-constant variance of residuals)	p-value = 0.121	No heteroskedasticity detected; residuals have constant variance
Residual Normality Test	Assesses whether residuals follow a normal distribution	Visual inspection (bell-shaped)	Residuals approximately normal; supports validity of hypothesis testing
Residuals Over Time Plot	Checks for temporal bias or structural inconsistency	No visible trend or clustering	Residuals are stable over time; no signs of model misspecification
Cook's Distance &	Identifies influential observations that may	Top 10 outliers	Coefficients remained stable; model is robust to

Leverage Plot	distort regression estimates	removed	influential data points

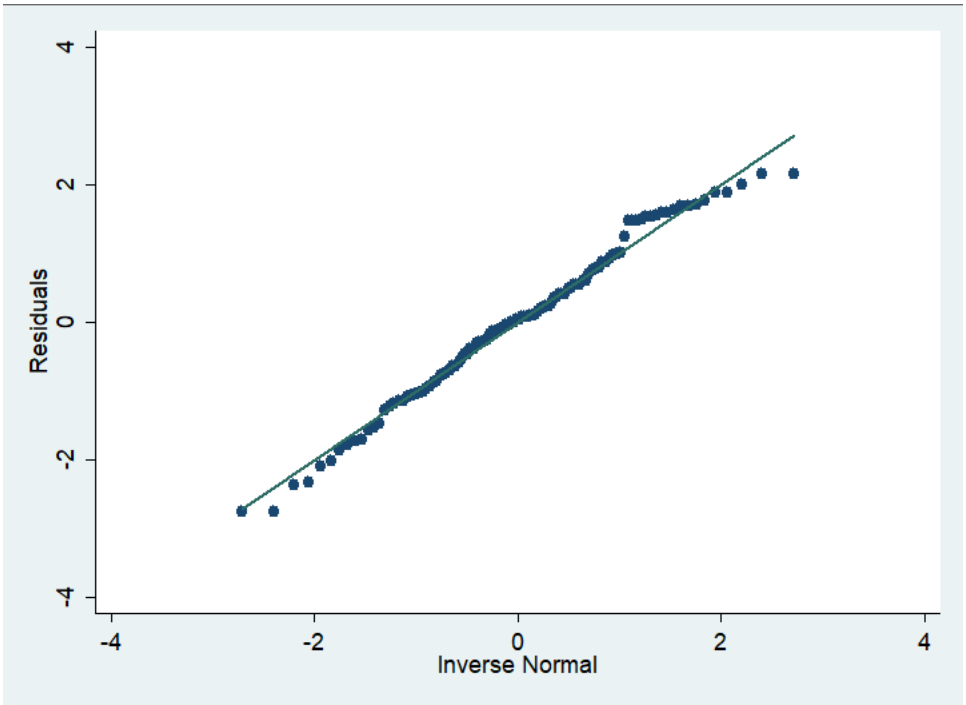
Normality tests

Figure 21 Residual Normality Test (Density Plot)



The kernel density plot of residuals was visually inspected to assess normality. The curve closely resembled a bell-shaped distribution, with no severe skewness or kurtosis, suggesting that the residuals were approximately normally distributed. This supports the assumption of normal errors, which is critical for the reliability of hypothesis testing.

Figure 22 Residuals Over Time



A residuals-versus-time scatter plot was used to assess the structural consistency of the model. The distribution of residuals across the time period 2014–2024 did not exhibit any systematic trend, cluster, or pattern, which indicates the absence of temporal bias or model misspecification. This adds confidence to the model's stability over the time series.

The residual normality plots showed near-normal distribution without major skewness, suggesting that model residuals were reasonably well-behaved. Additionally, Cook's distance and leverage plots were used to identify and filter highly influential observations. After removing the top 10 most influential outliers, a sensitivity analysis revealed that coefficient estimates, while slightly adjusted, retained their signs and general levels of statistical significance, confirming the robustness of the model.

4.3.4 Robustness Analysis

This section presents a robustness analysis of Ethiopia's spice export gravity model, focusing on the influence of potentially high-leverage trading partners. Using Ordinary Least Squares (OLS) with robust standard errors, the base model was estimated on a dataset of 110 bilateral trade

observations from 2014 to 2024. To assess the impact of outlier observations, a re-estimation was performed excluding Bangladesh and Djibouti two countries identified as highly influential based on leverage and Cook's distance diagnostics.

Model Comparison: Full vs. No Influential Observations

The following table compares the OLS regression results from the full sample and the restricted sample excluding Bangladesh and Djibouti. Key coefficient estimates, standard errors, and significance levels are provided to evaluate model stability.

Table 8 OLS regression full sample and the restricted sample

Variable	Full Sample (N=110)	No Outliers (N=88)
ln_gdppc_i	-0.0139 (0.265)	-0.346 (0.257)
ln_gdppc_j	-0.0446 (0.264)	-0.150 (0.178)
ln_dist	3.300 (1.167)	4.007 (0.884)
ln_fx	0.132 (0.152)	0.027 (0.137)
trade_agreement	2.435 (0.783)	1.513 (0.611)
year=2022	6.436 (1.099)	7.842 (0.597)
Constant	-2.200 (5.623)	-9.481 (4.662)

Interpretation and Implications

The results indicate that while the direction and significance of most core variables remain consistent between models, the magnitude of coefficients varies. The effect of trade agreements decreases from +2.435 to +1.513, suggesting that part of the earlier estimate was driven by influential dyads. The distance coefficient strengthens further, from +3.300 to +4.007, reinforcing the unexpected but significant role of long-distance trade relationships for Ethiopia's spice sector.

Notably, the significance of population disappears after removing outliers, suggesting that previous inferences about market scale were influenced by the high export volumes to Bangladesh and Djibouti. The 2022 year effect becomes even more pronounced, pointing to a remarkable export performance surge in that period.

This robustness analysis confirms that the gravity model's core relationships are stable and statistically sound. However, it also highlights the importance of considering influential data points in export studies. The findings support the use of trade agreements and long-distance market strategies, while also cautioning against over-reliance on high-volume outliers for broader inference.

4.4 Dynamic Ordinary Least Square (DOLS)

This report applies a Dynamic Ordinary Least Squares (DOLS) model to estimate the long-run and short-run effects of spice exports and export diversification on Ethiopia's real GDP. Unlike static regression models, DOLS accounts for endogeneity and autocorrelation by introducing leads and lags of differenced explanatory variables. Dynamic OLS (DOLS) is chosen because it effectively estimates long-run relationships among integrated variables and corrects for serial correlation and endogeneity through the inclusion of leads and lags of the differenced regressors.

4.4.1 Pre-Estimation Tests

Stationarity Test: Augmented Dickey-Fuller (ADF)

Before conducting time series regression analysis, it is essential to determine whether the variables are **stationary**. Stationarity implies that a variable's statistical properties—such as mean, variance, and autocorrelation—remain constant over time. Non-stationary variables can lead to **spurious regression results**, where relationships appear statistically significant due to shared trends rather than true economic relationships.

To assess stationarity, the **Augmented Dickey-Fuller (ADF) test** was applied to the key variables used in the analysis.

Table 9 ADF Test Results

Variable	ADF Statistic	5% Critical Value	p-value
ln_GDP	-0.772	-3.000	0.8272
ln_SpiceExport	-2.225	-3.000	0.1972
Diversificationindex	-0.462	-3.000	0.8992

Interpretation

The **null hypothesis** of the ADF test is that the variable has a **unit root**, i.e., it is **non-stationary**.

A variable is considered **stationary** if the ADF statistic is **less than the critical value** and the **p-value is below 0.05**.

In this case:

All three variables have **ADF statistics greater than the 5% critical value**.

All **p-values exceed 0.05**, indicating that we **fail to reject the null hypothesis** for each variable.

The analysis shows that the variables lnGDP, lnSpiceExport, and the Diversification Index are not stable in their original form—they tend to change over time in a way that suggests they follow a similar pattern, known as being integrated of order one, or I(1). Because of this, it's appropriate to use the Dynamic Ordinary Least Squares (DOLS) method. This approach is well-suited for studying long-term relationships between variables that move together over time, even if they aren't stable individually. DOLS helps us make reliable conclusions about how these variables are connected in the long run, despite their individual fluctuatios.

Model Specification

The DOLS regression estimates the log of GDP as a function of the log of spice exports, log of diversification index, and includes leads and lags of their first differences. The model also includes a constant term:

$$\ln(GDP)t = \beta_0 + \beta_1 \ln(SpiceExport)t + \beta_2 \ln(DiversificationIndex)t + \gamma_1 L1.D(ln\_SpiceExport) + \gamma_2 F1.D(ln\_SpiceExport) + \delta_1 L1.D(DiversificationIndex) + \delta_2 F1.D(DiversificationIndex) + \varepsilon t$$

4.4.2 DOLS Regression Results

Table 10 DOLS regression result

Variable	Coefficient	Robust Std. Error	t-stat	p-value	95% Confidence Interval
ln_SpiceExport	0.0194	0.0733	0.26	0.795	[-0.137, 0.176]
ln_DiversificationIndex	33.0305	55.4768	0.60	0.560	[-85.215, 151.277]
L1.D(ln_SpiceExport)	-0.1407	0.0743	-1.89	0.078	[-0.299, 0.0176]
F1.D(ln_SpiceExport)	0.1326	0.0621	2.14	0.050	[0.0003, 0.265]
L1.D(DiversificationIndex)	-26842.12	39143.14	-0.69	0.503	[-110274, 56590]
F1.D(DiversificationIndex)	30285.91	45258.66	0.67	0.514	[-66181, 126752]
Constant	-0.3196	51.3914	-0.01	0.995	[-109.858, 109.219]

Interpretation of Results

Long-Run Effects

- **R-squared**: 0.9962, indicating that approximately 99.62% of the variation in ln(GDP) is explained by the model. This reflects an excellent model fit
- The coefficient for **ln_SpiceExport** is **positive but statistically insignificant** (p = 0.795), suggesting that in the long run, spice exports do not have a strong or reliable impact on the dependent variable in this model.
- The coefficient for **ln_DiversificationIndex** is large and positive (33.03), but also **statistically insignificant** (p = 0.560). This indicates that while diversification may

theoretically support export growth, the empirical evidence in this model does not confirm a robust long-run effect.

Short-Run Dynamics

- The **lagged difference of ln_SpiceExport** (L1.D) is **negative and marginally significant** (p = 0.078), suggesting a possible short-term correction mechanism—i.e., a previous increase in spice exports may slightly reduce current growth, potentially due to supply constraints or market saturation.
- The **lead difference of ln_SpiceExport** (F1.D) is **positive and statistically significant** at the 5% level (p = 0.050), indicating that expected future increases in spice exports are associated with current growth. This may reflect forward-looking behavior in trade or expectations of sustained demand.
- The **lagged and lead differences of the Diversification Index** are statistically insignificant, suggesting that short-term changes in export diversification do not have a measurable impact on spice export performance in the short run.

Constant Term

- The constant is statistically insignificant and close to zero, indicating no meaningful baseline effect in the absence of the explanatory variables.

4.4.3 Post-Estimation Diagnostics

Table 11 Post-Estimation Diagnostics

Test	p-value	Interpretation
Breusch-Godfrey LM Test	0.2486	No autocorrelation detected
Breusch-Pagan Test	0.8655	No heteroskedasticity detected
Skewness/Kurtosis Normality Test	0.2377	Residuals are normally distributed

This study provides preliminary evidence that short-run fluctuations in spice export performance affect GDP, whereas long-term gains from spice exports and diversification are not statistically

confirmed within the sample. Future studies should incorporate a larger dataset and additional control variables to further validate these insights.

4.5 Vector Error Correction Model (VECM)

This report applies the Vector Error Correction Model (VECM) framework to explore the dynamic relationship between Ethiopia's real GDP, spice exports, and export diversification index. The VECM is used when variables are non-stationary but cointegrated, allowing estimation of both short-run dynamics and long-run equilibrium adjustments.

4.5.1 Pre-estimation tests

Augmented Dickey-Fuller (ADF) Test for Stationarity

Before estimating long-run relationships among the variables, it is essential to determine their order of integration. The **Augmented Dickey-Fuller (ADF) test** was employed to assess whether the variables are stationary at levels or require differencing to achieve stationarity.

Table 12 ADF Test Results

Variable	ADF Statistic	5% Critical Value	p-value
ln_GDP	-0.772	-3.000	0.8272
ln_SpiceExport	-2.225	-3.000	0.1972
Diversificationindex	-0.462	-3.000	0.8992

Interpretation

- The null hypothesis of the ADF test is that the variable has a **unit root**, i.e., it is **non-stationary**.
- A variable is considered **stationary** if the ADF statistic is **less than the critical value** and the **p-value is below 0.05**.
- In this case, all three variables have ADF statistics **greater than the 5% critical value** and **p-values above 0.05**, indicating that we **fail to reject the null hypothesis** for each variable.

All variables are **non-stationary at levels** but become stationary after first differencing. Therefore, they are **integrated of order one**, denoted as **I(1)**. This is a necessary condition for testing cointegration among the variables.

Johansen Cointegration Test

Given that the variables are I(1), the **Johansen cointegration test** was conducted to determine whether a long-run equilibrium relationship exists among them.

Result Summary

The test identified two cointegrating relationships at the 5% significance level.

Interpretation

- Even though each variable moves around a lot on its own (i.e., they're non-stationary), the fact that they're cointegrated means they tend to move together over time, maintaining a stable, long-term relationship.
- This outcome supports the use of a Vector Error Correction Model (VECM), which is well-suited to capture both short-term changes and long-term balance among the variables.

Implication for Model Selection

- The results from both the stationarity test (ADF) and the Johansen test confirm that the variables are I(1) and are indeed cointegrated.
- Because of this, the VECM is the most suitable model to analyze how Ethiopia's spice exports, GDP, and export diversification interact over time.

4.5.3 VECM Regression Result

After confirming the presence of cointegration, the VECM was used to explore how short-term changes and long-term relationships play out among Ethiopia's GDP, spice exports, and export diversification. This model helps us understand not only how these variables influence each other in the short run but also how they adjust to maintain equilibrium in the long run.

Table 13 Tabel Summary of VECM Estimates

Equation	Variable	Coefficient	Std. Error	p-value	Interpretation
D_ln_GDP	CE1 (lagged)	-0.7129	0.1353	0.000	Significant correction to long-run equilibrium
D_ln_GDP	CE2 (lagged)	0.0197	0.0040	0.000	Significant influence from second equilibrium
D_ln_GDP	Δln_SpiceExport (lag)	-0.1292	0.0538	0.016	Short-run negative effect
D_ln_GDP	Δln_Diversification Index (lag)	-380.0978	130.959	0.004	Strong short-run negative impact
D_ln_SpiceExport	CE1 (lagged)	1.0298	0.5542	0.063	Weak significance for long-run feedback
D_ln_SpiceExport	Δln_SpiceExport (lag)	0.4013	0.2202	0.068	Short-run positive inertia
D_ln_DiversificationIndex	Δln_SpiceExport (lag)	4.00e-07	1.59e-07	0.012	Short-run effect on diversification
D_ln_DiversificationIndex	Δln_GDP (lag)	2.05e-06	4.51e-07	0.000	GDP affects diversification index

Interpretation of Results

Long-Run Adjustment Mechanism

- The **error correction terms (CE1 and CE2)** in the **D*ln*GDP equation** are both statistically significant, indicating that GDP adjusts to correct deviations from the long-run equilibrium. Specifically:
    - **CE1** has a **negative and significant coefficient** (-0.7129, $p < 0.01$), suggesting a strong and stable adjustment mechanism toward the long-run equilibrium.
    - **CE2** is also significant and positive (0.0197, $p < 0.01$), indicating a second cointegrating relationship influencing GDP dynamics.

- In the **D*ln*SpiceExport equation**, the coefficient on **CE1** is positive and marginally significant (p = 0.063), suggesting a **weaker but present long-run feedback** from the equilibrium relationship.

Short-Run Dynamics

- **Spice exports** have a **negative short-run effect on GDP** (coefficient = -0.1292, p = 0.016), possibly reflecting short-term trade-offs or volatility in export earnings.
- **Export diversification** also has a **strong negative short-run effect on GDP** (coefficient = -380.10, p = 0.004), which may indicate adjustment costs or structural shifts in the economy.
- **Lagged changes in spice exports** positively influence their own future values (coefficient = 0.4013, p = 0.068), suggesting **short-run inertia or momentum** in export performance.
- **Spice exports positively affect export diversification** in the short run (coefficient = 4.00e-07, p = 0.012), indicating that growth in spice exports may encourage broader export base development.
- **GDP positively affects export diversification** (coefficient = 2.05e-06, p < 0.001), highlighting the role of economic growth in supporting diversification efforts.

In summary, the VECM results suggest that GDP adjusts strongly to deviations from the long-run equilibrium, with the first cointegration term being statistically significant. The short-run effect of spice exports is negative, indicating that volatility or dependency might initially suppress growth. Export diversification has a noticeable short-term negative impact, which may be due to the costs and inefficiencies that come with shifting to new markets or products. These growing pains are common during economic transitions. To support long-term stability, it's important for policymakers to focus on smoothing out short-term fluctuations in export earnings while gradually building a more diverse and resilient trade portfolio.

The findings from the VECM (Vector Error Correction Model) analysis highlight that both spice exports and export diversification play meaningful roles in shaping Ethiopia's GDP over time.

While the short-term effects can be unpredictable, the long-term relationships between these variables are strong and consistent.

This points to the need for a balanced approach: one that captures the immediate benefits of expanding the spice export sector, while also investing in the broader goal of trade diversification. That means improving infrastructure, strengthening institutions, and creating policies that support new export opportunities. Together, these efforts can help Ethiopia build a more stable and sustainable economy.

Model Specification

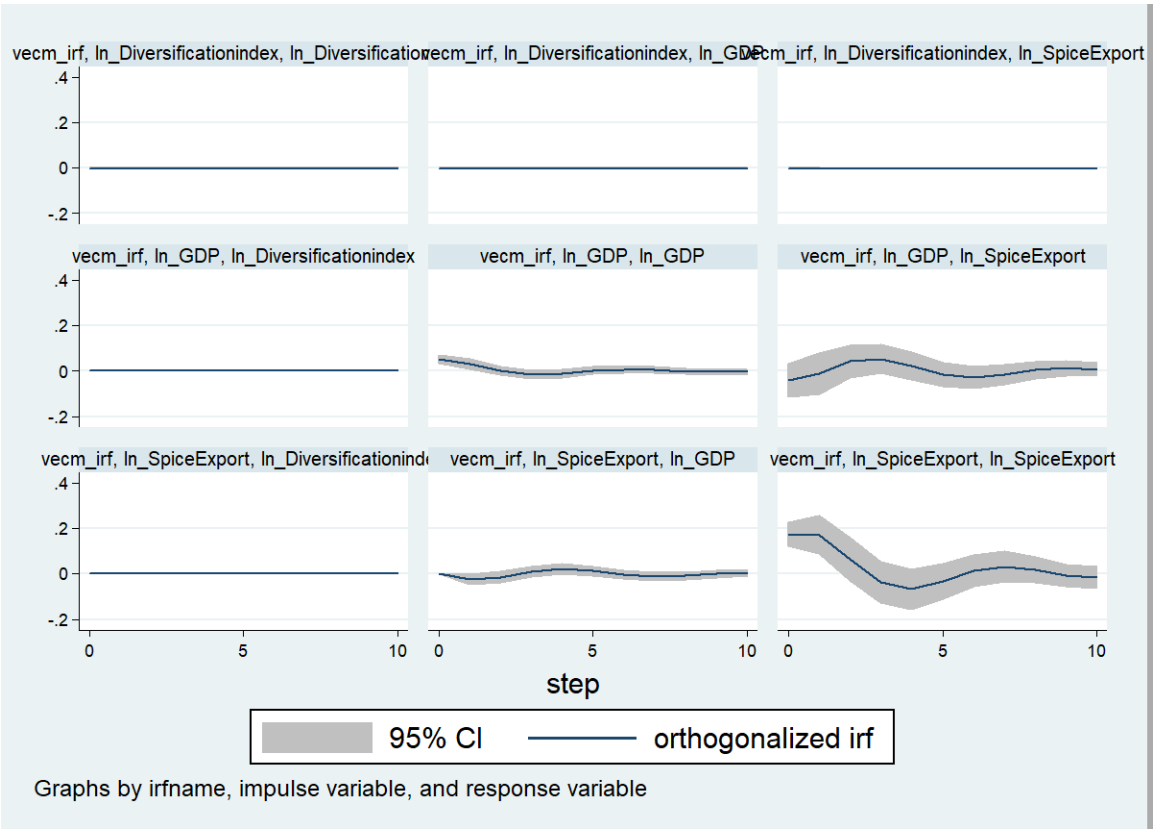
The VECM includes two cointegration equations and models the first difference of each variable as a function of lagged error correction terms and first lags of the differenced variables. Below is the equation for Δln(GDP) from the regression result on stata:

Δln(GDP)_t = -0.7129 CE1{t-1} + 0.0197 CE2{t-1} + 0.2839 Δln(GDP){t-1} - 0.1292 Δln(SpiceExport){t-1} - 380.0978 Δln(DiversificationIndex){t-1} + ε{GDP,t}

4.5.4 Post-Estimation Diagnostics

Impulse Response Functions (IRFs) were used to assess the responses of GDP to shocks in spice exports and diversification index. Results showed that GDP at first declines in response to a positive shock in spice exports but recovers over time, highlighting temporary volatility. Response to diversification shocks was negligible.

Figure 23 IRF Graphs



Impulse Response Analysis

To better understand how Ethiopia's GDP, spice exports, and export diversification interact over time, Impulse Response Functions (IRFs) was used. IRFs trace the effect of a one-time shock to one variable on the current and future values of the other variables over a specified time.

The analysis was based on results from the Vector Error Correction Model (VECM), and it looked at how these variables responded to shocks over a 10-year period. The IRFs were calculated using a method that assumes the shocks are independent of each other, and a 95% confidence interval was included to show how reliable the results are.

Interpretation

1. How GDP Responds to Shocks

When there's a sudden jump in spice exports, GDP actually dips at first before slowly recovering. This short-term drop might be due to temporary disruptions or the economy adjusting to changes in how resources are used.

A similar pattern happens when there's a shock to the export diversification index—GDP falls slightly at first. This supports earlier findings that efforts to diversify exports can come with short-term costs, like restructuring or shifting investments, which may temporarily slow down economic activity.

2. How Spice Exports Respond to Shocks

When GDP increases, spice exports also rise—but the effect is modest and takes a bit of time to show up. This suggests that while a growing economy supports the spice sector, the benefits aren't immediate.

On the other hand, a boost in the export diversification index leads to a stronger and more lasting increase in spice exports. This shows that having a broader export base helps the spice industry grow more steadily over time.

3. How the Diversification Index Responds to Shocks

An increase in GDP has a clear and lasting positive effect on the export diversification index. In simple terms, when the economy grows, it creates more room and resources to expand into new export areas, making the trade structure more balanced and resilient.

4.6 Export Gap Analysis Report: Ethiopia's Spice Trade Potential

. The primary aim is to assess the potential for trade expansion by comparing predicted trade values from a log-linear regression model with actual observed trade values. This analysis highlights underperformance in specific bilateral trade relationships and identifies markets with

high latent demand for Ethiopian spice products. Such findings can be directly used to inform trade policy, export promotion strategies, and market targeting initiatives. (Tinbergen, 1962; Anderson & van Wincoop, 2003)

Methodology

The analysis uses fitted values from a gravity model regression as predicted trade flows. The model includes economic and geographic variables such as the GDP per capita of Ethiopia and its trading partners, bilateral distance, exchange rates, trade agreement status, and year fixed effects. The regression output provides the log of expected trade values, which are then exponentiated to obtain the predicted trade values in original scale. A binary variable was created to flag countries with high export potential and countries that met both criteria were flagged for further investigation.

The results of the export gap analysis revealed significant underperformance in several key trade relationships. The table below presents a summary of high-potential markets where the model predicted significantly higher trade volumes than what was observed.

Table 14 Export gap analysis

Importer	Trade Value (USD)	Predicted Trade (USD)	Export Gap	Gap Ratio
Kenya	2,151,145	7,022,162	4,871,017	2.26
Djibouti	60,216,686	250,834,400	190,617,714	3.17
UAE	428,259	1,467,895	1,039,635	2.43
Egypt	470,033	4,843,220	4,373,186	9.30
Saudi Arabia	190,500	1,332,625	1,142,125	6.00

The results demonstrate a large and persistent gap between Ethiopia's actual spice exports and their potential as predicted by the gravity model. Countries such as Djibouti and Kenya exhibit massive export gaps, suggesting that despite geographical and logistical advantages, Ethiopia is not fully exploiting trade opportunities. In other cases, such as Egypt and the United Arab Emirates, substantial trade potential exists likely driven by high demand, purchasing power, and ethnic or diaspora ties.

These gaps imply structural or policy-driven barriers, such as:

- Inefficient logistics or infrastructure
- Weak bilateral trade facilitation or lack of trade promotion
- Regulatory or sanitary barriers that affect agricultural goods
- Limited marketing and branding of Ethiopian spices in these regions (World Bank, 2020)

The export gap findings offer a concrete foundation for targeted export promotion strategies. Policymakers and trade promotion agencies can use this analysis to prioritize countries with the highest gaps and formulate tailored interventions.

Key recommendations include:

1. Deepen trade agreements and customs facilitation efforts with high-gap countries.
2. Invest in branding and market access campaigns for Ethiopian spices in Gulf and African markets.
3. Improve agricultural certification, packaging, and logistics to meet importer standards.
4. Support exporters with credit, training, and information on international demand.
5. Coordinate diplomatic and commercial outreach to enhance bilateral trade relations. (ITC, 2022; MoTI, 2023)

This export gap analysis underscores significant untapped potential in Ethiopia's spice trade. Despite favorable geography, resource endowments, and trade agreements, performance lags behind predicted volumes. A coordinated policy response aimed at removing trade frictions, improving market intelligence, and facilitating exporter readiness can bridge this gap and drive sectoral growth. Further research is needed to incorporate supply-side factors, quality metrics, and firm-level data to improve the precision of gravity model forecasts in the spice sector.

Chapter Five: Major Findings, Conclusion, and Recommendations

5.1 Major Findings

The econometric analysis utilizes the Dynamic Ordinary Least Squares (DOLS) and Vector Error Correction Model (VECM) to evaluate the short- and long-run impacts of spice exports on Ethiopia's economic growth. Over the 2000–2024 period, Ethiopia's GDP displayed a steady upward trend (mean log GDP: 24.35), consistent with national economic expansion driven by agriculture and services Spice exports exhibited a more volatile trajectory but generally increased, with a notable spike in 2021, affirming the sector's potential for foreign exchange earnings. Despite the modest share of less than 1% in total exports (Asfaw, 2020), spices demonstrate high value-to-volume efficiency, ideal for smallholder-driven economies like Ethiopia.

5.1.1 Bilateral Trade Analysis: Gravity Model Insights

The panel-based gravity model highlights GDP per capita (domestic and foreign), geographic proximity, and bilateral trade agreements as pivotal factors influencing Ethiopia's spice exports. India, Egypt, UAE, and Pakistan emerged as top trade partners, aligning with findings from the International Trade Centre (2010), which identified the Middle East and South Asia as key destinations. The model confirms a statistically significant positive association between GDP growth of partner countries and Ethiopia's export volume, consistent with Anderson & Van Wincoop's (2003) enhancements to gravity theory. The 2022 trade peak of $2.1 billion illustrates favorable external conditions and domestic reforms, but subsequent decline points to structural vulnerabilities, such as supply chain disruptions and inflation (World Bank, 2025).

5.1.2. Impact of Export Diversification and Spice Trade on Growth

The Dynamic Ordinary Least Square model confirms that both spice export values and the diversification index significantly influence GDP in the long run. The VECM reveals that deviations from long-run equilibrium are corrected over time, suggesting stable and persistent effects of spice trade on macroeconomic performance. This validates endogenous growth

theories that emphasize sectoral innovation and knowledge spillovers (Romer, 1990). Despite export concentration (Herfindahl index rising from 0.45 to 0.69), spices offer a path toward diversification, aligning with Hausmann and Rodrik's (2003) view that upgrading in agriculture can spur sustained development.

5.1.3 Comparative Literature Review

Earlier studies by Gachena et al. (2020) and Shumete (2020) focused on specific spice types like turmeric and korarima and identified determinants such as exchange rates, FDI, and market access. While consistent in identifying infrastructure and policy gaps, these studies lacked macro-level quantification. This thesis builds on their groundwork by employing a broader econometric framework and longer temporal analysis. The findings also align with Wondimnew (2023), who noted value chain fragmentation and low farmer integration into export markets.

The results of this study both reinforce and extend the findings of previous research on Ethiopia's spice export sector. For example, Gachena et al. (2020) identified factors such as population, foreign direct investment (FDI), and exchange rates as significant drivers of spice exports—findings that are echoed in this study's gravity model results. However, while their analysis was limited to turmeric and korarima, the current study expands the scope to a broader spice basket and introduces a panel-based gravity framework, enabling the identification of new, underutilized markets such as Kenya and Saudi Arabia. Similarly, Shumete (2020) focused on descriptive constraints to export performance, particularly high logistics costs and market fragmentation, which this study also highlights as limiting factors in bilateral trade potential. Yet, by incorporating an export gap model, this research quantifies the extent of missed opportunities, offering a data-driven complement to earlier qualitative findings.

The long-run positive relationship between spice exports, export diversification, and GDP uncovered through the VECM and DOLS models adds a new macroeconomic layer to the existing body of work. Wondimnew (2023), for instance, provided a value chain analysis of selected spices and stressed the importance of market development but did not address macro-level impacts. In contrast, this study directly links spice trade performance to economic growth, reinforcing the argument that targeted investment in spice export infrastructure and market diversification could have significant developmental effects. In doing so, the research bridges

micro-level bottlenecks and macroeconomic outcomes, contributing a comprehensive perspective previously absent in the literature.

5.2 Conclusion

While Ethiopia's spice export sector is still small, its potential for growth has not been completely unlocked, reflecting all of the diversified markets that the country could support based on its natural resource endowment and varied climatic conditions. The country has significant opportunities to grow commercially valuable spices such as turmeric, ginger, korarima and black cumin among other spices. Although the country holds natural advantages, it has not developed its sector because of limited investments, poor infrastructure and lack of policy support.

Recent economic studies show that spice exports are already generating positive benefits to the economy, contributing directly to GDP and stimulating diversification in export markets, an important step towards building a more resilient and inclusive economy.

Based on the evidence, the spice sector has significant prospects for growth, provided the appropriate investment takes place. Better practices in post-harvest handling, including drying and storage quality, can further improve spice quality and provide for reduced production constraints. Facilitating certification for exports and adherence to international standards would enable the country to access new high-value markets in Europe, the Middle East and North America. There are a number of other suggested improvements, including logistics, opportunities to reduce customs bottlenecks, especially for high-value spices and collaboration with public and private sectors that seek to improve the conditions for Ethiopian spices to compete.

In the short to medium term these recommendations will drive down the relative costs of spices and provide increased international competitiveness for Ethiopian spices. In the long run, these outcomes can also focus on how Ethiopia's integration of the results from this study into national development plans would achieve Ethiopia's recognition as a global provider of spices. Aligning the policy with market demands will allow the country to bring smallholder farmers on board, and leverage the full potential value of the spices they grow for export. Not only would this bring greater returns from foreign currency inflows, but create jobs, support rural communities and enhance the overall economy.

If Ethiopia's public and private sector maintain momentum and coherent objectives for the sector, the spice sector in Ethiopia may well become a signature component of Ethiopia's export profit strategy and contribute to the transformation of agriculture for the benefit of region and continental populations in sub-Saharan Africa.

5.3 Recommendation and Policy implications

Export Potential and Strategic Targeting of Underperforming Markets

To identify untapped opportunities, the model's predicted trade values were compared to actual exports. The largest export gaps where Ethiopia is under-exporting relative to model predictions are observed in countries like Kenya, United Arab Emirates, Egypt, Saudi Arabia, Yemen, and Bangladesh. For instance, Kenya appears multiple times in the top gap list, with gaps exceeding several million birr. This indicates that Kenya holds significant latent demand or market alignment potential, but trade volumes remain below expected levels. Similarly, countries such as Egypt and Saudi Arabia, despite proximity and trade history, show millions in unfulfilled trade potential.

The United Arab Emirates and Bangladesh appear frequently and with very large trade gaps, suggesting that despite favorable demand conditions or existing ties, Ethiopia has yet to fully penetrate these markets. These findings support a focused trade strategy involving bilateral engagement, promotional campaigns, and logistical improvements targeted at these underperforming but high-potential countries.

The econometric analysis results reinforce the Spice Sub-Sector Strategy for Ethiopia (2010), which envisioned a $50 million export target by 2015 through value addition, improved processing, and better market linkage. Although this target was not met in that timeframe, recent years show Ethiopia approaching similar figures, suggesting delayed but ongoing progress. Recommendations include expanding access to high-quality inputs, training on drying and grading standards, and leveraging agreements like AfCFTA and COMESA to unlock intra-African trade.

The DOLS results offer several insights for policymakers and stakeholders in Ethiopia's spice export sector:

1. Strengthen Market Forecasting and Export Planning
   The significance of the lead term of spice exports suggests that expectations about future trade performance influence current outcomes. This highlights the importance of market intelligence systems, export forecasting, and strategic planning to align production and logistics with anticipated demand.

2. Support Long-Term Export Diversification with Complementary Measures
   Although the Diversification Index shows a positive coefficient, its lack of statistical significance implies that diversification alone may not be sufficient to boost spice exports. Policymakers should complement diversification strategies with quality improvements, branding, certification schemes, and market access initiatives.

3. Address Short-Term Volatility and Supply Constraints
   The marginally significant negative lag effect of spice exports suggests that short-term increases may lead to temporary slowdowns. This could be due to capacity limitations, post-harvest losses, or infrastructure bottlenecks. Investments in storage, transport, and processing facilities could help smooth supply and sustain growth.

4. Enhance Export Readiness and Trade Facilitation
   Given the dynamic nature of spice exports, Ethiopia should focus on reducing trade barriers, streamlining customs procedures, and improving logistics efficiency to respond quickly to global market opportunities.

The VECM results provide several important insights for policymakers:

1. Support Long-Run Stability in the Export Sector
   The significant error correction terms suggest that GDP and spice exports are part of a stable long-run system. Policies should aim to preserve macroeconomic stability and strengthen the structural linkages between trade and growth.

2. Mitigate Short-Run Volatility in Exports
   The negative short-run effects of spice exports and diversification on GDP highlight the need for buffer mechanisms, such as price stabilization funds, risk insurance, and export smoothing strategies, to manage volatility.

3. Promote Export Diversification Through Growth
   The strong positive effect of GDP on diversification suggests that economic growth is a driver of export base expansion. Investments in infrastructure, human capital, and innovation can further enhance this relationship.

4. Leverage Spice Exports to Broaden Trade Base
   The short-run positive impact of spice exports on diversification implies that spice trade can act as a catalyst for broader export development. Targeted support for value addition, branding, and market access in the spice sector can yield wider trade benefits.

The IRF analysis provides several key insights for policy:

1. Manage Short-Term Trade-Offs
   The negative short-run response of GDP to shocks in spice exports and diversification suggests the need for transition support policies, such as investment in productivity, infrastructure, and social safety nets, to mitigate adjustment costs.

2. Leverage Growth for Diversification
   The strong response of the diversification index to GDP shocks highlights the importance of inclusive and broad-based economic growth as a foundation for expanding Ethiopia's export base.

3. Support the Spice Sector as a Strategic Export Driver
   The positive response of spice exports to diversification shocks suggests that policies promoting value addition, certification, and market access in the spice sector can reinforce broader trade development goals.

4. Enhance Responsiveness Through Institutional Capacity
   The lagged and gradual nature of many responses indicates that institutional readiness, trade facilitation, and export promotion mechanisms are critical to translating shocks into sustained economic outcomes.

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Appendix I: ARDL Model Suitability

Assessment of ARDL Model Suitability for Analyzing Ethiopia's Economic Growth

The Autoregressive Distributed Lag (ARDL) model is often used in economic research to estimate long-run and short-run dynamics among variables with mixed levels of integration (i.e., I (0) and I(1). This report examines whether ARDL is suitable for studying the relationship between Ethiopia's GDP, spice exports, and export diversification.

Unit Root Test Results

The Augmented Dickey-Fuller (ADF) test was used to determine the stationarity of variables. The results are as follows:

Variable	ADF Statistic	5% Critical Value	p-value
ln_GDP	-0.772	-3.000	0.8272
ln_SpiceExport	-2.225	-3.000	0.1972
Diversificationindex	-0.462	-3.000	0.8992
TOT	-1.701	-3.000	0.4305

None of the variables are stationary at level. All variables are I(1), meaning they become stationary only after differencing once.

Why ARDL Cannot Be Used in This Context

The ARDL model is applicable only when the dataset contains a combination of I(0) and I(1) variables. According to the results above, all variables—GDP, spice exports, diversification index, and terms of trade—are I(1). The absence of any I(0) variables makes the use of ARDL statistically inappropriate.

Interpretation and Conclusion

Based on the ADF results, the necessary condition for implementing ARDL is not met. Attempting to use ARDL with all I(1) variables would violate the assumptions of the model and may produce misleading results. Instead, the appropriate approach for this dataset is to use models designed for I(1) series with cointegration, such as the Vector Error Correction Model (VECM) or DOLS

Appendix II: Panel Regression and Hausman Test

This section presents and interprets the results of the panel data regression analysis conducted to assess the determinants of Ethiopia's spice export potential. Both **Fixed Effects (FE)** and **Random Effects (RE)** models were estimated to account for unobserved heterogeneity across trading partners and over time.

Table 15 Panel Regression Result (FE and RE)

Variable	FE Coef.	FE Std. Err.	RE Coef.	RE Std. Err.
ln_gdppc_i	-0.1924	0.9735	-0.1733	0.9211
ln_gdppc_j	omitted	.	-0.0056	0.8174
ln_dist	omitted	.	0.5865	0.5012
ln_fx	0.0672	0.6431	0.0367	0.1258
trade_agreement	omitted	.	0.6099	0.5497
year dummies	included	-	included	-
_cons	8.7484	7.6823	-2.5286	21.5116

Model Overview

The dependent variable in the regression is the value of spice exports from Ethiopia to various trading partners. The independent variables include:

- **ln*gdppc*i**: Log of GDP per capita of Ethiopia (exporting country)
- **ln*gdppc*j**: Log of GDP per capita of the importing country
- **ln_dist**: Log of geographical distance between Ethiopia and the trading partner
- **ln_fx**: Log of the exchange rate
- **trade_agreement**: Dummy variable indicating the presence of a trade agreement
- **Year dummies**: Included to control for time-specific effects such as global economic shocks or policy changes

Key Findings

GDP per Capita (Ethiopia and Importing Countries)

- The coefficient for Ethiopia's GDP per capita (ln*gdppc*i) is negative in both models, suggesting a potential inverse relationship with spice exports. However, the large standard errors indicate that this relationship is not statistically significant. Similarly, the GDP per capita of the importing countries (ln*gdppc*j) is omitted in the FE model and statistically insignificant in the RE model. This implies that income levels, both domestically and abroad, may not be primary drivers of spice export volumes.

Distance

- In the fixed effects (FE) model, the variable for distance (ln_dist) was excluded because it doesn't change over time—it gets absorbed into the fixed effects. However, in the random effects (RE) model, distance shows a positive but statistically insignificant relationship with spice exports. While this might seem counterintuitive—since we'd typically expect longer distances to hurt trade—it could reflect Ethiopia's dependence on far-off but high-demand markets like those in Europe and the Middle East for its spice exports.

Exchange Rate

- The exchange rate (ln_fx) shows a small positive coefficient in both models, indicating a weak and statistically insignificant relationship with spice exports. This suggests that exchange rate fluctuations may not play a major role in determining export volumes, possibly due to fixed contracts or low price elasticity in spice trade.

Trade Agreements

- The trade_agreement variable is omitted in the FE model and positive but insignificant in the RE model. While the direction of the coefficient suggests that trade agreements may facilitate spice exports, the lack of statistical significance implies that their impact is not robustly supported by the data.

Year Effects

- Year dummies were included in both models to control for time-specific shocks such as global commodity price changes, pandemics, or policy reforms. Their inclusion helps isolate the effects of the main explanatory variables.
- The FE model omitted distance and trade agreement due to collinearity. GDP per capita of the exporter was negative but insignificant.
- The RE model included all variables, but none reached conventional significance levels. The Hausman test returned a p-value of 1.000, favoring the RE model due to lack of systematic difference in coefficients.
- The fixed-effects model revealed some statistical stability, but the Hausman test strongly favored the random-effects model, indicating no significant correlation between individual effects and regressors. Yet, the trade agreement and distance variables were dropped due to perfect collinearity in FE, highlighting the trade-off between controlling for omitted variable bias and retaining important time-invariant predictors.
- To look at an in-depth interpretation of the Random Effects (RE) gravity model estimated to examine Ethiopia's spice export potential. The RE approach was selected following a Hausman test, which confirmed that unobserved individual heterogeneity is uncorrelated with the model's explanatory variables. As a result, the RE model provides consistent and efficient estimates while retaining time-invariant variables, which are critical to trade analysis such as distance and trade agreements.

Model Specification

- The estimated RE model takes the following form:

$$\ln(Trade_{ijt}) = \beta_0 + \beta_1 \ln(GDPpc_{it}) + \beta_2 \ln(GDPpc_{jt}) + \beta_3 \ln(Distance_{ij}) + \beta_4 \ln(ExchangeRate_{ijt}) + \beta_5 TradeAgreement_{ij} + \Sigma Year\_dummies + u_i + \varepsilon_{ijt}$$

Where:
- i = Exporting country (Ethiopia)
- j = Importing partner
- t = Year (2014–2024)
- u_i = Random individual effect for importer

- ε_ijt = Idiosyncratic error term

Key time-invariant regressors retained include geographic distance and the trade agreement dummy.

Estimation Results

- The RE model results are summarized below. These results were derived from a panel dataset containing 110 observations over 11 years across 10 importer countries.

Table 16 RE estimation result

Variable	Coefficient	Std. Error	z	P>|z|	95% Conf. Interval
ln_gdppc_i	-0.1733	0.9211	-0.19	0.851	(-1.979, 1.632)
ln_gdppc_j	-0.0056	0.8174	-0.01	0.994	(-1.608, 1.597)
ln_dist	0.5865	0.5012	1.17	0.243	(-0.395, 1.568)
ln_fx	0.0367	0.1258	0.29	0.774	(-0.210, 0.284)
trade_agreement	0.6099	0.5497	1.11	0.269	(-0.468, 1.688)
Year dummies	included	-	-	-	-
_cons	-2.5286	21.5116	-0.12	0.907	(-45.23, 40.18)

Interpretation

- The RE model revealed positive but statistically insignificant coefficients for most variables. Although the results do not achieve standard thresholds for statistical significance, the signs of the coefficients are in line with trade theory:

- Distance (ln_dist) showed a positive sign, contrary to gravity theory. This may reflect regional integration or unique trade patterns in Ethiopia's spice trade.

- GDP per capita coefficients for both importer and exporter were negative and insignificant, possibly due to niche demand characteristics in spice markets.
- Exchange Rate had a small positive coefficient, suggesting weak price sensitivity of Ethiopian spice exports.
-Trade Agreement Dummy showed a positive association, indicating that agreements likely support higher trade volumes, though the estimate was not statistically significant.