Chapter One

Introduction

1.1 Background to the Study

In recent years, the global agriculture faces numerous challenges that threaten food security, sustainability, and the livelihoods of millions, thereby raising significant concerns among agriculture experts, development economists, and policymakers. Several factors have continually contributed to the growing concerns. The first and ongoing challenge for global agriculture is to produce sufficient food to meet the needs of the increasing world population [1,2].

Second, global food insecurity had been escalating in the recent years, largely due to climate-related factors such as temperature changes, changes in growing seasons, flooding, droughts, and extreme weather conditions. For example, acute food insecurity affected 345 million people in 82 countries by June 2022, up from 135 million in 2019, due to the war in Ukraine, supply chain disruptions, and the economic fallout from the COVID-19 pandemic, which drove food prices to record highs[3,4]. Unfortunately, by 2050, the global average temperature is projected to rise by 1.5°C to 2°C, potentially causing an additional 14.5 million deaths, $12.5 trillion in economic losses, and $1.1 trillion in additional healthcare expenses[5,6]. The third challenge in modern agriculture is to develop technologies, incentives, and policies that motivate small-scale farmers to sustainably manage natural resources, which is crucial for the world's forests and rangelands. Since agriculture consumes over 70% of the world's fresh water and houses significant biodiversity, enhancing natural resource management is closely linked to boosting the productivity and profitability of small-scale farmers in developing countries such as Economic Community of West African States (ECOWAS)[7].

Besides, the agricultural performance effect of the investment climate factors has been extensively studied for decades, due to the clear and well-established link between investment climate and global agricultural systems. Both the World Bank and the Food and Agriculture Organization (FAO) have emphasized the critical role of a favorable investment climate in boosting agricultural performance, which can alleviate poverty and ensure food security[8,9]. In developing regions such as Africa and ECOWAS countries, poor investment climates have been identified as a major cause of declining agricultural performance in terms of output growth, output per worker, employment, and exports. For example, a World Bank report highlights that agricultural productivity in sub-Saharan Africa increased by only 1.8% annually from 1980 to 2004, compared to 3.6% in Latin America and 4.5% in East Asia, due to inadequate infrastructure, lack of credit access, and insecure land tenure systems, all of which are elements of a poor investment climate[8]. Consequently, about 60% of the population in sub-Saharan Africa is employed in agriculture, yet the sector contributes only 15% to GDP, reflecting low productivity[10]. In addition, African countries represent only about 2% of global agricultural exports despite having over 60% of the world's uncultivated arable land[11]. In the ECOWAS sub-region, agriculture contributes approximately 35% to GDP, accounts for 16.3% of exports, and employs over 60% of the workforce[12,13]. While there is significant interest among agronomists, agriculturists, scientists and economists at modeling the agricultural production functions for developed nations, on the one hand, such studies are limited for developing nations[14,15,16,17,18]. This is surprising given the critical development impacts of agricultural performance and the priority it has been given by the FAO, aligning with the goals of the Millennium Development Goals and the Sustainable Development Goals[19,20].

Undeniably, numerous factors have been identified as critical drivers of agricultural performance in the agricultural development literature. These include climate conditions, soil quality, water availability and irrigation, access to credit and financing, technological advancements, government policies and subsidies, infrastructure development, market access and prices, labour availability and skills, research and development, and inputs availability. However, there is a clear and strong consensus that the investment climate has a direct, positive, and significant impact on agricultural performance. The declining agricultural performance in developing countries is primarily attributed to a poor investment climate[8,9,10]. While Africa, particularly West Africa, grapples with significant investment climate challenges, other regions in the world have managed to create more conducive environments for business through focused policy interventions and infrastructure development. For example, developed countries in the OECD generally have good infrastructure, stable political environments, and transparent regulatory systems that promote business and agricultural growth[21]. Also, the investment climate in North America is characterized by advanced infrastructure, political stability, and strong legal frameworks that protect business and agricultural investors[22].

Meanwhile, many Asian countries have made significant strides in improving their investment climates through infrastructure development, regulatory reforms, and economic liberalization, with countries like China and India experiencing rapid industrialization and economic growth due to focused investments in these areas[23]. However, the MENA region exhibits a mix of investment climates, with countries like the UAE and Qatar offering business-friendly environments with advanced infrastructure, while others like those in Africa face challenges such as political instability and regulatory complexities[24]. Among the regions of the world, ECOWAS seems to be the most severely affected by investment climate-related agricultural issues. As a corollary, the projected 8.6% decline in the agricultural sector's contribution to GDP in ECOWAS by 2043 can be attributed to an unstable investment climate characterized by economic restrictions, property rights violations, government corruption, judicial inefficiency, trade barriers, business regulations, and investment controls[25].

Furthermore, the relationship between investment climate and agricultural performance shows empirical regularity, although it appears less direct in practice, often mediated by intervening factors. This study underscores the pivotal role of institutions in this nexus, especially within the ECOWAS region, where institutional infrastructure is notably weak. Unlike developed economies, which attribute much of their agricultural success to robust institutional frameworks, institutions in developing nations are less effective at shaping economic structures and fostering favorable conditions for agricultural development[26,27]. The institutional framework of developed nations has played a crucial role in both shaping the structure of their economies and improving the investment environment for agricultural development. This has been achieved through the institutionalization of economic freedom, property right, government integrity, judicial effectiveness, trade freedom, business freedom, and investment freedom. Effective governance and institutional stability have gained recognition for supporting sustainable growth, sound macroeconomic policies, and overall economic advancement[28,29,30]. This highlights the critical importance of investigating these linkages among between institutions, investment climate and agricultural performance, as developed countries, despite strong institutional frameworks, face investment climate challenges such as regulatory burdens and market volatility, while developing countries struggle with dysfunctional institutions that hinder investment climate improvements. Thus, ensuring a conducive and sustainable investment environment remains a primary objective for responsive governments, contingent upon institutions fulfilling their regulatory and oversight roles effectively[28,29].

Following the above discussions, this study proposed to investigate the linkages among institutions, investment climate, and agricultural performance within the ECOWAS region because it becomes evident that weak institutional framework and poor investment climate significantly hamper agricultural performance. Despite the critical importance of these linkages, extant studies in developing countries, including ECOWAS, have primarily focused on infrastructure and credit access channels[31,32,33,34,35,36,37]. These studies aimed to determine whether the undesirable outcomes of agricultural resources on performance were due to poor infrastructure facilities and inadequate credit support. However, the broader investment climate, encompassing economic restrictions, property rights violations, government corruption, judicial inefficiency, trade barriers, business regulations, and investment controls, has not been adequately addressed in these studies. It is essential to recognize that merely formulating policies to ensure an adequate investment climate may not yield the desired agricultural performance if the institutional settings responsible for implementation and monitoring are weak. Meanwhile good institutional frameworks are crucial in translating favourable investment climates into tangible agricultural outcomes. Despite the theoretical consensus on this proposition, no empirical studies, at least to the best of my knowledge, have been conducted to validate or refute it. This research gap in the literature underscores the reason for this study, highlighting the need to explore the interplay between institutional quality, investment climate, and agricultural performance in the ECOWAS region.

1.2 Statement of the Problem

ECOWAS is among the region's most severely impacted by low agricultural performance, a situation that has been worsening annually[38]. This persistent decline in agricultural productivity has exacerbated extreme poverty and heightened food insecurity throughout the region. Subsistence farming for food security has consequently been a primary policy focus for many African governments, including those within the ECOWAS region[39]. The United Nations news stated that nearly 55 million people in West and Central Africa currently face food insecurity[40]. It further revealed that Mali is experiencing an extreme food crisis, with approximately 2,600 individuals presumed to be facing catastrophic hunger, classified as phase 5 on the IPC food classification index. Also, Niger alone saw over 2 million people facing food insecurity between October and December 2023[41].The agricultural sector in ECOWAS faces significant challenges compared to other regions, as reflected in various key metrics presented in Table 1.1 from 2000 to 2022 (see Appendix). Firstly, ECOWAS countries have a high dependence on agricultural raw materials exports, which constitute 12.69% of their merchandise exports. This is markedly higher than in other regions such as the Arab World (0.19%), the European Union (1.50%), Latin American & Caribbean (2.22%), Middle East & North Africa (0.23%), and North America (2.83%)[42]. Despite this high export reliance, the agricultural sector's value added per worker in ECOWAS is $1,660.22, significantly lower than in Arab World (5,406.85), Latin American & Caribbean (5,329,59), Middle East & North Africa ($6,380.17), North America ($83,184.31) and the European Union ($18,915.04), indicating lower productivity levels[42].

Moreover, the agriculture, forestry, and fishing sector's contribution to GDP in ECOWAS stands at 28.32%, which is considerably higher than other regions, like the Arab (6.45%), European Union (1.76%), Latin America & Caribbean (5.35%), Middle East & North Africa (5.66%), North America (1.12%), and OECD members (1.54%)[42]. This high percentage suggests that

ECOWAS economies are heavily reliant on agriculture. However, the annual growth rate of value added in this sector is 3.90%, which, while higher than regions like the European Union (0.40%) and OECD members (0.96%), still reflects a growth rate that is insufficient to significantly uplift the sector's productivity and overall economic contribution. In addition, employment in agriculture also remains a critical issue, with 51.70% of the total employment in ECOWAS engaged in the agricultural sector[42]. This is in stark contrast to developed regions such as North America (1.77%) and the European Union (5.97%), highlighting the dependence on agriculture for livelihood in ECOWAS, yet without corresponding productivity gains.

The persistently low performance of the agricultural sector in ECOWAS is likely driven by a confluence of factors, most notably economic shocks, climate extremes, and conflicts and farm insecurity. These factors have likely combined to create a worsening investment climate and undermine food security across the region. Poor investment climates in ECOWAS have been exacerbated by the insecurity of farmers on their farmlands, notably due to the herder-farmer conflicts prevalent in some regions. This crisis has had significant detrimental impacts on agricultural productivity and overall economic stability. Farmers in ECOWAS countries, such as Nigeria, Ghana, and Burkina Faso, often face violent clashes with nomadic herders over land and water resources. For example, a surge in farmer-herder violence between September 2017 and June 2018 resulted in a devastating humanitarian crisis. At least 1,500 people lost their lives, many more suffered injuries, and an estimated 300,000 were displaced from their homes[43].These conflicts not only lead to loss of lives and properties but also result in the abandonment of farmlands, disrupting agricultural activities and reducing crop yields.

Based on the data from the Heritage Foundation's Index of Economic Freedom, the ease of doing business in ECOWAS countries generally lag behind other regions of the world. The scores for business freedom, investment freedom, and other economic indicators are lower in ECOWAS compared to regions like the European Union, East Asia Pacific, and Latin America & Caribbean[44]. These lower scores reflect a more challenging business environment in ECOWAS, characterized by regulatory hurdles, bureaucratic inefficiencies, and less favorable conditions for investment. Also, a significant issue in ECOWAS is the high cost and time required for customs clearance and inspection procedures, as well as documentary compliance. According to the World Bank, as of 2019, the average cost for these processes in ECOWAS was $474.30 and $125.87, respectively[42]. Additionally, exporting and importing in ECOWAS require approximately 8 and 9 documents on average, compared to 4 and 5 in the European Union, 6 each in East Asia Pacific, and 6 and 7 in Latin America and the Caribbean[42]. The average time spent on documentary compliance and border compliance in ECOWAS is also significantly higher, at 61 hours and 94 hours, respectively[42].These cumbersome and costly procedures contribute to a weak investment climate, manifesting in increased costs for acquiring agricultural loans, shorter investment horizons, and a higher probability of negative returns on agricultural investments.

In addition, the inherent limitations of the investment climate in ECOWAS, potentially exacerbated by fragile institutional settings, may have hindered the potential for improved agricultural performance. These institutions often suffer from inefficiencies, corruption, and lack of transparency, which hinder the development and enforcement of policies that could improve the investment climate. The World Bank highlights that these institutional deficiencies lead to high transaction costs and unpredictable investment environments, further discouraging investment in agriculture[45]. Additionally, a report by the African Development Bank indicates that corruption and bureaucratic red tape in many ECOWAS countries impede effective policy implementation, thereby undermining efforts to improve agricultural performance[46].The average 2022 governance scores presented in Table 1.1 highlight significant disparities among regions, with OECD and North America demonstrating robust governance frameworks, while ECOWAS and other developing regions face substantial governance challenges. ECOWAS, with an average score of -0.85, indicates particularly weak governance, which adversely impacts its investment climate and overall economic performance[47].

1.3 Research Questions

Against this backdrop, the study attempts to provide answers to the following research questions:

i. How has institutional quality affected the investment climate in ECOWAS?

ii. What is the effect of investment climate on agricultural performance in ECOWAS?

iii. To what extent does institutional quality affect agricultural performance in ECOWAS?

iv. Are institutional quality variables ameliorating or deteriorating in the relationship between investment climate and agriculture performance in ECOWAS?

1.4 Objectives of the Study

The objective of this study is to investigate and analyze the interrelationship among investment climate, institutional quality, and agricultural performance in ECOWAS. The specific objectives of this study are to:

i. examine how institutional quality impact investment climate in ECOWAS.

ii. investigate the effect of investment climate on agricultural performance in ECOWAS.

iii. determine the effect of institutional quality on agricultural performance in ECOWAS

iv. evaluate the extent to which institutional quality variables ameliorate or deteriorate the nexus between investment climate and agriculture performance in ECOWAS.

1.5 Hypotheses

The following research hypotheses stated in null form are to be tested in the study

H_o1: There is no significant relationship between institutional quality and investment climate in ECOWAS.

H_o2: Investment climate has no significant effect on agricultural performance in ECOWAS.

H_o3: There is an insignificant relationship between institutional quality and agricultural performance in ECOWAS.

H_o4: Institutional quality factors does not significantly ameliorate or deteriorate investment climate and agricultural performance in ECOWAS.

1.6 Significance of the Study

This study focuses on addressing four key Sustainable Development Goals (SDGs) within the context of ECOWAS, building upon the Millennium Development Goals (MDGs). Specifically, it targets Goal 2 of the SDGs, which aims to eradicate hunger, ensure food security, improve nutrition, and promote sustainable agriculture - an extension of MDG 1. Additionally, the study addresses Goal 8, which promotes inclusive economic growth and decent work, Goal 9's emphasis on enhancing access for small-scale enterprises, and Goal 16's focus on fostering accountable and inclusive institutions at all levels. Over recent decades, regional efforts within ECOWAS to alleviate poverty and hunger, as set forth by the MDGs, face challenges due to weakening institutional frameworks, inadequate investment climates, and underperforming agriculture sectors. According to African Futures, the agriculture sector is projected to be the third most effective in reducing extreme poverty in ECOWAS by 2043, following the education and manufacturing sectors[48]. Meanwhile, international interventions have not yielded the desired impact, exacerbated by unpredictable and disjointed actions among ECOWAS countries concerning agriculture output growth, output per labour, employment, and exports. These factors collectively jeopardize the region's ability to improve agricultural performance and meet SDG targets by 2030.The outcomes of this study are expected to provide critical insights for formulating effective agricultural policies within ECOWAS, aiming to address these systemic challenges and enhance sustainable development outcomes across the region.

The huge benefits of the agricultural sector especially in developing economies have attracted the research interest on the determinants of agricultural sector performance. A review of the literature shows that studies exist studies on institutional quality and agricultural performance[49,50,51,52,53]. Similarly, investment climates and agricultural performance have been studied in the literature[54,55,56]. Studies also exist on institutions and investment climates[57,58,59]. A review of the literature however indicates that there isno study conducted to evaluate whether institutional quality act as an ameliorating or a deteriorating factor in the nexus between investment climate and agriculture performance in ECOWAS. Given the importance of agriculture to the sub-regions growth trajectory, examining the tripartite role is crucial given the inter-relationship between investment climate, institutional quality, and agricultural sector performance.

Previous studies have predominantly focused on a narrow scope of institutional quality, primarily examining indices like control of corruption and government effectiveness[49,50,51,52,53,57,58,59]. However, these studies often overlooked regulatory quality, which assesses the capability of authorities to formulate and implement effective policies supporting both private and public sector development[28,29,30]. This study takes a broader approach by integrating all three governance indicators, aiming to uncover deeper insights into how institutions operate within the context of the investment climate and agricultural performance in the ECOWAS region, thereby offering significant policy implications. More so, this study employs seven eases of doing business indices that is, economic freedom index, property right, government integrity, judicial effectiveness, trade freedom, business freedom, and investment freedom, as measures of investment climate. These indices offer insights into the regulatory environment, legal protections, and economic openness necessary for fostering sustainable agricultural growth and development across member states. By analyzing these factors, policymakers can identify strengths, weaknesses, and areas for improvement to enhance investment opportunities and agricultural productivity in the ECOWAS region.

Likewise, the growing literature on the role of institutions in agricultural sector performance has not focused on separate subsectors of the agricultural sector and the effects of specific institutional variables. Therefore, the decomposition of the agricultural performance into its constituent components such as agriculture output growth, agriculture output per worker, agriculture employment, and agriculture exports, is a notable gap in the literature. Previous studies often treated agricultural performance as a singular outcome, neglecting the multifaceted nature of the sector. This oversight limits the depth of understanding regarding how different aspects of agricultural performance respond to variations in the investment climate and institutional quality.

1.7 Scope of the Study

This study utilizes secondary panel data comprising fifteen ECOWAS countries. The dataset for one of the key indicators, institutional quality, begins in 1996, as provided by the World Governance Indicators (2023). Due to limitations in the datasets, the observations span from 2000 to 2022, encompassing the periods of the MDGs and SDGs. The focus on ECOWAS is based on the following reasons: (a) the region experiences the most severe impact of poor agricultural performance, characterized by low output per labour due to a deteriorating investment climate[42]. (b) being a region with high number of low middle (6) and lower (9) income countries, approximately 45.9% of businesses in ECOWAS face investment climate challenges[60]. The lists of low middle-income countries in ECOWAS are Benin, Cape Verde, Côte d'Ivoire, Ghana, Nigeria, and Senegal, whereas the lower-income nations are Burkina Faso, Gambia, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Sierra Leone, and Togo. (c) Agriculture remains a major economic activity within ECOWAS, crucial for employment, food security, and economic development. (d) ECOWAS faces significant investment climate challenges, including inadequate infrastructure, limited access to finance, and regulatory inefficiencies, which adversely affect agricultural performance. (e) The institutional settings of countries in the ECOWAS sub-region are notably weak. Data from the World Governance Indicators (WGI) reveal that these countries collectively exhibit a negative institutional index. Previous studies have corroborated this, highlighting the fragility of the institutional systems within ECOWAS nations[54,55,56,57,58,59].

1.8 Limitation of the Study

Some of the limitations expected to be faced in the conduct of this research projects include the constraints of resources and funds to accomplish the study. Since this study is a research thesis and it gets no grant, this could constitute a huge constraint to its accomplishment. This research may require the researcher to travel to some of the ECOWAS country states, which without grant can be very difficult, in terms of funds needed to transport and the funds required to stay for days in those countries. This may constitute some constraint on the execution of this research project.

One significant limitation is the presence of data irregularities. For example, the statistics provided by internationally recognized organizations such as the World Bank's World Development Indicators (WDI) and World Governance Indicators (WGI) often exhibit changes over a few years before stabilizing. This can complicate longitudinal analyses and trend identification. Changes in methodologies, data collection techniques, or reporting standards can lead to discrepancies that may affect the consistency and reliability of the datasets over time.

Combining data from various sources like the World Bank WDI, WGI, and the Heritage Foundation's indices presents another challenge due to the different methodologies employed in data compilation. Each organization may use distinct criteria, scales, and analytical approaches to measure similar variables. For instance, the WGI focuses on broad governance metrics, while the Heritage Foundation's Economic Freedom Index emphasizes economic policies and their impact on business environments. These differences can lead to variations in the interpretation and comparability of data.

Misalignment in data sources can result in biased or inaccurate findings, leading to incorrect policy recommendations. It is crucial to adopt robust statistical techniques to harmonize the data and account for these variations. With appropriate estimation strategies being employed in this study, these data irregularities and methodological differences which can significantly impact the research outcomes are addressed. Techniques such as panel data analysis, fixed-effects models, and instrumental variable approaches help mitigate these issues by controlling for unobserved heterogeneity and ensuring that the results are not unduly influenced by data inconsistencies.

1.9 Operational Definition of Terms

The following are the operational definition of key terms encountered in the study. It involves the detailed explanation of the technical terms and measurements used during the data collection. The definitions given to the key terms are as follows:

Agricultural Performance: The ability of farming to provide basic goods and services to the people of a country, which is measured by agricultural output growth, output per labour, employment, and exports.

Agricultural Sector: This is an industry that is into the production of crops, livestock, agricultural engineering, agricultural machinery, fertilizers, and other items that assist farming.

Institutions: Institution is defined in this study as systems of rules that structure social interactions. Institutions are systems of social (i.e., man-made and nonphysical) factors that are exogenous to everyone whose behaviour they influence.

International Trade Agreement: This is a formal agreement governing the terms of commercial transactions, such as intellectual property rights, trade facilitation policies, import and export restrictions, tariffs, quotas, and investment protection measures.

Investment and Institutional Policies: The Investment Policy Framework consists of three sets of operational guidelines, or action menus: guidelines for international investment agreements (IIAs) creation and application, guidelines for national investment policies, and an action menu for promoting investment in areas linked to the Sustainable Development Goals.

Investment Climate: It consists overall economic, financial, and social conditions within a country or region that affect the willingness and ability of individuals and businesses to invest such as economic freedom index, property right, government integrity, judicial effectiveness, trade freedom, business freedom, and investment freedom.

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Chapter Two

Literature Review

2.0 Preamble

This chapter presents the review of related concepts, theories, and empirical studies on investment climate, institutional quality and agricultural performance. Specifically, this section conceptualizes investment climate, institutional quality, agricultural performance, and the review of extant literature on the interrelationship among investment climate, institutional quality, and agricultural performance. Also, theories and empirics related to the topic of the study were discussed. Lastly, the gaps in literature are identified.

2.1 Conceptual Reviews

2.1.1 Investment Climate

Investment climate refers to the set of economic, social, and institutional conditions within a country that influence the attractiveness of that country for both domestic and foreign investments. It encompasses various factors that impact the ease of doing business, the level of investor confidence, and the overall environment for investment activities. As articulated by the World Bank, the investment climate includes elements such as regulatory frameworks, legal systems, infrastructure, macroeconomic stability, and the efficiency of public institutions[1]. Investment climate explains the environment in which firms of all types and sizes invest and grow. Investment climate is about the environment in which firms and entrepreneurs of all types (from farmers and micro-enterprises to local manufacturing concerns and multinationals) have opportunities and incentives to invest productively, create jobs and expand[1]. It consists of location specific factors that shape the enabling environment for firms to invest productively and grow[2].

An essential aspect of the investment climate is the regulatory environment. A conducive regulatory framework provides clear rules and procedures for businesses, reducing uncertainty and transaction costs. Regulations that are transparent, predictable, and efficiently enforced create a favorable environment for investment. For instance, two scholars emphasize the significance of business-friendly regulations and their correlation with higher levels of investment and economic growth[3].Infrastructure development is another critical component of the investment climate. Adequate transportation, energy, and communication infrastructure are essential for the smooth operation of businesses. Improvements in infrastructure contribute to increased productivity, cost-effectiveness, and the overall attractiveness of a country for investment[4]. This study highlights the positive impact of infrastructure on private investment in developing countries[5].Moreover, the institutional quality of a country, including the efficiency and transparency of public institutions, plays a crucial role in shaping the investment climate. Secure property rights, effective legal systems, and minimal corruption are associated with a more favorable investment climate[6]. These institutional factors not only foster investor confidence but also contribute to long-term sustainable economic development.

In Keynesian terminology, investment refers to real investment which adds to capital equipment. It leads to an increase in the level of income and production by increasing the production and purchase of capital goods. Investment, thus, includes new plants and equipment, construction of public works, net foreign investment, inventories, and stock and shares of new companies. In the words of Joan Robinson, “by investment means an addition to capital, i.e., making an addition to the stock of goods in existence. To be more precise, investment is the production or acquisition of real capital assets during any period.” Thus, emphasis on investment used to mean advocating greater quantities of investment, under the assumption that a financing gap was a barrier to development[7]. Past research, however, focuses on the quality and not the quantity of investment[8,9,10]. They focus on the institutional and policy environment that determines whether investments pay off in greater competitiveness for firms and in sustained growth for the economy. Afterwards, higher productivity in individual firms culminates in higher rates of growth of the gross domestic product (GDP). Therefore, though, the policy areas covered by investment climate is broad, the performance of individual firms is at the heart of the policy and micro-level data provide useful insights into how firms assess the package of policies and government behaviour using such criteria as risks, costs, and barriers to competition. At the firm level, uncertainty about the content and implementation of government policies are of important concern. In developing countries, policy inconsistency is very rampant and inefficient implementation of policies sometimes occasioned by corruption and nepotism is a common feature of government business relationships. Poor policy design and weak institutions exacerbate macroeconomic instability, arbitrary regulation, and weak protection of property rights. All these cloud business opportunities and chill incentives to invest productively[2].

Furthermore, investment climate is simply a condition of investment environment characterized and evaluated by the gross domestic product (GDP) growth paces, the existing level of taxes and benefits, interest rates, inflation, tariffs and prices, exchange rates, prices for corporate and public securities, and legal framework of investment activity[11,12]. However, scholars argued that it is not correct to equate investment climate and investment attractiveness, emphasizing that the latter one represents the narrower and more subjective concept[13]. They define the investment climate as a set of influence factors of various types (political, socio-economic, financial, socio-cultural, organizational-legal, and geographical) peculiar to a certain country (region, industry) and determine its attractiveness level for a foreign investor[13].

Meanwhile, the investment climate is considered as "a set of political, economic, legal, geographical, and socio-cultural conditions that together secure and impact the investment activity of domestic and foreign investors on a certain territory."

Given the foregoing analysis, this study employs the economic freedom index published by the Heritage Foundation, which include property rights, government integrity, judicial effectiveness, trade freedom, business freedom, and investment freedom. Property rights refer to the legal rights individuals or businesses must use, control, and transfer their property, including land, buildings, and intellectual property, without interference from others or the government. As to government integrity, it reflects the absence of corruption and the trustworthiness of government officials in carrying out their duties impartially, transparently, and in accordance with the law. Judicial effectiveness refers to the efficiency, fairness, and reliability of the judicial system in interpreting and enforcing laws, resolving disputes, and protecting the rights of individuals and businesses. Concerning trade freedom, it measures the extent to which governments allow free movement of goods and services across borders, with minimal tariffs, quotas, and other trade barriers, fostering open and competitive markets. Regarding business freedom, it assesses the ease of starting, operating, and closing a business, including factors such as regulatory burden, licensing requirements, and bureaucratic procedures, which can either facilitate or hinder entrepreneurial activities. Meanwhile, investment evaluates the openness of a country's investment climate, including restrictions on foreign investment, government policies affecting investment, and the ability of investors to repatriate profits and capital freely.

2.1.2 Institutional Quality

The concept "institutional quality" is a broad concept that captures law, individual rights and high-quality government regulation and services. North being one of the pioneers of institutional quality has contributed greatly to the subject matter[14]. He defines institutions as "humanly devised constraints that shape interaction between people". North acknowledged that institutional quality of an economy improves as limitations are being imposed on executive power which could either be "formal rules" or "informal constraints"[15]. This is to ensure that executives do not put themselves above the law by reducing the *de jure* power position convened on them. By doing this, this is to ensure that the properties and welfare of individuals, entrepreneurs as well as social groups that challenge the present economic system are protected by law. The protection also extends to their investment in human development, physical capital, and technology/innovations. The notable scholars noted that the protection is required to (a) speed up the adoption of technology which is available in other part of the world; and (b) add to the existing technologies by investing in research and development, most especially the disruptive ones[15]. These are extremely uncertain by nature, and this makes them a great challenger to executives in position of formal and informal power. Thus, this calls for quality institutions that would ensure that everyone (challengers and incumbents) is equally protected by law which was far from limited to North's definition of institutions.

Some scholars extended the argument further by taking a wider perspective beyond *de jure* executive power and including *de factor* power[14]. They opined for a *de facto* power of individuals, entrepreneurs and social groups that challenge the present economic system in their investments be it in human, physical capital, and technologies. This focuses on the legal right of individuals which was interpreted by researchers as a formalized trust[15]. A study on *trust societies*, four researchers discovered that trust amongst individuals not only in economic transaction but also in their legal right is key to determining institutional quality that would create a lasting progress in an economy[16]. Summarily, the legal right produces an inclusive institution, where rights and economic protection are for all regardless of their status (rich or poor), position and origin. This is not in line with the *extractive institution* where resources are extracted from the masses for the greater benefit of the ruling elites.

Another thought by Easterly which differs from previous scholars stressed the importance of effective public service as an internal element of institutional quality and not just the rights and opportunities of individual[14]. Speaking from the angle of the developing countries, he argued that "legal and political rights are quite unproductive if they are faced with poor public service". For instance, business failures as they could not cope with high production cost due to lack of public investment in infrastructure like poor electricity power supply, poor road network, lack of social amenities among others.

This study therefore defined "*institutional quality*" as a set of rules and regulations by government to govern an economy, check the power of public office holders, provides enabling environment for businesses to strive and ensure that the achieved goals of every individual or group do not infringe on the rights and opportunities of others. Several indices have been constructed to measure institutional quality for countries at large. This study employs the Worldwide Governance Indicators (WGI) constructed by Daniel Kaufman and Aart Kraay which is also available on the website of World Bank. Examples of other international organizations that provided indices for countries' institutional quality are International Political Risk Services Group (IPRSG), International Country Risk Guide (ICRG), etc. The study chooses the institutional data computed by the World Bank because it reflects on the governance views and perspectives of the public, private, and non-governmental organization (NGO) sector experts worldwide[14]. The WGI indicators constitute six dimensions of governance developed for over 200 countries and territories spanning from 1996 to 2021. The indicators contain all the essential elements of a good institutional quality. They are based on the perception of various informed stakeholders from thirty-five different sources such as surveys from individuals, domestic firms, business experts and commercial business personnel etc. The WGI data were provided by thirty-three organizations, international organizations (such as the African Development Bank, Asian Development Bank, European Bank for Reconstruction, and development) and information providers of private businesses (like Political Risk services and Economist Intelligent Unit)[14]. The indices are constructed by the World Bank yearly to keep track of improvements or deterioration in institutional settings over time. The four institutional variables picked from the six key dimensions of institutional quality provided by the World Bank are[7]:

Government Effectiveness: It captures the quality of public services and the degree of its independence from political pressures, thus fostering a benign context for private investment.

Regulatory Quality: The ability of the government to formulate and implement sound policies and regulations that permits and promotes private sector development, thus laying down uniform rules of economic engagement; and

Control of Corruption: This is the control of bureaucratic power used to convert public resources for private gain which tends to hinder the progress of an economy.

Rule of Law: It denotes the principle that all individuals and institutions, including the government, are subject to and accountable to law that is fairly applied and enforced, ensuring justice, and protecting fundamental rights.

Combining the three indices of institutional quality, the study will construct a composite index using the principal component analysis (PCA).

2.1.3 Agricultural Performance

Agricultural performance can be defined as the achievements of the agriculture sector which includes outputs, land, fertility, technology, labor productivity and exports. It measures the overall achievement of a country's agriculture industry and indicates the deviation from the preferred level of performance. Agricultural performance has to do with everything that has to do with the general accomplishment of the agriculture sector i.e., outputs, employment, and exports. The ECOWAS area, formed on May 28, 1975, transitioned into a Customs Union on January 1, 2015, with the implementation of the Common External Tariff (CET). In terms of agricultural trade strategy, West African Heads of State and governments finally embraced the ECOWAS Agricultural strategy (ECOWAP) in January 2005, after a prolonged period of neglect (ECOWAS, 2016). ECOWAP supersedes the agricultural policy of the West African Economic and Monetary Union (WAEMU), which was established in December 2001 and referred to as Politique Agricole de l'UEMOA (PAU). The 2008 global food crisis reemphasized the importance of the Regional Agricultural Policy on the region's agenda and significantly accelerated the implementation of ECOWAP through the National Agricultural Investment Plans (NAIPs) and the Regional Agricultural Investment Plan (RAIP). These programmes facilitated the reversal of some historical patterns and enabled the attainment of preliminary conclusions at the institutional level, particularly regarding the influence on Agriculture and food security in West Africa[17].

In addition, on a continental scale, the African Union (AU) established the Comprehensive African Agriculture Development Programme (CAADP) in 2003 in Maputo and reaffirmed its commitment in Malabo in 2014[17]. The New Partnership for Africa's Development (NEPAD), which was founded by the African Union (AU), prioritizes the Economic Community of West African States Agricultural Policy (ECOWAP) as a key component of its continental agenda. From this standpoint, a key goal of the transformation agenda is to convert rural African areas into thriving centres for the cultivation and processing of food, tuber, and forage crops by improving agricultural productivity and facilitating access to both domestic and international markets. The new guidelines of ECOWAP 2025 align with the commitments made at Malabo, 2014 Malabo Declaration, and the Sustainable Development Goals (SDGs). These guidelines consider the following factors: a volatile global food market, a significant surge in demand, increased regional trade, and concerns regarding terrorism and insecurity[18].

Agricultural Output Growth

Agricultural output growth is the persistent increase in the production of foods, feeds, fiber, and other goods through the systematic growing and harvesting of plants and animals. It is the constant improvement in the making use of land to raise plants and animals[19]. This also refers to the sustained increase in the quantity and quality of agricultural products over a specific period. The agriculture output growth is crucial for ensuring food security, alleviating poverty, and supporting overall economic development, especially in agrarian economies. Thus, it involves improvements in crop yields, livestock productivity, and other agricultural outputs, often driven by advancements in technology, efficient farming practices, and favorable policy environments.

According to the Food and Agriculture Organization, underdeveloped countries hope to move from the condition of stagnation to one of self-sustained growth if the agricultural sector is developed so that, surplus labour force is absorbed by new industries[20]. A scholar also viewed agriculture as a means of reducing dependence on certain importations, curtailing food price increases, earning foreign exchange, absorbing many new entrances to labour market, and increasing farmer's income[21]. For many other developing countries, agriculture remains the gate way to several desired ends which includes poverty reduction, rural transformation, employment generation, food security and improved national health profile of the citizenry[22].

Several factors contribute to agricultural output growth. Technological innovations, such as improved seed varieties, irrigation systems, and mechanization, play a vital role in enhancing productivity. Access to credit, education, and extension services for farmers also facilitates the adoption of modern and efficient farming methods. Additionally, supportive government policies, infrastructure development, and market access contribute to the overall growth of the agricultural sector. Sustainable agricultural output growth is not only essential for meeting the increasing demands of a growing population but also for promoting economic stability and reducing dependence on imported food items. Some of the key demographic trends affecting the West Africa's agriculture output growth are as follows[23]:

a) There has been rapid population growth in West Africa. Its yearly growth rate has been 2.7% throughout the past 30 years, more than doubling. The fastest-growing populations tend to be in the world's poorest nations. A decline in birth rates is a demographic transition that only a small number of countries have begun. As a result, the 300 million-strong regional population is projected to soar to 388 million in 2020 and 490 million in 2030.
b) Nearly half of West Africans are under the age of fifteen. Therefore, in the next ten years, 80 million children and teenagers will join the workforce.
c) Urbanization is developing throughout West Africa. Nearly half of the population lived in urban settlements in 2013, up from 33% in 1990, making it the most urbanized region in sub-Saharan Africa. There are two noticeable tendencies in urbanization: first, the predominance of national metropolitan areas (home to 40% of the urban population) over

secondary cities and towns and their fast expansion; and second, the spread of small towns along rural areas' lower urbanization boundaries, near big cities and important transportation corridors.

d) Rapid urbanization, rising populations, and uneven economic possibilities in the area all contribute to strong migratory flows both within and across countries. Many people have moved from the rural to the urban, from the Sahelian to the Sudano-Guinean zones, and from the poorer inland countries to the wealthier coastal states. These migrations are examples of intraregional migration.

e) The rural population is still growing, even as people are moving out of the area. On top of that, there is a high density of people living in rural areas; 51% of rural residents occupy 10% of rural land, while 16% occupy 1% of rural space. Consequently, land fragmentation and demand for natural resources are both exacerbated by rural population growth. This is particularly true in highly productive, densely populated areas that have excellent access to markets. The conversion of forest or rangelands into arable land causes rising environmental costs and tensions in West Africa, where there is a scarcity of underutilized land.

Agricultural Employment

Agricultural employment refers to the involvement of individuals in activities related to the cultivation of crops, raising livestock, forestry, and other agricultural practices. It encompasses a broad range of tasks within the agricultural sector, including planting and harvesting crops, tending to animals, managing farms, operating machinery, and engaging in agribusiness activities. Agriculture employment is a key component of the rural economy and plays a crucial role in providing livelihoods for a significant portion of the global population, especially in developing countries. In the context of labor statistics and economic analysis, agriculture employment is often measured as the number of individuals actively working in agriculture, either as self-employed farmers, hired laborers, or engaged in related agricultural enterprises.

Agricultural employment is defined as the total number of working age persons who were engaged in the agricultural activity to produce goods or provide services for pay or profit, whether at work during the reference period or not at work due to temporary absence from a job, or to working-time arrangement. The agriculture sector consists of activities in agriculture, hunting, forestry, and fishing. Until 2000, agriculture was the mainstay of employment around the world. Since then, the services sector has assumed this mantle and the gap between the two has widened. Although employment growth in agriculture has slowed, the number of workers in this sector reached over one billion, representing 1 in 3 of all workers[24].

The agricultural sector has some special characteristics that make it more difficult, compared to other sectors, to know precisely how many people it employs. Firstly, in many countries, agriculture is still dominated by family farms, where family members provide labour input at different times of the year. Secondly, many farmers and farm workers pursue agriculture as a part-time activity and have other important sources of income. Thirdly, agriculture is characterized by seasonal labour peaks, where large numbers of workers may be hired for relatively short periods[25].

Furthermore, with 1.3 billion people employed in the sector, agriculture is the second greatest source of employment worldwide after services and it accounts for 28% of global employment[24]. As countries develop, the share of the population working in agriculture is declining[25]. While more than two-third of the population in poor countries work in agriculture, less than 5% of the population does in rich countries[24]. Productivity gains make it possible to reduce the agricultural land needed to feed a given number of people. It is predominantly the huge productivity increase that makes this reduction in labor possible.

Agricultural Exports

Agriculture exports refer to the international trade of goods produced within the agricultural sector of a country, including but not limited to crops, livestock, and related products. These exports contribute significantly to a nation's economy by generating income, creating employment, and fostering economic growth. Agriculture exports encompass a wide range of commodities, such as grains, fruits, vegetables, meat, dairy products, and processed foods, which are produced for sale and consumption in foreign markets. Agricultural export refers to the crop grown locally in a country but sold to a buyer in another country. An agricultural export crop simply means a crop that is currently grown in a country like Nigeria but has export potentials, according to National Bureau of Statistics in 2020. Agricultural exports are goods and services produced domestically but purchased by foreigners. This form of export is one of the oldest forms of economic transfer and occurs on a large scale between nations. With a diverse range of climatic conditions and fertile lands, the region has the potential to produce a wide variety of agricultural products such as cocoa, coffee, palm oil, cashew nuts, cotton, fruits, and vegetables etc.

Cocoa: It is one of the most important agricultural exports in the ECOWAS region. Countries such as Cote d'Ivoire, Ghana, and Nigeria are major producers and exporters of cocoa beans. These beans are used to produce cocoa powder, cocoa butter, and chocolate, which are in high demand globally. The region's favorable climate and fertile soil make it an ideal location for cocoa cultivation. Cote d'Ivoire alone accounts for a significant share of global cocoa production.

Coffee: This is another significant agricultural export in ECOWAS. Countries like Cote d'Ivoire, Togo, and Liberia are known for their coffee production. The region produces both Robusta and Arabica coffee, with Robusta being more prevalent. Coffee exports contribute to foreign exchange earnings and provide employment opportunities for many smallholder farmers.

Palm Oil: It is a widely exported agricultural product in ECOWAS. Nigeria, Ghana, and Cote d'Ivoire are the major palm oil producers in the region. Palm oil is used in various industries, including food processing, cosmetics, and biodiesel production. The region's tropical climate and vast areas of suitable land make it a prime location for palm oil cultivation.

Cashew Nuts: Cashew nuts are an important cash crop in ECOWAS. Countries like Nigeria, Cote d'Ivoire, and Benin are major producers and exporters of cashew nuts. The region's favorable climate and suitable soil conditions make it a suitable location for cashew cultivation. Cashew nuts are in high demand globally, both as a snack and for use in the food processing industry.

Cotton: It is a significant agricultural export in several ECOWAS countries, including Mali, Burkina Faso, and Benin. These countries have favorable climatic conditions for cotton cultivation, and cotton exports contribute significantly to their economies. Cotton is used in the textile industry to produce fabrics, garments, and other textile products.

Fruits and Vegetables: ECOWAS countries also export a variety of fruits and vegetables. Products such as bananas, pineapples, mangoes, tomatoes, and peppers are exported to regional and international markets. These exports contribute to food security, income generation, and employment opportunities for farmers and traders.

In the ECOWAS region, agricultural exports have increased from 315,841.1 thousand US dollars in the 1996–2000 fiscal year to 1,201,912.2 thousand US dollars in the 2016–2018 fiscal year[17].

It is possible to explain the increase in agricultural exports by referring to the institutional and investment climate policies that the nations that make up ECOWAS have enacted. When examining the analysis of individual countries, it is evident that certain countries (Cote d'Ivoire, Ghana, Guinea Bissau, Nigeria, Senegal, Sierra Leone) experienced significant growth in agricultural exports, as measured by the export value of agricultural products in thousands of US dollars. However, agricultural exports in other countries (Benin, Burkina Faso, Cabo Verde, The Gambia, Mali, Niger, Togo) showed fluctuations[17]. ECOWAS countries primarily export their agricultural products to other African countries, Europe, and the United States[18]. Regional trade within ECOWAS is significant, with neighboring countries being major importers of agricultural products. Europe is a major market for cocoa, coffee, and fruits from the region. The United States is also an important market for agricultural exports, particularly for cashew nuts and cocoa products.

Challenges and Opportunities

Despite the potential for agricultural exports, ECOWAS faces several challenges in this sector. Inadequate infrastructure, including transportation and storage facilities, hinders the efficient movement of agricultural products. Limited access to finance and credit facilities restricts investment in modern farming techniques and value addition. Inconsistent policies and regulations across member states create barriers to trade, hindering the growth of agricultural exports.

ECOWAS countries have significant opportunities to enhance their agricultural exports. Investing in infrastructure development, such as roads, ports, and cold storage facilities, can improve the efficiency of agricultural value chains. Promoting regional integration and harmonizing trade policies can facilitate intra-regional trade and attract foreign investment.

Additionally, investing in research and development to improve farming techniques, increase productivity, and promote value addition can enhance the competitiveness of agricultural exports.

2.2 Review of Theoretical Literature

2.2.1 Theories Linking Institutions and Investment Climate

2.2.1.1 Institutional Theory of Investment

The institutional theory of investment was developed by Thorstein Veblen, an American economist and sociologist. Veblen proposed this theory in his seminal work "The Theory of the Leisure Class" in 1899 and further elaborated on it in "The Theory of Business Enterprise" in 1904. He argued that investment decisions are influenced not only by economic factors but also by social and institutional factors, such as social norms, cultural values, and institutional structures. According to Veblen, these non-economic factors play a significant role in shaping patterns of investment and economic behaviour[26].The institutional theory of investment is a perspective within the broader field of institutional economics, centering on the profound influence of institutions on investment behavior and outcomes. At its core, this theory contends that institutions, encompassing legal frameworks, regulatory bodies, and social norms, play a pivotal role in shaping the decisions of investors[26]. These institutions provide both formal and informal rules that structure economic activities, thereby influencing the incentives and constraints faced by individuals and organizations engaged in investment activities[27].

Furthermore, the theory emphasizes the importance of institutional stability and predictability. Investors seek environments where institutions remain stable over time, providing a level of predictability that enables effective planning and execution of long-term investment strategies[28]. Cultural and social norms are also recognized as influential factors in investment behavior, with trust and social capital embedded in cultural norms impacting the willingness of investors to engage in transactions and business relationships. The Institutional Theory of

Investment also delves into the dynamics of institutional change, acknowledging that institutions evolve over time in response to changing economic, social, and political conditions[29].

From a policy perspective, the institutional theory of investment suggests that policymakers should focus on creating and maintaining institutions that provide a conducive environment for investment[30,31]. This entails efforts to strengthen legal frameworks, reduce regulatory burdens, and foster a stable and predictable institutional environment. However, critics note the complexity of institutional dynamics and the challenges associated with isolating the impact of specific institutional factors. Additionally, the theory may not fully capture informal institutions or the intricate interactions between different institutional components. In conclusion, the Institutional Theory of Investment offers a valuable framework for understanding how institutions shape investment decisions and outcomes, emphasizing the importance of a supportive institutional environment for economic development, and attracting investments.

2.2.1.2 Political Economy of Investment Theory

The political economy of investment theory delves into the intricate relationship between political structures, power dynamics, and investment decisions within a society. At its core, this theory posits that the political environment significantly influences economic activities, with a particular emphasis on the impact on investment behavior and outcomes. A fundamental aspect of this theory revolves around the examination of power structures within a society. The distribution of political power, including the influence of political elites and interest groups, plays a pivotal role in shaping policies and regulations that, in turn, affect the overall investment climate. The theory contends that decisions related to investment are not solely based on economic considerations but are also shaped by political actors seeking to advance their interests through policy mechanisms[32].

Governance quality is identified as a crucial factor in the Political Economy of Investment theory. Effective governance, characterized by features such as the rule of law, transparency, and accountability, is seen as essential for creating an environment that is conducive to investment[33]. Conversely, weak governance can lead to uncertainties and inefficiencies, acting as a deterrent to potential investors. Political stability emerges as a key determinant in investment dynamics. Investors are generally more inclined to engage in long-term and substantial investments in politically stable environments[34]. Additionally, the theory emphasizes the significance of policy consistency and predictability. Abrupt policy changes can introduce uncertainties, causing hesitation among investors and negatively impacting the overall investment climate.

The concept of rent-seeking behavior is another dimension addressed by the theory. This behavior refers to the pursuit of economic benefits through political influence rather than through productive activities. In the context of investment, rent-seeking activities can distort incentives and lead to the suboptimal allocation of resources, potentially hindering economic growth. Furthermore, the political economy of investment theory suggests that successful institutional reforms, particularly those addressing issues like corruption, inefficient bureaucracies, and regulatory obstacles, are often contingent on political factors. Implementing reforms may require political will and strategic alliances to overcome resistance from vested interests that may oppose changes that threaten their economic advantages[35].

2.2.1.3 Property Rights Theory

The property rights theory constitutes a cornerstone in economic thought, examining the intricate link between well-defined property rights and economic development. At its essence, property rights refer to the legal entitlements individuals or entities possess over a particular resource or asset. The clarity and enforceability of these rights play a pivotal role in shaping economic incentives, investment decisions, and overall resource allocation within a society[35].One of the central tenets of the property rights theory is its assertion that secure property rights are a linchpin for encouraging investment. Investors are more likely to allocate resources when they have confidence that the fruits of their endeavors will be protected and that they can exercise control over, benefit from, and potentially transfer their assets without undue interference[37].

Moreover, well-defined property rights act as a bulwark against encroachment and unauthorized use of resources. This assurance is vital in fostering a conducive environment for investment, as individuals and businesses are more inclined to engage in economic activities when they have confidence in the protection of their property rights. Crucially, secure property rights contribute to the encouragement of long-term investment. The theory contends that when property owners are assured of their rights and can anticipate a stable environment over an extended period, they are more likely to engage in activities that promote economic development, such as infrastructure development, technological innovation, and sustainable resource management[38].

Property rights can take various forms, including private property rights, common property rights, and state property rights. The theory emphasizes the superiority of private property rights, positing that they provide the strongest incentives for responsible resource management and investment[39]. It underscores that clear ownership fosters a sense of responsibility and accountability among property owners. The interplay between property rights and economic institutions is a crucial facet of the theory. It suggests that the quality of economic institutions, such as legal systems and enforcement mechanisms, is paramount for the effective protection of property rights. Strong and reliable institutions are necessary to ensure that property rights are not only established on paper but are also upheld and enforced in practice.

Nations with secure property rights are generally expected to experience higher levels of investment, entrepreneurship, and overall economic growth[40]. The property rights theory provides a robust framework for understanding the foundational role of secure property rights in fostering economic development. It underscores the importance of creating legal frameworks that ensure the security and enforceability of property rights, as these factors act as catalysts for investment, entrepreneurship, and sustained economic growth.

2.2.2 Theories Linking Investment Climate and Agriculture Performance

2.2.2.1 The Resource-Based View

The resource-based view (RBV) is a strategic management theory that emerged in response to the limitations of traditional industrial organization economics, particularly Porter's five forces framework. Originating in the 1980s and 1990s, RBV provides a comprehensive framework for understanding how a firm's unique resources and capabilities contribute to its competitive advantage and, consequently, its performance[41]. In the context of agriculture, RBV offers valuable insights into how a farm or agribusiness can leverage its distinct resources to enhance agricultural performance. Resources within agriculture can encompass a wide range of assets, including physical resources like land and machinery, human capital such as skilled labor, knowledge and expertise in sustainable farming practices, and relationships with suppliers and distributors.

The core concepts of RBV (resources and capabilities) hold relevance in the agricultural sector[42]. For instance, a farm with advanced irrigation technology or a specialized knowledge of soil management may possess resources that contribute to increased agricultural productivity. These resources, when effectively combined and managed, become capabilities that distinguish the farm from others in terms of efficiency and output quality.

In assessing the strategic potential of resources within agriculture, the VRIN criteria (Valuable, Rare, Inimitable, and Non-substitutable) provide a useful framework. Valuable resources in agriculture could include innovative crop management techniques or access to premium markets. Rarity might involve possessing unique, locally adapted seed varieties. Inimitability could stem from exclusive contracts with suppliers or proprietary knowledge, while non-substitutability might be represented by a particularly fertile piece of land that cannot be easily replicated.

The application of RBV to agricultural strategy suggests that farms should focus on identifying and optimizing their unique resources and capabilities to create value for consumers and achieve a sustainable competitive advantage[43]. This perspective aligns with the broader goal of improving agricultural performance, not only in terms of increased yields but also in terms of economic viability and environmental sustainability[44].

RBV has also evolved to incorporate the concept of dynamic capabilities, recognizing that the agricultural sector, like other industries, faces changing external conditions. For agriculture, this could involve adapting to shifts in climate patterns, adopting new technologies, or responding to evolving consumer preferences. While RBV provides valuable insights into internal sources of competitive advantage, it is important to acknowledge its limitations. Critics argue that RBV does not provide clear guidance on how firms, including those in agriculture, can develop or acquire valuable resources. Additionally, the theory has been criticized for its inward focus, sometimes neglecting the role of industry structure and the external environment.

2.2.2.2 Supply Chain Management Theory

The origins of supply chain management (SCM) theory can be traced to the late 20th century, evolving in response to the challenges posed by globalization, technological advancements, and heightened competition. It represents a departure from traditional, siloed approaches to operations, emphasizing the need for a holistic view that considers the coordination and integration of various elements within a supply chain[45].

A foundational principle of SCM is the concept of end-to-end integration. This involves seamless collaboration across the entire supply chain, from raw material suppliers to end consumers. The goal is to optimize processes, reduce costs, and enhance overall supply chain performance. Another critical aspect is the efficient flow of information, emphasizing the importance of timely and accurate data sharing to improve decision-making and increase visibility throughout the supply chain. Additionally, effective inventory management is a cornerstone of SCM, balancing optimal stock levels with minimizing holding costs[46].

SCM theory acknowledges the Bullwhip effect, a phenomenon where small fluctuations in consumer demand can lead to amplified fluctuations upstream in the supply chain. Strategies to mitigate this effect involve improving communication, enhancing forecasting accuracy, and implementing effective inventory management practices. To balance efficiency and responsiveness, SCM theory distinguishes between lean and agile supply chains. Lean supply chains prioritize minimizing waste and optimizing processes, while agile supply chains focus on flexibility and responsiveness to changes in demand or supply. The choice between lean and agile strategies depends on the specific characteristics of the product and market[45].

Coordination mechanisms, such as collaborative planning, forecasting, and replenishment (CPFR) and vendor-managed inventory (VMI), play a crucial role in SCM theory. These mechanisms facilitate effective collaboration among supply chain partners, ensuring synchronization and efficiency. As environmental and social considerations gain prominence, SCM theory expands to include the concept of sustainable supply chain management. This involves integrating environmentally and socially responsible practices into supply chain operations, such as green sourcing, ethical labor practices, and reducing carbon footprints[46]. Advancements in technology significantly influence modernizing supply chain practices. SCM theory explores the impact of digitalization, automation, and data analytics on supply chain efficiency and responsiveness. Technologies like the Internet of Things (IoT), blockchain, and artificial intelligence contribute to the evolution of SCM in the digital age. When extending SCM theory to the agricultural sector, the principles of end-to-end integration, information flow, and effective inventory management become crucial in optimizing the agricultural supply chain. Coordinating activities from farm to market, implementing sustainable practices, and leveraging technology can enhance the efficiency and performance of the agricultural supply chain. For instance, technologies like precision agriculture and data analytics can improve farm management practices, while sustainable sourcing and ethical considerations contribute to a more responsible and resilient agricultural supply chain.

2.2.2.3 Agribusiness Value Chain Theory

The Agribusiness Value Chain Theory provides a comprehensive and integrated perspective on the entire agricultural and food production system, extending beyond traditional agricultural models by recognizing the interconnectivity of various stages involved in bringing agricultural products from the farm to the consumer[47]. At its core, this theory acknowledges that agriculture is not confined to the field but involves a network of activities, starting with input suppliers such as seed and equipment providers, extending through producers and processors, and culminating in distributors and retailers. Each component within this value chain contributes to the creation and delivery of agricultural products, with value continually added at each stage.

A fundamental concept within the Agribusiness Value Chain Theory is the notion of value addition. This emphasizes the importance of enhancing the quality of agricultural products and optimizing processes at every step. Whether through improvements in farming techniques, efficient processing methods, or strategic marketing, the theory underscores the need for continual enhancement to meet evolving consumer demands and preferences[48].

Vertical integration, another key aspect, allows agribusinesses to participate in multiple stages of the value chain. Companies that own both farms and processing facilities, for example, engage in vertical integration. This strategy provides opportunities for synergies, cost efficiencies, and greater control over the quality and consistency of the final agricultural product. Market access and the role of institutions are crucial considerations within this theory. Institutions, including regulatory bodies and industry associations, play a vital role in shaping the rules and norms governing interactions within the value chain[48]. The theory recognizes the impact of institutions on market access, influencing the functioning of agribusiness value chains.

Furthermore, technology and innovation are seen as critical drivers of success within the agribusiness value chain theory. Advancements in precision agriculture, genetic engineering, and information technology have the potential to improve efficiency, reduce costs, and enhance the overall quality and sustainability of agricultural products. In addressing sustainability and social responsibility, the theory acknowledges the increasing importance of environmentally friendly practices, ethical sourcing, and social responsibility within the agribusiness sector. As consumers and stakeholders demand transparency and sustainability, agribusinesses are compelled to align their practices with these expectations.

2.2.3 Growth Theories

2.2.3.1 Solow Growth Theory

The Solow growth theory, conceived by Robert Solow in the 1950s, holds a pivotal place in economic theory, providing a foundational framework to understand the determinants of sustained economic growth. This model, while simplifying the intricate dynamics of economic systems, accentuates the roles of capital, labor, and technology in the production process[49]. Its applicability to the investment climate and agricultural performance is particularly noteworthy.

At its essence, the model, expressed through the production function $Y = \text{f}\,(K, L, A)$, underscores the significance of capital accumulation for economic growth. This is especially relevant in the agricultural sector, where investments in physical capital, such as advanced machinery and irrigation systems, can significantly boost productivity. The Solow model's acknowledgment of diminishing marginal returns to capital reflects the practical reality that continuous growth is contingent on innovative and efficient use of resources[50].

In the context of the investment climate, the Solow growth model illuminates the critical role of sustained investment in both physical and human capistal. Policies that encourage agricultural investments, infrastructure development, and technology adoption align with the model's predictions of fostering long-term economic growth. Moreover, understanding the model's concept of convergence can guide policymakers in addressing disparities within the investment climate, ensuring that regions with lower initial capital levels experience faster growth rates[51].

The steady-state equilibrium predicted by the Solow model aligns with considerations of agricultural performance over time. In regions where investments are consistent and balanced, agricultural outputs can stabilize at a level that maximizes efficiency. However, this equilibrium is contingent on prudent policies that manage the delicate interplay between capital accumulation, technological progress, and population growth.

Technological progress, a key factor in the Solow Model, plays a transformative role in agriculture. Investments in research and development, coupled with the adoption of cutting-edge technologies, can lead to significant improvements in agricultural performance[52]. Precision farming, genetic innovations, and digital agriculture are examples of technological advancements that align with the model's emphasis on the role of technology in sustaining economic growth.

Population growth, integrated into the Solow Model, finds relevance in discussions of agricultural performance. While a growing labor force can contribute positively to agriculture, the model suggests that its benefits are contingent on parallel increases in capital to maintain a favorable capital-to-worker ratio. Thus, policies promoting investments in both agricultural infrastructure and education become crucial in optimizing the positive contributions of population growth to agricultural output.

2.2.3.2 Endogenous Growth Theory

The Endogenous growth theory represents a transformative evolution in economic theory, departing from the assumptions of the Solow growth theory by emphasizing the significance of internal, endogenous factors in driving sustained economic growth[53]. Developed in the late 20th century by economists like Paul Romer and Robert Lucas, this framework is particularly relevant when examining the complex interplay between the investment climate, agricultural performance, and long-term economic development.

At the heart of the endogenous growth theory is the recognition of human capital as a primary driver of growth[54]. Unlike the Solow theory, which treated labor as a homogeneous factor, the endogenous growth perspective acknowledges that investments in education and skills contribute to enhanced productivity. In the realm of agriculture, fostering a skilled and innovative workforce through targeted investments in agricultural education and training programs becomes crucial. Such investments not only elevate the capabilities of the workforce but also have the potential to spur technological innovations in farming practices.

A distinctive feature of the endogenous growth perspective is its focus on knowledge creation and technological progress as endogenous elements[55]. In contrast to the Solow Model, which considered technological progress as exogenous, the endogenous growth framework suggests that policies and investments in research and development can drive continuous technological advancements. This has direct implications for the agricultural sector, where proactive efforts to promote innovation, sustainable practices, and knowledge dissemination can significantly impact agricultural performance.

The concept of increasing returns to scale, central to the endogenous growth model, introduces a dynamic element. In agriculture, this implies that investments in knowledge and technology can lead to self-reinforcing growth. As more data, technology, and knowledge are applied, the potential for increased efficiency and productivity in farming practices expands. This insight underscores the importance of policies that encourage continuous learning, technology adoption, and innovation within the agricultural sector.

Population growth, when considered within the framework of the endogenous growth model, becomes an asset rather than a hindrance if accompanied by strategic investments. In the agricultural context, policies that support sustainable population growth, while simultaneously investing in education and technological advancements, lead to a more skilled and productive agricultural workforce, positively impacting agricultural performance.

Furthermore, the endogenous growth model underscores the role of institutions and policies in creating an environment conducive to innovation and growth. Policies that promote entrepreneurship, protect intellectual property rights, and foster competitive market structures are seen as essential for endogenous growth[56]. In the agricultural domain, this might involve policies incentivizing sustainable farming practices, allocating funds for agricultural research, and ensuring fair access to markets, particularly for small-scale farmers.

2.2.2.3 Schumpeterian Growth Theory

The Schumpeterian growth theory, pioneered by Joseph Schumpeter, injects dynamism into the study of economic growth by emphasizing the transformative power of innovation, entrepreneurship, and creative destruction. This theory represents a departure from traditional growth models, like the Solow growth theory, by attributing economic progress to the continuous process of introducing new ideas, technologies, and products. In the context of examining the investment climate and agricultural performance, the Schumpeterian growth theory offers unique insights into how innovation shapes long-term economic development[57].

Entrepreneurship and innovation are the cornerstones of the Schumpeterian growth theory. In agriculture, entrepreneurs play a pivotal role in driving transformative changes. This could manifest through the introduction of cutting-edge farming technologies, the development of sustainable agricultural practices, or the creation of novel products that enhance productivity and efficiency[58]. Policies that support and incentivize entrepreneurial ventures within the agricultural sector contribute to fostering an environment conducive to innovation.

Creative destruction, a central concept in the Schumpeterian framework, highlights the continual process of obsolescence and renewal that accompanies innovation. In agriculture, this could involve the phased-out use of traditional farming methods in favor of more resource-efficient and environmentally sustainable approaches. Understanding and navigating this process becomes critical for policymakers shaping the investment climate, as it necessitates a balance between facilitating innovation and managing the potential disruptions it can cause[59].

Technological progress, viewed as endogenous in the Schumpeterian growth theory, becomes a key driver of economic growth. Policies that encourage research and development in agriculture, protect intellectual property rights, and create an environment conducive to innovation contribute to technological advancements. The investment climate is thus shaped by policies that recognize and incentivize the importance of technological progress within the agricultural sector[60].

Dynamic competition, as outlined by Schumpeter, centers on firms' continuous pursuit of innovation to gain a competitive edge. In agriculture, this could translate into companies developing genetically modified crops, precision agriculture technologies, or sustainable farming practices that enhance productivity[61]. Policies fostering a competitive marketplace in agriculture can stimulate this dynamic competition, driving innovation and improving agricultural performance.

The concept of learning by doing underscores the importance of accumulated knowledge and experience through the process of innovation. In agriculture, this might involve farmers gaining expertise in implementing advanced technologies or refining sustainable practices over time. Policies supporting ongoing education and training for agricultural practitioners contribute to this process, enhancing overall agricultural performance.

Institutions and the policy environment play a critical role in the effectiveness of the Schumpeterian Growth process. Policies that cultivate a culture of entrepreneurship, provide incentives for research and development, and ensure a competitive marketplace within the agricultural sector can facilitate dynamic innovation[61]. Crafting a supportive policy environment contributes to a favorable investment climate, encouraging both established entities and new entrants to engage in innovative practices that enhance agricultural performance.

2.3 Review of Empirical Studies

2.3.1 Institutions and Investment Climate

This study reviews the intricate connections between institutional quality and the investment climate, with implications for economic growth and various factors influencing investment decisions at both regional and global levels. In addition, this study examines the relationship between private investment choices and different governance institutions, including corruption, judiciary system, property rights security, political stability, regulations and taxation, bureaucracy quality, as well as civil liberties and political rights[62]. An empirical estimation is conducted to analyze the link between private investment and governance institutions in a panel of 32 nations. A simultaneous model is used, where economic policy and other variables are considered to explain both variables concurrently. The study demonstrates that economic reforms, including financial development and trade openness, as well as human capital, have a dual effect on private investment decisions. They directly influence these decisions and indirectly enhance them by improving the quality of governance institutions. The research reveals that inadequate governance, political volatility, and limited public oversight were major factors that greatly influence the limited investment choices during the 1980s and 1990s in the MENA region.

A researcher critically examines the problems, difficulties, and potentials of implementing changes to improve the investment environment in the largest economy in ECOWAS, with the aim of generating accelerated economic growth[6]. More precisely, it examines matters relating to the management of organizations, physical structures, personnel, global cooperation, availability of funds, economic factors, and gender-related concerns. The obstacles to investment climate improvements in Nigeria encompass curbing rent-seeking behaviour, creating credibility, promoting public trust and legitimacy, addressing human resource difficulties, improving infrastructure, addressing the limitations of the financial markets, and reducing the heavy dependency on oil money. The article asserts that an optimal investment environment is crucial for fostering economic growth and alleviating poverty. Nevertheless, it is important to note that no country possesses an impeccable investment climate, and achieving perfection is not a necessity for capitalizing on the advantages of a favourable investment climate.

Two scholars discover that weak corruption control had a detrimental impact on investment levels in the Middle East and North Africa region between 2000 and 2009[9]. Similarly, a study discovers a negative correlation between corruption and investment in 67 nations from 1960 to 1985[8]. Their findings emphasize the notion that corruption is a detrimental force that impacts the investment climate, business prospects, government operations, public opinion, civil society, and the private sector. Their study analyses the primary factors influencing capital flows in 34 emerging and developing nations following the global financial crisis during the period of 2009: Q3-2015: Q4[63]. The study also utilizes a panel methodology to establish that comprehensive measures of institutional quality and financial development are the primary factors influencing both net and gross capital flows. Nevertheless, this study specifically tries to concentrate on both the high and low occurrences of capital flows and utilizes only a single combined metric of financial development.

This study investigates the factors that influence investment and productivity by utilizing the 2014 World Bank Enterprise Survey, which constituted the small, medium, and large enterprises in Nigeria[64]. The study examines five primary aspects, namely: the educational background of the workforce, availability of infrastructure, accessibility to financial resources, the scale of enterprises, and other characteristics related to the business environment. The survey encompasses 2,676 firms. Additional factors that influence the business climate include instability, bribery or corruption, the duration of time enterprises allocate to navigating government regulations, and inadequate electricity supply, among others. The findings indicates that the primary hindrances for business owners in Nigeria were access to money (33.1%), access to energy (27.2%), and the level of corruption (12.7%).

Two notable scholars conduct a comprehensive analysis of the obstacles faced in conducting business in Africa[65]. They explore the relationship between the ease of doing business and economic progress, while also exploring the specific issues encountered in the African business environment. The correlation between the facilitation of business activities and economic progress was examine through six key factors: generation and distribution of wealth, job opportunities, equitable regional and economic growth, Gross Domestic Product (GDP) and GDP per capita, living standards, and exports. Meanwhile, the obstacles to conducting business are expressed through the following four dimensions: concerns pertaining to the expenses associated with initiating and operating a firm, scarcity of energy and electricity, limited availability of financial resources, and elevated taxes and restricted international trade.

Three notable scholars investigate the links between finance, governance, and private investment in 53 African countries for the period 1996-2010[10]. They decompose the property rights institutions into political (voice and accountability and political stability), economic (government effectiveness and regulation quality), and institutional (corruption-control and rule of law) components. They also investigate the comparative concurrent links of financial dynamics of depth, efficiency, activity, and size. They discover that governance dynamics and private investment are positively and significantly related, but the nexus of financial depth, efficiency, size, and activity are not statistically confirmed. The study argued that the interaction of finance and governance is not significant in potentially promoting private investment, perhaps due to substantially documented surplus liquidity issues in African financial institutions.

A study presents empirical evidence from multiple countries to examine the influence of political, institutional, and financial factors on the patterns and changes in gross capital flows between 2000 and 2016[66]. The scholar utilizes panel regressions and dynamic panel GMM with country fixed effects to assert that the "Lucas Paradox" can be primarily attributed to institutional quality rather than the impact of declining returns of capital. The study confirms earlier empirical data indicating government effectiveness, regulatory quality, rule of law, and political stability are the key institutional indicators that determine the dynamics of gross capital flows. It emphasizes the balanced impact of these factors. However, it is important to note that gross capital outflows patterns are not significantly influenced by factors such as voice and accountability, as well as corruption. Their findings additionally demonstrates that a highly developed financial sector has a greater propensity to attract foreign investments and exerts an influence on overall capital outflows, albeit not on private capital outflows. The findings further emphasize the importance of financial institutions in the distribution of total capital flows. They contend that the degree to which the financial sector needs enhancement in each country is contingent upon country-specific circumstances, with the changes posing the greatest difficulties for low-income economies.

A study conducts a thorough examination of the key technological elements that influence the investment environments in Belarus and Poland[67]. According to their examination of the global innovation index, Poland outperforms Belarus in terms of innovative development, as measured by the main components of the index: innovation input and innovation output sub-indexes. The study equally identifies several key technological factors that significantly impact investment decisions. These factors include Global Innovation Rankings, funding for research and development, the extent to which advanced technology is being adopted, the digitalization of the economy, the development of e-services, and the effectiveness of technology transfer mechanisms. It has been found that the promising trends in the global innovation index, the rise in financing for research and development, the increasing inventive activity of businesses, the advancement of e-services, and the higher level of digitalization in economies all have a positive impact on investment climates. However, the disparity between the sub-indexes for innovation input and output, the limited proportion of R&D spending in GDP, and the inadequate methods for technology transfer have a detrimental impact on the investment appeal of the countries.

Furthermore, the study reviewed studies that examined how institutions impacted on economic components of investment climates like income growth, interest rates and inflation rates. There are two hypotheses considered in relation to institutions and income growth. The first hypothesis is the institutional quality-led economic growth hypothesis, which posits that institutional quality is the causal factor behind economic growth. The underlying reasoning is that by enhancing the quality of institutions, the resources of the country may be utilized more effectively to improve both allocative and productive efficiencies. Effective governance systems mitigate the tendencies of individuals to engage in rent-seeking and moral hazard activities. Reducing these adverse external effects yields higher investment returns for investors, so stimulating both local and foreign investments in the country, which in turn promotes economic growth. The second hypothesis pertains to the concept of economic growth-led institutional quality. Within this context, increased economic affluence enables governments to obtain the essential skills, technology, and knowledge required to enhance the regulatory and governance structure within the nation. Rising economic activity correspondingly amplifies the need for enhanced institutional structure and processes. The country's institutional governance improves because of increased resources and a greater demand for improved institutional quality[68].

Two researchers examine the link among economic growth, institutional quality, and financial development in a set of middle-income nations[69]. The results indicate a positive relationship between institutional quality and economic growth. However, the direction of causality varies depending on the specific proxies used to measure institutional quality. More precisely, the quality of legal institutions directly affects economic growth, whereas an increase in income leads to an enhancement in the quality of public sector institutions. Two scholars examine the interactive effects of total factor productivity and institutional quality on the economic growth of 13 low-middle income countries in Asia from 2000 to 2018[70]. The empirical findings indicate a negative link between institutional quality and GDP growth in low-middle income countries in Asia. The adverse impact can be attributed to the weak institutional framework prevalent in these low to middle-income nations. Nevertheless, total factor productivity has a positive influence on economic growth. Similarly, the interactive effects of institutional quality and total factor productivity have a positive influence on economic growth.

The study examines a growing body of research that explores the influence of institutional determinants on entrepreneurial activity and its impact on economic growth[71]. This comprehensive analysis, encompassing a wide range of diverse literature, allows for the differentiation between two unique research paths in the subject of entrepreneurship. Based on a comprehensive review of research conducted between 1992 and 2016, it has been found that institutions have a connection to economic growth by means of entrepreneurship. This raises further inquiries regarding the specific institutional factors that promote entrepreneurship, ultimately leading to economic growth.

A study investigates the influence of government power size on economic growth across different quality institutions in 23 Indian states[72]. They discovered that a larger government power size is associated with a detrimental effect on economic growth, particularly in the State. The magnitude of the detrimental impact of governmental authority on economic growth in each state is contingent upon the caliber of institutions within that state. States with high-quality institutions experience a lesser negative impact compared to those with low-quality institutions. Another study also examines the influence of effective governance and institutions on economic growth in Indonesia during the period from 2000: Q1 to 2018: Q4[109]. The study employs GDP growth as an indicator of economic growth. Governance was assessed based on factors such as voice and accountability, political stability, absence of violence, control of corruption, and government effectiveness. Institutional quality was examined using proxies such as the rule of law and the quality of regulation. The findings demonstrate that the efficiency and effectiveness of government programmes and other institutions contribute to overall economic growth.

Two researchers examine how institutional elements, including political stability, voice and accountability, government efficacy, regulatory quality, rule of law, and control of corruption, impact economic growth in the ASEAN region[73]. This study employs panel data estimate on a sample of 10 nations in the Association of Southeast Asian Nations (ASEAN) from 2002 to 2018. The results indicate that the quality of regulations and the presence of a strong legal framework had a significant and positive impact on the per capita GDP of ASEAN. Conversely, it was found that the voice and accountability had a negative effect. A study examines the impact of financial and institutional development on the economic growth of the Association of Southeast Asian

Nations (ASEAN) economies between 1995 and 2017[74]. The study found that the quality of institutions has a significant and direct impact on economic growth. Moreover, the study reveals that institutional development is mutually beneficial to financial institutions and markets.

Another research examines the links between institutional quality and economic growth in 27 post socialist economies from 1996 to 2016[75]. When using the Worldwide Governance Indicators to evaluate the quality of institutions, it was discovered that over time, economic growth is positively linked to the presence of a strong legal system and the ability of citizens to express their opinions and hold those in power accountable. Regulatory quality has a direct impact in the short term, while voice and accountability have a perplexing negative impact on economic growth, which requires further examination. When examining the causal link between the variables, they find compelling evidence that demonstrates the substantial link between the quality of institutions and economic growth.

During the investigation of low-income countries (LICs) and lower middle-income countries (LMICs) from 2005 to 2019, a study discovered that institutional quality, economic growth, and other factors such as government expenditure and tax revenue often exhibit endogenous relationships with each other in the short term[68]. Their empirical findings also showed a direct and significant relationship between institutional quality and economic growth in the LMICs and the pooled group in the short term. LMICs exhibit a two-way causal relationship between these variables, whereas the pooled data shows a one-way causal relationship from institutions to economic growth. Notably, the findings also indicate that the relationship between institutional quality and economic growth was not statistically significant in the short term for the low-income countries. These findings indicate that in low- and middle-income countries (LMICs), enhancing the quality of institutions will enhance economic growth, and conversely, economic growth will strengthen institutional quality. These findings emphasize that institutions in the low- and middle-income countries (LMICs) have a comparatively advantageous position in terms of governance, compared to their counterparts in the low-income countries (LICs), to contribute to economic growth.

As regards inflation and interest rates, three researchers examine the non-linear response of central banks to inflation in both developed and developing nations[76]. The researchers examined the asymmetrical impact of institutions on changes in inflation rates across 51 nations from 1983 to 2015. These countries included 28 advanced economies and 23 emerging and developing economies. The findings indicate that the calibre of political institutions has a noteworthy influence on the minimum level of the inflation rate. Those with strong institutional quality have a significantly lower inflation rate since monetary authorities adjust their conduct accordingly. This is in stark contrast to those with weak institutional quality. Their research indicates that countries characterized by low corruption, stable governments, effective bureaucracy, and favourable socio-economic conditions experience a significantly reduced inflation rate. Central banks in these nations take decisive action when the inflation rate surpasses a certain threshold. The inflation threshold level is more significantly influenced by the socio-economic condition index than by other sub-indexes of institutional quality. The findings suggest that enhancing institutional quality empowers central banks to effectively maintain low levels of inflation. A scholar contends that there is a positive relationship between the level of economic diversity in a country and the impartiality of its institutions, based on an analysis of cross-national time series data over the past 25 years[77].

The study conducted by five scholars validated that the quality of institutions is a crucial requirement for the advancement of the financial sector in the United States[78]. In addition, they discover that the relationship between natural resource rent and finance is influenced by the quality of institutions. A scholar investigates the influence of the financial and social performance of microfinance institutions (MFIs) on the lending interest rate[79]. The article has extensively examined microfinance institutions (MFIs) that have received a five-star rating in each of the six global areas, both individually and throughout the time span of 2006 to 2012. The data from 382 Microfinance Institutions (MFIs) across 70 countries worldwide has been extracted from the Microfinance Information Exchange (Mix Market). The findings indicate that the cost of funding, return on assets, and the quantity of credit clients exert a significant and positive influence on the lending interest rate globally. Nevertheless, there is a notable inverse correlation between the extent of outreach, as indicated by the average loan size, and the lending interest rates.

The collective findings from the reviewed studies reveal an intricate relationship between institutional quality and the investment climate. Institutional quality, encompassing governance, corruption control, rule of law, and political stability, emerges as a critical determinant of private investment decisions. Weaknesses in corruption control and governance are identified as detrimental factors, influencing investment levels, particularly evident in regions like the Middle East and North Africa. Simultaneously, economic reforms, financial development, and trade openness exhibit a dual effect on private investment decisions. These reforms not only directly shape investment choices but also indirectly enhance them by fostering an environment of improved governance institutions. The studies underscore the significance of considering the multifaceted nature of institutional quality in understanding its impact on investment climate dynamics.

Challenges in improving the investment climate are highlighted across diverse economies. These challenges range from rent-seeking behavior and credibility issues to limited public trust and human resource difficulties. Infrastructure gaps and heavy dependency on specific sectors, such as oil, further complicate efforts to create an optimal investment environment. The studies emphasize the need to address these challenges comprehensively to foster economic growth and alleviate poverty. They also shed light on the fact that achieving perfection in the investment climate is not a necessity for capitalizing on its advantages. Rather, a continuous process of addressing challenges and improving institutional quality is crucial for sustained economic development.

Technological factors emerge as significant drivers of investment decisions. Global innovation rankings, research and development funding, digitalization, and the adoption of advanced technology all play pivotal roles in shaping the investment climate. Moreover, insights from microfinance institutions indicate that the financial and social performance of these entities influences lending interest rates. The relationship between natural resource rent, finance, and institutional quality also underscores the interconnectedness of economic variables. The general insights collectively portray the diverse dimensions of the relationship between institutional quality and the investment climate, emphasizing its global significance and the need for imperative approaches in different regions and contexts.

2.3.2 Institutional Quality and Agricultural Performance

Institutional quality and its impact on agricultural sector development are a passionately contested topic. Relevant and associated studies were reviewed in this study following the indicators of agriculture performance such as its output growth, employment, and exports. A study discover that the presence of high-quality institutions has a positive impact on the expansion of the agricultural sector in Pakistan[80]. This conclusion was drawn from an analysis of time series data spanning from 1984 to 2015. The findings indicate that the quality of institutions has a beneficial impact on the expansion of the agricultural industry. A scholar discovere that democratization had a more positive impact on the economic well-being of less affluent farmers in comparison to wealthier farmers[81]. It is emphasized that political factors play a critical role in the analysis of agricultural policies, as nearly all agricultural policies are influenced by lobbying and pressure exerted by interest groups.

Three scholars conduct a study on institutional quality, using three indicators from the World Bank's world governance indicators[82]. They examined how these indicators specifically affected the bilateral coconut trade between the top 26 coconut producing countries and the top 15 importing economies from 1996 to 2016. The findings indicate that higher government effectiveness promotes the exchange of high-value goods, whereas improved voice and accountability ratings reduce the trade of coconut products at all stages of value addition.

A study examines the impact of institutional quality on the increase in agricultural value in seven East African nations between 2000 and 2020[83]. The findings indicate that voice and accountability exert a detrimental and statistically significant impact on regional agricultural value-added, whereas government effectiveness has a beneficial and statistically significant impact on regional agricultural value-added. The findings suggest that the quality of institutions plays a crucial role in determining the increase in agricultural value-added in East Africa. Within the area, the presence of efficient institutions leads to a rise in the value added to the agricultural sector. In addition, an increase in per capita gross domestic product, a decrease in the proportion of rural population, and an increase in the proportion of education expenditure were found to have notable additional impacts on agricultural value-added.

A research study proposes that an increase in agricultural productivity results in changes in the structure of the rural agricultural sector, as well as its relationship with contemporary industry and services[84]. This hypothesis was tested using data from eighteen nations in Sub-Saharan Africa. They contend that the expansion of agricultural output is crucial for the development of institutions. This structural modification presents chances for institutional entrepreneurs to expand institutional safeguards to these novel endeavours, so enhancing institutional integrity. The findings indicate that policies aimed at enhancing agricultural productivity play a crucial role in enhancing institutional quality.

A study examines the effects of institutional quality on several sectors in 42 countries in sub-Saharan Africa (SSA) from 2010 to 2018[85]. The findings suggest that, in contrast to the commonly accepted belief that institutions promote growth and development, the impact of institutional quality on both sectoral and overall economic performance in Sub-Saharan Africa (SSA) was generally limited. Nevertheless, the findings suggest that the starting level of real GDP and labour play a significant role in driving growth, especially in the overall economy. Hence, the study indicates that the sub-region necessitates institutional change, improved human capital development, and capital accumulation to stimulate sectoral and overall economic performance in sub-Saharan Africa.

Three scholars analyze how the agricultural sector's performance might be improved in the long term through the establishment of an institutional framework, hence guaranteeing food security in Nigeria[86]. The number of undernourished persons is utilized as a proxy for food security in the stability dimension. The independent variables are agricultural sector performance and institutional framework, while population is employed as a control variable. Two agricultural variables, namely agriculture production and agriculture credit, are utilized with six variables pertaining to the institutional framework. The findings indicate that over a long period of time, the production and credit related to agriculture will enhance food security by decreasing the proportion of undernourished individuals by 2% and 18% respectively. Regarding the institutional framework, political stability and the absence of violence and rule of law have a positive impact on food security. They decrease undernourishment by around 69% and 29% respectively. On the other hand, the control of corruption and the presence of voice and accountability have a negative effect on food security. They increase the number of undernourished people by approximately 74%, 51%, and 63% respectively.

A study investigates the impact of climatic change and financial growth on agricultural output in the ASEAN-4 countries, specifically Indonesia, Malaysia, the Philippines, and Thailand, during the period from 1990 to 2016[87]. More precisely, it examines how renewable energy, institutional quality, and human capital impact agricultural production. The findings demonstrate that the quality of institutions has a positive impact on agricultural production. Moreover, climate change has an adverse impact on agricultural productivity, but renewable energy and human capital have a direct influence on agricultural production. Furthermore, the impact of carbon emissions on agricultural productivity is influenced by using renewable energy, the level of human capital, and the quality of institutions.

In this study, five scholars analyze the influence of agriculture and forestry on carbon emissions, considering the quality of institutions[88]. They utilize data from global and five regional levels spanning the years 1996-2015. The findings suggest that agricultural production is positively correlated with CO_2 emissions, while forestry is negatively associated. The relationship between institutional quality and CO_2 emissions is positive, with institutional quality directly and indirectly influencing CO_2 emissions. These findings underscore the significance of institutional excellence in mitigating agricultural and forestry emissions.

A research study examines the impact of political institutions on Nigeria's economic performance by using descriptive statistics from a dataset spanning from 1999 to 2018[89]. The study reveal that political institutions exert a detrimental impact on the economic growth of Nigeria. Observing the inefficiency of political institutions in Nigeria, they contend that democracy alone is insufficient for achieving long-term economic progress. Therefore, they propose that strict regulations be implemented to curb the excessive influence of politicians' personal interests, which often come at the expense of the will of the population. The study employs descriptive statistics, which made its methodology less robust. A study demonstrates that, apart from regulatory quality and voice and accountability, the other governance variables exhibited adverse impacts on economic growth[90]. Additionally, the study observes that in Sub-Saharan Africa, enhanced performance in controlling corruption, government effectiveness, and the rule of law had a notable adverse impact on economic growth. The quality of regulations has a positive and considerable impact on economic growth. A scholar examines the impact of political institutions, such as the degree of democracy, political violence, the stability of the government, and accountability, on the economic growth of Ethiopia[91]. The impact of democracy on growth in the near term was negligible, whereas political violence had a substantial adverse effect. Over time, both the democracy index and accountability had a detrimental impact on real GDP per capita.

Some authors assert that economic growth is greatly improved by effective governance, robust democratic institutions, and minimal corruption[92]. The study encompasses 32 countries rich in resources and 47 countries without considerable resources. Two researchers also examine the impact of institutions on the correlation between natural resources and economic growth by analyzing panel data from 44 African nations during the period of 1996–2016[93]. The scholars contend that generalizing the result that institutions improve the connection between natural resource rents and economic growth across all six metrics of institutional quality is challenging. The variation in the extent and function of institutions is due to differences in the measures of institutional quality and the variable used to measure natural resources. However, the complex connection between natural resources and economic growth is greatly improved when they consider the factors of rule of law and regulatory quality. This applies to both the proportion of natural resource rents in GDP and the percentage of ores and metals exports in total merchandise exports.

Three researchers employ the gravity model to examine the impact of institutional quality and development on bilateral exports of 61 countries from 2000 to 2016, considering both homogeneous and heterogeneous effects[94]. The results indicate that there is a positive and statistically significant relationship between the quality of institutions and the level of development on bilateral exports. Moreover, the exporting country's institutional quality and level of development have a greater influence on bilateral exports compared to those of the importer country. The results indicate that when both trading countries possess equivalent levels of institutional quality, it significantly enhances bilateral exports. The study concluded that the interactive effects of institutional quality and level of development on bilateral exports is both positive and statistically significant.

A study investigates the impact of Iran's institutional quality and its primary trade partners on the export of agricultural products from Iran[95]. An analysis was conducted on Iran's agricultural exports to 45 significant trading partners using the gravity model from 2002 to 2014. The findings indicate that the institutional quality of Iran and its trading partners had exerted contrasting effects on Iran's agricultural exports, with negative impacts from Iran's institutional quality and positive impacts from its trading partners' institutional quality. The inadequate institutional quality of Iran has been acknowledged as a hindrance to Iran's agricultural exports. Furthermore, the Gross Domestic Product (GDP), trade agreements, and shared borders with trade partners have a significant and positive impact on Iranian agricultural exports. Conversely, factors such as distance and economic similarities have a detrimental and significant influence. A study also examines the impact of institutional quality on the availability of decentralized financial services, including microfinance and banking services, in a sample of seven UEMOA nations from 2011 to 2016[96]. The findings indicate that the use of microfinance loans for financial inclusion has a positive impact on the exportation of agricultural products. Additionally, it demonstrates that enhancing the calibre of institutions is the primary conduit via which financial inclusion measures impact the agricultural exports of WAEMU countries.

The collection of studies on institutional quality and agriculture performance provides a clear understanding of the complex interactions shaping the agricultural landscape across various regions and contexts. One common thread in these investigations is the acknowledgment of the positive influence of high-quality institutions on the expansion and development of agricultural sectors. The research, exemplified by four scholars, highlights the multifaceted impact that institutional frameworks can have on the agricultural industry, ranging from production dynamics to trade relationships[80]. Additionally, the studies emphasize the importance of considering political factors in the analysis of agricultural policies, as demonstrated by a study, who underscores the differential effects of democratization on the economic well-being of farmers based on their wealth status[81].

Another focal point of these studies is the examination of international trade dynamics in agriculture, showcasing how institutional quality affect as bilateral trade outcomes. A study exemplifies this by revealing the role of government effectiveness and voice and accountability in the coconut trade[82]. These findings underscore the significance of effective governance in facilitating not only domestic agricultural growth but also cross-border trade relationships. Moreover, the studies delve into the regional dimensions of agricultural value-added, as seen in the analysis by a group of scholars, who identify the contrasting impacts of various institutional components on regional agricultural value[83].

The studies also contribute insights into the broader implications of agricultural performance on issues such as food security, environmental sustainability, and economic growth. Three scholars highlight the long-term benefits of an institutional framework in enhancing food security in Nigeria[86]. Meanwhile, some scholars delve into the environmental aspect, emphasizing the intricate relationship between agriculture, forestry, and carbon emissions, further demonstrating the far-reaching consequences of institutional quality on diverse aspects of a nation's well-being[88]. In essence, these studies collectively emphasize the need for tailored and context-specific policies that enhance institutional frameworks to foster sustainable agricultural development and ensure food security.

2.3.3 Investment Climate and Agricultural Performance

The relationship between investment climates and the development of the agriculture industry is a highly debated subject. This study assesses relevant and connected studies that examined the economic, political, financial, and social aspects of investment climates. A study examines the cause-and-effect relationship between agricultural funding and the rise of agricultural output in Nigeria[97]. The findings indicated that there was no causal relationship between agricultural funding and the growth of agricultural output. Hence, it is crucial for Nigeria to thoroughly examine the reasons behind the limited influence of agricultural financing on the expansion of agricultural output.

A study employs IFPRI's IMPACT framework, which consists of interconnected biophysical and structural economic models, to analyze the evolution of worldwide agricultural production systems, the impact of climate change, and the state of food security[98]. Their analysis was combined with a novel investment estimating model, utilizing the perpetual inventory technique (PIM), which enables a more accurate evaluation of the expenses associated with attaining expected agricultural enhancements. Climate change will impede anticipated progress in reducing hunger in the future, resulting in a 16 million increase in the number of people at risk of hunger in Africa by 2030, compared to a scenario unaffected by climate change. Allocating resources towards enhancing agricultural productivity has the potential to counteract the negative effects of climate change and decrease the proportion of individuals vulnerable to hunger in Northern, Western, and Southern Africa to five percent or lower by 2030. However, in Eastern and Central Africa, this proportion is expected to persist at ten percent or higher. The anticipated cost for investments in Africa to accomplish these outcomes is around 15 billion USD annually from 2015 to 2030. These expenditures are part of a bigger package of initiatives totaling around 52 billion USD in developing nations.

Four researchers conduct a study to examine the patterns in investment and labour productivity in the agricultural sector of Ukraine[99]. The study also analyzes the many factors influencing agricultural production and the global agricultural commodities markets during the period of 2008-2017. The regression study validates that the labour productivity function is contingent upon the fixed capital per worker and the grain yield. Another four scholars conduct an analysis of the dynamics of stabilization policies and the impact of investment on agricultural output in Nigeria from 1981 to 2019[100]. The findings reveal that, in the immediate period, only government agriculture expenditure, as a fiscal policy variable, had an impact on agricultural output. The agricultural output was greatly influenced by the exchange rate and inflation rate, which are monetary policy variables. All policy mix variables had a considerable impact on agricultural output in the short term. However, only private domestic investment had a significant impact on agricultural output as an investment variable.

A study investigates the capacity of agriculture to create job opportunities, consequently diminishing poverty levels in West Africa[101]. Findings indicate that agriculture offers the potential for impoverished individuals to enhance their income and break free from the cycle of poverty. However, the ability of the poor to take advantage of these agricultural prospects' hinges on their level of human capital development.

A research study uses a comprehensive approach to studying the economy that combines analyzing the impact of investments on households using econometric analysis (specifically, propensity score matching) with modelling the connections between economic growth and poverty using a dynamic computable general equilibrium model that considers spatial differences[102]. The technique was implemented retrospectively to Mozambique. The simulation results suggest that the country's investment plan for the period of 2012 to 2017 would not successfully meet the national growth targets, even though there was a twofold increase in public expenditure on agriculture. Instead of augmenting expenditures, the government should have redirected resources towards agricultural research and extension, as opposed to subsidizing irrigation and fertilizer. Delivering extension services to small-scale farmers is highly efficient in promoting economic development and alleviating poverty across all areas of the nation.

Investing in irrigation would be more likely to enhance growth in the southern area of the country, given the less favourable agro-ecological circumstances. Their method, as seen in Mozambique, offers a systematic framework for assessing ex ante sector-wide agricultural investment proposals, considering factors such as economic growth, poverty reduction, and regional fairness.

A study examines the relationship between agricultural investment and economic growth in Tunisia from 1965 to 2016[103]. Ultimately, their findings demonstrate a clear and one-way relationship where agricultural investment positively influences economic growth, while other investments have a negative impact on economic growth. Granger tests in the short term only detect a bidirectional causal relationship between investments and economic development. The findings validate that investing in agriculture is beneficial for economic growth in Tunisia and supports the implementation of effective strategies to promote this industry.

A research study examines the expansion of agricultural total factor productivity (TFP) and its three constituents (technical change, technical efficiency change, and scale change) in 15 countries in South and Southeast Asia from 2002 to 2016[104]. During the sample period, agricultural productivity in South and Southeast Asian countries had a general decrease, raising concerns about the ability to maintain future agricultural expansion. The primary driver of Total Factor Productivity (TFP) growth has been technological advancement, but its impact has diminished in recent times. Conversely, the decrease in both scale change and technical efficiency change led to a decline in production over time. Different levels of productivity were found in distinct countries, primarily due to technical progress. In general, South-East Asia experienced a higher level of consistent and lasting agricultural expansion in comparison to south Asia. Human capital, urbanization level, and development flow to agriculture were found to have a positive impact on agricultural total factor productivity (TFP) growth. On the other hand, economic development level and agricultural imports were found to have a negative association with TFP growth.

In 2019, a study conducted a study to examine the direct and indirect effects of the investment development policy on the agriculture sector and its sub-sectors in Iran in 2011, focusing on the socio-economic implications[105]. The results encompassed three scenarios: a 15% augmentation in investment in the agricultural sector, a 10% augmentation in investment in the farming and gardening sub-sector, and a 10% augmentation in investment in the other sub-sectors. They stated that the overall economic income increased when these scenarios were realized. Nevertheless, the initial scenario exerted a more substantial influence on the overall income of the economy, amounting to 13.12%, in contrast to the other possibilities.

A study conducts an analysis on the impacts of the policy of agricultural investment growth[106]. An analysis has been conducted to evaluate the implications of implementing this policy in three different scenarios, considering both positive and negative impacts. The net effects analysis revealed that the production activities would experience an increase in income in each of the given scenarios. Furthermore, because of the first scenario's implementation, the industrial and agricultural sectors experienced significant growth. Similarly, the second and third scenarios led to substantial increases in production for the industries, agriculture, and horticulture sectors. Furthermore, the examination of open effects also demonstrates a rise in the revenue of the elements of production and establishments resulting from the implementation of the regulations. An examination of the indirect consequences of the package revealed that the general economy experiences a significant growth because of the scenarios. These indirect impacts are considerably more influential than the direct effects. The findings revealed that the impact of the mentioned scenarios on industries, services, and commerce was greater than on the agricultural sector and its sub-sectors. This suggests a strong connection between these sectors and the agricultural sector and its sub-sectors.

Two scholars investigate the factors influencing Ethiopian agricultural exports by employing the imperfect substitutes' model as a theoretical framework. The study includes the time span from 1998 to 2018[107]. The regression analysis using the two-step system generalized moment technique revealed that the key factors influencing agricultural exports in Ethiopia include gross domestic product, exchange rate, road network, corruption index, lagged export value, indirect tax income, and domestic saving. Nevertheless, there is a strong and inverse correlation between foreign direct investment and the labour force with Ethiopian agricultural exports. A study analyzes the impact of foreign direct investment on the agricultural exports of 13 Arab nations between 2000 and 2019[108]. The random-effects model reveals that foreign direct investment (FDI) has a favourable and very significant impact on agricultural research exports. Empirical findings demonstrate that a 1% rise in Foreign Direct Investment (FDI) resulted in a corresponding increase of 0.055% in agricultural exports.

The comprehensive review on investment climate and agriculture performance encompasses a diverse range of studies conducted across different geographical contexts and methodologies. These investigations delve into the intricate dynamics between agricultural funding, climate change, investment policies, and their implications for agricultural outcomes. The studies reveal multifaceted insights that contribute to a nuanced understanding of the complex interplay between various factors influencing agricultural performance.

The global perspective offered by some scholars, utilizing IFPRI's IMPACT framework, highlights the significance of climate change in shaping worldwide agricultural production systems and food security[98]. Their incorporation of a novel investment estimating model emphasizes the need for strategic resource allocation to counteract the adverse effects of climate change on hunger. The study underlines the potential of targeted investments to enhance agricultural productivity, particularly in regions vulnerable to climate-related challenges.

Country-specific studies, such as the examination in Ukraine by some authors, provide localized insights into the patterns of investment and labor productivity in the agricultural sector[99]. The findings underscore the importance of factors like fixed capital per worker and grain yield in shaping labor productivity, offering specific considerations for policymakers to enhance efficiency and output in agriculture. Similarly, studies focusing on Nigeria and Tunisia reveal specific insights into the relationships between agricultural funding, economic growth, and the effectiveness of investment policies, providing context-specific recommendations for these nations[97,103].

2.4 Methodological Reviews

This section presents methodological review of institutions, investment climates and agriculture performance. The review is presented in three sub-sections as it was done in the empirical literature section.

2.4.1 Institutions and Investment Climate

As to the trend analysis, a study conducted a study on the relationship between institutional factors, entrepreneurial activity, and economic growth[71]. They analyzed articles from journals in the Web of Science database to gain a better understanding of two distinct lines of research. This analysis helped them examine how institutions, entrepreneurship, and economic growth interact with each other. A research study utilized trend analysis to investigate technical factors influencing investment environments in Belarus and Poland[67]. Trend analysis allows for the identification of patterns and directional movements in variables over time, providing insights into the long-term trends influencing investment climates. The trend analysis approach identifies long-term patterns and trends in variables, offering insights into the sustained impact of institutions on investment. One major discredit of the approach is that it may oversimplify complex relationships by focusing on trends, potentially missing nuanced dynamics.

Some researchers adopted the percentage ranking approach to analyze factors impacting investment and productivity in Nigeria[64]. They analyzed data from the 2014 World Bank Enterprise Survey, which included small, medium, and large firms in Nigeria. This method involves assigning scores based on the relative importance of factors, offering a qualitative assessment of their impact. While less quantitative, this approach provides a nuanced understanding of the perceived significance of different variables in influencing investment decisions. As for the pros, the percentage ranking approach provides a qualitative assessment of the relative importance of different factors influencing investment, offering nuanced insights. Concerning the cons, it lacks the quantitative precision of other methods, making it challenging to precisely quantify the impact of variables.

Three researchers used a logistic smooth threshold autoregressive (LSTAR) model to investigate the non-linear characteristics of central banks' response to inflation in industrialized and developing nations[76]. This method is effective in capturing threshold effects and non-linear relationships in economic variables. As regards the merit, the LSTAR captures non-linear relationships, allowing for the identification of threshold effects in central banks' response to inflation. However, the approach requires careful specification of threshold values, which may impact the results.

Two notable scholars employed a systematic review process to investigate the connections between the ease of doing business, economic growth, and associated challenges in Africa[65]. This method involves a rigorous and comprehensive examination of existing literature, offering a synthesized understanding of the relationships between institutions and investment in the African context. The evaluation procedure took place from January 2018 to May 2018. The study obtained pertinent research from the following archives: Science Direct, Google Scholar, Research Papers in Economics (RePEc), Economic Literature (Econlit), and the mainstream search engine of Google. These studies align with the problem statement of the research. Additionally, the analysis prioritized papers published after 2010, and it did not consider studies that did not have an English edition. The approach ensures a comprehensive understanding of existing literature, providing a synthesized view of the relationships between institutions and investment. Also, it helps minimize publication bias by including a wide range of sources. However, conducting a systematic review is a time-consuming process, and the availability of relevant literature may be limited.

Several studies used different panel regression estimators. Three scholars utilized the three stages least square estimations technique (3SLS) to assess the linkages between private investment and institutions across a panel of developing nations[62].The panel was comprised of 32 countries. There were four separate sets of regressions that were carried out, and each of them used a different indicator of governance. These indicators included governance, political stability, public accountability, and quality of administration. The 3SLS estimator allows for a comprehensive examination of both time and cross-sectional variations, providing a holistic view of the factors influencing investment. The panel regressions often have more statistical power compared to time-series or cross-sectional analyses. As to the demerits, results may be sensitive to the specification of the regression model and choosing the appropriate model can be challenging.

Furthermore, three scholars examine the links between the quality of institutions and economic growth in 27 post socialist economies from 1996 to 2016[75]. They employ a panel cointegration methodology and causality analysis for their investigation. A study also employs a Panel Vector Autoregressive (PVAR) model to examine the correlation between economic growth, institutional quality, and financial development in a set of middle-income nations[69].

Studies that employed dynamic panel estimation are explained as follows. A study employed the dynamic panel estimation method to explore the relationships between institutions and investment in the Middle East and North Africa region[9]. This method allows for the consideration of time-varying factors, capturing the dynamics of institutional changes and their impact on investment over the selected period. The dynamic panel approach is particularly useful for examining the lagged effects of institutional variables on investment decisions. A study also used the panel regression method to investigate capital movement determinants post-global financial crisis, considering a broad sample of developing and emerging nations beginning in 2009: Q3 and continuing through 2015: Q4 [63]. Panel regression enables the consideration of both time and cross-sectional variations, providing a comprehensive understanding of the factors influencing investment. Another study examines the impact of financial and institutional development on economic growth in the economies of the Association of Southeast Asian Nations (ASEAN) within the period 1995-2017[74]. The study used a dynamic panel estimator to analyze the relationship. As to the pros, it captures the temporal evolution of variables, allowing for the examination of lagged effects and changes over time. Also, it enables the study of dynamic relationships between institutions and investment, offering insights into how changes in institutions influence investment decisions. However, susceptible to endogeneity problems, where the relationship between institutions and investment may be influenced by unobserved factors.

Studies that employed the panel system of generalized method of moments (GMM) estimators are discussed as follows. A study employs the Generalized Methods of Moments (GMM) time series to examine the influence of good governance and institutions on economic growth in Indonesia from 2000:Q1 to 2018:Q4[109].In their study, two scholars employed the panel difference Generalized Method of Moments (GMM) to examine the influence of total factor productivity, institutional quality, and their relationship on economic growth in 13 low-middle income countries in Asia during the period of 2000-2018[70].A researcher utilized panel regressions and dynamic panel GMM estimators to investigate the impact of political-institutional and financial drivers on gross capital flows during the time span of 2000–2016[66]. The dynamic panel GMM method is effective in handling endogeneity issues and capturing dynamic relationships over time. Three scholars employed the panel system of Generalized Method of Moments (GMM) to unravel the interrelationship between finance, institutions, and private investment in African countries[10]. The study only considered two control variables in their panel estimation process. They argued in support of GMM regressions because it gives a choice between controlling for variable omission bias and having robust estimations that are not affected by instrument proliferation. A study contends that some GMM specifications do not employ control variables to avoid instrument proliferation and have robust models[10].GMM is particularly useful in addressing endogeneity concerns and providing robust estimations. The GMM regressions effectively handle endogeneity concerns, providing robust estimates. Also, the estimator allows a choice between controlling variable omission bias and having robust models not affected by instrument proliferation. However, it requires careful selection and validation of instruments to ensure their relevance and validity.

2.4.2 Institutions and Agricultural Performance

As for OLS and ECM estimators, four scholars analyze the impact of institutional quality on the agricultural sector's growth in Pakistan[80]. They use time series data from 1984 to 2015. The researchers employed Ordinary Least Square (OLS) for estimating long-term effects, Error Correction Method (ECM) for estimating short-term effects, and the Vector Error Correction Model (VECM) Granger causality test for determining causality. In their study, they investigate the influence of agriculture and forestry on carbon emissions, considering the quality of institutions[88]. The data from 1996 to 2015 was analyzed using econometrics methods, including cross-sectional tests, panel unit root tests, cointegration tests, Driscoll & Kraay, and completely modified ordinary least square regressions. The assessment was conducted at both global and regional levels.

A study investigates the long-term improvement of the agricultural sector in Nigeria by utilizing the Autoregressive Distributed Lag (ARDL) estimator[86]. Their focus is on enhancing the institutional framework to ensure food security. Four scholars investigate the impact of climatic change and financial growth on agricultural output in the ASEAN-4 countries, specifically Indonesia, Malaysia, the Philippines, and Thailand, during the period from 1990 to 2016[87]. To determine the correlation between renewable energy, institutional quality, and human capital in agricultural productivity, researchers employed second-generation modelling tools, considering the cross-country impact of shocks. The cointegration tests of Westerlund in 2007 confirmed the existence of a long-term link among the variables. The parameter estimates were calculated using the cross-sectionally augmented autoregressive distributed lag (CS-ARDL) model estimator.

Three scholars examined the impact of institutional quality on bilateral coconut commerce[82]. They focused on three measures derived from the international Bank's international governance indicators to measure institutional quality. Specifically, they analyze coconut goods that have been enhanced to different extents. The researchers employed structural gravity models to quantify the impact of institutions on the trade performance of the leading 26 coconut producing nations with the top 15 importing economies during the period from 1996 to 2016.

Concerning LSDV, PPML, HDFE, PPML estimators, three researchers employ the bias corrected LSDV model estimator to examine the impact of institutional quality on agricultural value added in seven East African nations during the period of 2000 to 2020[83].A study employed the gravity model to examine the impact of institutional quality and development on bilateral exports of 61 countries from 2000 to 2016, considering both homogeneous and heterogeneous effects[94]. The researchers utilize the Poisson Pseudo Maximum Likelihood (PPML) econometric method in conjunction with a High-Dimensional Fixed Effect (HDFE) to estimate and analyze data that includes high dimensional fixed effects. A study investigates the impact of Iran's institutional quality and its primary trade partners on the export of agricultural products from Iran[95]. An analysis was conducted on Iran's agricultural exports to 45 significant trading partners using the gravity model from 2002 to 2014. The Poisson pseudo maximum likelihood (PPML) estimation method was employed, which is more efficient than conventional approaches for estimating gravity models.

As to GMM, a study employes the panel system GMM to examine the impact of institutional quality on the provision of decentralized financial services, including microfinance and banking services, in a sample of seven UEMOA nations from 2011 to 2016[96].Four scholars examined the effects of institutional quality on several sectors in Sub-Saharan Africa (SSA)[85]. The study reexamined the function of institutions in the overall economy. The estimating approach employed was the system GMM, and the panel consisted of 42 nations from the SSA region. The data covered the time span from 2010 to 2018.Two scholars examine the impact of institutions on economic growth by using panel data from 44 African nations between 1996 and 2016[93]. The researchers conducted cross-sectional instrumental variable analysis, system dynamic panel-data instrumental variable regression, and panel smooth transition regression to examine the presence of endogeneity, heterogeneity, and nonlinearity.

2.4.3 Investment Climate and Agricultural Performance

Four researchers examine the causal relationship between agricultural financing and agricultural output growth in Nigeria by employing the paired Granger causality test[97].A study examines the relationship between agricultural investment and economic growth in Tunisia from 1965 to 2016[103]. The researchers employ an empirical approach that utilized cointegration analysis and Vector Error Correction Models. Four scholars conduct an analysis of the patterns and impacts of stabilization policies and investment on agricultural production in Nigeria from 1981 to 2019[100]. The Autoregressive Distributed Lag Model was employed in the study.

A study also examines the socio-economic consequences, including both direct and indirect effects, of the investment development policy on the agriculture sector and its sub-sectors in Iran during the year 2011[105]. They employed a social accounting matrix (SAM) to conduct their analysis. Also, a study conducts an analysis on the impacts of the agricultural investment growth policy using the Social Accounting Matrix (SAM) methodology[106].

Five scholars investigate the capacity of agriculture to create job opportunities, therefore diminishing poverty levels in West Africa[101]. This study utilizes the Generalized Method of

Moments (GMM) econometric technique to analyze panel data spanning a 17-year period from 2000 to 2016. A study investigates the factors that influence Ethiopian agricultural exports[107]. They utilize the imperfect substitutes' model as a theoretical framework and employed the system generalized moment technique as an analytical model. The study coveres the period from 1998 to 2018.

A study analyzes the impact of foreign direct investment on the exportation of agricultural products[108]. The study utilizes a panel dataset encompassing 13 Arab countries spanning the years 2000 to 2019. According to the outcomes of the Breusch-Pagan (LM) test and the Hausman test, the random-effects estimator was deemed more dependable compared to the pooled OLS model and the fixed-effect model.

2.5 Conceptual Framework of Investment Climate, Institutions and Agriculture Performance

The conceptual link among investment climates, institutions, and agriculture performance, which is presented in Figure 2.1, represents a complex web of relationships that intertwine economic, political, financial, and social factors. While a favorable investment climate and institutional quality can enhance agriculture productivity, the performance of the agricultural sector also influences investment climates through its contribution to economic, political, social, and financial conditions. First, investment climates play a pivotal role in shaping the conditions under which businesses, including those in the agriculture sector, operate. Economic conditions, encompassing factors like income growth, interest rates, and inflation rates, are crucial determinants of investment attractiveness. Higher income levels can stimulate demand for agricultural products, while favorable interest and inflation rates encourage investment in the sector. A positive investment climate, therefore, creates an environment conducive to agricultural productivity[98,99,100,103].

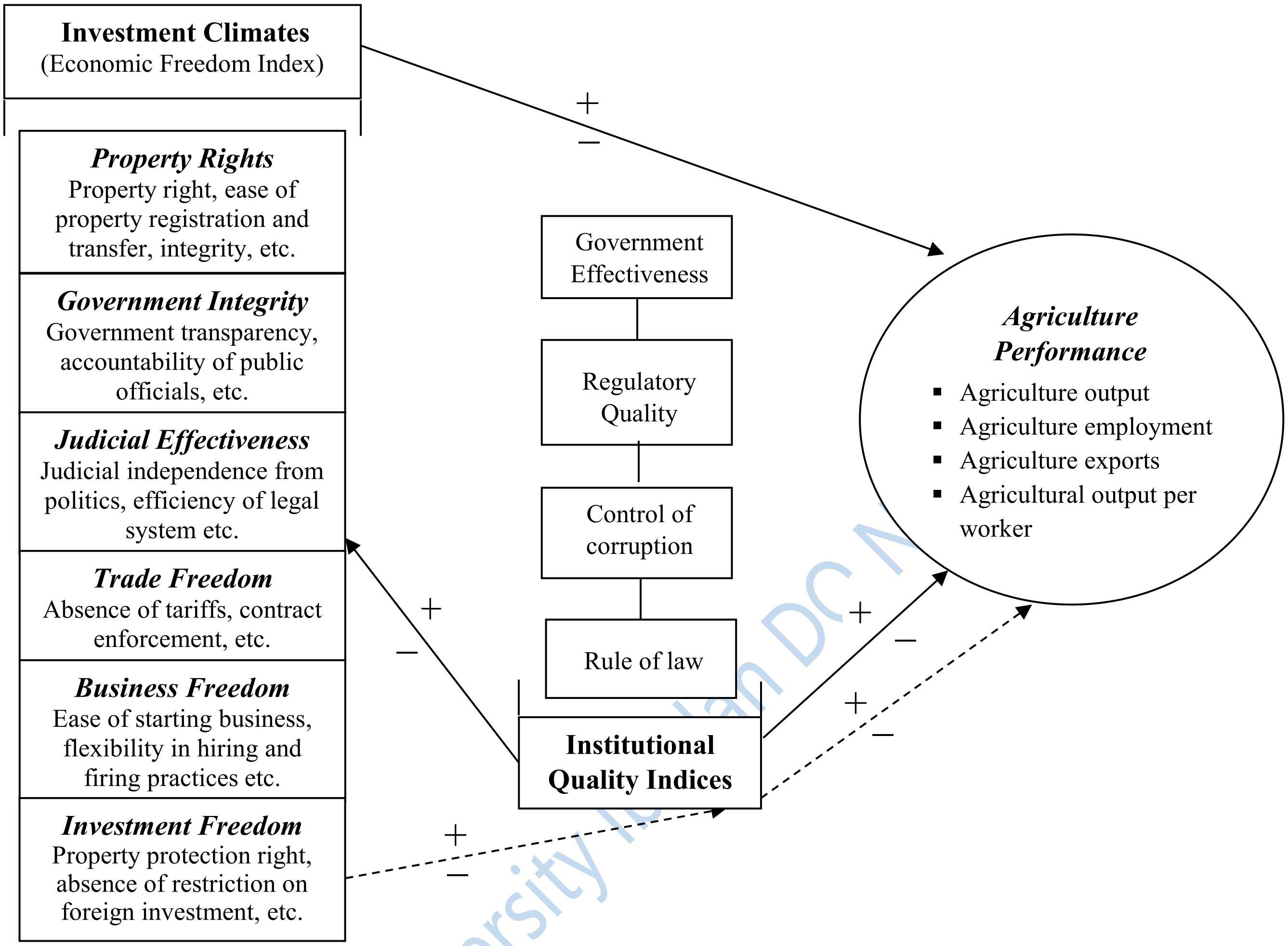

Figure 2.1: Conceptual linkages among investment climate, institutions, and agriculture performance
Note: + sign denotes increase; – sign implies decrease; broken line means indirect impact.
Source: Author's conceptualization.

Second, the political conditions within a country significantly influence agriculture productivity. Political stability and regime types are crucial components. A stable political environment provides a foundation for long-term planning and investment in agriculture[66,67,68]. Additionally, the nature of the political regime, whether democratic or autocratic, can affect the policy framework for the agriculture sector. Democratic governance often facilitates policies supporting inclusive and sustainable agricultural development.

Third, financial conditions, including the depth, activity, and size of the financial system, are vital for agricultural productivity. Access to credit and financial services is critical for farmers to invest in modern farming techniques, machinery, and inputs. A well-functioning financial system contributes to the overall efficiency and competitiveness of the agriculture sector, ultimately influencing productivity[70,71,72].

Fourth, social conditions such as life expectancy, women's education, and labor participation play an integral role in agriculture productivity. A healthier and educated population is better equipped to engage in productive agricultural activities. Women's education and participation in the labor force are particularly important, as they contribute significantly to the agriculture sector's workforce and can impact productivity through innovative approaches. Furthermore, the investment climate has a direct impact on institutional quality, which, in turn, affects agriculture productivity. A favorable investment climate characterized by stable economic conditions, such as income growth and low inflation rates, attracts investment in the agricultural sector[76,78,80]. This leads to increased productivity, as investments contribute to the adoption of modern farming techniques, improved infrastructure, and access to credit.

Moving on to institutional quality, the effectiveness of government, regulatory quality, and control of corruption are fundamental pillars influencing agriculture productivity. An effective government ensures the implementation of policies that support agriculture, while regulatory quality ensures that regulations are fair, transparent, and conducive to sector growth. Control of corruption is crucial in preventing leakages and ensuring that resources are directed toward productive agricultural activities. Thus, institutional quality plays a crucial role in agriculture productivity. Government effectiveness ensures the formulation and implementation of policies that support the growth of the agricultural sector. Effective regulations facilitate trade, reduce barriers, and promote investment in agriculture. Control of corruption is essential to prevent rent-seeking behavior and ensure that resources are allocated efficiently, benefiting the agricultural sector.

The intricate interplay between investment climates and institutional quality is evident in how improvements in one area can positively affect the other. For instance, a reduction in corruption can enhance the overall investment climate by increasing investor confidence and reducing transaction costs. Similarly, effective governance and regulatory frameworks can create a more favorable investment climate for the agriculture sector. Agriculture productivity, in turn, influences investment climates. A productive agricultural sector contributes to economic growth, employment generation, and export earnings. This positively impacts economic conditions, such as income growth and interest rates. It also enhances social conditions, such as improved life expectancy, women's education, and labor participation, as the agricultural sector provides livelihood opportunities and contributes to human development.

2.6 Theoretical Framework

This theoretical framework for this study is based on the endogenous growth model i.e. the extended Solow growth model proposed by Romer in 2012[110,111]. The Solow model specifically examines four variables: output (*Y*), capital (*K*), labour (*L*), and the "knowledge" or the "efficiency of labour" (A). At all times, the economy possesses varying quantities of capital, labour, and knowledge, which are amalgamated to generate output. The production function is expressed in the following form:

$$Y(t)=F(K(t),A(t)L(t)) \qquad \text{[Note that } t \text{ represents time]} \qquad (2.1)$$

It is important to observe that time does not have a direct impact on the production function, but rather influences it through the variables K, L, and A. Put simply, the output will only change over time if there are changes in the inputs to production. Specifically, the level of productivity achieved from a given amount of capital and labour grows with time, known as technological development, only if there is a gain in knowledge.

Additionally, it is important to observe that A and L enter the equation in a way that results in multiplication. AL stands for effective labour, and technological advancement that occurs in this manner is called *labour-augmenting* or *Harrod-neutral*. If knowledge is represented by the equation, $Y = F(AK, L)$, then technical development is said to be *capital-augmenting*. If the equation takes the form, $Y = AF(K, L)$, then technological progress is considered *Hicks-neutral*. The specified method of A's entry, along with the other assumptions of the model, will ultimately result in the stabilization of the capital to output ratio, K/L.

Empirically, capital-output ratios do not exhibit any discernible long-term trend in either an upward or decreasing direction[111]. Furthermore, constructing the model in such a way that the ratio eventually remains constant greatly simplifies the analysis. Given that A multiplies L, it is thus highly convenient. The model assumes that the inputs factors exhibit increasing returns to scale. Since, the focus of this study is based on time series framework, the time (t) is incorporated into the model as follows:

$$Y(t) = K(t)^{\alpha}[A(t)L(t)]^{1-\alpha} \qquad \text{Note: } \alpha > 0 \qquad (2.2)$$

The Solow model is based on two main assumptions: the characteristics of the production function and the changes in the three inputs to production (capital, labour, and knowledge) over time. The model assumes that the production function exhibits constant returns to scale with respect to both capital and effective labour. In other words, if the amounts of capital and effective labour are doubled (e.g., by doubling K and L while keeping A constant), the amount produced is also doubled. In general, if both arguments are multiplied by a nonnegative constant c, the output will change by the same factor:

$$F(cK, cAL) = cF(K, AL) \qquad \text{for all } c \geq 0 \qquad (2.3)$$

The assumption of continuous returns might be conceptualized as a fusion of two distinct assumptions. One reason is that the economy has reached a point where the benefits of specialization have been fully utilized. In a highly limited economy, there are many opportunities for increased specialization, such that when the amounts of capital and labour are doubled, production more than doubles. The Solow model assumes that in an economy of sufficient size, if both capital and labour are doubled, the new inputs are utilized in a manner that essentially mirrors the utilization of current inputs, resulting in a doubling of output[111].

The second premise posits that factors beyond money, labour, and knowledge hold relatively little significance. Specifically, the model fails to consider land and other natural resources. If natural resources have significance, increasing both capital and labour by two-fold may result in an output increase that is less than twofold. However, the presence of natural resources does not seem to significantly limit expansion. Assuming that there are constant returns to capital and labour alone seems to be a good estimate[111]. By assuming constant returns, we may simplify our analysis of the production function by working with it in its intensive version. Substituting the value $c = 1/AL$ into equation (2.3) results in:

$$F\left(\frac{K}{AL},1\right) = \frac{1}{AL}F(K, AL) \tag{2.4}$$

In this context, K/AL represents the capital per unit of effective labour, while $F(K, AL)/AL$ represents the output per unit of effective labour, denoted as Y/AL. Defining $k = K/AL$, $y = Y/AL$, and $f(k) = F(k,1)$. Subsequently, it is rephrased as:

$$y = f(k) \tag{2.5}$$

In other words, we may express the output per unit of effective labour as a mathematical function of the capital per unit of effective labour.

The variables k and y are not inherently significant. Instead, they serve as instruments for acquiring knowledge about the elements that pique our curiosity. To simplify the analysis of the model, it is more effective to examine the behaviour of the variable k rather than directly considering the behaviour of the two arguments of the production function, K and AL. As an illustration, we will analyze the performance of output per worker, Y/L, by expressing it as $A\left(Y/AL\right)$, or $Af(k)$, and examining the characteristics of A and k.

To have a better understanding of equation (2.5), consider the concept of partitioning the economy into several smaller economies, where each economy has a fixed amount of effective labour (1 unit) and a ratio of capital (K) to effective labour (AL) units. Due to the constant returns of the production function, each of these little economies generates a fraction of $1/AL$ compared to the production of the huge, undivided economy. Hence, the level of productivity per unit of labour is solely determined by the amount of capital per unit of labour and is independent of the overall scale of the economy. The mathematical expression for this is represented by equation (2.5).

The intensive-form production function, denoted as *f*(*k*), is assumed to have the following properties: $f(0)=0$, $f'(k)>0$, and $f''(k)<0$. Given that $F(K,AL)$ is equal to $ALf(K/AL)$, it can be deduced that the marginal product of capital, $\partial F(K,AL)/\partial K$, is equal to $ALf'(K/AL)(1/AL)$, which simplifies to $f'(k)$. Therefore, if we assume that $f'(k)$ is positive and $f''(k)$ is negative, it follows that the marginal product of capital is positive but decreases as the amount of capital per unit of effective labour increases. Furthermore, it is assumed that the function $f(\bullet)$ satisfies the Inada criteria: $\lim_{k\to 0} f'(k)=\infty$, and $\lim_{k\to\infty} f'(k)=0$ [112]. The conditions, which are more stringent than necessary for the model's main outcomes, assert that the marginal product of capital is significantly high when the capital stock is relatively small and decreases significantly as the capital stock increases. Their purpose is to guarantee that the trajectory of the economy remains stable and does not deviate. An example of a production function is the Cobb-Douglas function, stated as:

$$F(K,AL)=K^{\alpha}(AL)^{1-\alpha} \qquad 0<\alpha<1 \tag{2.6}$$

The analysis of this production function is easy, and it seems to be a reliable initial approximation to real production functions. Consequently, it is beneficial. Verifying that the Cobb-Douglas function exhibits constant returns is an easy task. By multiplying both inputs by the constant *c*, it gives:

$$\begin{aligned} F(cK,cAL) &= (cK)^{\alpha}(cAL)^{1-\alpha} \\ &= c^{\alpha}c^{1-\alpha}K^{\alpha}(AL)^{1-\alpha} \\ &= cF(K,AL) \end{aligned} \tag{2.7}$$

To get the intensive form of the production function, divide both inputs by the average level of productivity (AL); this will result in:

$$f(k) \equiv F\left(\frac{K}{AL}, 1\right) = \left(\frac{K}{AL}\right)^{\alpha} = k^{\alpha} \qquad (2.8)$$

Equation (3.7) indicates that the derivative of capital per output $f'(k) = \alpha K^{\alpha-1}$. It is evident that this expression is positive, it tends towards infinity ask tends towards zero, and it tends towards zero as k tends towards infinity. Ultimately, the function $f''(k) = -(1-\alpha)\alpha k^{\alpha-2}$ is negative.

The remaining assumptions in the model pertain to the dynamics of labour, knowledge, and capital stocks across time. The model operates in continuous time, meaning that the variables of the model are defined at every moment in time[111].

The initial levels of capital, labour, and knowledge are fixed and are presumed to be greater than zero. Labour and knowledge exhibit consistent and steady growth rates.

$$\dot{L}(t) = nL(t) \qquad (2.9)$$

$$\dot{A}(t) = gA(t) \qquad (2.10)$$

The variables n and g are exogenous parameters, and a dot over a variable indicates a derivative with respect to time (i.e., $\dot{X}(t)$ is a concise way of writing $dX(t)/dt$). By applying the theorem that states the growth rate of a variable is equal to the rate of change of its logarithm of equations (2.8) and (2.9), it can be deduced that the rates of change of the logarithms of L and A are constant. Furthermore, these rates of change are equal to n and g, respectively. Therefore,

$$\ln L(t) = [\ln L(0)] + nt$$

(2.11)

$$\ln A(t) = [\ln A(0)] + gt \qquad (2.12)$$

Where: $L(0)$ and $A(0)$ represent L and A's values at time 0. When they are exponentiated, both sides of these equations give:

$$L(t) = L(0)e^{nt}$$

(2.13)

$$A(t) = A(0)e^{gt}$$

(2.14)

It is assumed that both L and A grew exponentially.

The output is allocated between consumption and investment. The proportion of production allocated to investment, denoted by s, is determined externally, and remains constant. Allocating one unit of output to investment results in the creation of one unit of new capital. Furthermore, the current capital experiences depreciation at a rate δ. Therefore:

$$\dot{K}(t) = sY(t) - \delta K(t) \qquad (2.15)$$

While there are no specific limitations on the values of n, g, and δ individually, it is believed that their combined sum is positive. The model description is now complete.

Regarding institutional settings, a notable scholar offered two distinct ways on how institutional quality influence output growth[113]. The scholar offered those institutions can affect growth through capital or total factor productivity channel. Under the investment channel, he claimed that if institutions affect investment, it then implies that institutions affect growth indirectly. A scholar offered three points on the direct links between institutions and investment, which are: (a) secure property rights may protect the fruits of investment from expropriation by the state or other individuals; (b) favorable institutions governing credit markets and the enforcement of contracts can eliminate bamers to the financial and contractual arrangements that are necessary to carry out investment; (c) institutions which facilitate economic transactions between individuals and firms enhance the gains from trade and, therefore, increase the potential return to investment[114].

On the other hand, the effect of institutions on growth through the total factor productivity channel indicates that differences in institutional settings across countries may lead to variations in their productive efficiency. This suggests that a nation blessed with abundant resources may experience a deficiency in growth and development due to the weakness of institutional settings that support the efficient allocation of resources[113]. It was therefore assumed that institutional quality affect growth through the total factor productivity and not via investment. This is because following the investment channel, investment will be omitted which would not be appropriate in this regard. Therefore, the assumption that institutions affect total factor productivity can enter the model by specifying technology, A as a function of institutions (IQ).

$$A(t) = A_0(t)e^{IQ(t)} \quad (2.16)$$

Thus, incorporating equation (2.16) into equation (2.2) and taking the natural logs of technology, it then becomes:

$$\ln Y(t) = \alpha \ln K(t) + (1-\alpha)\left[\ln A(t) + L(t) + IQ(t)\right] \quad (2.17)$$

Furthermore, the derivation of the variables for both sides with respect to time is further taken because the time differentials of the natural log of variables equal to their growth rates. It is stated as thus:

$$g_Y(t) = \alpha g_K(t) + (1-\alpha)\left[g_A(t) + g_L(t) + iq\right] \quad (2.18)$$

For simplification of the model, the growth rates of *L*, and *A*, are incorporated into equation (2.18), thereby becoming:

$$g_Y(t) = \alpha g_K(t) + (1-\alpha)\left[g + n + iq\right] \quad (2.19)$$

Where: g_Y and g_K are growth rates of outputs and capital; g and n denote growth rates of labour and knowledge; and iq is institutional quality. The theoretical framework that establishes the links among investment climate, institutions, and economic performance in ECOWAS is presented in equation (2.19).

2.7 Summary of Gaps in Literature Reviewed

The existing literature on the links between investment climate, institutions, and agricultural performance in ECOWAS reveals a significant gap that calls for comprehensive exploration. Following the findings of existing studies that can best be described as inconclusive, there is need for reinvestigation of the interrelationship among investment climate, institutions, and agricultural performance in developing countries, most especially the ECOWAS. A notable pattern in previous studies is the isolated focus on either the relationships between investment climate and agricultural performance or institutions and agricultural performance. This identified gap becomes evident when considering the intricate tripartite relationship among investment climate, institutions, and agricultural performance. The literature lacks a holistic examination of how these three elements interact and jointly influence the agricultural sector in the ECOWAS region.

In addition, the absence of existing research addressing the complementarity or substitution dynamics between institutions and investment climate further accentuates the need for a more nuanced understanding of their combined impact on agricultural performance. While both investment climate and institutions are recognized as essential determinants of agricultural performance, the intricate ways in which they may complement each other or act as substitutes remain largely unexplored. Understanding whether improvements in one factor can compensate for deficiencies in the other or whether they amplify each other's effects is critical for formulating targeted policy interventions. The lack of research in this specific domain underscores the need for studies that delve into the synergistic or antagonistic relationships between investment climate and institutions for enhancing agricultural performance in ECOWAS. Thus, this study highlights the need for understanding how these two crucial factors (institutions and investment climate) synergize or counteract to influence agricultural performance indicators.

Moreover, a critical gap exists in the decomposition of the investment climate. While this crucial determinant of economic activities encompasses various dimensions, including economic, political, financial, and social conditions, literature predominantly treats it as a singular entity. The lack of detailed investigation into economic conditions (such as income growth, interest rates, and inflation rates), political conditions (including stability and regime types), financial conditions (encompassing system depth, activity, and size), and social conditions (covering life expectancy, women's education, and labor participation) underscores the need for a more granular analysis. The present study aims to contribute significantly by thoroughly considering each component of the investment climate, offering a more comprehensive picture of its impact on agricultural performance.

Similarly, the decomposition of agricultural performance into its constituent components such as agriculture output growth, agriculture employment, and agriculture exports, is a notable gap in the literature. Previous studies often treated agricultural performance as a singular outcome, neglecting the multifaceted nature of the sector. This oversight limits the depth of understanding regarding how different aspects of agricultural performance respond to variations in the investment climate and institutional quality. Furthermore, literature has not adequately addressed the specific dimensions of institutions that influence agricultural performance. While institutions encompass regulatory quality, government effectiveness, and control of corruption, prior studies often lack granularity in dissecting these elements. This research gap highlights the necessity of exploring how each institutional dimension independently shapes agricultural outcomes, offering insights into potential policy interventions for fostering sustainable development in the agricultural sector.

Lastly, the methodological gap in the literature pertains to the utilization of advanced econometric techniques. Specifically, the second-generation unit root and cointegration tests of variables have been underutilized, potentially leading to less robust and accurate findings. The incorporation of these advanced statistical methods in the present study aims to enhance the rigor and reliability of the analysis. Additionally, the absence of pooled mean and mean group estimation tests in previous research methodologies presents an opportunity for the current study to contribute novel insights into understanding the tripartite relationship among investment climate, institutions, and agricultural performance in ECOWAS.

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Chapter Three

Methodology

This chapter of the study focused on the methodology employed to examine the nexus among investment climate, institutional quality, and agriculture performance in Nigeria. This described the specification of empirical models, a-priori expectations, data sources, estimation techniques, diagnostic tests, and data measurements.

3.1 Model Specification

3.1.1 Empirical Model of Institutions and Investment Climate

There are a few numbers of empirical research that investigates how investment climate is affected by institutions. Most of the previous studies developed their analytical framework around the institutional theory of investment. Following the institutional theory of investment and the conceptual framework in the last chapter, they serve as a basis for understanding how institutions influence the investment climate in the ECOWAS. This theory posits that institutions, including regulation quality, control of corruption, rule of law, and government effectiveness, play a crucial role in shaping the behaviour of economic actors and ultimately determine the attractiveness of a region for investment[1,2,3,4,5,6]. In the context of ECOWAS, where governance challenges and institutional weaknesses are prevalent, the institutional theory provides a comprehensive lens through which to analyze the complexities of the investment climate.

Regulatory quality is a key aspect of institutional theory, emphasizing the importance of clear, transparent, and consistent regulations for fostering investment[1]. In ECOWAS, regulatory frameworks across member states often suffer from inconsistencies, bureaucratic hurdles, and lack of enforcement. Weak regulatory quality can deter investors due to uncertainties and increased transaction costs. Therefore, the institutional theory suggests that improving regulatory quality through reforms aimed at streamlining processes, enhancing transparency, and strengthening legal frameworks can positively impact the investment climate in ECOWAS. Also, control of corruption is another critical institutional dimension affecting investment climate. Corruption undermines investor confidence, distorts market competition, and increases business risks[2,3]. ECOWAS countries frequently grapple with corruption challenges, leading to perceptions of rent-seeking behaviour, bribery, and favouritism. According to the institutional theory, combating corruption through institutional reforms, anti-corruption measures, and increased transparency can create a more conducive environment for investment. However, the appropriateness of this theory depends on the effectiveness of anti-corruption efforts and the political will to enforce accountability mechanisms.

More so, government effectiveness is a significant factor influencing the investment climate in ECOWAS. Weak governance, inefficient public services, and lack of policy coherence can hinder investment by creating uncertainties and operational challenges for businesses[4,5]. The institutional theory posits that enhancing government effectiveness through capacity-building, public sector reforms, and better service delivery can improve the investment climate. Nonetheless, the appropriateness of this theory hinges on the willingness of governments in ECOWAS to implement reforms and strengthen institutional capacities. As well the rule of law is a fundamental pillar of institutional quality that ensures legal predictability, property rights protection, and contract enforcement[6]. Strong legal frameworks and an independent judiciary are essential for creating a conducive environment for investment. Countries with a robust rule of law attract more investment by providing investors with confidence that their rights will be protected, and disputes will be resolved fairly. In ECOWAS, strengthening the rule of law is crucial for improving the investment climate and promoting sustainable development. The empirical model linking institutions and investment climate is presented as:

$$incl_{i,t} = \theta_0 + \Phi' inst_{i,t} + v_{i,t} \tag{3.1}$$

Where: *incl* represents the vector of investment climates captured by economic freedom index, property right, government integrity, monetary freedom, trade freedom, business freedom, and investment freedom; *inst* is a vector of institutional quality measured by the average of regulation quality, control of corruption, rule of law, and government effectiveness. The stochastic term is v; θ_0, Φ' are parameters; *i* is country; *t* represents time; where $i = 1, 2, 3, \ldots n$.

The study further considered the influence of other key variables such as GDP growth rate, trade openness, macroeconomic instability captured by inflation rate, broad money supply to GDP, and external debt to GDP. Investment climate of a country is heavily influenced by GDP growth. Investment is drawn to strong economies with high GDP growth. Investments are more likely in circumstances with growth and returns on investment[7,8]. High GDP growth boosts consumer demand, company expansion, and economic vibrancy, attracting domestic and foreign investment. Low or negative GDP growth rates can weaken investor sentiment and make investment less attractive. In such cases, businesses may delay investment choices and international investors may seek better alternatives. Business and investor opportunities from trade openness greatly impact a country's investment climate[9]. International commerce opens up new markets and opportunities for a nation. Trade openness boosts competition, efficiency, and innovation, making business more dynamic and investment friendly. Global marketplaces offer economies of scale and profit for businesses. Open trade policies also demonstrate economic interconnectedness, which can reassure investors.

The investment climate is also affected by macroeconomic instability, such as inflation. High and fluctuating inflation rates breed uncertainty and devalue investments[10]. Investors are wary of long-term investment in uncertain rewards. In addition, rising inflation raises borrowing costs, decreasing investment project credit. Stable and low inflation rates allow investors to plan and manage risk more predictably. The investment climate is affected by broad money supply since it influences the investment climate by affecting the availability of credit and liquidity in the economy. An increase in broad money supply generally enhances the investment climate by making more funds available for businesses to borrow and invest, thereby stimulating economic activity[11]. However, if not well-managed, excessive money supply can lead to inflationary pressures, which may undermine economic stability and deter investment by increasing uncertainty and costs. High foreign debt raises concerns about a country's ability to service its debt, perhaps causing default and higher borrowing costs[12]. As investors become risk-averse, uncertainty might inhibit investment, especially international investment. Heavy debt may also reduce public spending on infrastructure and social services, which are vital for long-term economic growth and investment. So, countries with controllable foreign debt are seen as having a more stable and attractive investment climate because they can promote sustainable economic development and attract investment. Incorporating the variables into model (3.1), the empirical model is represented as:

$$incl_{i,t} = \theta_0 + \Phi' inst_{i,t} + \vartheta_1 gdpg_{i,t} + \vartheta_2 topn_{i,t} + \vartheta_3 \inf_{i,t} + \vartheta_4 bm_{i,t} + \vartheta_5 exdt_{i,t} + e_{i,t} \tag{3.2}$$

Where: *incl* represents the vector of investment climates captured by economic freedom index, property right, government integrity, monetary freedom, trade freedom, business freedom, and investment freedom; *inst* is institutional quality measured by the average of regulation quality, control of corruption, rule of law, and government effectiveness; *gdpg* represents GDP growth rate, *topn* is trade openness, *inf* denotes macroeconomic instability captured by inflation rate, *bm* represents broad money supply, and *exdt* is external debt to GDP. $\theta_0, \Phi', \vartheta_{1-5}$ are parameters; *i* is country; *t* represents time; e is the stochastic term; where $i = 1, 2, 3, ... n$.

3.1.2 Empirical Model of the Effect of Investment Climate on Agricultural Performance

Following the endogenous growth framework and the previous empirical works, the empirical model to establish the relationship between investment climates and agriculture performance is stated as follows[13,14,15]:

$$agpf_{i,t} = \phi_0 + \mathrm{B}' incl_{i,t} + \upsilon_{i,t} \tag{3.3}$$

Where: *agpf* denotes the vector of agricultural performance measures captured by agriculture output growth, agriculture output per worker, agriculture employment, and agriculture exports; and *incl* is a vector of investment climate indices captured by economic freedom index, property right, government integrity, monetary freedom, trade freedom, business freedom, and investment freedom. The disturbance term is represented by υ; *i* and *t* denote country and time respectively (where $i = 1, 2, 3, ... n$); and ϕ_o, B' denotes volatility of investment climate in relation to agricultural performance

Following existing empirics and theory, other key factors of agriculture performance considered in this study are GDP growth rate, macroeconomic instability captured by inflation rate, and external debt. GDP growth rate significantly impacts agriculture performance. A higher GDP growth rate generally indicates increased economic activity, which translates to greater demand for agricultural products. High GDP growth stimulates consumer spending, leading to higher demand for food and agricultural commodities, and thereby driving output growth in the agriculture sector[16]. Moreover, a robust GDP growth rate often accompanies increased investment in infrastructure and agricultural technologies, which can enhance agricultural productivity and output. Consequently, higher GDP growth rates tend to correlate positively with output growth in agriculture.

Macroeconomic instability, as indicated by inflation rate and foreign debt, can significantly affect agriculture performance. High inflation rates erode consumers' purchasing power, leading to reduced demand for agricultural products and affecting output growth negatively[17,18]. More so, foreign debt impacts agricultural performance by influencing the availability of resources for investment in agricultural infrastructure and inputs. High levels of foreign debt can strain government budgets, leading to reduced public investment in the agricultural sector and potentially limiting access to necessary services and support for farmers[19,20]. Additionally, servicing large foreign debt can divert funds away from productive agricultural investments, which may hinder growth and development in the sector. Incorporating these variables, equation (3.3) becomes:

$$agpf_{i,t} = \phi_0 + \mathrm{B}'incl_{i,t} + \pi_1 gdpg_{i,t} + \pi_2 \inf_{i,t} + \pi_3 exdt_{i,t} + \upsilon_{i,t} \qquad (3.4)$$

Where: *agpf* denotes the vector of agriculture performance measures captured by agriculture output growth, agriculture output per labour, agriculture employment, and agriculture exports; *incl* is a vector of investment climates indices captured by economic freedom index, property right, government integrity, monetary freedom, trade freedom, business freedom, and investment freedom; *gdpg* represents GDP growth rate, *inf* denotes inflation rate, and *exdt* represents external debt. The disturbance term is represented by υ; *i* and *t* denote country and time respectively (where $i = 1, 2, 3, \ldots n$); and $\phi_o, \mathrm{B}', \pi_{1-3}$ are parameters.

3.1.3 Empirical Model of the Effect of Institutions on Agricultural Performance

Based on the theoretical exposition and previous studies, the empirical model that establishes the relationship between institutions and agriculture performance is stated as follows[21,22,23]:

$$agpf_{i,t} = \gamma_0 + \gamma_1 inst_{i,t} + \mu_{i,t} \tag{3.5}$$

Where: *agpf* denotes the vector of agriculture performance measures captured by agriculture output growth, agriculture output per labour, agriculture employment, and agriculture exports; and *inst* is institutional quality measured by average of regulation quality, control of corruption, rule of law, and government effectiveness. The disturbance term is represented by μ ; *i* and *t* denote country and time respectively; γ_0, γ_1 are parameters; where $i = 1, 2, 3, \ldots n$.

The study considers several important factors that contribute to agriculture performance, based on existing empirical evidence and theoretical frameworks. These factors include GDP growth rate, trade openness, macroeconomic instability captured by inflation rate, and broad money supply. The agriculture performance is substantially influenced by the rate of GDP growth. A higher GDP growth rate typically signifies a rise in economic activity, leading to an increased demand for agricultural products. Increased GDP growth encourages consumer expenditure, resulting in a surge in demand for food and agricultural commodities, thereby fueling expansion in the agriculture sector[16]. Furthermore, a strong GDP growth rate is frequently accompanied with higher investment in infrastructure and agricultural technologies, leading to improved agriculture productivity and production. As a result, when the GDP growth rates are higher, there is a favourable link with the rise of output in agriculture.

Trade openness is crucial in influencing the performance of agriculture. Trade openness, which is defined by the growth in imports and exports, enhances market prospects for agricultural products. Increased access to global markets enables agricultural producers to export their products, resulting in a rise in output growth. Moreover, the openness of trade enables the acquisition of sophisticated agricultural technologies and resources, hence enhancing productivity and output[17]. Nevertheless, the influence of trade openness on employment and exports in agriculture is subtle and requires careful consideration. Although the expansion of exports can generate employment possibilities and stimulate export development, the rise in imports can result in job losses and present difficulties for domestic manufacturers, affecting both employment levels and export volumes in the industry.

Macroeconomic fluctuations, as measured by changes in inflation, broad money supply, and external debt, have a substantial impact on the performance of the agriculture sector. High inflation rates diminish the ability of consumers to buy goods, resulting in a decrease in demand for agricultural products and having a negative impact on production growth[17,18]. Broad money supply affects agricultural performance by influencing the availability of credit for farmers and agribusinesses, which is crucial for financing inputs, technology, and expansion. An increase in broad money supply can enhance agricultural performance by providing the necessary funds for investment in productivity improvements and infrastructure[11]. However, if the increase in money supply leads to inflation, it can raise the cost of inputs and reduce profit margins, potentially harming agricultural performance. Foreign debt impacts agricultural performance by influencing the availability of resources for investment in agricultural infrastructure and inputs. High levels of foreign debt can strain government budgets, leading to reduced public investment in the agricultural sector and potentially limiting access to necessary services and support for farmers[19,20]. Additionally, servicing large foreign debt can divert funds away from productive agricultural investments, which may hinder growth and development in the sector. By including these variables, equation (3.5) is transformed:

$$agpf_{i,t} = \gamma_0 + \gamma_1 inst_{i,t} + \gamma_2 gdpg_{i,t} + \gamma_3 topn_{i,t} + \gamma_4 \inf_{i,t} + \gamma_5 bm_{i,t} + \mu_{i,t} \quad (3.6)$$

Where: *agpf* denotes the vector of agriculture performance measures captured by agriculture output growth, agriculture output per worker, agriculture employment, and agriculture exports; *inst* is institutional quality proxied by average of regulation quality, control of corruption, rule of law, and government effectiveness; *gdpg* represents GDP growth rate, *topn* is trade openness, *inf* denotes inflation rate, and *bm* is broad money supply. The disturbance term is represented by μ; *i* and *t* denote country and time respectively; γ_0, γ_{1-5} are parameters; where $i = 1, 2, 3, \ldots n$.

3.1.4 Model of the Interrelationship among Investment Climate, Institutions, and Agricultural Performance

Following the theoretical model and previous studies, the model is specified for the relationship among investment climate, institutions, and agriculture performance as[13,14,15,21,22,23]:

$$agpf_{i,t} = \omega_0 + \Psi' incl_{i,t} + \omega_1 inst_{i,t} + \Phi'(incl \times inst)_{i,t} + \mu_{i,t} \quad (3.7)$$

Where: *agpf* denotes the vector of agriculture performance measures captured by agriculture output growth, agriculture output per worker, agriculture employment, and agriculture exports; *incl* is a vector of investment climates indices captured by economic freedom index, property right, government integrity, monetary freedom, trade freedom, business freedom, and investment freedom; *inst* is institutional quality proxied by average of regulation quality, control of corruption, rule of law, and government effectiveness. The interactive term of investment climate and institutional quality is denoted by $incl \times inst$. The disturbance term is represented by μ; *i* and *t* denote country and time respectively; $\omega_0, \omega_1, \Psi', \Phi'$ are parameters; where $i = 1, 2, 3, \ldots n$.

The study considers several factors that influence agriculture performance, drawing from existing empirical evidence and theoretical frameworks. These factors include the GDP growth, inflation rate, broad money supply, trade openness, and external debt. GDP development greatly affects agriculture. A higher GDP growth rate indicates economic activity, which increases agricultural product demand. GDP growth boosts consumer spending, which boosts food and agricultural commodity demand, boosting agriculture[16]. A large GDP growth rate often leads to higher infrastructure and agricultural technology investment, improving agriculture productivity and production. Thus, greater GDP growth rates boost agricultural output.

Broad money supply affects agricultural performance by influencing the availability of credit for farmers and agribusinesses, which is crucial for financing inputs, technology, and expansion. An increase in broad money supply can enhance agricultural performance by providing the necessary funds for investment in productivity improvements and infrastructure[11]. However, if the increase in money supply leads to inflation, it can raise the cost of inputs and reduce profit margins, potentially harming agricultural performance. Agricultural performance depends on trade openness. Agriculture benefits from trade openness, which increases imports and exports. Access to global markets allows agricultural producers to export, increasing output. Open commerce allows the acquisition of advanced agricultural technologies and resources, increasing productivity and output[16].

However, the impact of trade openness on agricultural employment and exports is nuanced and requires careful examination. Export growth can create jobs and boost export development but import growth might hurt domestic manufacturers and lower export volumes. Agriculture is heavily impacted by macroeconomic variables like inflation and interest rates. High inflation rates reduce consumer spending, lowering agricultural product demand and output growth[17,18].

Foreign debt impacts agricultural performance by influencing the availability of resources for investment in agricultural infrastructure and inputs. High levels of foreign debt can strain government budgets, leading to reduced public investment in the agricultural sector and potentially limiting access to necessary services and support for farmers. Additionally, servicing large foreign debt can divert funds away from productive agricultural investments, which may hinder growth and development in the sector[19,20]. By incorporating these variables, equation (3.7) is modified.

$$agpf_{i,t} = \omega_0 + \Psi' incl_{i,t} + \omega_1 inst_{i,t} + \Phi'(incl \times inst)_{i,t} + \omega_2 gdpg_{i,t} + \omega_3 topn_{i,t} + \omega_4 \inf_{i,t} + \omega_5 bm_{i,t} + \omega_6 exdt_{i,t} + \mu_{i,t} \quad (3.8)$$

Where: *agpf* denotes the vector of agriculture performance measures captured by agriculture output growth, agriculture output per worker, agriculture employment, and agriculture exports; *inst* is institutional quality proxied by average of regulation quality, control of corruption, rule of law, and government effectiveness; *incl* is a vector of investment climates indices captured by economic freedom index, property right, government integrity, monetary freedom, trade freedom, business freedom, and investment freedom; *incl*×*inst* is the interactive term of investment climate and institutional quality; *gdpg* represents GDP growth rate, *topn* is trade openness, *inf* denotes inflation rate, *bm* represents broad money supply, and *exdt* is external debt. The disturbance term is represented by μ ; i and t denote country and time respectively; $\omega_0, \omega_{1-6}, \Psi', \Phi'$ are parameters; where $i = 1, 2, 3, \ldots n$.

The net effect of the interactive variable in equation (3.8) is calculated to determine if institutions act as ameliorating or deteriorating factor in the nexus between investment climates and agriculture performance. The partial derivate in respect of investment climate is derived as:

$$\frac{\partial(agpf_{i,t})}{\partial(incl_{i,t})} = \Psi' + \Phi' inst \quad (3.9)$$

It reveals the net impact of investment climates on agriculture performance at the average value of institutional quality. This equally denotes the investment climates elasticity of agriculture performance at the mean value of institutions. The interaction of institutions and investment climates on agriculture performance are conditional on the parameters: Ψ' and Φ' in equation (3.9). For instance, when the net effect value is negative, it means that institutional quality and investment climates are substitute, whereas complement if the net effect is positive. Furthermore, investment climates contribute positively to agriculture performance, but the quality of institutional settings acts as a drag, leaking out the beneficial impact if $\Psi' > 0$, and $\Phi' < 0$. Also, investment climates have a favourable impact on agriculture performance, and the quality of institutions improves and supplements the direct impact if $\Psi' > 0$, and $\Phi' > 0$. Meanwhile, investment climates have a deteriorating influence on agriculture performance at the same time as institutional quality mitigates and minimizes the negative impact if $\Psi' < 0$, and $\Phi' > 0$. However, the perspective changes when $\Psi' < 0$, and $\Phi' < 0$, which implies that investment climates harm agriculture performance, likewise, institutions degenerate or magnify the adverse impact.

3.2 A'priori Expectations

According to the investment climate model, higher scores in regulation quality, control of corruption, rule of law, and government effectiveness are expected to positively affect the investment climate, as they provide a transparent, fair, and efficient environment for businesses to operate. As to GDP growth rate, a higher GDP growth rate is expected to positively influence the investment climate, as it signals economic expansion, increased business opportunities, and higher potential returns on investment. Also, greater trade openness is anticipated to positively impact the investment climate, as it fosters competition, access to larger markets, and opportunities for businesses to grow and innovate. Lower inflation rates are expected to positively affect the investment climate, as they provide stability, predictability, and preserve the value of investments over time. Regarding broad money supply, it influences the investment climate by affecting the availability of credit and liquidity in the economy. Also, f not well-managed, excessive money supply can lead to inflationary pressures, which may undermine economic stability and deter investment by increasing uncertainty and costs. Concerning external debt to GDP, lower levels of external debt to GDP are expected to positively affect the investment climate, as they reduce the risk of default, lower borrowing costs, and provide greater fiscal stability, encouraging investment.

For agriculture performance model, the study expects that higher scores in economic freedom index, property rights, government integrity, monetary freedom, trade freedom, business freedom, and investment freedom are expected to positively affect agriculture performance. They signal a favourable business environment, secure property rights, transparent governance, monetary freedom, open trade policies, and investment opportunities, which can encourage investment, innovation, and growth in the agricultural sector. As to institutional quality measures, greater regulation quality, control of corruption, rule of law, and government effectiveness are expected to positively influence agriculture performance. These factors contribute to a transparent regulatory environment, reduced corruption, legal certainty, and effective governance, which can promote investment, productivity, and efficiency in agriculture.

Also, the study presumes that higher GDP growth rates are expected to positively impact agriculture performance by stimulating demand, increasing consumer spending power, and providing a conducive economic environment for agricultural investment, innovation, and productivity growth. More so, it expects greater trade openness is expected to positively affect agriculture performance by providing access to larger markets, facilitating the export of agricultural products, and fostering competition, innovation, and efficiency in the agricultural sector. Concerning price instability, lower inflation rates are expected to positively influence agriculture performance by providing price stability, reducing production costs, and preserving the purchasing power of agricultural incomes, encouraging investment and production in the sector. Regarding broad money supply, it affects agricultural performance by influencing the availability of credit for farmers and agribusinesses, which is crucial for financing inputs, technology, and expansion. More so, if the increase in money supply leads to inflation, it can raise the cost of inputs and reduce profit margins, potentially harming agricultural performance. Foreign debt impacts agricultural performance by influencing the availability of resources for investment in agricultural infrastructure and inputs. High levels of foreign debt can strain government budgets, leading to reduced public investment in the agricultural sector and potentially limiting access to necessary services and support for farmers.

3.3 Estimation Techniques

3.3.1 Panel Unit Root Tests

Before advancing to cointegration techniques, it is essential to ascertain that all variables exhibit the same level of integration. To achieve this, the study employs two main tests: the first-generation test of the panel unit root by Im, Pesaran, and Shin (IPS) and the second-generation test by Pesaran[24,25]. These tests are preferred over alternatives like those developed by Levin, Lin, and Chu, and Breitung[26,27,28]. The reason lies in their ability to accommodate heterogeneity in the autoregressive coefficient, a feature lacking in other tests. The IPS tests specifically address the serial correlation issue found in Levin and Lin’s tests by assuming heterogeneity between units within a dynamic panel framework. This approach allows for a more accurate evaluation of unit root properties across the variables of interest, enhancing the reliability and robustness of the analysis. The basic equation for the IPS panel unit root tests is as follows:

$$\Delta y_{i.t} = \beta_i + \varphi_i y_{i,t-1} + \sum_{j=1}^{p} \theta_{ij} \Delta y_{i,t-j} + v_{i,t} \qquad i = 1,2,\ldots, N\,; \; t = 1,2,\ldots, T \tag{3.10}$$

Where: $y_{i.t}$ represents each outcome variables under consideration in our empirical model, β_i denotes the individual fixed effect and p is chosen to ensure the residuals uncorrelated over time. The null hypothesis states that $\varphi_i = 0$ for all i versus the alternative hypothesis, which is that $\varphi_i < 0$ for some $i = 1,\ldots, N_1$ and $\varphi_i = 0$ for $i = N_1 + 1,\ldots, N$.

The IPS statistic is calculated by averaging individual Augmented Dickey–Fuller (ADF) statistics and can be expressed as follows:

$$\bar{t} = \frac{1}{N}\sum_{i=1}^{N} t_{iT} \tag{3.11}$$

Where: t_{iT} is the ADF t-statistic for country i based on the country-specific ADF regression, as in equation (3.10). The $\bar{t}$ statistic has been demonstrated to follow a normal distribution under null hypothesis (H_0), and the critical values for specific values of N and T are provided in IPS[24].

The IPS test assumes that cross-sections are independent, a limitation shared by all first-generation panel unit root tests. However, it has been noted in the literature that cross-sectional dependence can arise from various sources, such as unobserved common factors, externalities, regional and macroeconomic linkages, and residual interdependence. In recent time, new panel unit root tests, known as second-generation tests, have been developed to address this issue of dependence and correlation, acknowledging the prevalence of macroeconomic dynamics and linkages. One well-known second-generation test considered in this paper is the Cross-Sectional

Augmented IPS (CIPS) introduced by Pesaran[25]. To formulate a panel unit root test with cross-sectional dependence, Pesaran proposes the following Cross-Sectional Augmented Dickey–Fuller (CADF) regression, estimated using the OLS method for the *i*th cross-section in the panel[25]:

$$\Delta y_{i.t} = \beta_i + \varphi_i y_{i,t-1} + \vartheta_i \bar{y}_{t-1} + \sum_{j=0}^{k} \vartheta_{ij} \Delta \bar{y}_{i,t-j} + \sum_{j=0}^{k} \Delta y_{i,t-j} + v_{i,t} \qquad (3.12)$$

where, $\bar{y}_{t-1} = \left(\frac{1}{N}\right)\sum_{i=1}^{N} y_{i,t-1}, \Delta \bar{y}_t = \left(\frac{1}{N}\right)\sum_{i=1}^{N} y_{i,t}$, and $t_i(N,T)$ is the t-statistic of the estimate of φ_i in the above equation, used for computing the individual ADF statistics. More precisely, Pesaran proposed the following test CIPS statistic, which is based on the average of individual CADF statistics:

$$CIPS = \left(\frac{1}{N}\right)\sum_{i=1}^{N} t_i(N,T) \qquad (3.13)$$

Pesaran has compiled a table of the critical values for CIPS for several deterministic terms[25].

3.3.2 Panel Cointegration Tests

After establishing the order of stationary, the study proceeds to implement Pedroni's cointegration test approach. Indeed, similar to the IPS panel unit root, the panel cointegration tests suggested by Pedroni also include heterogeneity by incorporating particular characteristics that can change across individual members of the sample[29]. Considering such diversity is advantageous as it is not feasible to assume that the cointegration vectors are the same for all persons in the panel.

Prior to doing Pedroni's cointegration test, it is necessary to first estimate the following long-term relationship:

$$Y_{i,t} = \beta_i + \vartheta_i t + \alpha_{1i} X_{i,t} + v_{i,t} \tag{3.14}$$

For $i = 1,2,..., N; t = 1,2,..., T$, the dependent variable is denoted as *Y*, while the explanatory variables are represented by *X*. *N* indicates the number of individual members in the panel, and *T* refers to the number of observations throughout time. The estimated residuals are structured as follows:

$$\hat{v}_{i,t} = \hat{\rho}_i \hat{v}_{i,t-1} + \hat{\mu}_{i,t} \tag{3.15}$$

Pedroni has put up seven distinct statistical measures for examining cointegration in panel data. Among these seven statistics, four are derived via pooling, which is known as the "Within" dimension, while the remaining three are derived from the "Between" dimension. Both types of testing specifically target the null hypothesis that there is no cointegration. However, the differentiation arises from the explicit definition of the alternative hypothesis. Regarding the tests based on the "Within" dimension, the alternative hypothesis is $\rho_i = \rho < 1$ for all *i*. However, for the last three test statistics based on the "Between" dimension, the alternative hypothesis is $\rho_i < 1$ for all *i*.

Pedroni has used Monte Carlo simulations to tabulate the finite sample distribution for the seven statistics. In order to reject the null hypothesis of no cointegration, the calculated statistical tests must yield results that are smaller than the tabulated critical value.

3.3.3 Pooled Mean Group (PMG) approach

Panel data models are commonly estimated using two estimating approaches. The first method, known as the mean group estimator, involves calculating the average of individual estimates for each group in the panel[30]. Pesaran and Smith state that this estimator yields consistent estimates of the average parameters. Additionally, mean group estimator is an effective long-term estimator for a substantial sample size[31]. This method permits the parameters to vary independently among different groups and does not take into account the possibility of similarity between groups. The second approach is employing the conventional panel method, which encompasses random or fixed effects and GMM methods. These models enforce parameter uniformity across countries, which might result in inconsistent and deceptive long-term coefficients. This issue becomes more pronounced when the time period is extended.

A study suggested the use of an intermediate estimator that permits the short-term parameters to vary across groups, while enforcing equality of the long-term coefficients across countries[32]. An advantage of the PMG is its ability to accommodate variations in the short-term dynamic specification across different countries, while maintaining the constraint that the long-term coefficients remain consistent. In contrast to the Dynamic OLS (DOLS) and Fully Modified OLS (FMOLS), the PMG estimator specifically emphasizes the dynamic adjustment process between the short-run and long-run. The justifications for believing that short-term dynamics and error variances should be identical are typically less convincing. By not enforcing the equivalence of short-run slope coefficients, the dynamic specification is allowed to vary between countries.

Consequently, the link between regressors and outcome variables in the long term is anticipated to be the same across different countries, whereas the coefficients in the short term are predicted to vary depending on the country. The Hausman test can be used to verify the null hypothesis of homogeneity in the long-run coefficients.

Given that regressors and regress and are integrated of order 1 [I (1)] and cointegrated, it is expected that the variable i is integrated of order 0 [I(0)] for every *i* and is independently distributed over time *t*. The lag duration is determined by the existing research on the link between outcome variable and the explanatory variables and is validated by the Akaike

Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC). The autoregressive distributed lag, ARDL (1, 1) model introduced by Pesaran, Shin, and Smith is defined with a maximum of one lag for all variables[32].

$$Y_{i,t} = \pi_i + \theta_{0i} X_{i,t} + \theta_{1i} X_{i,t-1} + \psi_i Y_{i,t-1} + v_{i,t}$$

and the equilibrium error correction representation of the error correction equation can be expressed as:

$$\Delta Y_{i,t} = \theta_{1i} \Delta X_{i,t} + \omega_i Y_{i,t-1} - \hat{\lambda}_{0i} - \hat{\lambda}_{1i} X_{i,t-1} + v_{i,t}$$

Where: $\hat{\lambda}_{0i} = \frac{\pi_i}{1-\psi_i}$, $\hat{\lambda}_{1i} = \frac{\theta_{0i} + \theta_{1i}}{1-\psi_i}$, and $\omega_i = -(1-\psi_i)$.

3.4 Data Sources and Measurements

The analysis covers the period from 2000 to 2022. Furthermore, the sample covers 15 nations in ECOWAS, considering the presence of data on significant variables of interest. The requisite data were acquired from the World Bank database, specifically the World Development Indicators (2024), World Governance Indicators (2024), and the Heritage Foundation (2024). Table 3.1 displays the data measurements, explanation, and sources.

Table 3.1: Summary and measurements of data

Variables	Symbol	Measurement	Data Source
Agriculture output growth	*agpf1*	The rate at which the total production of goods and services from the agricultural sector grows on annual basis.	WDI (2024)
Agriculture employment	*agpf2*	Growth rate of agriculture workforce within a year.	WDI (2024)
Agriculture exports	*agpf3*	Total agriculture exports to GDP ratio	WDI (2024)
Agriculture output per	*agpf3*	The average amount of agriculture output	WDI (2024)

labour		produced per worker in an economy	
Investment climate	*incl*	Economic freedom index captured by property right, government integrity, monetary freedom, trade freedom, business freedom, and investment freedom	Heritage Foundation (2024)
Institutional quality	*inst*	It is captured by institutions index by taking the average of rule of law, regulatory quality, government effectiveness, and control of corruption.	WGI (2024)
GDP growth rate	*gdpg*	Annual rate of income growth on annual basis	WDI (2024)
Broad money supply	*bm*	Broad money supply to GDP ratio	WDI (2024)
Inflation rate	*inf*	Annual rate of consumer price index	WDI (2024)
Trade openness	*topn*	Total trade to GDP ratio	WDI (2024)
External debt	*exdt*	External debt to GDP	WDI (2024)

Source: Author's Compilation (2024).

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Chapter Four

Results and Discussion of Findings

This chapter of the study covers the empirical and econometric assessments of the investment climate, institutional quality, and agricultural performance in ECOWAS from 2000 to 2022. These analyses were carried out within the context of the millennium development goals (MDGs) and sustainable development goals (SDGs). The analysis was conducted using the theoretical framework and empirical models outlined in the previous section. The subsequent portions in this chapter are categorized into seven sections. The first part of the discussion focuses on the presentation of data, while the second section presents summary statistics, and trend analysis of the variables. The presentation of results based on the specified objectives is provided in sections three, four, five, and six, while the pre-estimation tests such as correlation, cross-sectional dependency, stationarity, and cointegration tests are estimated prior to the pooled mean group estimation findings. Finally, the last section discusses the findings.

4.1 Presentation of Data

The data utilized for examining the correlation between investment climate, institutional quality, and agricultural performance in ECOWAS from 2000 to 2022 is provided in the Appendix. The comprehensive and precise approximated results for the complete test conducted in this study are supplied in the appendix, categorized into distinct categories.

4.2 Summary Statistics, and Trend Analysis

The summary statistics of the variables used to analyse the relationship among investment climate, institutional quality, and agricultural performance in ECOWA is presented in this section. The results of the summary statistics include agricultural output (% of GDP), agricultural employment (% of total employment), agricultural exports (% of merchandise exports), property right, government integrity, business freedom, monetary freedom, trade freedom, investment freedom, institutional quality, GDP growth, broad money (% of GDP), inflation rate, trade (% of GDP), and external debt stocks (% of GNI). In Table 4.1, the average contribution of agriculture, forestry, and fishing to the GDP across ECOWAS countries is 28.51%. When compared to this overall average presented in Table 4.2, several countries have a higher agricultural contribution, reflecting a greater reliance on the primary sector for economic activities. Notably, Sierra Leone and Liberia have the highest percentages, with agriculture, forestry, and fishing contributing 53.68% and 51.82% of their GDP, respectively. Guinea-Bissau, Mali, and Niger also exceed the ECOWAS average, with percentages of 41.05%, 34.44%, and 36.72%, respectively. These higher values indicate a significant dependence on agriculture, possibly due to less industrialization or diversification of their economies. Conversely, countries like Cabo Verde, Senegal, and Cote d'Ivoire fall significantly below the ECOWAS average, with values of 6.84%, 14.71%, and 17.14%, respectively. Cabo Verde’s low percentage suggests a more diversified economy with a smaller reliance on agriculture, possibly due to its focus on services such as tourism and finance. Similarly, the relatively lower contributions in Senegal and Cote d'Ivoire might indicate more diversified economies with significant industrial and service sectors. Other countries like Benin, Ghana, and Nigeria hover around the ECOWAS average, with percentages close to 26%, reflecting balanced economies where agriculture still plays a vital role but is not overwhelmingly dominant.

Table 4.1: Descriptive statistics

Signs	Variable measurements	Mean	Std Dev.	Minimum	Maximum	Kurtosis	Skewness	Coeff. of Variation	Obs.
Outcome variables									
agpf1	Agriculture Output, forestry, and fishing, value added (% of GDP)	28.505	13.758	3.688	79.042	1.127	0.939	0.483	345
agpf2	Employment in agriculture (% of total employment) (modeled ILO estimate)	51.377	16.566	10.605	85.282	-0.355	-0.186	0.322	345
agpf3	Agricultural raw materials exports (% of merchandise exports)	9.890	16.949	0	76.839	5.693	2.525	1.714	341
agpf4	Agriculture output per worker (constant 2015 US$)	1570.12	1021.66	364.29	4817.62	1.361	1.333	0.651	331
Principal variables									
Prt	Property right	34.951	12.878	10	75	0.721	0.550	0.368	334
Gint	Government integrity	27.549	9.910	10	60.9	0.465	0.188	0.360	334
Bfr	Business freedom	51.641	9.661	23.4	85	0.881	-0.073	0.187	334
Mfr	Monetary freedom	75.867	7.506	50.4	90.4	0.192	-0.623	0.099	334
Tfr	Trade freedom	62.520	8.445	19	76.2	5.926	-1.951	0.135	334
Ifr	Investment freedom	50.763	13.969	20	80	-0.686	-0.067	0.275	334
Inst	Institutional quality	-0.679	0.447	-1.627	0.430	-0.243	0.462	-0.658	345
Control variables									
Gdpg	GDP growth (annual %)	4.354	4.522	-30.145	26.524	15.818	-1.671	1.039	344
Bm	Broad money (% of GDP)	28.914	17.682	5.210	113.653	5.257	2.145	0.612	338
Inf	Inflation, consumer prices (annual %)	6.033	7.017	-3.503	41.510	4.771	1.864	1.163	331
Topn	Trade (% of GDP)	63.719	33.347	16.352	311.354	22.884	3.920	0.523	343
Exdt	External debt stocks (% of GNI)	62.246	73.442	4.951	610.452	21.834	4.188	1.180	345

Note: Std Dev. – standard deviation; Obs. - observation.

Source: Author's computation (2024).

Also, the average of agricultural employment as a percentage of total employment across ECOWAS countries is 51.38%. Several countries exceed this average, indicating a significant reliance on agriculture for employment. Burkina Faso and Niger, with agricultural employment percentages of 78.73% and 75.38%, respectively, have the highest reliance on agriculture. These figures suggest that a large majority of the workforce in these countries engaged in agricultural activities, reflecting limited industrial and service sector development. Similarly, Mali and Guinea also have high agricultural employment rates, at 66.35% and 65.13%, respectively, further demonstrating their economies' dependence on agriculture as a major source of employment. On the other hand, other ECOWAS countries fall below the overall average of agricultural employment, indicating more diversified employment sectors. Cabo Verde, with only 17.56% of its total employment in agriculture, has the lowest percentage among the ECOWAS countries, which may be due to its emphasis on sectors like tourism and services. Senegal and Nigeria also have lower agricultural employment rates at 35.49% and 40.89%, respectively, suggesting a more balanced distribution of employment across different economic sectors. Benin, Ghana, and Togo have agricultural employment rates close to the overall ECOWAS average, with figures around 41%, 45%, and 42%, respectively. This mix of higher and lower agricultural employment rates among the ECOWAS countries highlights the diverse economic structures within the region, ranging from those heavily dependent on agriculture to those with more varied employment sectors.

Furthermore, the overall mean of agricultural exports as a percentage of merchandise exports for the countries stood at 9.89%. When comparing individual countries to this average, there are significant variations that reflect the differing economic structures and export dependencies within the region. Benin and Burkina Faso have agricultural export percentages significantly higher than the ECOWAS average, at 54.68% and 32.68%, respectively. This indicates that agriculture plays a crucial role in these countries' economies, with a large proportion of their merchandise exports derived from agricultural products. Similarly, Mali and Togo, with agricultural export percentages of 16.32% and 10.16%, respectively, also exceed the ECOWAS average, suggesting a substantial dependence on agricultural commodities for export earnings. Conversely, several countries fall below the ECOWAS average, indicating a lesser dependence on agricultural exports. Cabo Verde, Guinea-Bissau, and Nigeria have the lowest agricultural export percentages at 0.54%, 0.25%, and 1.035%, respectively, reflecting their reliance on other sectors, such as services in Cabo Verde or oil in Nigeria. Ghana, Guinea, Niger, Senegal, Liberia, and Sierra Leone also have agricultural export percentages well below the regional average, ranging from 1.52% to 3.23%, highlighting their more diversified export bases. Côte d'Ivoire and Gambia are slightly below the average, with agricultural exports at 9.46% and 7.21%, respectively, suggesting a balanced mix of agricultural and non-agricultural exports. These disparities illustrate the varying degrees of agricultural export dependence among ECOWAS countries, influenced by each country's unique economic landscape and natural resource endowments.

Moreso, the overall average agricultural output per worker in ECOWAS, measured in constant 2015 US dollars, stood at $1,570.12, reflecting the diverse performance across member countries. Nigeria recorded the highest average of $3,715.90, highlighting its relatively advanced agricultural productivity despite structural challenges. Cabo Verde and Côte d'Ivoire followed with averages of $2,751.95 and $2,264.34, respectively, showcasing efficient agricultural practices and better resource utilization. Conversely, countries like Burkina Faso and Niger registered significantly lower averages at $497.14 and $540.64, respectively, indicating limited agricultural productivity, possibly due to arid climates and resource constraints. Other countries, such as Ghana ($2,026.87) and Senegal ($2,140.78), achieved notable performances, while Guinea ($688.56) and Liberia ($1,117.21) demonstrated moderate productivity. This wide variation underscores disparities in agricultural resources, technology adoption, and investment across the region.

Regarding investment climate, the mean property rights score for ECOWAS countries is 34.95. This average reflects the general state of legal protection for property rights within the region, which tends to be relatively weak. Cabo Verde and Ghana stand out with significantly higher property rights scores of 60.52 and 50.53, respectively. These scores indicate a comparatively stronger legal framework for protecting property rights and suggest a more favorable investment climate in these countries. Senegal also exceeds the ECOWAS average with a property rights score of 46.90, indicating a moderate level of property protection that could help attract and secure investments. On the other hand, other countries fall well below the ECOWAS average, indicating weaker protection of property rights. Sierra Leone, Guinea-Bissau, and Guinea have the lowest scores, with property rights indices of 19.41, 20.76, and 26.09, respectively. These low scores suggest significant challenges related to the enforcement of property rights and the potential for insecure property ownership, which could deter investment. Other countries, including Nigeria, Niger, Togo, and Liberia, have scores slightly below the regional average, ranging from 28.66 to 32.18, pointing to moderate weaknesses in their property rights protections. Thus, the variation in property rights scores among ECOWAS countries highlights a diverse investment climate within the region, with some countries offering more secure environments for property and investment than others.

Table 4.2: Average Value of Investment Climate, Institutional Quality, and Agricultural Performance in ECOWAS (2000-2022)

S/N	Country(s)	Agriculture output (% of GDP)	Agriculture employment (% of total employment)	Agricultural exports (% of merchandise exports)	Agriculture output per worker (constant 2015 US$)	Property right	Government integrity	Business freedom	Monetary freedom	Trade freedom	Investment freedom	Institutional quality
1	Benin	26.411	41.081	54.682	1907.752	33.339	30.752	52.817	80.452	59.943	55.435	-0.515
2	Burkina Faso	23.077	78.725	32.676	497.1405	34.496	31.061	52.535	80.791	65.761	58.696	-0.417
3	Cabo Verde	6.841	17.564	0.544	2751.954	60.517	43.083	64.387	81.652	57.204	65.870	0.294
4	Cote d'Ivoire	17.136	47.160	9.464	2264.342	33.026	26.013	54.026	77.822	66.491	53.913	-0.855
5	Gambia,	25.423	51.944	7.214	1029.978	36.596	26.539	55.904	69.687	61.883	57.391	-0.548
6	Ghana	26.114	45.912	3.233	2026.868	50.526	37.357	59.957	65.626	63.361	60	-0.097
7	Guinea	20.334	65.133	2.033	688.5636	26.091	23.470	49.657	68.826	57.835	43.696	-1.095
8	Guinea-Bissau	41.050	56.964	0.253	1314.894	20.757	16.670	36.074	76.387	58.843	34.348	-1.273
9	Liberia	51.819	46.082	1.517	1117.205	28.664	29.521	51.671	68.557	61.650	40	-1.135
10	Mali	34.444	66.351	16.319	1071.319	34.822	24.591	52.587	81.443	67.730	57.609	-0.667
11	Niger	36.722	75.383	2.255	540.6426	32.183	24.139	44.065	81.800	63.757	50	-0.683
12	Nigeria	24.212	40.893	1.035	3715.895	31.165	19.839	52.739	70.591	58.278	41.957	-1.051
13	Senegal	14.712	35.493	2.086	2140.776	46.904	35.543	55.265	80.930	68.822	52.609	-0.221
14	Sierra Leone	53.680	59.370	3.222	1737.61	19.410	22.352	49.243	70.952	61.448	45.238	-0.996
15	Togo	25.608	42.602	10.158	1107.523	31.952	22.622	43.487	79.204	64.361	40	-0.919

Source: Author's computation (2024).

The average score for government integrity among ECOWAS countries is 27.55. This average reflects moderate to low levels of government integrity across the region, indicating prevalent issues related to corruption, transparency, and ethical governance. Cabo Verde and Ghana have the highest government integrity scores, at 43.08 and 37.36, respectively, significantly above the regional average. These scores suggest that these countries have relatively stronger systems in place to promote government integrity, reduce corruption, and maintain ethical standards, which can foster a more attractive investment climate. Senegal and Burkina Faso also exceed the ECOWAS average, with scores of 35.54 and 31.06, respectively, reflecting moderate levels of government integrity that can support stable governance and economic growth. In contrast, several ECOWAS countries score well below the regional average, highlighting concerns about governance and corruption. Guinea-Bissau and Nigeria have the lowest scores, at 16.67 and 19.84, respectively, indicating significant challenges with government integrity that could hinder economic development and deter foreign investment. Guinea, Sierra Leone, Togo, Niger, and Mali also fall below the average, with scores ranging from 22.35 to 24.59, suggesting persistent governance issues that may undermine trust in public institutions and the effectiveness of policy implementation. Countries such as Benin and Liberia have scores slightly above the average, at 30.75 and 29.52, respectively, reflecting moderate efforts to uphold government integrity but still facing notable challenges. The variation in government integrity scores across ECOWAS countries points to diverse political and institutional environments, with some countries making more progress than others in promoting transparent and ethical governance.

As to business freedom, its average score for the countries is 51.64. This score reflects the overall regulatory business environment within the region, which indicates a moderate level of freedom for businesses to operate without undue government intervention. Cabo Verde has the highest business freedom score at 64.39, significantly above the ECOWAS average, indicating a more conducive environment for business activities with fewer regulatory hurdles and a more streamlined process for business operations. Ghana and Gambia also have higher-than-average scores of 59.96 and 55.90, respectively, suggesting relatively favorable conditions for businesses, including ease of starting a business, obtaining licenses, and accessing markets. Senegal and Côte d'Ivoire are slightly above the average, with scores of 55.27 and 54.03, respectively, pointing to moderately favorable business climates that still have room for improvement. Conversely, several countries in the ECOWAS region fall below the average business freedom score, indicating more restrictive regulatory environments. Guinea-Bissau, with a score of 36.07, has the lowest business freedom in the region, suggesting significant barriers to business operations, such as complex regulations, bureaucratic inefficiencies, and possibly higher costs of compliance. Niger, Togo, and Sierra Leone also score below the average, with scores of 44.07, 43.49, and 49.24, respectively, reflecting challenges such as regulatory obstacles and less supportive environments for business growth and entrepreneurship. Guinea and Liberia have scores close to the ECOWAS average, at 49.66 and 51.67, respectively, indicating a balance between regulatory challenges and opportunities. More so, the variation in business freedom scores across ECOWAS countries highlights a diverse regulatory landscape, with some countries offering more supportive environments for business operations while others face significant regulatory and administrative hurdles.

For monetary freedom score, the average of the ECOWAS countries stood at 75.87. This score reflects stable tendency towards ensuring price stability and inflation control, as well as the level of government intervention in the economy. Numerous ECOWAS countries score above the regional average, indicating relatively stable monetary environments with low inflation and minimal government interference in price setting. Notably, Niger and Cabo Verde have the highest monetary freedom scores of 81.80 and 81.65, respectively, suggesting robust price stability and effective inflation management in these countries. Other countries such as Burkina Faso, Senegal, Benin, Mali, and Togo also have high scores, ranging from 80.79 to 79.20, demonstrating similar economic stability and favorable conditions for maintaining the value of currency and purchasing power. In contrast, a few ECOWAS countries score below the regional average, indicating more challenges with price stability and higher levels of inflation or government control over prices. Ghana has the lowest monetary freedom score at 65.63, reflecting significant issues with inflation and possibly more extensive government involvement in the economy, which could hinder economic growth and investor confidence. Liberia, Guinea, and Gambia also have scores below the ECOWAS average, ranging from 68.56 to 69.69, highlighting similar concerns about inflation control and economic management. Nigeria and Sierra Leone have scores that are slightly below the regional average, with scores of 70.59 and 70.95, respectively, pointing to moderate inflation and government intervention challenges. These variations in monetary freedom across the ECOWAS region illustrate differing levels of economic stability and government control, impacting the overall investment climate and agricultural growth potential in each country.

The average trade freedom score for ECOWAS countries is 62.52. This score reflects moderate openness of the region to international trade, including factors such as tariff rates, trade barriers, and other restrictions on imports and exports. Several countries in the ECOWAS region have trade freedom scores above this average, indicating a more open and liberal trade environment. Senegal, Mali, and Côte d'Ivoire have the highest scores in the region, at 68.82, 67.73, and 66.49, respectively, suggesting relatively low tariffs, fewer trade barriers, and policies that encourage free trade. Burkina Faso and Niger also score above the regional average, with trade freedom scores of 65.76 and 63.76, respectively, indicating moderately open trade environments that facilitate cross-border commerce and economic integration. On the other hand, some ECOWAS countries have trade freedom scores below the regional average, indicating a more restrictive trade environment. Cabo Verde, Nigeria, and Guinea have some of the lowest trade freedom scores in the region, at 57.20, 58.28, and 57.84, respectively. These lower scores suggest higher tariffs, more significant trade barriers, or restrictive trade policies that could hinder international trade and economic growth. Guinea-Bissau, Benin, and Sierra Leone also fall below the average, with scores ranging from 58.84 to 61.45, reflecting similar challenges in creating an open trade environment. Ghana and Gambia have scores slightly above and below the regional average, at 63.36 and 61.88, respectively, suggesting moderate trade freedom. These variations in trade freedom scores across ECOWAS countries highlight diverse trade policies and economic openness, with some countries more conducive to international trade and investment than others.

The average investment freedom score for ECOWAS countries stood at 50.76. This score reflects moderate ability of individuals and firms to move resources into and out of activities both within and outside a country. Some ECOWAS countries have investment freedom scores above this regional average, indicating a more open investment climate with fewer barriers to capital flows. Cabo Verde has the highest investment freedom score at 65.87, suggesting a highly conducive environment for both domestic and foreign investment, with minimal regulatory obstacles. Ghana, Burkina Faso, and Mali also have scores above the average, with 60, 58.70, and 57.61, respectively, reflecting relatively favorable conditions for investment. Benin and Gambia also slightly exceed the regional average, demonstrating a moderate openness to investment. Conversely, a number of ECOWAS countries score below the regional average, indicating more restrictive investment environments. Guinea-Bissau has the lowest investment freedom score at 34.35, pointing to significant regulatory barriers and restrictions that could deter both domestic and foreign investments. Other countries like Liberia, Togo, and Nigeria have scores ranging from 40 to 41.96, which suggests notable challenges in their investment climates, possibly due to bureaucratic inefficiencies, political instability, or restrictive laws and regulations. Guinea, Sierra Leone, and Niger also fall below the average, with scores from 43.70 to 50, reflecting similar constraints on investment freedom. Côte d'Ivoire and Senegal are slightly above and below the average, with scores of 53.91 and 52.61, respectively, indicating moderate conditions that balance opportunities and restrictions. These variations in investment freedom across ECOWAS countries highlight the diverse economic landscapes and the need for policy reforms to enhance the overall investment climate in the region.

As regards institutional quality, its mean score is -0.679. This score reflects weak effectiveness of government institutions, including aspects such as regulatory quality, government effectiveness, rule of law, and control of corruption. The negative score indicates challenges in governance and institutional effectiveness in the region. Among ECOWAS countries, Cabo Verde stands out with a positive institutional quality score of 0.294, suggesting strong governance and effective institutions relative to its regional peers. Ghana also performs better than most, with a score of -0.097, indicating relatively moderate institutional quality within the region. Senegal and Burkina Faso, with scores of -0.221 and -0.417 respectively, also show comparatively better institutional governance, though still below the global average. Other ECOWAS countries score significantly below the regional average, highlighting more substantial governance challenges. Guinea-Bissau has the lowest institutional quality score at -1.273, reflecting severe issues with governance, regulatory quality, and the rule of law. Liberia, Guinea, and Nigeria also score well below the ECOWAS average, with scores of -1.135, -1.095, and -1.051, respectively, indicating notable difficulties in institutional quality. Countries like Sierra Leone, Togo, and Côte d'Ivoire, with scores of -0.996, -0.919, and -0.855, also face considerable governance challenges. Mali and Niger have institutional quality scores close to the ECOWAS average, with -0.667 and -0.683 respectively, reflecting moderate governance issues. These variations in institutional quality across ECOWAS countries underscore the diverse governance landscapes and the need for targeted reforms to improve institutional effectiveness and governance quality in the region.

Concerning other control variables, an average GDP growth of 4.35% indicates moderate economic expansion in ECOWAS countries. This growth rate is above the global average, suggesting that the region is experiencing positive economic momentum. The broad money supply, at 28.91% of GDP, reflects the level of liquidity in the economy. This indicates that the monetary policy in ECOWAS countries is somewhat supportive of economic activities but not excessively expansive. An inflation rate of 6.03% suggests that ECOWAS countries experience moderate inflation. While this is not excessively high, it still poses challenges, particularly for lower-income households. Trade, accounting for 63.72% of GDP, indicates a significant reliance on international trade in ECOWAS economies. This reliance on trade implies that these countries are exposed to global market fluctuations, which can impact economic stability. External debt stocks at 62.25% of GNI reveal a considerable level of indebtedness. This level of debt could pose risks to financial stability if not managed effectively, especially if economic growth slows or if there are adverse changes in global financial conditions.

In Table 4.1, the summary statistics further include Kurtosis, skewness, and the coefficient of variation. The skewness results reveal that agricultural employment, business freedom, monetary freedom, trade freedom, investment freedom, and GDP growth are negatively skewed, while the other variables are positively skewed. Regarding Kurtosis, none of the variables are normally distributed, as they exhibit either flatness or peakedness.

In the sample analysis, the coefficient of variation is used to measure the heterogeneity of the regressors. The result indicates high heterogeneity in agricultural exports, while agricultural output and employment show less variability across the sampled countries. Among the principal variables, institutional quality has a negative coefficient of variation, suggesting that its variability is inversely related to its average level. Property rights and government integrity have similar coefficients of variation, indicating moderate variability. In contrast, business freedom, monetary freedom, and trade freedom display relatively lower coefficients of variation, suggesting more consistency across countries.

For the control variables, external debt stocks, inflation, and GDP growth show the highest variability. On the other hand, broad money supply and trade openness have moderate coefficients of variation, indicating that these variables are relatively more consistent across the region. Given the extensive data and the heterogeneity of the regressors across samples, along with the potential for nonlinearities among the regressors, the study proceeds to test for common factor restrictions. This leads to the verification of the presence of cross-sectional dependence, unit root, and cointegration in sections 4.3, 4.4, 4.5, and 4.6.

Figures 4.1, 4.2, 4.3, and 4.4 show the time-series plots of agricultural performance, investment climate, institutional quality, and control variables (GDP growth, money supply, inflation rate, trade, and external debt) of ECOWAS. Over the period from 2000 to 2022, the contribution of agriculture, forestry, and fishing to GDP in Figure 4.1 shows a declining trend across most

ECOWAS countries. For instance, Benin, Burkina Faso, and Cote d'Ivoire maintained a relatively stable contribution from agriculture to GDP in the early years but saw a gradual decline towards the later years. Benin's contribution hovered around 26-28% in recent years, while Burkina Faso saw a decrease from about 27% to around 20%. Meanwhile, Ghana, Senegal, and Nigeria experienced a declining trend, with Ghana showing a significant drop from around 35% in 2000 to about 19% in 2022. Nigeria also decreased from around 36% in the early 2000s to about 24% in 2022, reflecting the impact of oil reliance and industrial sectors' growth. Also, Guinea-Bissau and Liberia show a high percentage of GDP from agriculture, particularly in the early 2000s. Guinea-Bissau started at over 40%, and Liberia was very high at over 76%, but both have seen fluctuations with some declines by 2022. As for Mali, Niger, and Sierra Leone, these nations show varying trends, with Mali and Niger maintaining a steady but high contribution (around 32-37% for Mali and 34-38% for Niger). Sierra Leone has shown stability but at a high level (around 55-60%). Thus, the decline in agricultural value-added raises concerns about the sustainability of agricultural development and rural livelihoods in the region.

In Figure 4.1, employment in agriculture as a percentage of total employment also shows a downward trend across the ECOWAS countries. Countries like Burkina Faso, Niger, and Guinea-Bissau have consistently high agricultural employment rates, with Burkina Faso remaining above 70% throughout the period, and Niger slightly declining from 78% to around 70%. This indicates that agriculture is the dominant employer in these economies, with slow structural transformation. In Ghana, Senegal, and Nigeria, they have seen a significant decline in agricultural employment. For example, Ghana's employment in agriculture dropped from 53% in 2000 to about 39% in 2022, indicating a shift towards urbanization and growth in other sectors like services and industry. Meanwhile, Liberia, Togo, and Sierra Leone exhibit a declining trend in agricultural employment, reflecting gradual diversification of their economies. For instance, Liberia dropped from around 50% to 40%, showing the gradual emergence of other employment sectors.

Regarding the agricultural value-added per worker of Benin, Cabo Verde, Ghana, and Sierra Leone, there was a steady and substantial increase in agricultural productivity over the years. For instance, Benin's value-added per worker grew consistently, from $1,129 in 2000 to $3,325 in 2022, reflecting sustained improvements in agricultural practices and investment. Similarly, Cabo Verde showed notable growth, with value-added per worker increasing from $1,656 in 2000 to $4,817 in 2020, before experiencing fluctuations in subsequent years. On the other hand, countries such as Burkina Faso and Niger displayed slower and more erratic progress. While Niger's productivity rose steadily from $364 in 2000 to $863 in 2022, Burkina Faso experienced periods of stagnation and decline, particularly from 2017 to 2021, highlighting challenges such as climate variability, infrastructure limitations, and policy constraints. In contrast, countries like Nigeria and Senegal exhibited high levels of productivity compared to their regional counterparts. Nigeria, despite being the largest economy in the region, saw a moderate increase in value-added per worker from $1,548 in 2000 to $4,540 in 2022, albeit with slight stagnation in recent years. Senegal, however, showed rapid growth, particularly from 2016 onward, with value-added per worker increasing sharply from $1,936 in 2016 to $3,570 in 2022, underscoring improvements in agricultural innovation and policy support. However, some countries faced persistent challenges. For example, The Gambia and Liberia showed erratic trends, with declines during certain periods due to socio-economic instability and weak agricultural modernization.

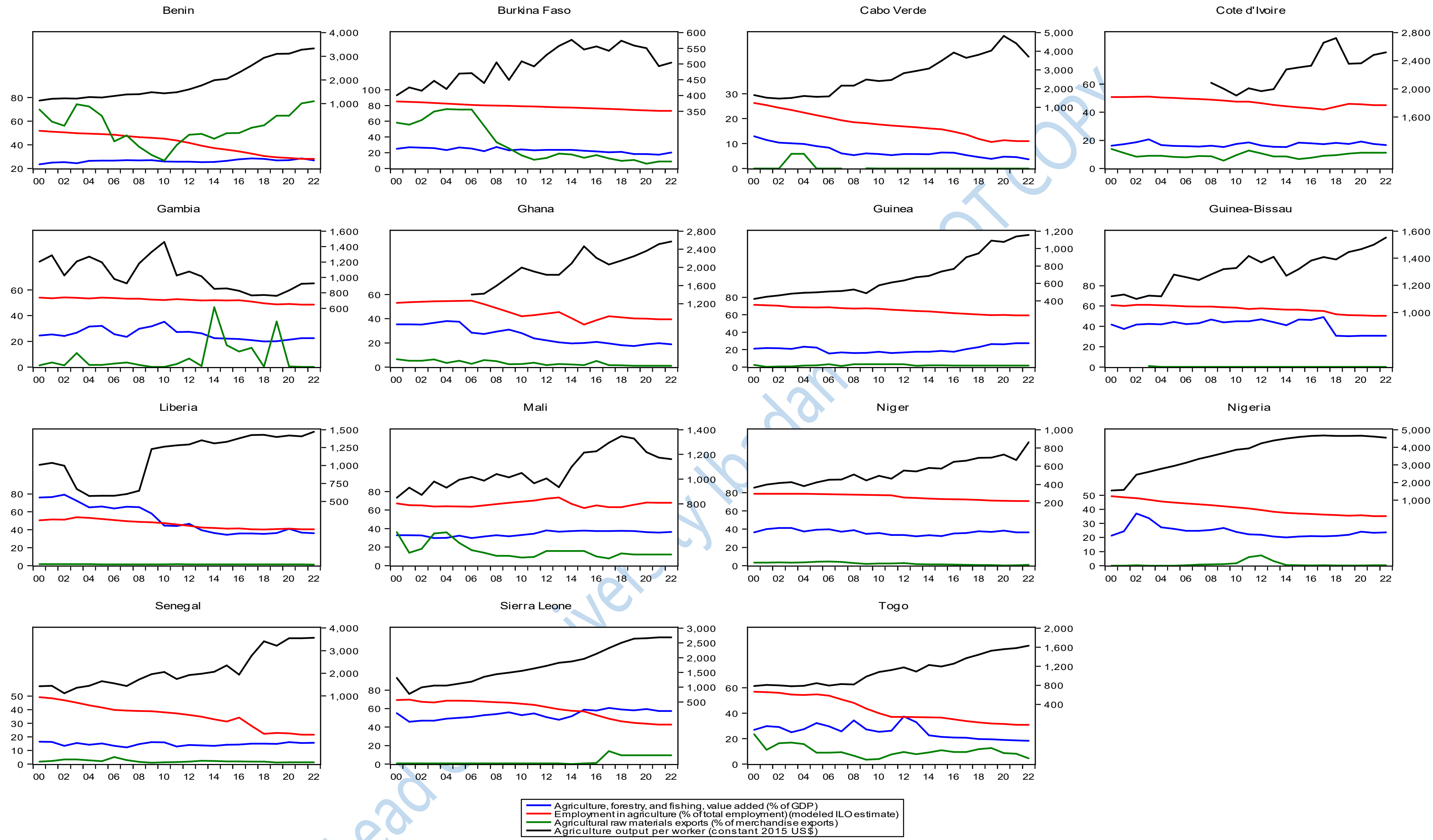

Figure 4.1: Plots of agricultural output growth, employment, exports, and output per worker of ECOWAS

More so, the share of agricultural raw materials in total merchandise exports as depicted in Figure 4.1 has been volatile but shows a general trend of reduction in some countries, such as Ghana, and Nigeria. This is due to diversification into other export sectors like minerals, oil, and manufacturing. For example, Ghana decreased from around 6% in the early 2000s to just over 1% by 2022, while Nigeria, heavily reliant on oil, shows negligible agricultural exports. For countries like Togo and Benin, however, agricultural exports still represent a significant portion of merchandise exports, although there has been a notable decline over the years. Cote d'Ivoire shows a moderate level of agricultural exports, but with fluctuations, reflecting the importance of cocoa and other cash crops. The Gambia has had highly variable agricultural exports, with significant peaks and troughs, showing an inconsistent agricultural export base. For Benin, Burkina Faso, and Mali, they have seen fluctuations in the share of agricultural exports, with Benin seeing a recent increase to over 76% by 2022. Burkina Faso has seen a significant drop from 72% in 2003 to around 9% by 2022, reflecting possible diversification into other sectors. Senegal has maintained a relatively low but stable share of agricultural exports, while Sierra Leone saw a sharp increase in the late 2010s, driven by specific export commodities. Thus, the trends of these agricultural performance indicators highlight a slow but noticeable structural transformation in the ECOWAS region's economies, characterized by a declining reliance on agriculture for GDP contribution, employment, and exports. The shifts suggest both opportunities and challenges, particularly in ensuring sustainable development and inclusive growth that can provide sufficient alternative employment opportunities and maintain food security in the region.

Figure 4.2 depicts the trend movement of key investment climate indicators for 15 ECOWAS countries from 2000 to 2022. Across the ECOWAS region, property rights are generally weak for most countries with the exception of Cabo Verde. Cabo Verde consistently ranks as the highest performer in the region, with property rights scores ranging from 50 to 75 throughout the period. This indicates a relatively strong legal framework and enforcement of property rights, making it a standout among ECOWAS countries. Ghana and Senegal also show relatively better performance compared to the rest of the region, with both countries maintaining property rights scores around 50 for much of the period. Ghana's consistency at this level suggests a fairly stable legal environment, although it still leaves room for improvement. Senegal started strong but saw a slight decline towards the end of the period, indicating some challenges in maintaining strong property rights. However, Benin, Burkina Faso, and Cote d'Ivoire consistently score around 30, reflecting weaker property rights enforcement compared to the higher-performing countries. Liberia, which has data starting from 2009, also falls into the lower performance category. While its scores began low at around 25, there has been minimal fluctuation, suggesting ongoing difficulties in strengthening property rights post-conflict. Guinea, Mali, Niger, Nigeria, Togo, and Sierra Leone are among the consistently low performers, with property rights scores predominantly in the 20-30 range. This group of countries faces significant challenges in enforcing property rights, often due to weak legal systems, political instability, or both. Nigeria, despite being the largest economy in the region, does not show a strong performance in this area, with scores stagnating around 30 and even declining towards the end of the period. Guinea-Bissau consistently ranks as one of the lowest, with scores as low as 10 for much of the period.

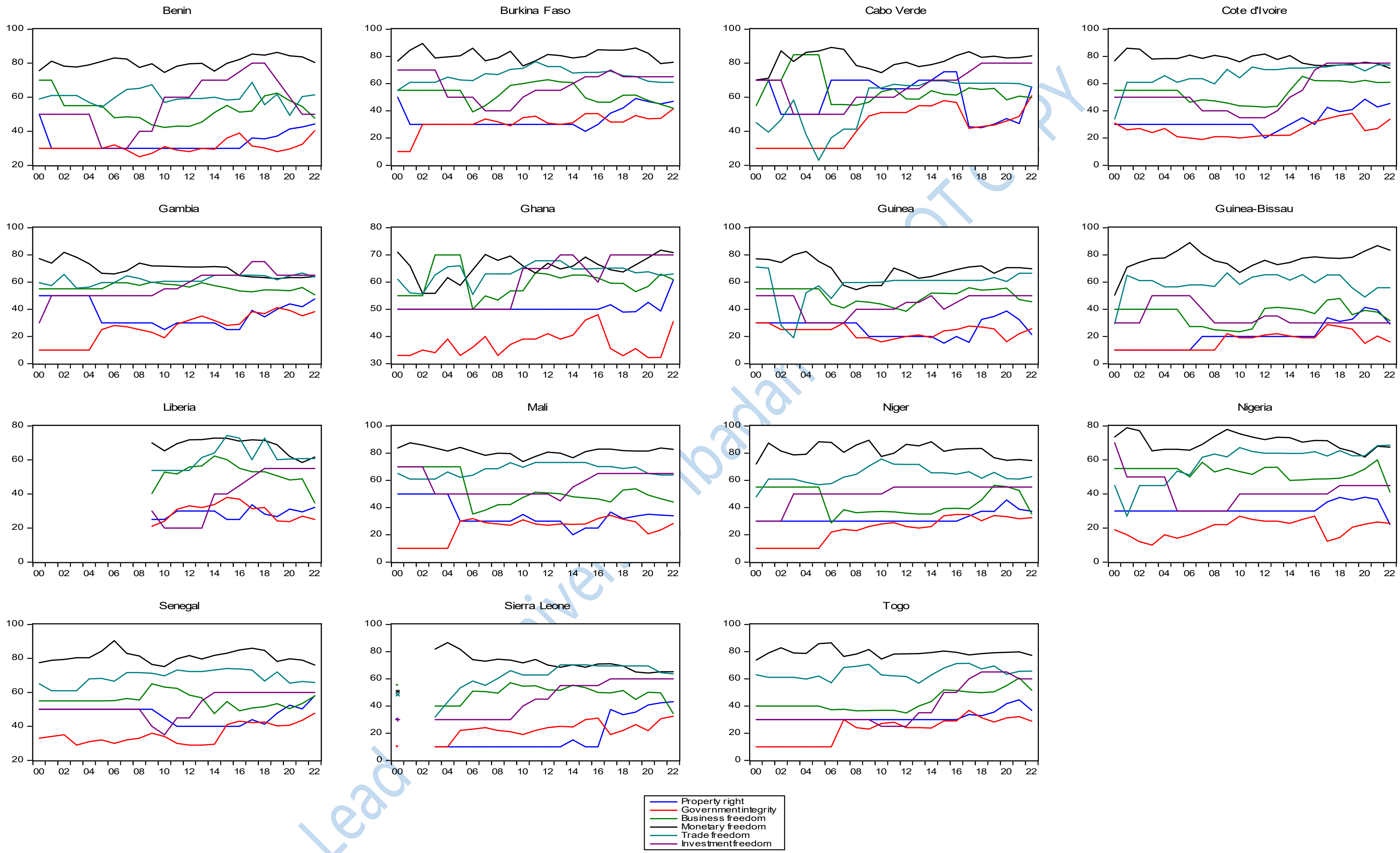

Figure 4.2: Plots of investment climate components of ECOWAS

In Figure 4.2, most ECOWAS countries have low scores in government integrity, with Guinea-Bissau, Liberia, and Sierra Leone showing particularly low levels of government integrity, often scoring between 10 and 30. These countries face significant challenges related to corruption, weak institutions, and lack of transparency. Also, Mali and Niger show low scores, generally in the 20-30 range. Despite some slight improvements in the later years, these countries continue to struggle with governance issues, particularly in maintaining transparency and reducing corruption. In addition, Benin and Burkina Faso have lower scores, typically ranging from 25 to 40, indicating ongoing struggles with government integrity but showing some improvement over time. For instance, Burkina Faso's scores increased from 10 in the early 2000s to over 40 by 2022, reflecting efforts to combat corruption and enhance governance. Nigeria also falls into this category, with scores typically around 20-30, with some years showing slight improvements. However, Ghana shows a moderate level of government integrity, with scores generally in the range of 30 to 50. Ghana experienced some improvements over the years, particularly in the late 2010s, reflecting efforts to enhance transparency and reduce corruption. Senegal also demonstrates moderate government integrity, with scores fluctuating between 30 and 50. Although Senegal started strong, the scores saw some decline in the mid-2000s before improving again in the 2010s. Cabo Verde again performs better than most, with scores consistently higher than the regional average, reflecting more robust governance structures. The country stands out as the top performer in the region, particularly from 2008 onward, where it consistently scores above 40, reaching as high as 60.9 in 2022. Cabo Verde’s higher scores suggest a more transparent and accountable government, contributing to its overall stability and attractiveness for investment.

In the ECOWAS region, the business environment has seen mixed trends. Cabo Verde consistently ranks among the top performers in Business Freedom within the ECOWAS region. Starting with scores around 55 in the early 2000s, Cabo Verde saw improvements in the mid-2000s, with scores reaching as high as 70. Ghana also ranks well, particularly in the mid-2000s, where scores reached around 70. However, from 2010 onwards, the scores slightly declined, hovering around 60. This suggests that Ghana offers a moderately favorable business environment, though there have been challenges in maintaining regulatory efficiency and reducing barriers to business operations in recent years. Benin, Cote d'Ivoire, and Senegal are moderate performers, with business freedom scores generally fluctuating between 45 and 60. For instance, Cote d'Ivoire's scores improved significantly from around 43 in 2010 to the 60s by 2022, reflecting efforts to enhance the business environment. Burkina Faso and Mali also fall into this category, with scores generally in the 40s and 50s. Burkina Faso, for example, improved its Business Freedom score from 39.2 in 2006 to the mid-50s by 2011, showing progress in reducing regulatory burdens, although the pace of improvement has been slow. Nigeria and Niger are examples of countries that have struggled with low scores, typically in the 40s and 50s, but have shown some improvement over the years. Guinea and Liberia also show low scores, particularly in the early 2000s, with Guinea's scores often hovering around 40. However, both countries made some improvements in the 2010s, with scores inching upwards, reflecting ongoing reforms aimed at reducing bureaucratic hurdles and improving regulatory efficiency. Guinea-Bissau consistently ranks among the lowest in Business Freedom, with scores around 40 or below throughout the period. Sierra Leone also performs poorly, with scores generally below 50, reflecting ongoing challenges in creating a business-friendly environment. The low scores are indicative of a challenging regulatory landscape, with significant barriers to starting and operating businesses.

As regards monetary freedom, Cabo Verde consistently ranks among the highest in the region, with scores generally ranging between 74 and 89 throughout the period. This indicates effective monetary policies that have successfully controlled inflation and limited government intervention in pricing. Burkina Faso also scores well, particularly from 2001 to 2022, with scores often exceeding 80. This reflects Burkina Faso's effective management of inflation and limited interference in the economy, contributing to economic stability. Benin and Senegal demonstrate moderate performance in monetary freedom, with scores fluctuating between 74 and 85. These countries have generally maintained moderate levels of inflation and relatively stable prices, although they have experienced some fluctuations, particularly in response to external economic shocks. Ghana and Cote d'Ivoire also fall into the moderate category, with Ghana's scores generally in the range of 55 to 70 and Cote d'Ivoire ranging from 70 to 80. Both countries have managed to maintain moderate price stability but have experienced periods of higher inflation, reflected in occasional dips in their scores. Nigeria and Guinea have shown lower scores in monetary freedom, particularly in the early 2000s, with scores often below 70. However, both countries have made some improvements over time, with Nigeria's scores gradually increasing to the low 70s by 2021 and Guinea showing similar trends. Mali and Niger also started with lower scores, particularly in the early 2000s, but have shown improvements in recent years, with scores generally stabilizing around the mid-70s. Guinea-Bissau and Liberia consistently score lower in monetary freedom, particularly in the early and mid-2000s, with scores often ranging from 50 to 70. These low scores reflect high levels of inflation and significant government intervention in the economy, which can distort market prices and lead to economic instability.

Sierra Leone also performs poorly in this area, with scores fluctuating widely but generally remaining below 75. The country's low scores suggest persistent issues with inflation and price instability, which are often exacerbated by external economic shocks and internal governance challenges.

Regarding trade freedom, ECOWAS countries have high trade freedom scores, with most countries scoring above 70. Cabo Verde still ranks as one of the highest performers in trade freedom among ECOWAS countries. Throughout the period, Cabo Verde's scores generally range from 70 to 85, indicating a strong commitment to reducing trade barriers and maintaining an open economy. Senegal also ranks highly, with scores often in the 70s and 80s. Senegal's consistent performance suggests a stable trade environment with relatively low tariffs and few non-tariff barriers. Benin, Ghana, and Cote d'Ivoire fall into the moderate category, with trade freedom scores generally fluctuating between 60 and 75. These countries have made efforts to reduce trade barriers, but still face challenges in maintaining consistent openness. Burkina Faso and Mali also show moderate scores, with trade freedom generally around the 60-70 mark. These countries have relatively open trade policies, but occasional regulatory hurdles or tariff increases have kept them from reaching the higher performance levels seen in Cabo Verde or Senegal. Nigeria and Guinea have consistently lower trade freedom scores, often in the 50s and 60s. However, both countries have shown some improvement over time. Nigeria, for example, has struggled with high tariffs and significant regulatory barriers, but efforts to liberalize trade and reduce tariffs in recent years have led to a gradual increase in scores. Similarly, Guinea has made incremental progress, though it still faces significant challenges in achieving a fully open trade environment. Liberia and Niger also started with low scores but have shown gradual improvements. Liberia, particularly post-conflict, worked to rebuild its trade infrastructure and reduce barriers, leading to a modest rise in trade freedom scores. Niger's improvements have been more modest, reflecting ongoing efforts to align its trade policies with regional and international standards. Guinea-Bissau and Sierra Leone rank among the lowest in trade freedom, with scores generally in the 40s and 50s. These countries have significant trade barriers, including high tariffs and complex regulatory frameworks, which limit their openness to international trade. Togo also performs poorly in trade freedom, with scores typically below 60. Togo's low scores reflect a combination of high tariffs, non-tariff barriers, and regulatory challenges that hinder its trade openness.

As to investment freedom, it shows significant variability across the ECOWAS region. Cabo Verde ranks as the highest performer in Investment Freedom within the ECOWAS region. Throughout the period, Cabo Verde's scores range from 65 to 75, reflecting a favorable investment climate with minimal government intervention, low regulatory barriers, and strong protections for investors. Ghana also ranks relatively high, particularly in the mid-2000s to the 2020s, with scores generally ranging from 60 to 70. Benin, Senegal, and Cote d'Ivoire fall into the moderate category, with Investment Freedom scores generally fluctuating between 50 and 65. These countries have made efforts to create more open and favorable investment environments, but still face challenges related to regulatory efficiency and government intervention. Burkina Faso and Mali also exhibit moderate scores, with investment freedom typically around the 50-60 range. While these countries have made some progress in reducing barriers to investment, they still experience fluctuations due to political instability or inconsistent policy implementation. Nigeria and Guinea have consistently lower investment freedom scores, often in the 40s and 50s, but have shown some improvement over time. Nigeria, for example, has struggled with significant regulatory barriers and government controls, but efforts to liberalize the economy and attract foreign direct investment in recent years have led to modest increases in scores. Similarly, Guinea has made incremental progress in reducing barriers to investment, though it continues to face challenges in creating a fully conducive environment. Liberia and Niger started with low scores but have shown gradual improvements. Liberia, particularly after its post-conflict recovery, worked to rebuild its investment climate, leading to a modest rise in investment freedom scores. Niger's improvements have been more modest, reflecting ongoing efforts to align its investment policies with regional and international best practices. Guinea-Bissau and Sierra Leone consistently rank among the lowest in Investment Freedom, with scores generally in the 30s and 40s. These countries have significant barriers to investment, including complex regulations, high levels of government intervention, and unstable political environments that deter both domestic and foreign investors. Togo also performs poorly in investment freedom, with scores typically below 50. Togo's low scores reflect a combination of high regulatory barriers, government controls, and an overall lack of transparency in the investment process.

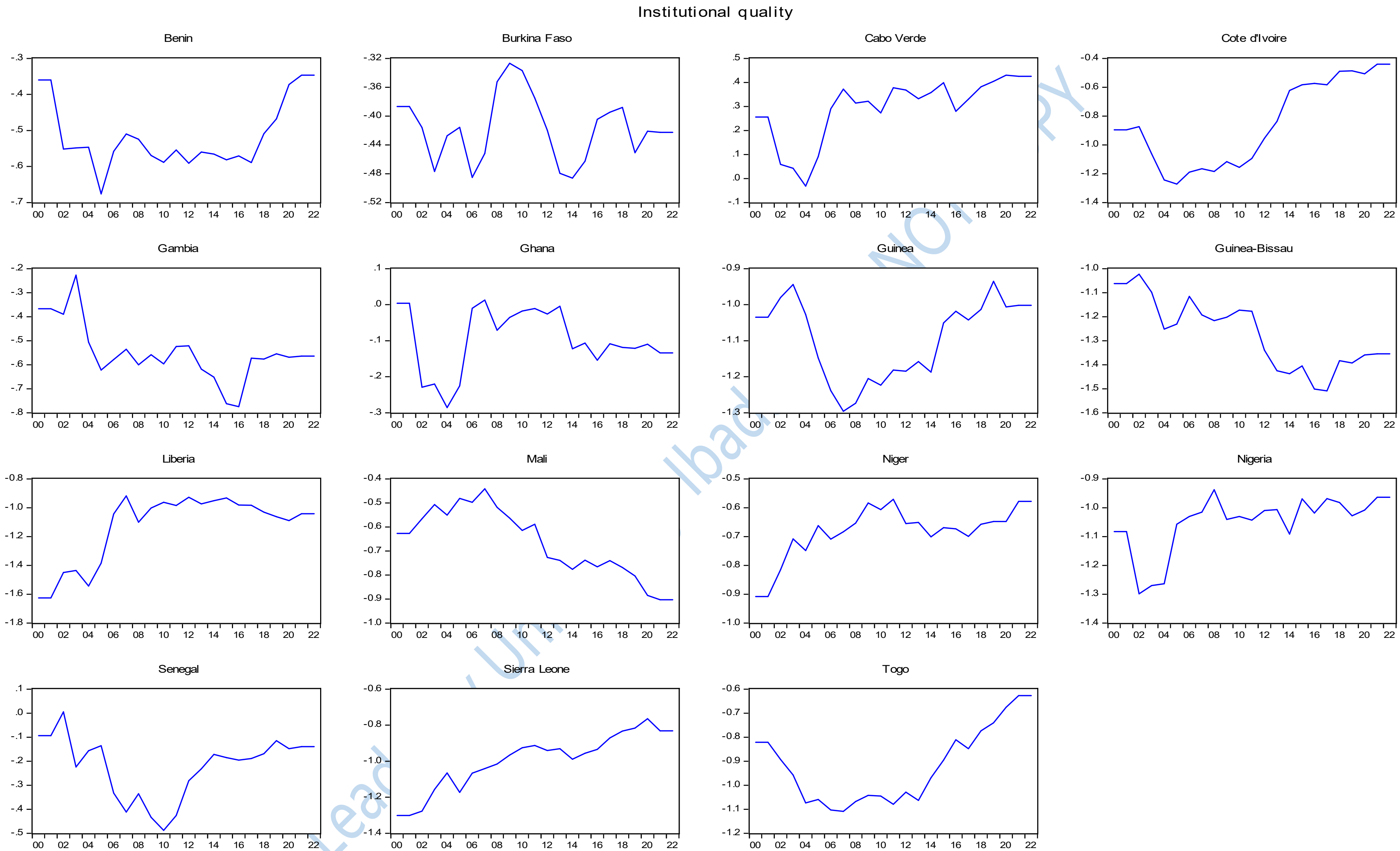

Figure 4.3: Plots of institutional quality of ECOWAS

Figure 4.3 presents the institutional quality index for 15 ECOWAS countries from 2000 to 2022. This index reflects the effectiveness of governance, the rule of law, the control of corruption, and the regulatory quality within these countries. Cabo Verde consistently outperforms other ECOWAS countries in terms of institutional quality. Starting with a positive score of 0.256 in 2000, Cabo Verde experienced a generally upward trend, peaking at 0.4302 in 2020 before slightly stabilizing at 0.4253 by 2022. Ghana and Senegal are moderate performers, showing some stability with their institutional quality scores, although both countries fluctuate around zero. Ghana starts at a marginally positive 0.0036 in 2000, experiences some minor dips and slight recoveries, and end at -0.134 in 2022. Senegal's journey is similar, starting at -0.0938 in 2000 and ending at -0.1397 in 2022, with fluctuations in between. Ghana and Senegal have shown resilience in maintaining relatively stable institutions, though they face challenges that prevent them from achieving stronger scores. Benin and Burkina Faso demonstrate weaker but gradually improving institutional quality. Benin starts at -0.360 in 2000 and fluctuates over the years, showing some improvement toward the end of the period, reaching -0.3466 in 2022. Burkina Faso follows a similar trajectory, starting at -0.3870 in 2000 and moving to -0.4228 by 2022. These two nations have made efforts to strengthen their institutional frameworks, but the progress has been slow and uneven, reflecting ongoing challenges in governance and corruption.

What's more, Cote d'Ivoire, Mali, and Niger have seen significant struggles with institutional quality, though some improvements have been noted. Cote d'Ivoire began at -0.8967 in 2000, worsened during periods of political turmoil, and then improved, reaching -0.4410 by 2022. Mali started at -0.6269 in 2000, showed some initial improvements, but then declined, ending at -0.9035 in 2022 due to ongoing conflicts and governance issues. Niger also shows a slight improvement from -0.9081 in 2000 to -0.5779 in 2022. These patterns reflect the impact of political instability and conflict on institutional quality, though efforts to stabilize and improve governance have yielded some positive results. Also, Nigeria, Guinea, and Togo consistently rank lower in institutional quality within the region. Nigeria starts at -1.083 in 2000, shows minor improvements and fluctuations, and ends at -0.964 in 2022. Guinea follows a similar pattern, starting at -1.035 in 2000 and ending at -1.002 in 2022, indicating persistent issues with corruption and governance. Togo starts at -0.822 in 2000, dips further, but then show some recovery, reaching -0.627 by 2022. The consistently low scores for these three countries suggest deep-seated challenges in governance and institutional effectiveness, which have hindered their development efforts. As for Sierra Leone, Liberia, Guinea-Bissau, and The Gambia, they are among the poorest performers in institutional quality. Sierra Leone and Liberia start with very low scores, reflecting the devastating effects of civil wars and political instability. Sierra Leone begins at -1.301 in 2000 and improves slightly to -0.832 by 2022, while Liberia starts at -1.627 in 2000, improving to -1.0423 by 2022. Guinea-Bissau's institutional quality deteriorates further, starting at -1.062 in 2000 and ending at -1.355 in 2022. The Gambia also shows declining institutional quality, starting at -0.367 in 2000 and worsening to -0.564 in 2022. Their trends highlight the severe governance challenges in these countries, including corruption, weak rule of law, and political instability, which have severely impacted their institutional quality and overall development.

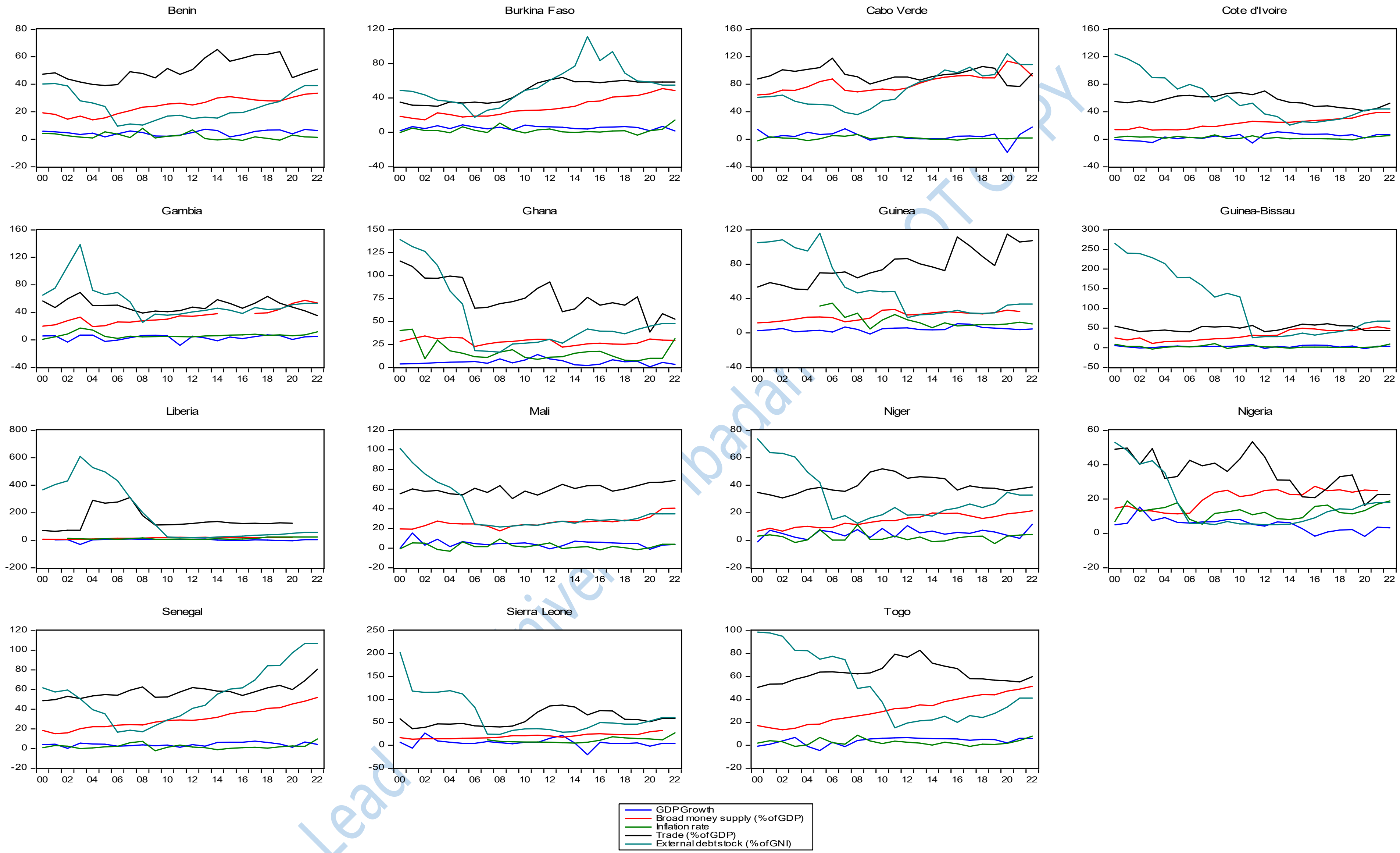

Figure 4.4: Plots of GDP growth, money supply, inflation, trade, and external debt of ECOWAS

In Figure 4.4, the GDP growth rates across the ECOWAS countries have shown significant variability, reflecting both periods of strong economic expansion and contraction. Cabo Verde and Ghana are notable for their relatively consistent economic growth throughout the period. Cabo Verde, for example, saw particularly strong growth in the mid-2000s, with a peak GDP growth rate of 15.17% in 2007, driven by tourism, foreign investment, and structural reforms. Ghana also experienced robust growth, especially around 2010-2011, where GDP growth peaked at 14.05% in 2011, partly due to the commencement of oil production. Liberia and Sierra Leone show the most volatility in GDP growth, primarily due to the severe impacts of civil conflict and subsequent recovery periods. Liberia experienced a catastrophic economic decline in 2003 with a GDP contraction of -30.15% due to the civil war, followed by rapid growth in the post-conflict years as the country began to stabilize. Similarly, Sierra Leone saw a sharp decline during the Ebola crisis, with a significant contraction of -20.49% in 2015. Senegal and Burkina Faso represent more moderate and stable GDP growth performers. These countries generally maintained steady growth rates without the extreme highs and lows seen in more volatile economies. Senegal, for example, managed to sustain growth rates between 3-7% for most of the period, reflecting a stable political environment and gradual economic reforms. Burkina Faso exhibited similar stability, though with slightly lower growth rates, indicating a slower but steady economic expansion.

Furthermore, Nigeria and Cote d'Ivoire, two of the largest economies in the region, show mixed performance. Nigeria's growth has been highly influenced by the global oil market, with high growth during periods of high oil prices, such as 2004-2008, and contractions during periods of low oil prices and economic mismanagement, such as in 2016 (-1.62%). Cote d'Ivoire, after a period of economic decline in the early 2000s due to political instability, showed a strong recovery post-2011, with growth rates consistently above 7% in the latter part of the period. Guinea-Bissau, Togo, and Guinea have generally shown lower GDP growth rates, reflecting deep-seated structural challenges, including political instability, poor infrastructure, and limited economic diversification. Guinea-Bissau had very low and sometimes negative growth rates throughout the period, indicating chronic economic stagnation. Togo and Guinea, while performing slightly better, still struggled to achieve significant economic growth, often hampered by governance issues and external shocks.

As shown in Figure 4.4, broad money as a percentage of GDP varies widely across the ECOWAS region, reflecting differing levels of financial sector development. Cabo Verde consistently ranks among the highest in the region in terms of broad money as a percentage of GDP. Throughout the period, Cabo Verde's ratio fluctuates but generally stays well above 60%, reflecting a well-developed banking sector relative to the size of its economy. Senegal and Benin also exhibit relatively high broad money ratios, particularly in the latter years. Both countries have ratios often exceeding 40-50%, suggesting that their financial sectors are comparatively more developed within the region. Ghana and Nigeria show moderate levels of broad money relative to GDP. Ghana's ratio gradually increased from around 20% in the early 2000s to over 40% by the 2020s, reflecting a growing financial sector alongside economic expansion. Nigeria's broad money as a percentage of GDP also increased over the period, from around 18% in 2000 to about 35% by 2022. Cote d'Ivoire falls into this category as well, with ratios generally between 30-40%. The steady increase in broad money reflects gradual improvements in financial sector efficiency and monetary policy effectiveness, contributing to a more stable economic environment.

Mali, Burkina Faso, and Niger generally show lower broad money ratios, typically ranging from 20-30% of GDP. These countries exhibit modest improvements over time, indicating some progress in financial sector development but still lagged than more developed financial ECOWAS economies. Togo also exhibits low to moderate financial depth, with ratios fluctuating but generally staying around 20-30% of GDP. Liberia, Guinea-Bissau, and Guinea consistently show some of the lowest broad money ratios in the region, often below 20% of GDP. These low ratios reflect significant challenges in financial sector development, including low banking penetration, limited access to financial services, and instability. For example, Liberia's ratio was around 13% in 2000, showing only slight improvements by 2022. Similarly, Guinea-Bissau and Guinea have struggled to expand their financial sectors, which have hampered broader economic development. Sierra Leone also falls into this category, with broad money as a percentage of GDP generally below 20%. Gambia shows significant fluctuations in its broad money ratio, reflecting periods of economic instability and policy changes. For instance, Gambia's broad money as a percentage of GDP fluctuated from around 20% in the early 2000s to over 30% in the late 2010s, indicating a somewhat unstable financial environment.

Inflation rates have also varied significantly across the ECOWAS region in Figure 4.4. Ghana and Liberia stand out as countries with consistently high inflation rates, particularly in the early 2000s. Ghana experienced very high inflation rates, peaking at around 40.24% in 2000. Despite efforts to control inflation, Ghana continued to struggle with high inflation throughout the 2000s, although it gradually reduced to more moderate levels in the 2010s. Liberia, similarly, faced extreme inflationary pressures, especially during and after the civil conflict. Liberia's inflation peaked at 23.56% during the period of instability and has remained volatile, reflecting ongoing economic challenges. Guinea also faced high inflation rates, particularly in the 2000s. Inflation in Guinea often exceeded 20%, reflecting macroeconomic instability, political challenges, and fluctuations in commodity prices. Nigeria and Sierra Leone exhibited moderate inflation rates, with occasional spikes. Nigeria, as one of the largest economies in the region, saw inflation rates fluctuate widely, influenced by factors such as oil price volatility, exchange rate fluctuations, and inconsistent monetary policies. Nigeria's inflation rates were particularly high during periods of economic crisis, such as in 2008 and 2016, when inflation approached 18%. Cote d'Ivoire and Mali generally maintained moderate inflation rates, usually within the range of 5-10%. These countries managed to avoid the extreme inflation seen in other parts of the region, likely due to more stable economic policies and better control of monetary supply.

Also, Senegal and Burkina Faso are among the countries that maintained relatively low inflation rates throughout the period. Senegal's inflation rates typically remained below 5%, reflecting stable economic policies and a relatively stable macroeconomic environment. Burkina Faso also managed to keep inflation under control, with rates rarely exceeding 5%, indicating effective management of the money supply and consistent economic policies. Benin and Cabo Verde also enjoyed relatively low and stable inflation rates. Cabo Verde maintained one of the most stable inflation environments in the region, often recording inflation rates close to 2-3%. Liberia and Sierra Leone demonstrated high volatility in their inflation rates, particularly during and after periods of conflict. For example, Sierra Leone saw a dramatic spike in inflation during the Ebola crisis in 2014-2015, reflecting the economic disruption caused by the epidemic. Similarly, Liberia's inflation was highly volatile in the early 2000s due to the aftermath of civil war, but it showed some signs of stabilization in the subsequent years. Guinea-Bissau also experienced volatility, although on a smaller scale. Gambia and Niger displayed mixed performance in controlling inflation. The Gambia's inflation rates fluctuated, often influenced by changes in agricultural output and external economic conditions. At times, inflation spiked to over 10%, reflecting economic vulnerabilities. Niger, on the other hand, managed to maintain relatively stable inflation rates, although occasional spikes were observed, particularly during periods of drought or external shocks that affected food prices.

In Figure 4.4, Cabo Verde exhibits one of the highest trades to GDP ratios in the ECOWAS region, often exceeding 90% throughout the period. This high ratio reflects Cabo Verde's reliance on imports and exports, particularly due to its limited domestic production capacity and small domestic market. Gambia also shows a high trade to GDP ratio, often exceeding 70%. Like Cabo Verde, The Gambia's small size and limited production capacity necessitate significant imports, while re-export activities contribute to its trade figures. Benin, Senegal, and Ghana fall into the moderate category, with trade typically accounting for 40-70% of GDP. These countries have more diversified economies than the high-dependency countries but still rely significantly on trade, particularly for key exports like agricultural products (e.g., cocoa in Ghana) and imports of industrial goods. Cote d'Ivoire also exhibits moderate trade dependency, with trade ratios usually between 40-60%. Nigeria presents a unique case with fluctuating trade-to-GDP ratios, generally ranging from 20-50%. As the largest economy in the region, Nigeria's trade dependency is lower relative to its GDP size due to its diversified economy, which includes a substantial domestic market and significant oil production. Burkina Faso and Mali show similar fluctuating trade ratios, typically around 30-50% of GDP. These countries are landlocked and rely on neighboring countries for access to international markets, which affects their trade activities.

Also, Guinea, Liberia, and Sierra Leone generally have lower trade to GDP ratios, often below 30%. These countries, although engaged in international trade, have economies that are less integrated with global markets compared to other ECOWAS members. Guinea, for instance, has significant mining activities, but its overall trade ratio is lower due to the relatively small size of the economy and limited diversification. Liberia and Sierra Leone, emerging from periods of conflict, have faced challenges in rebuilding their trade infrastructure, which has kept their trade ratios low. Togo also has a relatively low trade-to-GDP ratio, fluctuating around 30-40%. Despite being a small economy, Togo's trade ratio is lower than expected, possibly due to domestic economic constraints and limited diversification in exports. Niger and Guinea-Bissau exhibit some of the lowest trade-to-GDP ratios in the region, often hovering around 20-30%. Niger's low ratio can be attributed to its landlocked geography, which limits access to international markets, and its reliance on subsistence agriculture rather than export-oriented production. Guinea-Bissau's low trade ratio reflects its small economy, political instability, and limited infrastructure, which severely constrain its ability to engage in international trade.

Concerning countries with high external debt burden, Liberia and Guinea-Bissau have the highest external debt stocks as a percentage of GNI within the ECOWAS region. Liberia, for instance, had an extraordinarily high debt burden, with external debt stocks peaking at over 610% of GNI in the early 2000s, reflecting the severe economic challenges following years of civil conflict. Guinea-Bissau also faced a significant debt burden, with external debt exceeding 265% of GNI in 2000. This high level of debt reflects the country's chronic economic instability and dependence on external financing. Gambia and Niger fall into the category of countries with moderate to high external debt levels. The Gambia's debt ratio has fluctuated but generally remains high, often exceeding 80-100% of GNI, reflecting its reliance on external loans and aid. Niger has shown a more varied trend, with debt ratios fluctuating between 60-90% of GNI, indicating periods of debt accumulation followed by efforts to stabilize or reduce debt levels.

Mali and Burkina Faso also exhibit moderate to high debt ratios, typically ranging from 50-80% of GNI. These countries rely heavily on external financing for development projects and budgetary support, which has led to substantial external debt stocks relative to their national income.

Also, Cote d'Ivoire and Ghana show significant fluctuations in their external debt stocks as a percentage of GNI. Cote d'Ivoire, after periods of political instability and economic challenges, saw its debt levels rise significantly in the early 2000s but has since managed to stabilize its debt ratio, keeping it within the 40-60% range. Ghana's debt levels have also fluctuated, particularly in the 2010s, where significant public spending and borrowing led to increases in external debt ratios, often exceeding 50% of GNI. Benin and Senegal have managed to maintain more stable debt ratios, generally within the 40-60% range. Both countries have implemented fiscal policies aimed at managing their external debt, keeping it at relatively sustainable levels compared to other countries in the region. Nigeria and Cabo Verde generally maintain lower external debt stocks relative to their GNI. Nigeria, as the largest economy in the region, has benefitted from oil revenues, which have helped to keep its external debt ratio relatively low, typically under 30% of GNI. This lower debt burden reflects Nigeria's capacity to manage its external obligations, although it has faced challenges during periods of low oil prices. Cabo Verde, despite its small size, has managed to maintain a lower debt ratio, generally fewer than 50% of GNI. This reflects the country's cautious borrowing practices and efforts to manage its external debt, supported by strong governance and economic management. Togo and Sierra Leone have shown signs of improving external debt ratios over the period. Togo, which had a high debt ratio in the early 2000s, has made efforts to reduce its external debt burden, bringing it down to more manageable levels. Similarly, Sierra Leone, which faced a high debt burden following its civil war, has seen its debt ratio decrease over time as the country stabilized and implemented debt relief measures.

4.3 Empirical Results of the Effects of Institutional Quality on Investment Climate in ECOWAS

4.3.1 Correlation Analysis

The partial correlation coefficients of the series are presented in Table 4.3. The correlation analysis indicates that institutional quality is directly associated with various investment climate measures, including property rights, government integrity, business freedom, monetary freedom, trade freedom, and investment freedom. Specifically, the positive correlation of institutional quality and property right suggests that stronger institutions tend to better protect property rights, which encourages investment and economic stability. As to government integrity, it implies that higher institutional quality is associated with greater government integrity, fostering a more transparent and trustworthy environment for investors. Concerning monetary freedom, its positive correlation with institutional quality suggests that better institutions support a more stable and predictable monetary policy environment, which is crucial for economic growth. A positive correlation of institutional quality and trade freedom indicates that stronger institutions tend to facilitate freer trade, which can enhance market access and competitiveness. Regarding investment freedom, the positive correlation with institutions implies that high institutional quality typically promotes a more open and secure environment for investments, attracting both domestic and foreign investors. While most of these measures of investment climate show a positive correlation among one another, business freedom is negatively correlated with both monetary freedom and trade freedom. The negative correlation of business freedom with monetary freedom and trade freedom suggests that in environments where business operations are more regulated or restricted, monetary and trade policies might be less liberal or competitive, potentially limiting economic flexibility.

Table 4.3: Correlation Matrix

	prt	*gint*	*Bfr*	*mfr*	*tfr*	*ifr*	*inst*	*gdpg*	*Bm*	*inf*	*topn*
gint	0.548	1									
bfr	0.504	0.346	1								
mfr	0.091	0.015	-0.051	1							
tfr	0.022	0.322	-0.029	0.055	1						
ifr	0.480	0.529	0.420	0.090	0.226	1					
inst	0.778	0.671	0.546	0.196	0.128	0.609	1				
gdpg	0.042	0.028	0.058	0.022	-0.092	0.040	0.107	1			
bm	0.571	0.568	0.306	0.162	0.020	0.415	0.595	0.002	1		
inf	0.010	-0.049	0.021	-0.582	-0.165	-0.112	-0.149	-0.021	-0.196	1	
topn	0.244	0.325	0.241	-0.151	-0.034	0.075	0.034	0.071	0.160	0.206	1
exdt	-0.043	-0.184	-0.083	0.007	-0.254	-0.048	-0.213	-0.234	-0.094	0.077	0.467

Note: prt - property right; gint - government integrity; bfr - business freedom; mfr - monetary freedom; tfr - trade freedom; ifr - investment freedom; inst - institutional quality; gdpg - GDP growth (annual %); bm - broad money (% of GDP); inf - inflation, consumer prices (annual %); topn - trade (% of GDP); exdt - external debt stocks (% of GNI).
Source: Author’s computation (2024).

The table shows that GDP growth positively correlates with investment climate measures, except for trade freedom. Additionally, broad money supply has a direct association with the investment climate. However, external debt is negatively associated with investment climate measures, except for monetary freedom. The inflation rate is positively associated with property rights and business freedom, but negatively correlated with government integrity, monetary freedom, trade freedom, and investment freedom. Regarding trade openness, it negatively correlates with monetary freedom and trade freedom, but positively associates with property rights, government integrity, business freedom, and investment freedom.

The correlation matrix table indicates that the correlation coefficients among the various determinants of investment climate indices vary in magnitude and degree. The values of these coefficients suggest that multicollinearity is not a concern, ensuring that multicollinearity does not pose a problem in the empirical analysis. However, these correlation results are preliminary and will be further confirmed in subsection 4.3.3, where additional determinants of the investment climate will be considered.

4.3.2 Cross-Sectional Dependence, Stationary and Cointegration Tests

Table 4.4 reported the results of the cross-sectional dependence test. These statistics were calculated for fifteen West African countries (Benin, Burkina Faso, Cabo Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo) over a 23-year period (2000–2022). The Breusch-Pagan LM test outcomes, shown in Table 4.4, confirm the rejection of the null hypothesis of no correlation at a 5% significance level. Additionally, the Pesaran scaled LM test results are asymptotically standard normal, with the statistical values providing strong evidence against the null hypothesis at the 5% significance level. Regarding the test statistic values from the standard normal Pesaran CD test, these values are considerably lower than those of the LM tests but still reject the null hypothesis at the 0.05 significance level.

Table 4.4: Cross-Sectional Dependence Test Results (d.f. = 105)

	Statistics	**Probability**
Model 1: prt inst gdpg bm inf exdt		
Breusch-Pagan LM	463.8993	0.0000
Pesaran scaled LM	24.76640	0.0000
Pesaran CD	7.481730	0.0000
Model 2: gint inst gdpg bm inf exdt		
Breusch-Pagan LM	272.8061	0.0000
Pesaran scaled LM	11.57972	0.0000
Pesaran CD	2.654285	0.0079
Model 3: bfr inst gdpg bm inf topn exdt		
Breusch-Pagan LM	357.9033	0.0000
Pesaran scaled LM	17.45199	0.0000
Pesaran CD	3.980978	0.0001
Model 4: mfr inst gdpg inf topn exdt		
Breusch-Pagan LM	339.9784	0.0000
Pesaran scaled LM	16.21505	0.0000
Pesaran CD	5.139738	0.0000
Model 5: tfr inst gdpg bm inf topn exdt		
Breusch-Pagan LM	350.4203	0.0000
Pesaran scaled LM	16.93561	0.0000
Pesaran CD	0.512359	0.6084
Model 6: ifr inst gdpg bm inf exdt		
Breusch-Pagan LM	315.3631	0.0000
Pesaran scaled LM	14.51643	0.0000
Pesaran CD	5.392593	0.0000

Note: prt - property right; gint - government integrity; bfr - business freedom; mfr - monetary freedom; tfr - trade freedom; ifr - investment freedom; inst - institutional quality; gdpg - GDP growth (annual %); bm - broad money (% of GDP); inf - inflation, consumer prices (annual %); topn - trade (% of GDP); exdt - external debt stocks (% of GNI).
Source: Author's computation (2024).

The panel unit root and cointegration tests are also discussed. Table 4.5 presents the results of the unit root tests using the Levin, Lin, and Chu (LLC), Breitung (Breit), and Im, Pesaran, and Shin (IPS) methodologies. According to the table, all three methods confirmed that monetary freedom, trade freedom, investment freedom, GDP growth, and trade openness are stationary at the level, I(0). Additionally, the results indicate that property rights, government integrity, and business freedom are integrated at the first difference, I(1). For institutional quality, broad money supply, inflation rate, and external debt stocks, the unit root test results are mixed across the three estimators. Specifically, the LLC test found that institutional quality and external debt stocks are stationary at levels, while the Breit and IPS tests indicated stationarity at first differences. In contrast, the broad money supply and inflation rate were found to be stationary at levels according to the LLC and IPS tests, but the Breitung test suggested stationarity at the first difference. Based on these findings, the study concluded that institutional quality, broad money supply, inflation rate, and external debt stocks are best considered stationary at the first difference, I(1).

Table 4.5: Panel Unit Root Test Results

Signs	Variable Description	Levels			1st Difference			Decision
		LLC	Breit	IPS	LLC	Breit	IPS	
prt	Property right	3.2725	4.1164	-0.7238	-4.8021***	-4.4410***	-11.891**	I(1)
gint	Government integrity	0.4218	-0.4799	-0.7719	-10.575***	-4.9969***	-9.6340***	I(1)
bfr	Business freedom	-0.9114	0.9540	-0.8807	-8.0001***	-2.6210***	-10.699***	I(1)
mfr	Monetary freedom	-4.3102***	-2.3721***	-4.0188***	-	-	-	I(0)
tfr	Trade freedom	-5.5140***	-1.8769***	-4.4264***	-	-	-	I(0)
ifr	Investment freedom	-4.6706***	-1.6686***	-3.6411***	-	-	-	I(0)
inst	Institutional quality	-2.3392***	-0.2858	-1.1439	-	-7.8911***	-6.4500***	I(1)
gdpg	GDP growth (annual %)	-7.0548***	-6.2469***	-10.495***	-	-	-	I(0)
bm	Broad money (% of GDP)	-3.09422***	-0.7056	-2.2856**	-	-4.9022***	-	I(1)
inf	Inflation, consumer prices (%)	-5.6012***	-0.7471	-5.2576***	-	-3.2883***	-	I(1)
topn	Trade (% of GDP)	-2.8492***	-1.6469***	-4.5224***	-	-	-	I(0)
exdt	External debt stocks (% of GNI)	-2.6541***	3.5341	0.9871	-	-7.5279***	-11.150***	I(1)

Note: LL denotes Levin, Lin & Chin (2002); Brrit represents Breitung (2001); Im, Pesaran and Shin (2003); ***, ** & * denote 1%, 5% & 10% significance levels.

Source: Author's computation (2024).

Table 4.6 presents the results of the KAO Residual test for cointegration. According to the conventional probability test criteria, the table indicates a rejection of the null hypothesis of no cointegration across all six models at the 5% significance level. This finding suggests that there is a long-term relationship between the dependent variables (investment climate measures) and the independent variables (institutional quality and control variables) in all the estimated models. Specifically, it confirms the existence of a long-run relationship between institutional quality and investment climate in ECOWAS countries. The confirmation of a long-run relationship between institutional quality and investment climate implies that improvements in institutional quality have a long-term link with the investment environment in ECOWAS countries. This suggests that efforts to strengthen institutions, such as enhancing governance, reducing corruption, and improving legal frameworks, will contribute to sustained economic growth and development. The presence of cointegration also means that any short-term deviations from this relationship are likely to be corrected over time, reinforcing the importance of maintaining strong institutions.

Table 4.6: KAO Residual Test for Cointegration

	t-Statistics	Probability
Model 1: prt inst gdpg bm inf exdt		
ADF	-2.105253	0.0176
Residual variance	26.42162	
HAC variance	23.23099	
Model 2: gint inst gdpg bm inf exdt		
ADF	-4.511839	0.0000
Residual variance	20.25771	
HAC variance	17.38582	
Model 3: bfr inst gdpg bm inf topn exdt		
ADF	-3.446018	0.0003
Residual variance	27.86247	
HAC variance	24.30040	
Model 4: mfr inst gdpg inf topn exdt		
ADF	-5.220395	0.0000
Residual variance	16.29776	
HAC variance	12.47441	
Model 5: tfr inst gdpg bm inf topn exdt		
ADF	-3.304805	0.0005
Residual variance	29.98829	
HAC variance	24.94816	
Model 6: ifr inst gdpg bm inf exdt		
ADF	-3.096441	0.0010
Residual variance	28.14708	
HAC variance	31.26944	

Note: prt - property right; gint - government integrity; bfr - business freedom; mfr - monetary freedom; tfr - trade freedom; ifr - investment freedom; inst - institutional quality; gdpg - GDP growth (annual %); bm - broad money (% of GDP); inf - inflation, consumer prices (annual %); topn - trade (% of GDP); exdt - external debt stocks (% of GNI).
Source: Author's computation (2024).

4.3.3 Panel Regression Results of Institutional Quality and Investment Climate in ECOWAS

This section presents the empirical findings of the pooled mean group estimator's analysis of the impacts of institutional quality on the investment climate in ECOWAS member states. In Table 4.7, the Hausman tests' null hypotheses show that, at the 5% level of significance, the difference between the mean group and the pooled mean group coefficients is not rejected. This indicates that the pooled mean group is a suitable estimate for testing the study hypothesis. Property rights, government integrity, business freedom, monetary freedom, trade freedom, and investment freedom were used to measure the investment climate as the outcome variable. As a result, six models (labeled 1, 2, 3, 4, 5, and 6) were estimated. To provide a suitable degree of freedom, the Bayesian Information Criterion (BIC) was set to two and then automatically used to identify the appropriate lag durations on the variables. Among the fifteen ECOWAS nations, one lag for each of the variables is the most prevalent.

In the pooled mean group or panel autoregressive distributed (ARDL) parameter, both short- and long-term estimates are presented in Table 4.7. The table indicates that, at the conventional level, the coefficients of the error correction term are statistically significant and negative. In particular, the probability values of their t-statistic are less than 1%, and the coefficients of the error correction term are -0.431, -0.417, -0.279, -0.497, -0.509, and -0.316. This suggests that in order to return to the long run equilibrium, the empirical models of property rights, government integrity, business freedom, monetary freedom, trade freedom, and investment freedom must correct their short-run disequilibrium by 43.1%, 41.7%, 27.9%, 49.7%, 50.9%, and 31.6% speed of adjustment. This provides more evidence that the investment climate and agricultural performance in the ECOWAS are correlated over the long term. It therefore verified the long-term validity of the models' equilibrium nature.

Table 4.7: Pooled mean group estimates of institutional quality and investment climate

Variables	**Dependent Variable:** Investment Climate					
	Property right	**Government Integrity**	**Business Freedom**	**Monetary Freedom**	**Trade Freedom**	**Investment Freedom**
	1	**2**	**3**	**4**	**5**	**6**
			Short-run Estimates			
ECT(-1)	**-0.431*** **	**-0.417*** **	**-0.279*** **	**-0.497*** **	**-0.509*** **	**-0.316*** **
	(0.124)	**(0.063)**	**(0.086)**	**(0.070)**	**(0.085)**	**(0.101)**
Δ(Institutional quality)	-2.045	-5.760	**20.813*** **	**7.967** **	-4.757	-5.826
	(4.353)	(5.455)	**(6.827)**	**(3.301)**	(6.487)	(6.692)
Δ(GDP growth rate)	**-0.223*** **	-0.003	**-0.221* **	0.109	0.046	-0.041
	(0.058)	(0.063)	**-0.126**	(0.095)	(0.098)	(0.124)
Δ(Broad money supply (%of GDP))	0.221	**-0.287** **	0.163		-0.017	-0.189
	(0.243)	**(0.115)**	(0.127)		(0.077)	(0.150)
Δ(Inflation rate)	0.294	-0.119	0.112	**0.263*** **	-0.147	**0.198** **
	(0.217)	(0.112)	(0.078)	**(0.064)**	(0.104)	**(0.089)**
Δ(Trade (%of GDP))			0.046	0.057	-0.082	
			(0.051)	(0.039)	(0.081)	
Δ(External debt (%of GDP))	-0.119	-0.036	0.110	-0.041	**0.063* **	**0.131*** **
	(0.129)	(0.052)	(0.079)	(0.028)	**(0.038)**	**(0.040)**
Constant	**11.841*** **	**16.839*** **	10.144	**39.214*** **	**34.033*** **	**18.937*** **
	(3.501)	**(3.237)**	(6.250)	**(5.707)**	**(5.831)**	**(6.333)**
			Long-run Estimates			
Institutional quality	**14.929*** **	**19.424*** **	**-48.411*** **	**-6.522*** **	**10.745*** **	**16.299*** **
	(3.359)	**(4.801)**	**(6.358)**	**(1.988)**	**(2.253)**	**(3.946)**
GDP growth rate	**0.510*** **	**-0.629*** **	**0.567*** **	**-0.350** **	0.162	0.108
	(0.079)	**(0.126)**	**(0.194)**	**(0.137)**	(0.125)	(0.196)
Broad money supply (%of GDP)	**0.336*** **	**0.438*** **	**-0.270*** **		**-0.104* **	**0.420*** **
	(0.071)	**(0.089)**	**(0.080)**		**(0.054)**	**(0.087)**
Inflation rate	0.066	**-0.622*** **	**-0.958*** **	**-0.580*** **	**-0.154* **	**-0.424*** **
	(0.057)	**(0.097)**	**(0.124)**	**(0.124)**	**(0.094)**	**(0.121)**
Trade (%of GDP)			**0.123* **	**-0.066* **	**0.163*** **	
			(0.067)	**(0.039)**	**(0.040)**	
External debt (%of GDP)	**0.153*** **	**-0.051* **	**0.176*** **	**0.039*** **	**-0.041*** **	**-0.092*** **
	(0.026)	**(0.029)**	**(0.039)**	**(0.014)**	**(0.011)**	**(0.033)**
Log Likelihood	-746.65	-768.36	-765.39	-721.08	-726.07	-803.89
Hausman Test (Prob.)	2.35(0.799)	2.96(0.735)	8.18(0.225)	10.1(0.072)	0.96(0.987)	4.83(0.437)
Country	15	15	15	15	15	15
Observations	301	301	301	307	301	301

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10.
Source: Author's computation (2024).

As regards the short-run coefficients, the short-run parameters of institutional quality are positive and statistically significant at 5% level under the models of business freedom and monetary freedom. It means that institutional quality has a positive impact on business and monetary freedom measures of investment climate in ECOWAS. Thus, business and monetary freedom are directly and significantly influenced by the quality of institutions. Intuitively, strong institutions typically provide a transparent legal framework, enforce property rights, and reduce corruption, all of which contribute to an environment where businesses can operate more freely. This suggests that improvements in institutional quality substantially enhance business freedom within ECOWAS countries. It implies that as institutions become more effective, transparent, and reliable, they foster an environment conducive to business activities by reducing uncertainties and costs associated with regulatory compliance. Effective institutions streamline processes and protect business interests, which in turn promotes a more favorable investment climate. In addition, high-quality institutions enforce sound monetary policies, which include controlling inflation, ensuring stable currency values, and avoiding arbitrary price controls that could distort market operations. Thus, effective institutions, such as central banks with clear mandates for price stability and independent from political pressures, contribute to a higher degree of monetary freedom. It further implies that by strengthening institutional frameworks, the region will achieve more stable monetary environments as it reduces economic uncertainty and promotes investor confidence, further enhancing the investment climate. In the empirical results, the positive and statically coefficients for the impact of institutional quality on business and monetary freedom are 20.81 and 7.97 respectively. At 1% changes in institutional quality, business and monetary freedom increases by 20.81 and 7.97 respectively.

However, the findings indicate that institutional quality does not significantly impact property rights, government integrity, trade freedom, and investment freedom in the short run within ECOWAS countries. For property rights and government integrity, the non-significant coefficients suggest that these metrics are not immediately influenced by changes in institutional quality, likely due to the complex and deeply rooted nature of legal and governance structures that require more time and targeted reforms to improve. Similarly, trade freedom and investment freedom also show non-significant results, indicating that general improvements in institutional quality do not directly enhance these aspects of the investment climate. Trade freedom may be more dependent on specific trade policies, international agreements, and global market conditions rather than domestic institutional quality alone. Investment freedom is often constrained by regulatory barriers and financial market conditions that are not easily addressed by broad institutional improvements.

Concerning the covariates, GDP growth rate is statistically significant in the property rights and business freedom models, with coefficients of -0.223 and -0.221 respectively. The negative impact indicates that higher GDP growth rates are associated with a reduction in the investment climate metrics related to property rights and business freedom in the short run. This result suggests that rapid economic growth bring about volatility or institutional stresses that temporarily undermine regulatory stability and business operations. This reflects a scenario where growth is driven by sectors that do not necessarily reinforce institutional frameworks or where rapid growth strains existing regulatory capacities. Also, broad money supply as a percentage of GDP is only significant in the government integrity model, with a negative coefficient of -0.287. This indicates that an increase in broad money supply is associated with a decline in government integrity. In the context of ECOWAS, where monetary policy can be influenced by varying degrees of fiscal discipline and regulatory oversight, an expanding money supply may lead to economic environments that facilitate corruption or reduce government accountability, thus adversely affecting investment conditions.

The inflation rate is statistically significant in the monetary freedom and investment freedom models, with coefficients of 0.263 and 0.198, respectively. A positive impact on these metrics suggests that moderate levels of inflation may positively correlate with economic freedoms related to monetary policy and investment, possibly reflecting a dynamic where controlled inflation supports business profitability and investment returns. It implies that moderate inflation is an indicative of active economic activity and expansion, fostering an environment where businesses feel freer to invest and operate. More so, external debt as a percentage of GDP is significant in the trade freedom and investment freedom models, with coefficients of 0.063 and 0.131, respectively. These positive impacts suggest that, when managed prudently, external debt can play a beneficial role in enhancing trade and investment freedoms. For ECOWAS countries, this reflects the use of external borrowing to finance infrastructure improvements, trade facilitation, or investments that lower operational barriers for businesses. Furthermore, when external debt is allocated effectively, it would stimulate investor confidence by providing the necessary capital for growth without excessive regulatory interference, thereby improving the overall investment climate.

The long-run estimates from the pooled mean group model in Table 4.7 provide insightful findings on how institutional quality impacts various dimensions of the investment climate in ECOWAS countries. The results indicate that institutional quality significantly influences all six metrics of investment climate. The magnitude and direction of these effects, however, vary considerably, reflecting the multifaceted role of institutional quality in shaping the investment environment. For property rights, the positive and statistically significant coefficient of 14.93 suggests that in the long run, improvements in institutional quality strongly enhance property rights within ECOWAS countries. This implies that as institutions become more robust via better enforcement of laws, reduction of corruption and more transparent governance, property rights are better protected. Thus, this is critical for fostering a secure investment climate, as strong property rights are essential for encouraging both domestic and foreign investment, ensuring that investors feel confident their assets will be protected. Similarly, the coefficient of 19.42 for government integrity also shows a significant positive impact from institutional quality. This result indicates that higher institutional quality leads to greater government integrity, which in turn bolsters investor confidence. It suggests that government integrity, encompassing transparency, accountability, and the reduction of corruption, is crucial for creating a trustworthy environment where businesses can operate effectively and ethically. The significant impact of institutional quality on government integrity underscores the importance of sound governance structures in promoting a stable and attractive investment climate.

Likewise, the positive and significant coefficient of 10.745 for trade freedom indicates that strong institutional quality enhances trade freedom. This relationship suggests that better institutions facilitate easier and more efficient trade by reducing barriers, improving customs processes, and enforcing fair trade practices. Thus, trade freedom is vital for economic growth, particularly in a region like ECOWAS, where cross-border trade is a significant component of economic activity. Quality institutions help lower the costs and risks associated with trading, thereby promoting a more vibrant and competitive trade environment. As well, the significant positive coefficient of 16.3 for investment freedom suggests that institutional quality positively impacts the ability of investors to move capital freely and engage in various investment activities. Therefore, improved institutional quality reduces bureaucratic hurdles, enhances transparency, and provides a more stable legal environment, all of which are conducive to greater investment freedom. This result underscores the importance of institutional reforms in attracting and retaining investment, as investors are more likely to commit capital in regions where they perceive the institutional environment to be supportive and predictable.

In contrast, the relationship between institutional quality and business freedom is negative and significant, with a coefficient of -48.41. This finding suggests that higher institutional quality reduces business freedom in the long run. One possible explanation is that as institutions improve, they impose stricter regulations and oversight to maintain standards and ensure compliance, which is likely to reduce business freedom. As such regulations seem necessary for maintaining a level playing field and protecting consumers, they are likely to introduce challenges for businesses, particularly small and medium enterprises (SMEs) which struggle with the regulatory burden. The impact of institutional quality on monetary freedom is also negative, with a significant coefficient of -6.52. This suggests that as institutional quality improves, monetary freedom is constrained, possibly due to tighter controls over monetary policy and inflation management. This is likely to occur as the region's institutional settings prioritize economic stability over absolute monetary freedom, implementing policies that control inflation and regulate currency flows to ensure a stable macroeconomic environment.

In addition, the results presented in Table 4.7 offer a detailed examination of how various macroeconomic variables, such as GDP growth rate, broad money supply, inflation rate, trade openness, and external debt, have significantly influenced different aspects of the investment climate in ECOWAS countries. GDP growth rate has shown mixed effects across different dimensions of the investment climate. Specifically, GDP growth has positively and significantly impacted property rights and business freedom within ECOWAS countries. The positive coefficient of 0.510 for property rights indicates that as GDP grows, there is an associated strengthening of property rights protection. This could be attributed to the increased economic resources available for legal and institutional reforms, which in turn enhance the security of property ownership and investments. Similarly, the significant positive impact on business freedom, with a coefficient of 0.567, suggests that economic growth in the region has contributed to a more favorable business environment. This growth likely facilitates easier market entry, reduces bureaucratic hurdles, and encourages entrepreneurship. However, the significant negative impact of GDP growth on government integrity and monetary freedom, as indicated by the coefficients of -0.629 and -0.350, respectively, highlights challenges in managing the pace of economic expansion. In particular, the deterioration in government integrity reflects issues related to governance, where rapid growth has potentially exacerbated corruption or weakened institutional checks and balances. The negative effect on monetary freedom suggests that economic growth may have been accompanied by inflationary pressures or increased government intervention in monetary policy, reducing the freedom of monetary operations in the region.

Concerning the broad money supply as a percentage of GDP parameter, it had a significant positive impact on property rights, government integrity, and investment freedom, indicating that higher liquidity in the economy is associated with improvements in the region. The significant positive coefficient of 0.336 for property rights suggests that an increase in the money supply supports better protection and enforcement of property rights, possibly through increased financial sector development and improved access to credit. Similarly, the positive impact on government integrity, with a coefficient of 0.438, implies that a well-managed money supply contributes to greater transparency and accountability in government operations, potentially reducing opportunities for corruption. The positive influence on investment freedom, indicated by a coefficient of 0.420, highlights that increased money supply facilitates easier access to capital, thus encouraging investment activities across ECOWAS countries. However, the negative impact on business and trade freedom, as shown by the coefficients of -0.27 and -0.104 respectively, indicates that an excessive increase in money supply may lead to inflationary pressures or financial instability, which could impose additional constraints on businesses, particularly in terms of operational costs and access to affordable credit.

Inflation rate parameters demonstrate a generally negative impact across the investment climate metrics. The significant negative coefficients for government integrity, business freedom, monetary freedom, and investment freedom, ranging from -0.622 to -0.958, indicate that higher inflation has been detrimental to these aspects of the investment climate. The sharp decline in government integrity with a coefficient of -0.622 suggests that rising inflation undermines trust in government institutions, likely due to the increased cost of living and reduced purchasing power, which can lead to public discontent and corruption. Similarly, the substantial negative impact on business freedom, as shown by a coefficient of -0.958, reflects the challenges businesses face in an inflationary environment, including higher costs for goods and services, uncertainty in pricing, and potential disruptions in supply chains. The negative effects on monetary freedom and investment freedom indicate that inflationary pressures limit the effectiveness of monetary policies and reduce investor confidence, as inflation erodes the real value of returns and creates an unpredictable economic environment.

As regards trade openness, its parameter under business freedom model is positive and statistically significant at 0.123. This suggests that improved trade integration tends to reduce market entry barriers, promote competition, and encourage regulatory reforms that favor easier business operations. Thus, increased trade in ECOWAS countries would likely drive the need for a more efficient and transparent business environment to attract and maintain trade relationships, thereby improving overall business freedom. Also, the positive and significant coefficient of 0.163 for trade openness under trade freedom highlights the expected beneficial effect of trade on this dimension of the investment climate. Therefore, it indicates that high trade openness directly enhances trade freedom. This reflects the efforts of the region to lower tariffs, streamline customs procedures, and engage in regional trade agreements that facilitate smoother cross-border trade. Conversely, the coefficient for trade openness under monetary freedom is -0.066, which is negative and statistically significant, albeit at 10% level. This negative impact suggests that while increased trade openness benefits business freedom, it may simultaneously impose constraints on monetary freedom. This could be due to the exposure to external economic shocks, such as fluctuations in global commodity prices or exchange rate volatility, which necessitates tighter monetary controls to maintain economic stability. In the context of ECOWAS, where many economies are still developing, increased trade sometime results to high external dependencies, thereby limiting the ability of central banks to exercise full monetary autonomy.

For external debt as a percentage of GDP, it also shows significant effects on various aspects of the investment climate. The positive coefficients for property rights, business freedom, and monetary freedom indicate that external borrowing has supported institutional improvements and economic freedoms in these areas. The positive impact on property rights, with a coefficient of 0.153, suggests that external debt has been used effectively to finance reforms that enhance the security of property ownership. Similarly, the positive coefficients for business freedom and monetary freedom indicate that external debt has facilitated economic activities by providing the necessary financial resources for business operations and monetary stability. However, the negative impacts on government integrity, trade freedom, and investment freedom, as reflected by coefficients of -0.051, -0.041, and -0.092, respectively, highlight the risks associated with high levels of external debt. These findings suggest that while external debt supports certain aspects of the investment climate, it also poses significant challenges, such as increased vulnerability to external pressures and potential mismanagement, which undermine investment climate like government integrity, trade freedom, and investment freedom.

4.4 Empirical Results of the Effects of Investment Climate on Agricultural Performance in ECOWAS

4.4.1 Correlation Analysis

The partial correlation coefficients presented in Table 4.8 indicate that the relationship between investment climate indices (such as property rights, government integrity, business freedom, monetary freedom, trade freedom, and investment freedom) and agricultural output growth is generally negative. This suggests that factors beneficial to general economic environments might not directly translate to agricultural growth. In addition, while most investment climate indicators are indirectly linked to agricultural employment, monetary policy stands out with a positive correlation. Furthermore, the study reveals an indirect relationship between agricultural employment and most investment climate indicators, with monetary policy being a notable exception, showing a positive association. This implies that while broader economic reforms might not always benefit agricultural employment, monetary policy improvements can positively boost job creation in the agricultural sector. Interestingly, agricultural exports generally correlate positively with investment climate improvements, except in the cases of property rights and trade freedom, which show negative association. This indicates that while an improved investment climate might bolster exports, specific factors like property rights and trade policies require careful management to avoid adverse association with agricultural sectors. Thus, this suggests that traditional investment climate improvements, typically aimed at fostering general economic growth, may not always translate into increased agricultural output or employment.

Table 4.8: Correlation Matrix

	agpf1	*agpf2*	*agpf3*	*agpf4*	*prt*	*gint*	*bfr*	*mfr*	*tfr*	*ifr*	*gdpg*	*inf*
agpf2	0.418	1										
agpf3	-0.070	0.125	1									
agpf4	-0.248	-0.813	-0.129	1								
prt	-0.570	-0.508	-0.036	0.300	1							
gint	-0.454	-0.453	0.018	0.281	0.548	1						
bfr	-0.394	-0.331	0.083	0.252	0.504	0.346	1					
mfr	-0.181	0.020	0.256	-0.124	0.091	0.015	-0.051	1				
tfr	-0.049	-0.002	-0.002	0.100	0.022	0.322	-0.029	0.055	1			
ifr	-0.357	-0.237	0.160	0.171	0.480	0.529	0.420	0.090	0.226	1		
gdpg	-0.048	0.023	0.032	0.025	0.042	0.028	0.058	0.022	-0.092	0.040	1	
inf	0.199	-0.021	-0.225	0.109	0.010	-0.049	0.021	-0.582	-0.165	-0.112	-0.021	1
exdt	0.438	0.032	-0.153	-0.182	-0.043	-0.184	-0.083	0.007	-0.254	-0.048	-0.234	0.077

Note: agpf1 - agriculture, forestry, and fishing, value added (% of GDP); agpf2 - employment in agriculture (% of total employment) (modeled ILO estimate); agpf3 - agricultural raw materials exports (% of merchandise exports); agpf4 - agriculture output per worker (constant 2015 US$); prt - property right; gint - government integrity; bfr - business freedom; mfr - monetary freedom; tfr - trade freedom; ifr - investment freedom; gdpg - GDP growth (annual %); inf - inflation, consumer prices (annual %); exdt - external debt stocks (% of GNI).
Source: Author's computation (2024).

Agricultural output per worker positively correlates with property right, government integrity, business freedom, trade freedom, and investment freedom but indirectly associates with monetary freedom. Regarding agricultural performance metrics, there is a positive correlation between agricultural employment and agricultural outputs and exports in the region. This implies that higher levels of employment have a positive impact on production and commerce. Nevertheless, there exists a negative correlation between the development of agricultural output and exports, indicating that while agricultural outputs increase, exports may not rise in proportion or could potentially decrease. Meanwhile, agricultural output per worker has a negative level of association with agricultural output growth, employment, and exports.

Although most of these indicators of investment climate have a positive link with one other, business freedom is inversely correlated with both monetary freedom and trade freedom. The inverse relationship between business freedom and both monetary freedom and trade freedom implies that in situations where business operations are subject to greater regulations or limitations, monetary and trade policies may be less open or competitive, thus constraining economic adaptability. The result reveals that GDP growth has a negative correlation with agricultural output, indicating that as the economy expands, agricultural production may decline. However, GDP positively correlates with agricultural employment and exports, suggesting these sectors thrive with economic growth. Conversely, inflation correlates positively with agricultural output but negatively with employment and exports, implying that rising prices may boost production but reduce job opportunities and trade. Also, external debt negatively impacts agricultural exports while promoting output growth and employment, possibly due to increased spending in these areas. The correlation matrix table reveals varying degrees and magnitudes of correlation coefficients among the determinants of agricultural performance indices, indicating no multicollinearity issues. This suggests that the empirical analysis is free from multicollinearity concerns. However, these correlation coefficients are preliminary findings, which will be further validated in Section 4.4.3 after incorporating additional determinants of agricultural performance.

4.4.2 Cross-Sectional Dependence, Stationary and Cointegration Tests

The cross-sectional dependence test results in the panel study of the links between investment climate and agricultural performance for 15 ECOWAS countries from 2000 to 2022 is presented in Table 4.9. The results from the Breusch-Pagan LM test, presented in Table 4.9, indicate a strong rejection of the null hypothesis of no correlation at conventional significance levels. Similarly, the Pesaran scaled LM test results are asymptotically standard normal, and the statistical values also reject the null hypothesis at the 5% significance level. Although the standard normal Pesaran CD test statistic values are lower than those of the LM tests, they still reject the null hypothesis at the 0.05 critical level. Thus, the findings indicate significant cross-sectional dependence across all models, as evidenced by the Breusch-Pagan LM, Pesaran scaled LM, and Pesaran CD statistics. The p-values are all near zero, confirming that the variables in the models are not independent across countries. This suggests that shocks or changes in one country may have significant effects on others, which is critical to consider in panel data analysis for these countries.

Table 4.9: Cross-Sectional Dependence Test Results (d.f. = 105)

	Statistics	**Probability**
Model 1: agpf1 prt gint bfr mfr tfr ifr gdpg inf exdt		
Breusch-Pagan LM	380.1344	0.0000
Pesaran scaled LM	18.98608	0.0000
Pesaran CD	4.053857	0.0001
Model 2: agpf2 prt gint bfr mfr tfr ifr gdpg exdt		
Breusch-Pagan LM	429.3728	0.0000
Pesaran scaled LM	22.38385	0.0000
Pesaran CD	6.015864	0.0079
Model 3: agpf3 prt gint bfr mfr tfr ifr inf exdt		
Breusch-Pagan LM	357.0250	0.0000
Pesaran scaled LM	17.39138	0.0000
Pesaran CD	0.276976	0.7818
Model 4: agpf4 prt gint bfr mfr tfr ifr		
Breusch-Pagan LM	233.7883	0.0000
Pesaran scaled LM	8.887240	0.0000
Pesaran CD	6.164178	0.0000

Note: agpf1 - agriculture, forestry, and fishing, value added (% of GDP); agpf2 - employment in agriculture (% of total employment) (modeled ILO estimate); agpf3 - agricultural raw materials exports (% of merchandise exports); agpf4 - agriculture output per worker (constant 2015 US$); prt - property right; gint - government integrity; bfr - business freedom; mfr - monetary freedom; tfr - trade freedom; ifr - investment freedom; gdpg - GDP growth (annual %); inf - inflation, consumer prices (annual %); exdt - external debt stocks (% of GNI).
Source: Author's computation (2024).

The panel unit root test results in Table 4.10 assess whether the variables are stationary or non-stationary. The tests applied include Levin, Lin & Chu (LLC), Breitung (Breit), and Im, Pesaran and Shin (IPS). All three methods confirmed that monetary freedom, trade freedom, investment freedom, and GDP growth are stationary at level I(0). Thus, they are stationary at level, indicating no need for differencing. Conversely, agricultural output, agricultural employment, agricultural output per worker, property rights, government integrity, and business freedom were found to be stationary at the first difference, I(1). Consequently, they become stationary after first differencing, indicating they are non-stationary at level. The results for agricultural exports, inflation, and external debt were mixed. The Breitung test indicated agricultural exports are stationary at level, while LLC and IPS showed stationarity at first differences. Inflation was stationary at levels in LLC and IPS, but at the first difference in Breitung. External debt was stationary at level according to LLC, but at the first difference according to Breitung and IPS. The study ultimately concluded that agricultural exports, inflation, and external debt are stationary at the first difference.

Table 4.10: Panel Unit Root Test Results

Signs	Variable Description	Levels			1st Difference			Decision
		LLC	Breit	IPS	LLC	Breit	IPS	
agpf1	Agriculture Output, forestry, and fishing, value added (% of GDP)	2.8767	-1.3979	0.9365	-2.2234**	-4.7239***	-5.6568***	I(1)
agpf2	Employment in agriculture (% of total employment)	0.2672	4.3131	0.3460	-7.4485***	-38891***	-5.8311***	I(1)
agpf3	Agricultural raw materials exports (% of merchandise exports)	6.5565	-1.9711**	-0.4742	-15.741***	-	-13.818**	I(1)
agpf4	Agricultural output per worker (constat 2015 US$)	-0.5501	0.9035	-1.2672	-11.618***	-8.1539***	-13.187***	I(1)
prt	Property right	3.2725	4.1164	-0.7238	-4.8021***	-4.4410***	-11.891**	I(1)
gint	Government integrity	0.4218	-0.4799	-0.7719	-10.575***	-4.9969***	-9.6340***	I(1)
bfr	Business freedom	-0.9114	0.9540	-0.8807	-8.0001***	-2.6210***	-10.699***	I(1)
mfr	Monetary freedom	-4.3102***	-2.3721***	-4.0188***	-	-	-	I(0)
Tfr	Trade freedom	-5.5140***	-1.8769***	-4.4264***	-	-	-	I(0)
Ifr	Investment freedom	-4.6706***	-1.6686***	-3.6411***	-	-	-	I(0)
gdpg	GDP growth (annual %)	-7.0548***	-6.2469***	-10.495***	-	-	-	I(0)
inf	Inflation, consumer prices (%)	-5.6012***	-0.7471	-5.2576***	-	-3.2883***	-	I(1)
Exdt	External debt stocks (% of GNI)	-2.6541***	3.5341	0.9871	-	-7.5279***	-11.150***	I(1)

Note: LL denotes Levin, Lin & Chin (2002); Breit represents Breitung (2001); Im, Pesaran and Shin (2003); ***, ** & * denote 1%, 5% & 10% significance levels.
Source: Author's computation (2024)

The results of the KAO Residual test for cointegration are presented in Table 4.11. Based on the standard criteria for probability testing, the table shows that the null hypothesis of no cointegration is rejected in all three models at a significance level of 5%. The finding indicates a co-integration between the outcome variables (agricultural performance indicators) and the explanatory variables (investment climate and control variables) in all the estimated models. More precisely, the study validates the presence of a long-run relationship between investment climate and agricultural performance in nations belonging to the Economic Community of West African States (ECOWAS). The confirmation of a long-run relationship suggests that improvements in the investment climate are likely to have a long-term connection with the agricultural performance in ECOWAS countries. This implies that policies aimed at enhancing the investment environment could lead to long-term growth in the agricultural sector, contributing to overall economic development and food security in the region. The presence of cointegration also means that any short-term deviations from this relationship are likely to be corrected over time, reinforcing the importance of maintaining sustainable investment climate.

Table 4.11: KAO Residual Test for Cointegration

	t-Statistics	Probability
Model 1: agpf1 prt gint bfr mfr tfr ifr gdpg inf exdt		
ADF	-2.423407	0.0077
Residual variance	7.710661	
HAC variance	6.608224	
Model 2: agpf2 prt gint bfr mfr tfr ifr gdpg exdt		
ADF	-1.701775	0.0444
Residual variance	1.803316	
HAC variance	2.888058	
Model 3: agpf3 prt gint bfr mfr tfr ifr inf exdt		
ADF	-1.658080	0.0475
Residual variance	1.658493	
HAC variance	2.525408	
Model 4: agpf4 prt gint bfr mfr tfr ifr		
ADF	-2.813509	0.0025
Residual variance	0.007412	
HAC variance	0.007351	

Note: agpf1 - agriculture, forestry, and fishing, value added (% of GDP); agpf2 - employment in agriculture (% of total employment) (modeled ILO estimate); agpf3 - agricultural raw materials exports (% of merchandise exports); agpf4 - agriculture output per worker (constant 2015 US$); prt - property right; gint - government integrity; bfr - business freedom; mfr - monetary freedom; tfr - trade freedom; ifr - investment freedom; gdpg - GDP growth (annual %); inf - inflation, consumer prices (annual %); exdt - external debt stocks (% of GNI).
Source: Author's computation (2024).

4.4.3 Panel Regression Results of Investment Climate and Agricultural Performance in ECOWAS

In this sub-section, the study described the empirical outcome of how the investment climate affects agricultural performance in ECOWAS, using the pooled mean group estimator. Table 4.12 display the results of the Hausman tests, which show that the difference in the mean groups and the pooled mean group's coefficients is not statistically significant at the 5% level. This finding supports the premise that the pooled mean group is the most appropriate estimate for this study. Agricultural output growth, employment, exports, and output per worker were the metrics used to capture agricultural performance. So, the study estimated six models, which were labeled from 1 to 7. After setting the Bayesian Information Criterion (BIC) to two to ensure there were enough degrees of freedom, the variables' optimal lag durations were automatically selected using this method. The most common lag for variables across the fifteen ECOWAS countries is one for each variable.

Table 4.12 summarizes the parameter estimates for the pooled mean group or panel autoregressive distribution in both the short and long runs. The table shows that, at the 5% significance level, the error correction term's coefficients are negative and statistically significant. In particular, the t-statistics probability values for the error correction term are less than 5%, and the coefficients fall within the range of -0.049 to -0.511. So, to get back to the long run equilibrium, the empirical models of agricultural output, employment, and exports need to fix their short run disequilibrium by 13.3%-17.4%, 4.6%-5.9%, and 29.4%, -51.1% speed of adjustment, respectively. This provides more evidence that the investment climate and agricultural success in ECOWAS are related in the long run. This proved, for the long term at least, that the models are indeed equilibrium-based.

Table 4.12: Pooled mean group estimates of investment climate and agricultural performance

Variables	**Dependent Variable:** Agricultural Performance						
	Agricultural Output Growth		**Agricultural Employment**		**Agricultural Export**		**Agricultural Output per Worker (ln)**
	1	**2**	**3**	**4**	**5**	**6**	**7**
				Short-run Estimates			
ECT(-1)	**-0.174****	**-0.133****	**-0.059****	**-0.046****	**-0.294*****	**-0.511*****	**-0.2381*****
	(0.069)	**(0.058)**	**(0.029)**	**(0.021)**	**(0.105)**	**(0.083)**	**(0.0758)**
Δ(Property right)	**0.105****	**0.230***	0.011	0.007	0.074	0.077	0.1167
	(0.052)	**(0.120)**	(0.018)	(0.019)	(0.079)	(0.073)	(0.1195)
Δ(Government integrity)	0.014	**0.090***	0.018	0.026	0.051	-0.048	**-0.2032***
	(0.037)	**(0.050)**	(0.016)	(0.020)	(0.039)	(0.044)	**(0.1184)**
Δ(Business freedom)	0.102	0.012	**-0.035****	**-0.062*****	-0.142	-0.114	0.0071
	(0.065)	(0.067)	**(0.015)**	**(0.022)**	(0.112)	(0.116)	(0.1126)
Δ(Monetary freedom)	0.111	0.023	0.009	**-0.031***	-0.117	-0.167	0.0326
	(0.072)	(0.067)	(0.016)	**(0.019)**	(0.112)	(0.121)	(0.0862)
Δ(Trade freedom)	**-0.072***	-0.023	0.023	**0.044***	0.082	0.096	**-0.5442****
	(0.043)	(0.060)	(0.021)	**(0.026)**	(0.086)	(0.080)	**(0.2609)**
Δ(Investment freedom)	-0.079	-0.054	**-0.035****	**-0.031***	**-0.164****	**-0.151****	0.0565
	(0.050)	(0.051)	**(0.018)**	**(0.016)**	**(0.083)**	**(0.075)**	(0.0617)
Δ(GDP growth)	**0.150***	-0.013	0.004				
	(0.083)	(0.076)	(0.031)				
Δ(External dent stock (% of GNI))	0.035	**0.101****		-0.001		0.011	
	(0.029)	**(0.047)**		(0.011)		(0.031)	
Δ(Inflation rate)		0.070			**0.130***		
		(0.101)			**(0.070)**		
Constant	**16.246*****	**11.409****	**8.105***	3.630	**6.903*****	**2.723*****	**1.4895*****
	(6.240)	**(4.953)**	**(4.186)**	(2.559)	**(2.391)**	**(0.894)**	**(0.4664)**
				Long-run Estimates			
Property right	**-0.190****	**-0.702*****	**-0.178*****	**-0.321*****	0.081	**0.0003****	0.2969
	(0.088)	**(0.070)**	**(0.061)**	**(0.116)**	(0.055)	**(0.0001)**	(0.1883)
Government integrity	-0.070	**-0.529*****	**-0.802*****	**-1.134*****	**-0.453*****	-0.0001	**0.4405***
	(0.104)	**(0.104)**	**(0.067)**	**(0.174)**	**(0.049)**	(0.0003)	**(0.1195)**
Business freedom	**-0.413*****	**-0.405*****	**-0.141****	**0.541*****	0.052	**-0.0005*****	-0.2292
	(0.092)	**(0.076)**	**(0.064)**	**(0.140)**	(0.054)	**(0.0001)**	(0.1556)
Monetary freedom	**-0.563*****	-0.081	**-0.773*****	-0.042	**-0.219****	**0.00023****	-0.0952
	(0.142)	(0.108)	**(0.130)**	(0.200)	**(0.100)**	**(0.0001)**	(0.3105)
Trade freedom	**0.319*****	-0.004	0.083	**-0.802*****	**0.202*****	**0.0007*****	**1.4390*****
	(0.106)	(0.117)	(0.101)	**(0.222)**	**(0.063)**	**(0.0003)**	**(0.3407)**
Investment freedom	**-0.127****	**-0.177*****	0.004	-0.046	0.044	**0.00017***	**0.2987*****
	(0.050)	**(0.056)**	(0.041)	(0.078)	(0.031)	**(0.0001)**	**(0.0946)**
GDP growth	**-1.080*****	**1.392*****	**-1.644*****				
	(0.238)	**(0.233)**	**(0.181)**				
External dent stock (% of GNI)	-0.026	**-0.043*****		0.002		**0.00037*****	
	(0.021)	**(0.010)**		(0.027)		**(0.00001)**	
Inflation rate		**1.650*****			**-1.018*****		
		(0.268)			**(0.152)**		
Log Likelihood	-523.86	-437.77	-221.49	-240.37	-482.19	-407.04	-490.79
Hausman Test (Prob.)	5.31(0.385)	4.07(0.635)	4.53(0.578)	5.53(0.343)	5.26(0.384)	5.04(0.410)	3.91(0.645)
Country	15	15	15	15	15	15	15
Observations	318	309	318	318	304	313	304

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10.
Source: Author's computation (2024)

The results presented in Table 4.12 provide the analysis of how different aspects of the investment climate (property rights, government integrity, business freedom, monetary freedom, trade freedom, and investment freedom) affect agricultural performance in ECOWAS countries, specifically in terms of agricultural output, employment, and export. In the context of agricultural output growth, the short-run coefficient for property rights is positive and statistically significant in both models, with values of 0.11 and 0.23 in Models 1 and 2 respectively. This indicates that improvements in property rights have had a significant positive impact on agricultural output in the short run within ECOWAS. It suggests that as property rights are strengthened, farmers and agricultural businesses in the region are more likely to invest in their land and resources, leading to increased productivity and higher agricultural output. In a region where land tenure issues and property rights are often contested, securing these rights provides a critical foundation for enhancing agricultural productivity. Government integrity also shows a positive and significant impact on agricultural output in model 2, with a coefficient of 0.09 at 10% level. This result highlights the importance of transparent and accountable governance in boosting agricultural productivity. When government integrity is high, there is likely a reduction in corruption and bureaucratic inefficiencies, which otherwise stifle agricultural development. This further suggests that ECOWAS countries that have made strides in improving governance have seen corresponding increases in agricultural productivity. However, trade freedom has a significant negative impact on agricultural output in model 1, with a coefficient of -0.072 at 10% level. This suggests that trade openness have led to a decrease in agricultural output in the short run. One possible explanation for this outcome is that as trade barriers are reduced, domestic agricultural producers in ECOWAS face increased competition from imported goods, which are more competitively priced. This increased competition results in a reduction in market share for local producers, leading to lower domestic agricultural production. Other investment climate metrics like business, monetary, and investment freedom have no significant influence on agricultural outputs in the short run.

For agricultural employment models, business, investment, and monetary freedom show a statistically significant negative impact on agricultural employment. The results indicate that as business freedom increases, agricultural employment tends to decrease in the short run. It suggests that business freedom, typically associated with reduced regulatory constraints and easier market entry, lead to a reallocation of labour from agriculture to other, potentially more lucrative, sectors. As regulatory barriers decrease, businesses in other sectors expand, attracting labour away from agriculture, which traditionally employs a large proportion of the workforce in ECOWAS countries. Also, as monetary freedom increases, agricultural employment may decrease, potentially due to the stabilization of prices and reduction of inflation, which lower the profitability of agricultural activities that are sensitive to price changes. Likewise, when investment freedom increases, agricultural employment tends to decrease in the short run. This is due to capital being redirected towards sectors that are perceived as offering higher returns, such as manufacturing or services, leading to a decline in investment in agriculture. Additionally, investment freedom leads to greater efficiency and productivity in the agricultural sector through the adoption of modern technologies, which reduce the need for labour. In magnitude, at 10% changes in business, monetary, and investment freedom, agricultural employment reduces by 0.62%, 0.31% and 0.31% respectively. Conversely, trade freedom parameter shows a positive and significant impact on agricultural employment in model 4, with a coefficient of 0.044 at 10% level. This can be attributed to the expansion of trade-related activities within the agricultural sector, such as processing, transportation, and export logistics, which create additional employment opportunities. As trade barriers are reduced, ECOWAS countries experience a growth in agricultural exports, leading to increased demand for labour to support these activities. For property right and government integrity, they do not significantly impact short-run agricultural employment.

In the analysis of agricultural exports, investment freedom shows a significant negative impact on agricultural exports in both models, with coefficients of -0.164 and -0.151. This suggests that while greater investment freedom is likely to attract capital to the region, it might also divert resources away from the agricultural sector towards other, more lucrative industries, such as manufacturing or services. As a result, the agricultural sector will experience a decline in the resources available for export activities, leading to a reduction in agricultural export volumes. The other variables, including property rights, government integrity, business freedom, monetary freedom, and trade freedom, do not show significant effects on agricultural exports in the short run.

As to agricultural output per capita model, the short-run property rights and investment freedom show positive but statistically insignificant coefficients, suggesting limited short-term impacts on agricultural output per worker. Government integrity in the short run, however, has a negative and significant effect, implying that weaker governance reduces agricultural productivity. Similarly, the short-run trade freedom exerts a significant negative influence (-0.5442), potentially reflecting vulnerabilities to trade policy disruptions or external competition. Other factors, such as business freedom and monetary freedom, exhibit insignificant effects, highlighting their relatively muted role in short-term agricultural performance.

For the covariates, the coefficient for GDP growth and external debt stock are positive and significant in Models 1 and 2 respectively. Thus, higher GDP growth rates are associated with increased agricultural output in the short run. This suggests that as the overall economy grows, there is likely increased demand for agricultural products, as well as greater availability of resources for investment in the agricultural sector. Likewise, when external borrowings are effectively utilized, they support agricultural activities. This is through investments in agricultural infrastructure, procurement of inputs such as seeds and fertilizers, or through financing of agricultural extension services that improve productivity. Inflation rate has a positive and significant impact on agricultural exports, with a coefficient of 0.130. This suggests that higher inflation rates in the short run are associated with an increase in agricultural exports within ECOWAS countries. A plausible explanation is that inflation reduces the real value of the domestic currency, making exports more competitive in international markets. As the prices of agricultural goods in foreign currencies become more attractive, there is likely an increase in demand for these exports. Additionally, inflation prompts producers to focus on exporting goods to generate higher returns in more stable currencies, thereby boosting export activities.

Table 4.12 also reports the long-run estimates of how investment climate influence agricultural outputs, employment, and exports in 15 ECOWAS countries. Property rights have a significant negative impact on agricultural output in both models, with coefficients of -0.190 and -0.702. This suggests that contrary to the *a'priori* expectation, property rights in the long run are associated with a reduction in agricultural output in ECOWAS. Intuitively, this implies that as property rights in ECOWAS are strengthened, there is an increase in land speculation and a shift in land use away from traditional agriculture toward other uses perceived as more profitable, such as real estate development or commercial ventures. This shift reduces the amount of land available for agricultural production, thereby decreasing overall agricultural output. Government integrity also shows a significant negative impact on agricultural output. A possible explanation is that when governance becomes more stringent and corruption is reduced, previously informal or corrupt practices that have facilitated agricultural production (such as informal land use arrangements or unregulated resource extraction) are curtailed. This shift leads to disruptions in agricultural practices or increase the cost of compliance with regulations, thereby reducing output.

Similarly, business freedom consistently shows a significant negative impact on agricultural output. The decline in output is due to the reallocation of resources away from agriculture towards other sectors that are perceived as more dynamic or profitable. Thus, as business freedom increases, capital and labour in the region are drawn into industries such as manufacturing or services, reducing the resources available for agricultural production. Also, monetary freedom has a significant negative impact on agricultural output. Intuitively, as monetary policies stabilize, the agricultural sector, which often benefits from inflationary environments (where prices for agricultural products rise faster than costs), faces tighter margins and reduced profitability. Additionally, monetary freedom leads to an environment where agricultural producers are more exposed to global price fluctuations, which negatively impact output. As well, investment freedom has a significant negative impact on agricultural output. The negative impact is due to capital being diverted away from agriculture towards other sectors that offer higher returns on investment, such as manufacturing, services, or technology. This diversion of resources results in reduced investment in agricultural infrastructure, technology, and inputs, leading to a decline in output. Conversely, trade freedom has a significant positive impact on agricultural output. The positive impact indicates that as trade barriers are lowered, ECOWAS countries benefit from greater access to international markets, which drive agricultural production by increasing demand for exports. This finding supports the argument that trade liberalization is beneficial for agricultural development, particularly when the sector is competitive on the global stage.

In the context of agricultural employment, property rights exhibit a significant negative impact on agricultural employment. This suggests that stronger property rights lead to greater land consolidation and mechanization, which, while improving productivity, reduces the demand for labour in agriculture. As large-scale farming operations expand and utilize more capital-intensive methods, the need for manual labour decreases, leading to a reduction in agricultural employment. Government integrity also shows a significant and negative impact on agricultural employment. This negative relationship is likely to arise because greater government integrity leads to stricter enforcement of regulations and land use policies, which disrupt informal agricultural practices that rely on less formal arrangements. As governance improves, there is a shift towards more formal and regulated agricultural operations, which, while beneficial for overall productivity and sustainability, reduce the demand for labour. Monetary freedom shows a significant negative impact on agricultural employment, with a coefficient of -0.773. This decline is due to the reduced profitability of certain agricultural activities in a stable monetary environment, leading to lower demand for labour. Additionally, monetary freedom result in greater exposure to global price fluctuations, which negatively impact agricultural producers and reduce their ability to maintain employment levels. Trade freedom's impact on agricultural employment is negative and statistically significant. This negative relationship suggests that increased trade freedom leads to a decline in agricultural employment, potentially due to increased competition from imported agricultural goods, which possibly reduce the market share and profitability of domestic agricultural producers. As trade barriers are lowered, domestic producers struggle to compete, leading to a contraction in agricultural activities and a corresponding reduction in employment.

The impact of business freedom on agricultural employment presents a mixed picture. In model 3, business freedom has a significant negative impact on agricultural employment, indicating that increased business freedom reduces agricultural employment in the long run. This reduction may occur as business freedom facilitates the expansion of non-agricultural sectors, attracting labour away from agriculture. However, in model 4, business freedom has a significant positive impact on agricultural employment. This positive relationship suggests that under certain conditions, increased business freedom stimulates agricultural employment, possibly by encouraging entrepreneurship and investment in the agricultural sector. The contrasting results between the two models highlight the context-dependent nature of business freedom's impact on agricultural employment, suggesting that the effects vary depending on the specific economic environment and the presence of complementary policies that support the agricultural sector.

For agricultural export models, property rights exhibit a statistically significant positive impact on agricultural exports in the long run. This implies that secure property rights enhance farmers' and agricultural businesses' ability to invest confidently in export-oriented production, knowing that their land and resources are legally protected. This increased investment leads to higher productivity and greater export volumes. Government integrity shows a significant negative impact on agricultural exports. A plausible explanation is that as government integrity improves, informal practices that have previously facilitated export activities (such as unofficial trading channels or tax evasion) are curtailed, leading to a temporary reduction in export volumes. Business freedom has a significant negative impact on agricultural exports. It suggests that increased business freedom, which generally reduces regulatory barriers and facilitates easier market entry, lead to a reallocation of resources away from agriculture towards other sectors perceived as more profitable. As businesses diversify and expand into non-agricultural sectors, the focus on agricultural exports diminishes, leading to a decline in export volumes. Monetary freedom shows a significant but contrasting impact on agricultural exports between the two models. In model 5, monetary freedom has a negative impact, suggesting that greater monetary freedom reduce agricultural exports in the long run. This could be due to the increased exposure to global market fluctuations that comes with monetary freedom, potentially leading to instability in export revenues. Conversely, in model 6, monetary freedom has a positive impact, indicating that a stable and predictable monetary environment enhance agricultural exports by reducing uncertainty and fostering a more conducive environment for long-term investment in export-oriented agriculture. The differing impacts across the models suggest that the effects of monetary freedom on agricultural exports depend on specific country contexts and the broader economic environment.

However, trade freedom consistently shows a significant positive impact on agricultural exports in both models. These results indicate that increased trade freedom, characterized by the reduction of trade barriers and the facilitation of cross-border trade, strongly supports the growth of agricultural exports in ECOWAS countries. By lowering tariffs, improving customs procedures, and fostering trade agreements, ECOWAS countries have enhanced their ability to compete in global agricultural markets, leading to higher export volumes. Also, investment freedom shows a positive impact on agricultural exports, suggesting that increased investment freedom, which allows for easier movement and allocation of capital, positively influence agricultural export performance. This result implies that when capital flows freely and investments are not hindered by excessive regulations, there is greater potential for investment in export-oriented agricultural projects, leading to an increase in exports.

In the case of agricultural output per worker model, trade freedom exhibits the most substantial and positive influence, with a highly significant coefficient of 1.439. This suggests that in the long run, increased openness to trade fosters agricultural performance, likely by enhancing market access, facilitating the import of inputs, and promoting export opportunities. Similarly, investment freedom (coefficient of 0.299) and government integrity (coefficient of 0.441) positively and significantly influence agricultural productivity. The effect of investment freedom underscores the importance of reducing barriers to investment, while government integrity reflects the role of governance and transparency in creating a stable environment for agricultural growth. These findings emphasize that addressing trade and investment constraints while enhancing investment climate unlocks long-term agricultural potential in the region. On the other hand, the long-run estimates indicate mixed results for other investment climate variables. For instance, property rights show a positive but statistically insignificant effect (0.2969), suggesting that while secure property rights are important, their impacts may require further institutional strengthening to be fully realized. Conversely, business freedom and monetary freedom exhibit negative coefficients (-0.2292 and -0.0952, respectively), though these effects are not statistically significant. The negative sign of business freedom indicates inefficiencies in regulatory reforms or misalignments with sector-specific needs, while that of monetary freedom suggests that inflationary or monetary policies has no direct influence agricultural productivity.

For the covariates, GDP growth shows a significant negative and positive impact on agricultural output in models 1 and 2 respectively. The differing signs of the GDP growth coefficients between the two models highlight the complexity of the relationship between economic growth and agricultural output. This suggests that the impact of GDP growth on agriculture varies depending on country-specific factors such as the stage of economic development, the structure of the economy, and the presence of supportive agricultural policies. GDP growth exhibits a significant negative impact on agricultural employment. The adverse impact of GDP growth on agricultural employment reflects structural transformation, where economic growth leads to a shift in labour from agriculture to more productive sectors such as industry and services. As economies grow and diversify, the agricultural sector often becomes less labour-intensive, resulting in a reduction in agricultural employment.

Meanwhile, external debt stock has a significant negative impact on agricultural output. The negative impact of external debt on agriculture could be attributed to the debt burden diverting resources away from productive investments in the agricultural sector, as countries need to allocate a significant portion of their budgets to debt servicing rather than to supporting agricultural development. Additionally, high external debt levels lead to macroeconomic instability, including fluctuations in exchange rates and inflation, which further undermines agricultural productivity. However, external debt stock as a percentage of GNI has a significant positive impact on agricultural exports. This finding suggests that higher levels of external debt, when managed effectively, can support agricultural exports by providing the necessary financial resources for investment in export infrastructure, technology, and market development. However, the positive impact of external debt on exports underscores the importance of ensuring that borrowed funds are directed towards productive investments that enhance the agricultural sector's competitiveness in global markets.

As well, inflation rate shows a significant positive impact on agricultural output. A possible explanation for this positive link is that inflation led to higher nominal prices for agricultural products, which incentivizes farmers to increase production to take advantage of better prices. Additionally, in some cases, moderate inflation stimulates economic activity by encouraging spending and investment, which benefits the agricultural sector. Conversely, inflation rate shows a significant negative impact on agricultural exports. This result indicates that higher inflation rates are detrimental to agricultural exports in the long run, likely due to the destabilizing effects of inflation on the economy. Thus, high inflation erodes the profitability of agricultural exports by increasing input costs, reducing the real value of export revenues, and creating uncertainty that discourages long-term investment in the sector.

4.5 Empirical Results of the Effects of Institutional Quality on Agricultural Performance in ECOWAS

4.5.1 Correlation Analysis

The partial correlation coefficients of the series are presented in Table 4.13. The correlation results revealed that institutional quality negatively correlates with agricultural outputs and employment, but positively associates with agricultural exports and output per worker. This suggests that quality institutions such as stronger governance, regulations, and policies might be creating a challenging environment for domestic agricultural outputs and employment, possibly due to increased costs, stringent regulations, or reduced incentives for local production. However, the positive association with agricultural exports implies that these improved institutions may be enhancing the export competitiveness of the agricultural sector, likely through better trade policies, infrastructure, and compliance with international standards, which facilitate access to global markets. As to agricultural performance indicators, it shows that agricultural employment positively relates with agricultural outputs and exports in the region. This suggests that higher employment levels contribute to increased production and trade. However, there is an inverse relationship between agricultural output growth and exports, implying that as agricultural outputs grow, exports may not increase proportionally or might even decline. Meanwhile, agricultural output per worker has a negative level of association with agricultural output growth, employment, and exports.

Table 4.13: Correlation Matrix

	agpf1	*agpf2*	*agpf3*	*agpf4*	*inst*	*gdpg*	*bm*	*inf*	*topn*
agpf2	0.418	1							
agpf3	-0.070	0.125	1						
agpf4	-0.248	-0.813	-0.129	1					
inst	-0.573	-0.402	0.140	0.245	1				
gdpg	-0.048	0.023	0.032	0.025	0.107	1			
bm	-0.508	-0.619	-0.131	0.409	0.595	0.002	1		
inf	0.199	-0.021	-0.225	0.109	-0.149	-0.021	-0.196	1	
topn	0.182	-0.237	-0.200	-0.040	0.034	0.071	0.160	0.206	1
exdt	0.438	0.032	-0.153	-0.182	-0.213	-0.234	-0.094	0.077	0.467

Note: agpf1 - agriculture, forestry, and fishing, value added (% of GDP); agpf2 - employment in agriculture (% of total employment) (modeled ILO estimate); agpf3 - agricultural raw materials exports (% of merchandise exports); agpf4 - agriculture output per worker (constant 2015 US$); inst - institutional quality; gdpg - GDP growth (annual %); bm - broad money (% of GDP); inf - inflation, consumer prices (annual %); topn - trade (% of GDP); exdt - external debt stocks (% of GNI).
Source: Author's computation (2024).

As regards other covariates, the findings indicate that there is a negative link between GDP growth and agricultural output. This suggests that as the economy grows, there is a possibility of a fall in agriculture productivity. Nevertheless, there is a positive correlation between GDP and agricultural employment as well as exports, indicating that these sectors flourish as the economy grows. On the other hand, there is a positive relationship between inflation and agricultural output, but a negative relationship with employment and exports. This means that increasing prices may lead to higher production, but it can also result in fewer job possibilities and less commerce. Broad money supply negatively correlates agricultural outputs, employment, and exports, suggesting that increased money supply might not favour the agricultural sector, possibly due to inflationary pressures or misaligned financial policies. Conversely, trade openness positively associates with agricultural outputs but negatively relates with agricultural employment and exports. It implies that while openness boosts production, it might reduce job opportunities and export competitiveness due to increased competition or market volatility. Additionally, external debt positively correlates with agricultural outputs and employment but negatively associates with exports, highlighting that borrowing might support domestic growth but hinder international trade performance.

The correlation matrix table displays different levels and strengths of correlation coefficients among the factors influencing agricultural performance metrics, suggesting the absence of any concerns related to multicollinearity. This indicates that the empirical analysis is not affected by multicollinearity issues. Nevertheless, these correlation coefficients are preliminary results that will undergo further verification in Section 4.5.3 by including additional factors that influence agricultural production.

4.5.2 Cross-Sectional Dependence, Stationary and Cointegration Tests

The cross-sectional dependence test results for the panel study analyzing the relationship between institutional quality and agricultural performance in 15 ECOWAS nations from 2000 to 2022 are displayed in Table 4.14. The findings of the Breusch-Pagan LM test, as shown in Table 4.14, provide a significant rejection of the null hypothesis of no association at standard levels of significance. Likewise, the results of the Pesaran scaled LM test follow an asymptotically standard normal distribution, and the statistical values also indicate rejection of the null hypothesis at the 5% significance level. Even though the values of the standard normal Pesaran CD test statistic are lower than those of the LM tests, they nevertheless reject the null hypothesis at the 0.05 critical thresholds. Therefore, the results suggest a substantial level of interdependence among all models, as demonstrated by the Breusch-Pagan LM, Pesaran scaled LM, and Pesaran CD statistics. The p-values are all close to zero, indicating that the variables in the models are not independent across nations. This implies that unexpected events or alterations in one country can have substantial impacts on other countries, which is crucial to consider when conducting panel data analysis for these nations.

Table 4.14: Cross-Sectional Dependence Test Results (d.f. = 105)

	Statistics	**Probability**
Model 1: agpf1 inst gdpg bm inf topn		
Breusch-Pagan LM	294.7438	0.0000
Pesaran scaled LM	13.09357	0.0000
Pesaran CD	1.435668	0.1511
Model 2: agpf2 inst gdpg bm inf topn		
Breusch-Pagan LM	373.7076	0.0000
Pesaran scaled LM	18.54259	0.0000
Pesaran CD	10.73494	0.0000
Model 3: agpf3 inst gdpg bm inf topn		
Breusch-Pagan LM	345.3468	0.0000
Pesaran scaled LM	16.58550	0.0000
Pesaran CD	7.219929	0.0000
Model 4: agpf4 inst gdpg bm inf topn		
Breusch-Pagan LM	353.9710	0.0000
Pesaran scaled LM	17.18063	0.0000
Pesaran CD	5.929274	0.0000

Note: agpf1 - agriculture, forestry, and fishing, value added (% of GDP); agpf2 - employment in agriculture (% of total employment) (modeled ILO estimate); agpf3 - agricultural raw materials exports (% of merchandise exports); agpf4 - agriculture output per worker (constant 2015 US$); inst - institutional quality; gdpg - GDP growth (annual %); bm - broad money (% of GDP); inf - inflation, consumer prices (annual %); topn - trade (% of GDP); exdt - external debt stocks (% of GNI).
Source: Author's computation (2024).

The results of the panel unit root test in Table 4.15 evaluate the stationarity of the variables. The tests utilized include Levin, Lin & Chu (LLC), Breitung (Breit), and Im, Pesaran and Shin (IPS). All three techniques have verified that the GDP growth and trade openness exhibit stationarity at level I(0). Therefore, they remain stationary at levels, suggesting that differencing is unnecessary. In contrast, the study observed that agricultural output, agricultural employment, and agricultural output per worker were determined to be stationary at the first difference, denoted as I(1). As a result, they remain stationary after the first difference, which indicates that they are not stationary at levels. The outcomes for agricultural exports, institutional quality, broad money supply, and inflation were varied. The Breitung test revealed that agricultural exports are stationary at level, although LLC and IPS demonstrated stationarity when considering first differences. The level of institutional quality remained stationary at level when utilizing LLC, but stationary at the first difference in Breitung and IPS. Broad money supply and inflation were stationary at levels using the LLC and IPS estimators, but they exhibited stationarity at first difference in Breitung. External debt remained stationary at level according to LLC but showed a change in stationarity according to Breitung and IPS when taking the first difference. The study eventually concluded that agricultural exports, institutional quality, broad money supply, inflation, and foreign debt exhibit stationarity at the first difference.

Table 4.15: Panel Unit Root Test Results

Signs	Variable Description	Levels			1st Difference			Decision
		LLC	Breit	IPS	LLC	Breit	IPS	
agpf1	Agriculture output, forestry, and fishing, value added (% of GDP)	2.8767	-1.3979	0.9365	-2.2234**	-4.7239***	-5.6568***	I(1)
agpf2	Employment in agriculture (% of total employment)	0.2672	4.3131	0.3460	-7.4485***	-38891***	-5.8311***	I(1)
agpf3	Agricultural raw materials exports (% of merchandise exports)	6.5565	-1.9711**	-0.4742	-15.741***	-	-13.818**	I(1)
agpf4	Agricultural output per worker (constat 2015 US$)	-0.5501	0.9035	-1.2672	-11.618***	-8.1539***	-13.187***	I(1)
Inst	Institutional quality	-2.3392***	-0.2858	-1.1439	-	-7.8911***	-6.4500***	I(1)
gdpg	GDP growth (annual %)	-7.0548***	-6.2469***	-10.495***	-	-	-	I(0)
Bm	Broad money (% of GDP)	-3.09422***	-0.7056	-2.2856**	-	-4.9022***	-	I(1)
Inf	Inflation, consumer prices (%)	-5.6012***	-0.7471	-5.2576***	-	-3.2883***	-	I(1)
Topn	Trade (% of GDP)	-2.8492***	-1.6469***	-4.5224***	-	-	-	I(0)

Note: LL denotes Levin, Lin & Chin (2002); Brrit represents Breitung (2001); Im, Pesaran and Shin (2003); ***, ** & * denote 1%, 5% & 10% significance levels.
Source: Author's computation (2024).

The results of the KAO Residual test for cointegration are presented in Table 4.16. Based on the standard criteria for probability testing, the table shows that the null hypothesis of no cointegration is rejected in all three models at a significance level of 5%. The rejection of the null hypothesis of no cointegration at a 5% significance level indicates a long-run equilibrium relationship between institutional quality and agricultural performance. The finding indicates a co-integration between the outcome variables (agricultural performance indicators) and the explanatory variables (institutional quality and control variables) in all the estimated models. More precisely, research validates the presence of a long-run relationship between institutional quality and agricultural performance in nations belonging to the ECOWAS. This means that improvements in institutional quality, such as better governance, regulatory frameworks, and corruption control, lead to sustained enhancements in agricultural outcomes. This relationship underscores the importance of governance reforms as a strategic lever for enhancing agricultural sector performance in the region.

Table 4.16: KAO Residual Test for Cointegration

	t-Statistics	Probability
Model 1: agpf1 inst gdpg bm inf topn		
ADF	-2.798754	0.0026
Residual variance	7.690341	
HAC variance	5.838878	
Model 2: agpf2 inst gdpg bm inf topn		
ADF	-2.375777	0.0088
Residual variance	1.861302	
HAC variance	3.820134	
Model 3: agpf3 inst gdpg bm inf topn		
ADF	-2.351453	0.0093
Residual variance	1.633840	
HAC variance	2.534635	
Model 4: agpf4 inst gdpg bm inf topn		
ADF	-2.502189	0.0062
Residual variance	0.008019	
HAC variance	0.008097	

Note: agpf1 - agriculture, forestry, and fishing, value added (% of GDP); agpf2 - employment in agriculture (% of total employment) (modeled ILO estimate); agpf3 - agricultural raw materials exports (% of merchandise exports); agpf4 - agriculture output per worker (constant 2015 US$); prt - property right; gint - government integrity; bfr - business freedom; mfr - monetary freedom; tfr - trade freedom; ifr - investment freedom; gdpg - GDP growth (annual %); bm - broad money (% of GDP); inf - inflation, consumer prices (annual %); topn - trade (% of GDP).
Source: Author's computation (2024).

4.5.3 Panel Regression Results of Institutional Quality and Agricultural Performance in ECOWAS

This section discusses the empirical findings about the impact of institutional quality on agricultural performance in ECOWAS countries, using the pooled mean group estimator. The null hypotheses of the Hausman tests in Table 4.17 suggest that there is no systematic difference in the coefficients between the mean group and pooled mean group, and this conclusion is not rejected at a 5% level of significance. Thus, the use of pooled mean group is indicated as the appropriate estimator to test the research hypothesis. The measurement of agricultural performance as the dependent variable was based on agricultural output growth, employment, exports, and output per worker. Consequently, three models were calculated and designated as 1, 2, and 3. The ideal lag durations for the variables were automatically determined using the Bayesian Information Criterion (BIC) with a fixed value of two, ensuring an adequate degree of freedom. Each variable of interest has the same lag length of one in all fifteen ECOWAS countries.

Table 4.17 displays the concise representation of the estimated parameters for both the short-run and long-run effects of the pooled mean group or panel autoregressive distributed - ARDL (1, 1, 1, 1, 1, 1). The table reveals that the coefficients of the error correction term are both negative and statistically significant at the conventional level. The error correction term coefficients are precisely -0.188, -0.107, -0.323, and -0.031. Additionally, the t-statistics probability values for these coefficients are below 1% significant level. The empirical models of agricultural output growth, employment, exports, and output per worker exhibit a speed of adjustment of 18.8%, 10.7%, 32.2%, and 3.1% respectively, which allows them to rectify their short-run disequilibrium and revert to the long-run equilibrium. This provides additional evidence that there is a persistent connection between the quality of institutions and agricultural performance in ECOWAS. Therefore, it has been verified that the equilibrium character of the models remains valid over the extended periods.

The short-run estimates presented for agricultural performance in ECOWAS countries in Table 4.17 provide valuable insights into how institutional quality, and other co-factors like GDP growth rate, broad money supply, inflation rate, and trade openness, impact agricultural output growth, employment, exports, and output per worker. The short-run estimates of institutional quality show a significant negative impact on agricultural employment, with a coefficient of -1.741. This decline can be attributed to the formalization and restructuring of agricultural practices, which often accompany improvements in institutional quality. As agricultural operations become more efficient and formalized, the demand for labour, particularly informal labour, may decrease, leading to a short-term reduction in employment. However, the impact of institutional quality on agricultural output growth, agricultural exports, and agricultural output per worker is not statistically significant, indicating that in the short run, changes in institutional quality do not have a short-run effect on these aspects of agricultural performance within the region at 5% significance level.

Table 4.17: Pooled mean group estimates of institutional quality and agricultural performance

Variables	**Dependent Variable:** Agricultural Performance			
	Agricultural Output Growth	**Agricultural Employment**	**Agricultural Export**	**Agricultural Output per Worker (ln)**
	1	**2**	**3**	**4**
	Short-run Estimates			
ECT(-1)	**-0.188***** **(0.058)**	**-0.107***** **(0.012)**	**-0.323***** **(0.107)**	**-0.0307***** **(0.0133)**
Δ(Institutional quality)	-3.197 (2.822)	**-1.741*** **(0.929)**	-9.971 (6.817)	-0.0356 (0.0994)
Δ(GDP growth rate)	**0.131***** **(0.037)**	-0.022 (0.022)	0.102 (0.079)	0.2247 (0.1790)
Δ(Broad money supply (% of GDP))	0.037 (0.068)	0.007 (0.013)	-0.029 (0.058)	0.00038 (0.1725)
Δ(Inflation rate)	0.025 (0.030)	0.009 (0.029)	0.130 (0.105)	**-0.3439*** **(0.1913)**
Δ(Trade (% of GDP))	**-0.053***** **(0.020)**	-0.016 (0.022)	-0.057 (0.040)	0.0016 (0.0918)
Constant	**3.830**** **(1.473)**	**-0.440***** **(0.161)**	**2.269***** **(1.106)**	**0.3699***** **(0.1412)**
	Long-run Estimates			
Institutional quality	**-14.344***** **(4.782)**	**-48.305***** **(12.951)**	**7.300***** **(1.507)**	**3.4696***** **(0.7572)**
GDP growth rate	**-0.359***** **(0.058)**	**0.938**** **(0.394)**	**-0.385***** **(0.092)**	**20.986***** **(6.3859)**
Broad money supply (% of GDP)	**-0.265***** **(0.063)**	**-0.204***** **(0.072)**	-0.035 (0.030)	-0.4579 (0.6517)
Inflation rates	**1.024***** **(0.101)**	**-0.580*** **(0.307)**	**-0.266***** **(0.089)**	**6.0189***** **(2.9782)**
Trade (% of GDP)	**0.081***** **(0.026)**	**0.711***** **(0.199)**	**0.161***** **(0.034)**	**-6.6843***** **(0.2890)**
Log Likelihood	-529.75	-237.37	-521.64	-511.1165
Hausman Test (Prob.)	2.63(0.757)	8.12(0.153)	3.18(0.685)	5.19(0.425)
Country	15	15	15	15
Observations	308	308	303	294

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10.
Source: Author's computation (2024).

As to the co-factors, the coefficient for trade openness is negative and statistically significant, with a value of -0.053. This indicates that in the short run, increased trade openness is associated with a decline in agricultural output growth within ECOWAS. The negative impact suggests that as trade barriers are reduced, domestic agricultural producers in ECOWAS face intensified competition from imported agricultural products, which are often more competitively priced. Conversely, the GDP growth rate has a positive and significant impact on agricultural output growth. The positive relationship suggests that as the overall economy grows, there is greater demand for agricultural products, as well as increased availability of resources for investment in agriculture. Economic growth leads to improvements in infrastructure, access to markets, and availability of credit, all of which contribute to higher agricultural productivity. Meanwhile, inflation rate negatively impacts agricultural output per worker at 10% significance level.

The long-run estimates of how institutional quality impacted agricultural performance in ECOWAS countries is presented in Table 4.17. Institutional quality has a significant negative impact on both agricultural output and employment, with coefficients of -14.34 and -48.31 respectively. These findings suggest that, over the long term, improvements in institutional quality, such as enhanced governance, law enforcement, and reduced corruption, lead to a decrease in both agricultural productivity and employment. This is due to the formalization of the sector and the shift towards more capital-intensive and less labour-intensive practices, which, while improving efficiency, reduce the reliance on labour and limit the extent of agricultural activities. On the other hand, institutional quality has a positive impact on agricultural exports, with a coefficient of 7.300, indicating that better institutions support the development of export-oriented agriculture. This positive relationship reflects the role of strong institutions in creating a stable and predictable environment for trade, enhancing the competitiveness of agricultural exports from ECOWAS countries in global markets. Institutional quality has a strong and statistically significant positive influence on agricultural output per worker in the long run, with a coefficient of 3.4696. This shows the critical role of robust institutions in enhancing agricultural productivity in ECOWAS. High institutional quality, characterized by effective governance, rule of law, control of corruption, and strong public institutions, creates a stable and predictable environment that supports agricultural investment, innovation, and efficient resource allocation. It fosters trust and reduces transaction costs, enabling farmers and agricultural enterprises to operate more effectively.

Regarding the co-founding factors, GDP growth rate negatively and significantly impacts agricultural output and exports, with coefficients of -0.36 and -0.39 respectively, while it positively influences agricultural employment (0.94), and output per worker (20.99). This suggests that while economic growth may reduce the focus on agriculture by shifting resources to other sectors, it still supports job creation within agriculture. Broad money supply has a significant negative impact on both agricultural output (-0.27) and employment (-0.204), indicating that an increase in money supply may lead to inefficiencies or inflationary pressures that harm agricultural productivity and job retention. Inflation rates show mixed effects, with a positive impact on agricultural output growth (1.02) and agricultural output per worker (6.019) but a negative impact on both employment (-0.58) and exports (-0.27), suggesting that while inflation might initially boost outputs by increasing agricultural prices, it ultimately harms employment and export competitiveness. Finally, trade openness positively affects agricultural output growth (0.081), employment (0.711), and exports (0.161), but has negative impact on agricultural output per worker (-6.684) respectively.

4.6 Empirical Results of Institutional Quality Acting as an Ameliorating or a Deteriorating Factor in the Nexus between Investment Climate and Agriculture Performance in ECOWAS

4.6.1 Correlation Analysis

Table 4.18 displays the partial correlation coefficients for agricultural performance, institutional quality, and investment climate. It shows that there is typically a negative association between agricultural output growth and investment climate indices (such as property rights, government integrity, company freedom, monetary freedom, trade freedom, and investment freedom). This implies that factors beneficial to overall economic conditions might not necessarily result in an increase in agriculture. Furthermore, monetary policy stands out with a positive correlation to agricultural employment, as most investment climate indicators are indirectly related to agricultural employment. This suggests that while changes in monetary policy can help create jobs in the agricultural sector, more comprehensive economic reforms may not always be beneficial for agricultural employment. It is interesting to note that improvements in the investment climate and agricultural exports connect positively, except for indirect associations with trade freedom and property rights. This suggests that while more favourable investment conditions may increase exports, certain elements such as trade regulations and property rights need to be carefully managed to prevent negative associations with the agriculture industry. This implies that conventional investment climate enhancements, which are often intended to promote overall economic expansion, might not necessarily result in higher agriculture productivity or job creation. Agricultural output per worker positively correlates with property right, government integrity, business freedom, trade freedom, and investment freedom but indirectly associates with monetary freedom.

Table 4.18: Correlation Matrix

	agpf1	*agpf2*	*agpf3*	*agpf4*	*Prt*	*gint*	*bfr*	*mfr*	*tfr*	*ifr*	*inst*	*gdpg*	*bm*	*inf*	*topn*
agpf2	0.418	1													
agpf3	-0.070	0.125	1												
agpf4	-0.248	-0.813	-0.129	1											
prt	-0.570	-0.508	-0.036	0.300	1										
gint	-0.454	-0.453	0.018	0.281	0.548	1									
bfr	-0.394	-0.331	0.083	0.252	0.504	0.346	1								
mfr	-0.181	0.020	0.256	-0.124	0.091	0.015	-0.051	1							
tfr	-0.049	-0.002	-0.002	0.100	0.022	0.322	-0.029	0.055	1						
ifr	-0.357	-0.237	0.160	0.171	0.480	0.529	0.420	0.090	0.226	1					
inst	-0.573	-0.402	0.140	0.245	0.778	0.671	0.546	0.196	0.128	0.609	1				
gdpg	-0.048	0.023	0.032	0.025	0.042	0.028	0.058	0.022	-0.092	0.040	0.107	1			
bm	-0.508	-0.619	-0.131	0.409	0.571	0.568	0.306	0.162	0.020	0.415	0.595	0.002	1		
inf	0.199	-0.021	-0.225	0.109	0.010	-0.049	0.021	-0.582	-0.165	-0.112	-0.149	-0.021	-0.196	1	
topn	0.182	-0.237	-0.200	-0.040	0.244	0.325	0.241	-0.151	-0.034	0.075	0.034	0.071	0.160	0.206	1
exdt	0.438	0.032	-0.153	-0.182	-0.043	-0.184	-0.083	0.007	-0.254	-0.048	-0.213	-0.234	-0.094	0.077	0.467

Note: agpf1 - agriculture, forestry, and fishing, value added (% of GDP); agpf2 - employment in agriculture (% of total employment) (modeled ILO estimate); agpf3 - agricultural raw materials exports (% of merchandise exports); agpf4 - agriculture output per worker (constant 2015 US$); prt - property right; gint - government integrity; bfr - business freedom; mfr - monetary freedom; tfr - trade freedom; ifr - investment freedom; inst - institutional quality; gdpg - GDP growth (annual %); bm - broad money (% of GDP); inf - inflation, consumer prices (annual %); topn - trade (% of GDP); exdt - external debt stocks (% of GNI).
Source: Author's computation (2024).

The correlation analysis showed that while institutional quality positively corresponds with agricultural exports and output per worker, it negatively correlates with employment and agricultural outputs. This implies that high-quality institutions, like better governance, rules, and policies, may be making it difficult for domestic agricultural outputs and jobs to flourish. This may be because of higher expenses, stricter rules, or fewer incentives for local production. The positive correlation with agricultural exports, however, suggests that these enhanced institutions might be raising the agricultural sector's export competitiveness. This is probably due to improved infrastructure, trade laws, and international standard compliance, which make it easier for farmers to reach international markets. According to agricultural performance metrics, the region's agricultural outputs and exports have a positive relationship with employment in the agricultural sector. This implies that increased trade and production are correlated with higher employment rates. The growth of agricultural output and exports, however, are inversely correlated, suggesting that while agricultural outputs rise, exports may not rise in tandem with them or may even fall. Meanwhile, agricultural output per worker has a negative level of association with agricultural output growth, employment, and exports.

Regarding other cofactors, the results show that GDP growth and agricultural output are negatively correlated. This implies that there may be a potential decline in agricultural productivity as the economy expands. However, there is a positive association between GDP and exports and employment in the agriculture sector, suggesting that these industries develop as the economy expands. Conversely, inflation has a negative correlation with agricultural employment and exports but has a positive correlation with agricultural output. This indicates that while price increases may result in increased output, they may simultaneously cause decreased employment opportunities and decreased trade. Increased money supply may not benefit the agricultural sector owing to inflationary pressures or mismatched financial policies, as evidenced by the negative correlations found between broad money supply and agricultural outputs, employment, and exports. On the other hand, trade openness has a negative association with agricultural employment and exports but a direct relationship with agricultural outputs. It suggests that although openness increases output, higher competition or market volatility may result in a decline in job prospects and export competitiveness. Furthermore, there exists a positive correlation between external debt and agricultural production and employment, but a negative correlation is observed with exports. These findings suggest that borrowing may bolster local growth while impeding the effectiveness of international trade.

The correlation coefficients between the other factors influencing agricultural performance metrics are likewise displayed in the correlation matrix table, albeit to varying degrees and magnitudes. Our coefficient values showed that there was no multicollinearity issue. As a result, the empirical analysis avoids the multicollinearity issue. Nevertheless, after considering additional factors that influence agricultural performance, the correlation coefficient results are merely preliminary assessments that are verified in section 4.6.3.

4.6.2 Cross-Sectional Dependence, Stationary and Cointegration Tests

In Tables 4.19(a-d), the cross-sectional dependence test results for the panel study that examined the relationship between investment climate, institutional quality, and agricultural performance metrics (output growth, employment, export, and output per worker) in 15 ECOWAS nations from 2000 to 2022 are presented. The null hypothesis of no association is significantly rejected at standard levels of significance by the results of the Breusch-Pagan LM test, as illustrated in Tables 4.19(a-d). Similarly, the Pesaran scaled LM test yields results that conform to an asymptotically standard normal distribution. The statistical values also suggest that the null hypothesis is rejected at the 5% significance level. The null hypothesis is rejected at the 0.05 critical thresholds, even though the values of the standard normal Pesaran CD test statistic are lower than those of the LM tests. Consequently, the Breusch-Pagan LM, Pesaran scaled LM, and Pesaran CD statistics indicate a significant degree of interdependence among all models, as indicated by the results. The p-values are all near zero, suggesting that the variables in the models are not independent across nations. This suggests that the effects of unforeseen events or changes in one country can be significant in other countries, making it essential to consider this when undertaking panel data analysis for these nations.

Table 4.19a: Cross-Sectional Dependence Test Results of Agricultural Output (d.f. = 105)

	Statistics	Probability
Model 1: agpf1 prt inst prt×inst gdpg inf topn exdt		
Breusch-Pagan LM	340.3207	0.0000
Pesaran scaled LM	16.23867	0.0000
Pesaran CD	2.314786	0.0206
Model 2: agpf1 gint inst gint×inst gdpg bm topn exdt		
Breusch-Pagan LM	301.9155	0.0000
Pesaran scaled LM	13.58846	0.0000
Pesaran CD	2.700669	0.0069
Model 3: agpf1 bfr inst bfr×inst gdpg bm inf exdt		
Breusch-Pagan LM	315.6819	0.0000
Pesaran scaled LM	14.53843	0.0000
Pesaran CD	4.128756	0.0000
Model 4: agpf1 mfr inst mfr×inst gdpg inf exdt		
Breusch-Pagan LM	331.8414	0.0000
Pesaran scaled LM	15.65354	0.0000
Pesaran CD	2.173988	0.0297
Model 5: agpf1 tfr inst tfr×inst gdpg bm topn exdt		
Breusch-Pagan LM	375.1057	0.0000
Pesaran scaled LM	18.63907	0.0000
Pesaran CD	1.848738	0.0645
Model 6: agpf1 ifr inst ifr×inst gdpg bm topn		
Breusch-Pagan LM	293.5875	0.0000
Pesaran scaled LM	13.01377	0.0000
Pesaran CD	2.430384	0.0151

Note: agpf1 - agriculture, forestry, and fishing, value added (% of GDP); prt - property right; gint - government integrity; bfr - business freedom; mfr - monetary freedom; tfr - trade freedom; ifr - investment freedom; inst - institutional quality; gdpg - GDP growth (annual %); bm - broad money (% of GDP); inf - inflation, consumer prices (annual %); topn - trade (% of GDP); exdt - external debt stocks (% of GNI).
Source: Author's computation (2024).

Table 4.19b: Cross-Sectional Dependence Test Results of Agricultural Employment (d.f. = 105)

	Statistics	**Probability**
Model 1: agpf2 prt inst prt×inst bm inf exdt		
Breusch-Pagan LM	318.5634	0.0000
Pesaran scaled LM	14.73728	0.0000
Pesaran CD	2.991693	0.0028
Model 2: agpf2 gint inst gint×inst inf exdt		
Breusch-Pagan LM	395.6622	0.0000
Pesaran scaled LM	20.05760	0.0000
Pesaran CD	5.929090	0.0000
Model 3: agpf2 bfr inst bfr×inst bm inf exdt		
Breusch-Pagan LM	282.2493	0.0000
Pesaran scaled LM	12.23137	0.0000
Pesaran CD	0.297712	0.7659
Model 4: agpf2 mfr inst mfr×inst bm inf exdt		
Breusch-Pagan LM	475.8847	0.0000
Pesaran scaled LM	25.59348	0.0000
Pesaran CD	2.929678	0.0034
Model 5: agpf2 tfr inst tfr×inst bm topn exdt		
Breusch-Pagan LM	447.2997	0.0000
Pesaran scaled LM	23.62092	0.0000
Pesaran CD	8.516000	0.0000
Model 6: agpf2 ifr inst ifr×inst inf topn exdt		
Breusch-Pagan LM	405.8560	0.0000
Pesaran scaled LM	20.76104	0.0000
Pesaran CD	10.82253	0.0000

Note: agpf2 - employment in agriculture (% of total employment); prt - property right; gint - government integrity; bfr - business freedom; mfr - monetary freedom; tfr - trade freedom; ifr - investment freedom; inst - institutional quality; bm - broad money (% of GDP); inf - inflation, consumer prices (annual %); topn - trade (% of GDP); exdt - external debt stocks (% of GNI).
Source: Author's computation (2024).

Table 4.19c: Cross-Sectional Dependence Test Results of Agricultural Export (d.f. = 105)

	Statistics	**Probability**
Model 1: agpf3 prt inst prt×inst gdpg bm		
Breusch-Pagan LM	281.6545	0.0000
Pesaran scaled LM	12.19032	0.0000
Pesaran CD	1.083168	0.2787
Model 2: agpf3 gint inst gint×inst bm inf topn exdt		
Breusch-Pagan LM	277.2012	0.0000
Pesaran scaled LM	11.88301	0.0000
Pesaran CD	7.205429	0.0000
Model 3: agpf3 bfr inst bfr×inst gdpg bm inf		
Breusch-Pagan LM	248.3915	0.0000
Pesaran scaled LM	9.894952	0.0000
Pesaran CD	1.226016	0.2202
Model 4: agpf3 mfr inst mfr×inst gdpg bm topn exdt		
Breusch-Pagan LM	312.7346	0.0000
Pesaran scaled LM	14.33505	0.0000
Pesaran CD	5.742652	0.0000
Model 5: agpf3 tfr inst tfr×inst inf topn exdt		
Breusch-Pagan LM	352.7751	0.0000
Pesaran scaled LM	17.09811	0.0000
Pesaran CD	5.378975	0.0000
Model 6: agpf3 ifr inst ifr×inst bm inf topn		
Breusch-Pagan LM	350.9415	0.0000
Pesaran scaled LM	16.97158	0.0000
Pesaran CD	2.917166	0.0035

Note: agpf3 - agricultural raw materials exports (% of merchandise exports); prt - property right; gint - government integrity; bfr - business freedom; mfr - monetary freedom; tfr - trade freedom; ifr - investment freedom; inst - institutional quality; gdpg - GDP growth (annual %); bm - broad money (% of GDP); inf - inflation, consumer prices (annual %); topn - trade (% of GDP); exdt - external debt stocks (% of GNI).
Source: Author's computation (2024).

Table 4.19d: Cross-Sectional Dependence Test Results of Agricultural Output per Worker (d.f. = 105)

	Statistics	Probability
Model 1: agpf4 prt inst prt×inst bm topn exdt		
Breusch-Pagan LM	393.8384	0.0000
Pesaran scaled LM	19.93174	0.0000
Pesaran CD	5.329880	0.0000
Model 2: agpf4 gint inst gint×inst gdpg bm topn exdt		
Breusch-Pagan LM	434.5611	0.0000
Pesaran scaled LM	22.74188	0.0000
Pesaran CD	6.473833	0.0000
Model 3: agpf4 bfr inst bfr×inst gdpg bm topn		
Breusch-Pagan LM	464.2889	0.0000
Pesaran scaled LM	24.79329	0.0000
Pesaran CD	3.448535	0.0006
Model 4: agpf4 mfr inst mfr×inst gdpg bm exdt		
Breusch-Pagan LM	385.3379	0.0000
Pesaran scaled LM	19.34515	0.0000
Pesaran CD	4.607970	0.0000
Model 5: agpf4 tfr inst tfr×inst bm topn exdt		
Breusch-Pagan LM	488.9568	0.0000
Pesaran scaled LM	26.49553	0.0000
Pesaran CD	5.608315	0.0000
Model 6: agpf4 ifr inst ifr×inst bm		
Breusch-Pagan LM	480.4088	0.0000
Pesaran scaled LM	25.90567	0.0000
Pesaran CD	0.227408	0.8201

Note: agpf4 - agriculture output per worker (constant 2015 US$); prt - property right; gint - government integrity; bfr - business freedom; mfr - monetary freedom; tfr - trade freedom; ifr - investment freedom; inst - institutional quality; gdpg - GDP growth (annual %); bm - broad money (% of GDP); inf - inflation, consumer prices (annual %); topn - trade (% of GDP); exdt - external debt stocks (% of GNI).
Source: Author's computation (2024).

The stationarity of the variables is assessed by the panel unit root test results in Table 4.20. Levin, Lin & Chu (LLC), Breitung (Breit), and Im, Pesaran, and Shin (IPS) comprise the assessments implemented. The monetary freedom, trade freedom, investment freedom, GDP growth, and trade openness have all been determined to exhibit stationarity at level I(0) by all three methodologies. Therefore, they remain stationary at levels, indicating that differencing is not necessary. In contrast, the three methodologies verified that agricultural output, agricultural employment, agricultural output per worker, property rights, government integrity, and business freedom were stationary at the first difference, denoted as I(1). Consequently, they remain stationary following the first difference, suggesting that they are not stationary at levels. The results of agricultural exports, institutional quality, inflation, broad money supply, and external debt were inconsistent. The Breitung test revealed that agricultural exports are stationary at level, even though LLC and IPS exhibited stationarity when first differences were considered. The level of institutional quality remained stationary at the level when LLC was employed, but it remained stationary at the first difference in Breitung and IPS. The broad money supply and inflation were stationary at levels using the LLC and IPS estimators, but they exhibited stationarity at the first difference in Breitung. Breitung and IPS observed stationarity when the first difference was taken, while LLC maintained stationarity at levels for external debt. The study ultimately concluded that agricultural exports, institutional quality, inflation, foreign debt, and the broad money supply exhibit stationarity at the first difference.

Table 4.20: Panel Unit Root Test Results

Signs	Variable Description	Levels			1st Difference			Decision
		LLC	Breit	IPS	LLC	Breit	IPS	
agpf1	Agriculture output, forestry, and fishing, value added (% of GDP)	2.8767	-1.3979	0.9365	-2.2234**	-4.7239***	-5.6568***	I(1)
agpf2	Employment in agriculture (% of total employment)	0.2672	4.3131	0.3460	-7.4485***	-38891***	-5.8311***	I(1)
agpf3	Agricultural raw materials exports (% of merchandise exports)	6.5565	-1.9711**	-0.4742	-15.741***	-6.9392***	-13.818**	I(1)
agpf4	Agricultural output per worker (constat 2015 US$)	-0.5501	0.9035	-1.2672	-11.618***	-8.1539***	-13.187***	I(1)
prt	Property right	3.2725	4.1164	-0.7238	-4.8021***	-4.4410***	-11.891**	I(1)
gint	Government integrity	0.4218	-0.4799	-0.7719	-10.575***	-4.9969***	-9.6340***	I(1)
bfr	Business freedom	-0.9114	0.9540	-0.8807	-8.0001***	-2.6210***	-10.699***	I(1)
mfr	Monetary freedom	-4.3102***	-2.3721***	-4.0188***	-	-	-	I(0)
tfr	Trade freedom	-5.5140***	-1.8769***	-4.4264***	-	-	-	I(0)
ifr	Investment freedom	-4.6706***	-1.6686***	-3.6411***	-	-	-	I(0)
inst	Institutional quality	-2.3392***	-0.2858	-1.1439	-5.2510***	-7.8911***	-6.4500***	I(1)
gdpg	GDP growth (annual %)	-7.0548***	-6.2469***	-10.495***	-	-	-	I(0)
bm	Broad money (% of GDP)	-3.09422***	-0.7056	-2.2856**	-9.0594***	-4.9022***	-9.1578***	I(1)
inf	Inflation, consumer prices (%)	-5.6012***	-0.7471	-5.2576***	-11.651***	-3.2883***	-13.635***	I(1)
topn	Trade (% of GDP)	-2.8492***	-1.6469***	-4.5224***	-	-	-	I(0)
exdt	External debt stocks (% of GNI)	-2.6541***	3.5341	0.9871	-8.3478***	-7.5279***	-11.150***	I(1)

Note: LL denotes Levin, Lin & Chin (2002); Brrit represents Breitung (2001); Im, Pesaran and Shin (2003); ***, ** & * denote 1%, 5% & 10% significance levels.
Source: Author's computation (2024).

The results of the KAO Residual test for cointegration are demonstrated in Tables 4.21(a-d). The null hypothesis of no cointegration is rejected in all models at a significance level of 5%, as indicated by the tables, in accordance with the standard criteria for probability testing. The null hypothesis of no cointegration was rejected at a 5% significance level, suggesting that there is a long-term equilibrium relationship between agricultural performance, institutional quality, and investment climate. The results suggest that the explanatory variables (investment climate, institutional quality, and control variables) and the outcome variables (agricultural performance indicators) are co-integrated in all the estimated models. More specifically, the research has confirmed the existence of a long-term relationship among institutions, investment climate, and agricultural performance in countries that are members of the Economic Community of West African States (ECOWAS). This implies that sustainable improvements in agricultural outcomes are the result of improvements in institutional quality and the investment climate. This relationship emphasizes the significance of investment and governance reforms as a strategic instrument for improving the performance of the agricultural sector in the region.

Table 4.21a: KAO Residual Test for Cointegration of Agricultural Output

	t-Statistics	Probability
Model 1: agpf1 prt inst prt×inst gdpg inf topn exdt		
ADF	-2.689959	0.0036
Residual variance	7.300447	
HAC variance	5.824896	
Model 2: agpf1 gint inst gint×inst gdpg bm topn exdt		
ADF	-3.644240	0.0001
Residual variance	7.540604	
HAC variance	5.814805	
Model 3: agpf1 bfr inst bfr×inst gdpg bm inf exdt		
ADF	-2.720429	0.0033
Residual variance	7.632444	
HAC variance	6.381950	
Model 4: agpf1 mfr inst mfr×inst gdpg inf exdt		
ADF	-2.272844	0.0115
Residual variance	7.352556	
HAC variance	6.073688	
Model 5: agpf1 tfr inst tfr×inst gdpg bm topn exdt		
ADF	-3.737880	0.0001
Residual variance	7.707508	
HAC variance	6.131681	
Model 6: agpf1 ifr inst ifr×inst gdpg bm topn		
ADF	-4.135310	0.0000
Residual variance	8.010467	
HAC variance	7.399985	

Note: agpf1 - agriculture, forestry, and fishing, value added (% of GDP); prt - property right; gint - government integrity; bfr - business freedom; mfr - monetary freedom; tfr - trade freedom; ifr - investment freedom; inst - institutional quality; gdpg - GDP growth (annual %); bm - broad money (% of GDP); inf - inflation, consumer prices (annual %); topn - trade (% of GDP); exdt - external debt stocks (% of GNI).
Source: Author's computation (2024).

Table 4.21b: KAO Residual Test for Cointegration of Agricultural Employment

	t-Statistics	Probability
Model 1: agpf2 prt inst prt×inst bm inf exdt		
ADF	-2.041882	0.0206
Residual variance	1.920939	
HAC variance	2.754580	
Model 2: agpf2 gint inst gint×inst inf exdt		
ADF	-1.764706	0.0388
Residual variance	1.929079	
HAC variance	2.754235	
Model 3: agpf2 bfr inst bfr×inst bm inf exdt		
ADF	-2.006508	0.0224
Residual variance	1.941007	
HAC variance	2.856456	
Model 4: agpf2 mfr inst mfr×inst bm inf exdt		
ADF	-2.183340	0.0145
Residual variance	1.931943	
HAC variance	2.787978	
Model 5: agpf2 tfr inst tfr×inst bm topn exdt		
ADF	-1.739738	0.0410
Residual variance	1.871691	
HAC variance	2.530978	
Model 6: agpf2 ifr inst ifr×inst inf topn exdt		
ADF	-1.875151	0.0304
Residual variance	1.906748	
HAC variance	3.014299	

Note: agpf2 - employment in agriculture (% of total employment); prt - property right; gint - government integrity; bfr - business freedom; mfr - monetary freedom; tfr - trade freedom; ifr - investment freedom; inst - institutional quality; gdpg - GDP growth (annual %); bm - broad money (% of GDP); inf - inflation, consumer prices (annual %); topn - trade (% of GDP); exdt - external debt stocks (% of GNI).
Source: Author's computation (2024).

Table 4.21c: KAO Residual Test for Cointegration of Agricultural Export

	t-Statistics	Probability
Model 1: agpf3 prt inst prt×inst gdpg bm		
ADF	-1.735355	0.0410
Residual variance	1.709102	
HAC variance	3.471980	
Model 2: agpf3 gint inst gint×inst bm inf topn exdt		
ADF	-1.784871	0.0332
Residual variance	1.590327	
HAC variance	3.474858	
Model 3: agpf3 bfr inst bfr×inst gdpg bm inf		
ADF	-1.745698	0.0392
Residual variance	1.857708	
HAC variance	3.232758	
Model 4: agpf3 mfr inst mfr×inst gdpg bm topn exdt		
ADF	-1.886851	0.0305
Residual variance	1.555723	
HAC variance	3.247381	
Model 5: agpf3 tfr inst tfr×inst inf topn exdt		
ADF	-1.825191	0.0325
Residual variance	1.560516	
HAC variance	3.444860	
Model 6: agpf3 ifr inst ifr×inst bm inf topn		
ADF	-1.887416	0.0297
Residual variance	1.716115	
HAC variance	3.568390	

Note: agpf3 - agricultural raw materials exports (% of merchandise exports); prt - property right; gint - government integrity; bfr - business freedom; mfr - monetary freedom; tfr - trade freedom; ifr - investment freedom; inst - institutional quality; gdpg - GDP growth (annual %); bm - broad money (% of GDP); inf - inflation, consumer prices (annual %); topn - trade (% of GDP); exdt - external debt stocks (% of GNI).
Source: Author's computation (2024).

Table 4.21d: KAO Residual Test for Cointegration of Agricultural Output per Worker

	t-Statistics	Probability
Model 1: agpf4 prt inst prt×inst bm topn exdt		
ADF	-1.951449	0.0256
Residual variance	0.007414	
HAC variance	0.007654	
Model 2: agpf4 gint inst gint×inst gdpg bm topn exdt		
ADF	-2.595850	0.0042
Residual variance	0.006922	
HAC variance	0.007650	
Model 3: agpf4 bfr inst bfr×inst gdpg bm topn		
ADF	-2.671573	0.0038
Residual variance	0.006959	
HAC variance	0.008198	
Model 4: agpf4 mfr inst mfr×inst gdpg bm exdt		
ADF	-1.730590	0.0418
Residual variance	0.007234	
HAC variance	0.007606	
Model 5: agpf4 tfr inst tfr×inst bm topn exdt		
ADF	-2.508060	0.0061
Residual variance	0.007417	
HAC variance	0.006793	
Model 6: agpf4 ifr inst ifr×inst bm		
ADF	-1.881252	0.0300
Residual variance	0.007647	
HAC variance	0.007720	

Note: agpf4 - agriculture output per worker (constant 2015 US$); prt - property right; gint - government integrity; bfr - business freedom; mfr - monetary freedom; tfr - trade freedom; ifr - investment freedom; inst - institutional quality; gdpg - GDP growth (annual %); bm - broad money (% of GDP); inf - inflation, consumer prices (annual %); topn - trade (% of GDP); exdt - external debt stocks (% of GNI).
Source: Author's computation (2024).

4.6.3 Panel Regression Results of Investment Climate, Institutional Quality and Agricultural Performance in ECOWAS

a) Panel Regression Results of Investment Climate, Institutional Quality and Agricultural Output in ECOWAS

The empirical outcome of the role of institutional quality in the relationship between investment climate and agricultural output in ECOWAS countries is depicted in Table 4.22a, which employs the pooled mean group estimator. The empirical model incorporates the interaction between institutional quality and investment climate. Afterward, the partial derivative with respect to investment climate is taken, equated to zero, and the net effects are derived, which represent the net impact of investment climates on agriculture output growth at the average value of institutional quality. The null hypotheses of Hausman tests in the table do not reject the hypothesis that the difference in coefficients between the mean group and the aggregated mean group is not systematic at the 5% level of significance. Thus, it indicates the appropriateness of the aggregated mean group as the appropriate estimator for testing the hypothesis.

Additionally, six models were estimated following the metrics of investment climate. In order to guarantee an adequate degree of freedom, the Bayesian Information Criterion (BIC) was implemented to autonomously determine the optimal lag lengths for the variables. Lag one is the most prevalent among the variables. The coefficients of the error correction term are statistically significant and negative at 5% level, as shown in Table 4.22a. More specifically, the error correction term's coefficients are -0.275, -0.268, -0.283, -0.265, -0.352, and -0.260, with a probability value of less than 1% for their t-statistic. It suggests that the empirical models of agricultural output correct their short-run disequilibrium within a 26% and 35.2% speed of adjustment in order to revert to the long-term equilibrium. This serves as additional evidence that there is a long-run relationship among institutions, investment climate, and the growth of agricultural output in the ECOWAS.

The short-run estimates for agricultural output growth in ECOWAS countries, as presented in Table 4.22a, indicate that the interrelationship between investment climate, institutional quality, and agricultural performance. The results show that none of the coefficients for the interaction between investment climate and institutional quality are statistically significant, indicating that in the short run, the interplay between these factors does not have a direct and significant impact on agricultural output growth. This suggests that the combined effects of changes in institutional quality and the investment climate do not have a discernible impact on agricultural output growth in the short run. Intuitively, it indicates that while both institutional quality and investment climate are important factors independently, their interaction does not produce short-term effects on agricultural productivity in ECOWAS countries. For the unconditional effects of the investment climate and institutional quality, their coefficients are not statistically significant.

Table 4.22a: Pooled Mean Group Estimates of Investment Climate, Institutional Quality and Agricultural Output

Variables	**Dependent Variable:** Agricultural Output Growth					
	Property Right	**Government Integrity**	**Business Freedom**	**Monetary Freedom**	**Trade Freedom**	**Investment Freedom**
	1	**2**	**3**	**4**	**5**	**6**
	Short-run Estimates					
ECT(-1)	**-0.275*** **	**-0.268*** **	**-0.283*** **	**-0.265*** **	**-0.352*** **	**-0.260*** **
	(0.080)	**(0.069)**	**(0.101)**	**(0.071)**	**(0.113)**	**(0.099)**
Δ(Investment climate)	0.263	0.278	0.605	0.616	-0.151	-0.483
	(0.380)	(0.597)	(1.164)	(0.763)	(0.270)	(0.396)
Δ (Institutional quality)	-81.634	-15.540	-34.069	-43.234	0.736	16.626
	(83.538)	(15.790)	(65.064)	(55.214)	(25.644)	(17.898)
Δ(Investment climate × Institutional quality)	1.608	0.425	0.622	0.587	-0.028	-0.470
	(1.677)	(0.610)	(1.250)	(0.781)	(0.401)	(0.415)
Δ(GDP growth rate)	0.054	**0.146** **	**0.111** **	0.039	**0.060** **	**0.107** **
	(0.041)	**(0.068)**	**(0.055)**	(0.037)	**(0.033)**	**(0.046)**
Δ(Broad money supply (% of GDP))		-0.041	0.001		0.020	-0.017
		(0.081)	(0.122)		(0.039)	(0.077)
Δ(Inflation rate)	0.100		**0.104** **	**0.117** **		
	(0.064)		**(0.051)**	**(0.047)**		
Δ(Trade (% of GDP))	-0.023	-0.016			-0.014	0.005
	(0.019)	(0.030)			(0.022)	(0.027)
Δ(External debt stock (% of GDP))	**0.040***	0.0005	0.008	0.002	**0.031** **	
	(0.021)	(0.020)	(0.020)	(0.024)	**(0.013)**	
Constant	**1.708** **	**3.261*** **	**3.446*** **	**9.294*** **	**7.378*** **	**10.846** **
	(0.852)	**(0.994)**	**(1.161)**	**(2.381)**	**(2.061)**	**(4.426)**
	Long-run Estimates					
Investment climate	**0.319*** **	**0.313*** **	**0.255*** **	**-0.203*** **	**0.128***	**-0.177*** **
	(0.059)	**(0.091)**	**(0.085)**	**(0.077)**	**(0.069)**	**(0.064)**
Institutional quality	**-38.677*** **	**-17.510*** **	**-33.572*** **	**26.084***	**-28.624*** **	**-10.429** **
	(5.531)	**(5.142)**	**(10.816)**	**(13.860)**	**(7.198)**	**(5.019)**
Investment climate × Institutional quality	**0.745*** **	0.035	**0.464** **	**-0.426** **	**0.307*** **	**0.121*** **
	(0.115)	(0.175)	**(0.185)**	**(0.175)**	**(0.106)**	**(0.043)**
GDP growth rate	**0.418*** **	**0.277** **	0.013	0.102	-0.112	**0.247***
	(0.107)	**(0.112)**	(0.076)	(0.097)	(0.111)	**(0.138)**
Broad money supply (% of GDP)		**-0.188*** **	**-0.257*** **		**-0.227*** **	0.040
		(0.045)	**(0.010)**		**(0.024)**	(0.052)
Inflation rate	**0.197***		**0.246*** **	-0.011		
	(0.102)		**(0.042)**	(0.071)		
Trade (% of GDP)	**-0.077** **	-0.002			-0.029	**-0.095** **
	(0.031)	(0.045)			(0.027)	**(0.045)**
External debt stock (% of GDP)	**0.028*** **	**0.099*** **	**0.034*** **	**0.056*** **	**0.029*** **	
	(0.010)	**(0.018)**	**(0.005)**	**(0.012)**	**(0.008)**	
Log Likelihood	-486.22	-499.23	-471.14	-510.62	-505.94	-535.55
Hausman Test (Prob.)	2.51(0.867)	3.55(0.737)	3.04(0.804)	2.52(0.866)	5.41(0.492)	3.04(0.804)
Country	15	15	15	15	15	15
Observations	307	310	301	309	310	310

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10.
Source: Author's computation (2024).

In the long run, investment climate shows an unconditional positive and significant impact on agricultural output growth in most models. These results suggest that improvements in these aspects of the investment climate contribute positively to long-term agricultural productivity in ECOWAS. Institutional quality, on the other hand, has an unconditional significant negative impact on agricultural output growth in most models, except for monetary freedom model. This negative impact can be attributed to the formalization and restructuring of the agricultural sector that often accompanies improvements in institutional quality. As governance becomes more stringent and corruption decreases, informal agricultural practices may be curtailed, and resources shift toward more regulated sectors, reducing agricultural output in the long run.

The interaction terms between institutional quality and the investment climate offer additional insights into how these factors work together to influence agricultural output growth. For the interaction of institutional quality with property rights, business freedom, trade freedom, and investment freedom, the parameters are positive and significant, with coefficients of 0.75, 0.46, 0.31, and 0.12, respectively. These results indicate that when institutional quality and these aspects of the investment climate improve simultaneously, they have a reinforcing effect on agricultural output growth. This suggests that strong institutions amplify the positive effects of a favourable investment climate, creating a synergistic environment that significantly boosts agricultural output in the long run. However, the marginal effect of interactions between institutional quality and monetary freedom is statistically negative. This occurs when the stabilizing effects of monetary freedom led to tighter financial conditions that constrain investment in agriculture, particularly in a context where institutional reforms are also reducing informal agricultural practices.

Concerning other control variables, the results indicate that GDP growth has a positive and significant impact on agricultural output growth, suggesting that economic expansion contributes positively to short-term agricultural productivity in ECOWAS countries. Similarly, inflation and external debt show a positive and significant effect, implying that moderate inflationary pressures might enhance agricultural output growth by increasing the profitability of agricultural goods in the short run. For the long-run estimates, the mitigating impacts of broad money supply and trade openness on agricultural output growth are statistically significant when these factors are controlled for. Additionally, the amplifying role of GDP growth and trade openness in enhancing agricultural output growth is consistently confirmed across the various specifications. The results conclude that institutions act as both ameliorating and deteriorating factors in the relationship between investment climate and agricultural output growth in ECOWAS. Specifically, institutional quality amplifies the positive effects of the property rights, business freedom, trade freedom, and investment freedom on agricultural output growth. However, in the case of monetary freedom, institutional quality has a deteriorating effect, as it negatively impacts agricultural output growth when these factors interact, likely due to tighter financial conditions that constrain agricultural investment.

b) Panel Regression Results of Investment Climate, Institutional Quality and Agricultural Employment in ECOWAS

The empirical results showing the role of institutional quality in the nexus between investment climate and agricultural employment in ECOWAS nations are presented in Table 4.22b, using the pooled mean group estimator. The empirical model includes the interplay between institutional quality and investment climate. Subsequently, the partial derivative is calculated with regard to the investment environment, set equal to zero, and the resulting net effects are determined. These net effects indicate the overall influence of investment climates on agricultural employment, based on the average value of institutional quality. The null hypotheses of the Hausman tests in the table fail to reject the hypothesis that the difference in coefficients between the mean group and the aggregated mean group is not consistent at the 5% level of significance. Therefore, this suggests that the aggregated mean group is the most suitable estimator for testing the hypothesis.

In addition, six models were generated based on the measures of investment climate. The Bayesian Information Criterion (BIC) was utilized to autonomously ascertain the best lag durations for the variables, ensuring a satisfactory level of freedom. The variable with the highest prevalence is lag one. The error correction term coefficients exhibit statistical significance and a negative direction at a 5% significance level, as indicated in Table 4.22b. To be more precise, the coefficients of the error correction component are -0.084, -0.098, -0.097, -0.087, -0.119, and -0.0499. The t-statistic for these coefficients has a probability value of less than 1%. The empirical models of agricultural employment indicate that they adjust their short-run disequilibrium at a rate between 4.99% and 11.9% in order to return to the long-term equilibrium. This provides more evidence that there is a long-run relationship among institutions, investment climate, and agricultural employment in the ECOWAS.

Table 4.22b: Pooled Mean Group Estimates of Investment Climate, Institutional Quality, and Agricultural Employment

Variables	Dependent Variable: Agricultural Employment					
	Property Right	Government Integrity	Business Freedom	Monetary Freedom	Trade Freedom	Investment Freedom
	1	2	3	4	5	6
Short-run Estimates						
ECT(-1)	-0.084**	-0.098***	-0.097***	-0.087**	-0.119**	-0.0499***
	(0.039)	(0.03724)	(0.035)	(0.040)	(0.048)	(0.015)
Δ(Investment climate)	-0.019	-0.045	0.176	0.374	0.003	-0.095
	(0.254)	(0.090)	(0.290)	(0.419)	(0.065)	(0.122)
Δ(Institutional quality)	-80.740	-4.160	-19.569	-38.979	-2.633	-0.615
	(82.931)	(5.808)	(19.498)	(30.600)	(6.692)	(7.758)
Δ(Investment climate × Institutional quality)	1.460	0.014	0.298	0.544	0.025	-0.044
	(1.665)	(0.168)	(0.347)	(0.421)	(0.106)	(0.145)
Δ(Broad money supply (% of GDP))	0.019		0.074**	0.053***	-0.003	
	(0.051)		(0.036)	(0.033)	(0.034)	
Δ(Inflation rate)	-0.010	0.014	0.023	0.009		-0.005
	(0.025)	(0.019)	(0.026)	(0.025)		(0.032)
Δ(Trade (% of GDP))					-0.0088***	-0.007***
					(0.016)	(0.002)
Δ (External debt stock (% of GDP))	-0.019*	-0.001	-0.0057***	-0.011***	-0.014	0.005
	(0.018)	(0.016)	(0.0017)	(0.002)	(0.013)	(0.016)
Constant	2.778*	1.686***	2.179*	1.211**	-0.202***	4.860***
	(1.569)	(0.751)	(1.135)	(0.479)	(0.054)	(1.888)
Long-run Estimates						
Investment climate	0.133*	0.862***	0.811***	0.583***	0.600**	-0.395***
	(0.072)	(0.232)	(0.249)	(0.149)	(0.253)	(0.092)
Institutional quality	-17.760***	-26.306***	-28.910**	-19.350*	-40.052**	21.754*
	(2.812)	(5.687)	(12.521)	(11.599)	(15.970)	(11.374)
Investment climate × Institutional quality	0.202***	1.023***	0.758***	0.299*	0.515**	-0.382***
	(0.071)	(0.241)	(0.264)	(0.156)	(0.241)	(0.134)
Broad money supply (% of GDP)	-0.040		-0.892***	-0.744***	0.046	
	(0.044)		(0.076)	(0.055)	(0.050)	
Inflation rate	0.253***	0.050	-0.169	-0.102**		0.859***
	(0.058)	(0.093)	(0.135)	(0.049)		(0.286)
Trade (% of GDP)					-0.049	-0.710***
					(0.035)	(0.173)
External debt stock (% of GDP)	-0.004	0.104***	0.060***	0.087***	0.107***	0.108***
	(0.015)	(0.018)	(0.022)	(0.014)	(0.015)	(0.041)
Log Likelihood	-241.42	-247.86	-231.14	-232.52	-261.02	-230.99
Hausman Test (Prob.)	2.76(0.838)	3.91(0.562)	3.34(0.765)	2.77(0.837)	5.96(0.428)	3.35(0.764)
Country	15	15	15	15	15	15
Observations	301	309	301	301	310	307

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10.
Source: Author's computation (2024).

The short-run estimates for agricultural employment in ECOWAS countries, as presented in Table 4.22b, reveal that neither the investment climate nor institutional quality significantly impacts agricultural employment. The coefficients for changes in the investment climate, across the dimensions of property rights, government integrity, business freedom, monetary freedom, trade freedom, and investment freedom, are not statistically significant, suggesting that short-term fluctuations in these aspects of the investment climate do not immediately affect employment levels in the agricultural sector. Similarly, changes in institutional quality, whether improvements or declines, do not exhibit a significant impact on agricultural employment. This indicates that while institutional and investment reforms are essential for long-term economic development, their short-term effects on agricultural employment are not significant. The interaction terms between investment climate and institutional quality also show no significant impact, further supporting the conclusion that the combined short-term effects of these factors do not lead to substantial changes in agricultural employment within ECOWAS countries.

The long-run estimates revealed that the investment climate shows a positive influence on agricultural employment across most models except investment freedom model. These results suggest that improvements in these areas of the investment climate led to increased agricultural employment over the long term. It also suggests that while investment freedom may facilitate capital flows and business development, it leads to a reallocation of resources away from labour-intensive sectors like agriculture towards more capital-intensive industries, reducing employment in the agricultural sector. More so, institutional quality consistently shows a negative impact on agricultural employment across most models, with particularly positive coefficient under investment freedom. These findings indicate that improvements in institutional quality, while beneficial for overall governance and economic stability, lead to a reduction in agricultural employment. As institutions become more robust, the agricultural sector undergoes structural changes that favour capital over labour, reducing the number of jobs available in agriculture. The interaction terms between institutional quality and the investment climate have positive and significant coefficients, suggesting that when both institutional quality and investment climate improve simultaneously, they reinforce each other to enhance agricultural employment. However, the interaction term between institutional quality and investment freedom is negative and significant, indicating that when both institutional quality and investment freedom increase, they jointly reduce agricultural employment. This outcome likely reflects the tension between the capital-intensive nature of investment freedom and the labour demands of traditional agricultural practices.

For co-factor estimates, the change in broad money supply has a positive and significant effect on agricultural employment in models associated with business freedom and monetary freedom. This suggests that increases in broad money supply can enhance liquidity in the economy, potentially leading to greater investment in agriculture and thus boosting employment in the sector. However, trade openness shows a significant negative impact on agricultural employment. This indicates that higher trade openness may lead to increased competition from imported goods, which could reduce the demand for labor in domestic agriculture. Additionally, the change in external debt stock has a negative and significant impact on agricultural employment in the models associated with property rights and business freedom. This suggests that rising external debt levels may constrain public and private sector resources, reducing investment in agricultural activities and leading to lower employment in the sector. In the long run, inflation and external debt stock are shown to have an amplifying impact on agricultural employment, while trade openness and broad money supply exert mitigating effects. The results indicate that institutions generally act as an ameliorating factor in the relationship between the investment climate and agricultural employment in ECOWAS, as shown by the positive and significant interaction effects with property rights, government integrity, business freedom, monetary freedom, and trade freedom. These interactions suggest that improved institutional quality enhances the positive impact of a favorable investment climate on agricultural employment. However, the negative interaction with investment freedom indicates that institutions can also act as a deteriorating factor, potentially reducing agricultural employment when institutional improvements are coupled with increased investment freedom, likely due to shifts toward more capital-intensive practices.

c) **Panel Regression Results of Investment Climate, Institutional Quality and Agricultural Exports in ECOWAS**

Using the pooled mean group estimator, Table 4.22c displays the empirical outcome of the role of institutional quality in the linkages between investment climate and agricultural exports in ECOWAS nations. The empirical model considers the fact that investment climate and institutional quality interact with one another. Following this, we take the partial derivative regarding the investment climate, set it equal to zero, and then derive the net effects. These effects show how investment climates affect agricultural exports at the average institutional quality value. At the 5% level of significance, the null hypotheses of the Hausman tests presented in the table do not disprove the premise that there is no systematic difference in the coefficients between the mean group and the aggregated mean group. It follows that the aggregated mean group is a suitable estimator for this hypothesis test.

Furthermore, six models were estimated following the investment climate metrics. The ideal lag durations for the variables were determined autonomously using the Bayesian Information Criterion (BIC), which guaranteed a sufficient degree of freedom. Among the variables, lag one is by far the most common. At the 5% level of significance, the error correction term's coefficients are negative (see Table 4.22c). The t-statistic for the coefficients of the error correction term is less than 1%, and they are -0.39, -0.287, -0.3, -0.624, -0.411, and -0.414, respectively. It implies that to return to the long-term equilibrium, the empirical models of agricultural exports must correct their short-run disequilibrium within a speed of adjustment of 28.7 and 62.4 percent. This provides additional proof that there is a long-term relationship between institutions, investment climate, and agricultural exports in the ECOWAS.

The short- and long-run estimates for agricultural exports in ECOWAS countries, as presented in Table 4.22c, highlight significant impacts of the investment climate, institutional quality, and their interactions on export performance. Expressly, the investment climate has an unconditional positive and statistically significant effect on agricultural exports in the context of property rights and government integrity. These findings suggest that improvements in property rights and government integrity in the short run led to an increase in agricultural exports. When property rights are secure, and governance is transparent and effective, agricultural producers are likely to be more confident in expanding their operations and engaging in export activities, resulting in increased export volumes.

Table 4.22c: Pooled Mean Group Estimates of Investment Climate, Institutional Quality, and Agricultural Exports

Variables	**Dependent Variable:** Agricultural Exports					
	Property Right	**Government Integrity**	**Business Freedom**	**Monetary Freedom**	**Trade Freedom**	**Investment Freedom**
	1	**2**	**3**	**4**	**5**	**6**
Short-run Estimates						
ECT(-1)	**-0.390*** **	**-0.287** **	**-0.300*** **	**-0.624*** **	**-0.411*** **	**-0.414*** **
	(0.117)	**(0.114)**	**(0.107)**	**(0.162)**	**(0.088)**	**(0.121)**
Δ(Investment climate)	**0.478** **	**0.998***	0.997	**-1.067*** **	**-0.114*** **	0.129
	(0.203)	**(0.523)**	(1.202)	**(0.376)**	**(0.350)**	(0.225)
Δ(Institutional quality)	**-34.563** **	**-55.288** **	-117.94	129.376	10.940	**-48.177*** **
	(13.881)	**(22.818)**	(136.07)	(107.13)	(39.035)	**(11.958)**
Δ(Investment climate × Institutional quality)	**0.791*** **	**1.734** **	1.972	-1.851	-0.169	**0.653** **
	(0.304)	**(0.756)**	(2.370)	(1.474)	(0.610)	**(0.284)**
Δ(GDP growth rate)	-0.007		0.026	0.007		
	(0.042)		(0.055)	(0.054)		
Δ(Broad money supply (% of GDP))	-0.082	-0.0026	0.007	0.151		(0.104)
	(0.100)	(0.124)	(0.131)	(0.127)		-0.114
Δ(Inflation rate)		**0.265***	**0.171***		-0.009	**0.149***
		(0.141)	**(0.102)**		(0.053)	**(0.086)**
Δ(Trade (% of GDP))		-0.007		0.024	-0.040	-0.024
		(0.053)		(0.068)	(0.048)	(0.060)
Δ(External debt stock (% of GDP))		**-0.095** **		0.024	**-0.025*** **	
		(0.043)		(0.035)	**(0.003)**	
Constant	1.047	-2.865	**3.138*** **	**4.243*** **	**2.807*** **	**5.169*** **
	(0.710)	(1.908)	**(1.127)**	**(0.951)**	**(0.955)**	**(1.760)**
Long-run Estimates						
Investment climate	**0.067*** **	0.218	0.014	**-0.035*** **	**-0.003** **	**-0.126*** **
	(0.021)	(0.148)	(0.041)	**(0.009)**	**(0.001)**	**(0.016)**
Institutional quality	**4.206** **	-5.853	**7.869** **	**2.577*** **	**0.153** **	**10.381*** **
	(1.849)	(4.773)	**(3.498)**	**(0.560)**	**(0.068)**	**(1.362)**
Investment climate × Institutional quality	**-0.286*** **	0.305	**-0.179** **	**-0.033*** **	**-0.002***	**-0.135*** **
	(0.022)	(0.195)	**(0.073)**	**(0.007)**	**(0.001)**	**(0.018)**
GDP growth rate	**0.104*** **		0.045	**0.013*** **		
	(0.028)		(0.076)	**(0.001)**		
Broad money supply (% of GDP)	0.003	**0.295*** **	**0.051*** **	**0.005*** **		**0.069*** **
	(0.028)	**(0.066)**	**(0.019)**	**(0.001)**		**(0.013)**
Inflation rate		**-1.232*** **	**-0.626*** **		**-0.001*** **	**-0.036***
		(0.245)	**(0.147)**		**(0.0002)**	**(0.020)**
Trade (% of GDP)		**0.143** **		0.0004	**0.0002*** **	**0.042*** **
		(0.058)		(0.001)	**(0.00004)**	**(0.011)**
External debt stock (% of GDP)		**0.106*** **		**0.001*** **	**0.0001*** **	
		(0.017)		**(0.0001)**	**(0.00001)**	
Log Likelihood	-536.51	-408.92	-606.97	-453.78	-441.83	-491.66
Hausman Test (Prob.)	2.96(0.706)	4.19(0.758)	3.58(0.733)	2.97(0.888)	6.38(0.382)	3.59(0.732)
Country	15	15	15	15	15	15
Observations	305	296	296	305	302	296

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10.
Source: Author's computation (2024).

Conversely, the investment climate under monetary and trade freedom shows a significant negative impact on agricultural exports. This is due to the potential dampening effect of tight monetary policies on domestic demand, which limit the resources available for export-oriented activities. Additionally, it suggests that aspects of trade openness have a constraining effect on agricultural exports in the short term, possibly due to increased competition from imported goods, which pressure domestic agricultural producers. Institutional quality, on the other hand, exhibits a significant negative impact on agricultural exports in the short run, particularly under property rights, government integrity and investment freedom respectively. This mitigating effect occurs as reforms lead to the formalization of practices and the enforcement of stricter regulations, which initially hinder the ability of producers to adapt to new standards and requirements, thereby reducing export performance.

The interaction terms between institutional quality and the investment climate provide further insights. The positive and significant coefficients for the interaction terms under property rights, government integrity, and investment freedom suggest that when both institutional quality and these aspects of the investment climate improve together, they have a reinforcing effect on agricultural exports. This implies that the benefits of improved institutional quality are amplified when the investment climate is also favourable, leading to stronger export performance.

The long-run estimates for agricultural exports in ECOWAS countries, as shown in the analysis, indicate significant relationships between the investment climate, institutional quality, and their interactions across various dimensions. The investment climate has a mixed impact on agricultural exports depending on the specific aspect being examined. Under property rights, the investment climate has a positive and significant impact on agricultural exports. This suggests that improvements in property rights, which provide security and assurance to agricultural producers, lead to enhanced export performance in the long run. Conversely, the investment climate under monetary freedom, trade freedom, and investment freedom shows significant negative effects on agricultural exports. These results suggest that while certain freedoms are generally beneficial for overall economic growth, they pose challenges for the agricultural export sector in ECOWAS. For instance, greater monetary freedom, characterized by stable currency and controlled inflation, reduce the relative competitiveness of agricultural products on the global market, thereby decreasing exports. Similarly, increased trade freedom exposes domestic producers to heightened competition from imported goods, potentially diminishing their share in export markets. The negative impact of investment freedom indicates that while capital flows increase, they are diverted away from agriculture toward more lucrative sectors, reducing the resources available for agricultural exports. Institutional quality exhibits a positive and significant impact on agricultural exports. This implies that better institutional quality, reflected in stronger governance and reduced corruption, enhances the capacity of agricultural producers to engage in export activities. Thus, improved institutions provide a more predictable and supportive environment for agriculture, facilitating better access to markets and resources necessary for export growth.

The interaction terms between institutional quality and investment climate metrics except government integrity show a significant negative impact on agricultural exports. This suggests that when the formalization and regulation associated with improved institutions impose additional burdens on producers, making it more difficult to capitalize on property rights improvements in the export market. These results further indicate that while institutional quality and investment climate improvements increase, their interactions create challenges that need to be carefully managed. For example, the increased regulatory burden or shifts in resource allocation associated with improved institutions hinder the ability of agricultural producers to fully benefit from greater freedoms in business, trade, or investment, thereby reducing export growth. In the short run, inflation is found to have an amplifying impact on agricultural exports, while external debt stock exerts mitigating effects. In the long run, GDP growth, broad money supply, trade openness, and external debt stock positively influence agricultural exports, whereas inflation rates have a negative impact. In conclusion, it concludes that institutions act as an ameliorating factor in the nexus between investment climate (property rights, government integrity, and investment freedom) and agricultural exports in the short run. However, in the long run, institutions act as a deteriorating factor, particularly with property right, business freedom, monetary freedom, trade freedom, and investment freedom, where the interaction effects are negative. This suggests that while institutions enhance export performance in the short term, they introduce challenges in the long term that hinder agricultural exports.

d) Panel Regression Results of Investment Climate, Institutional Quality and Agricultural Output per Worker in ECOWAS

Using the pooled mean group estimator, Table 4.22d displays the empirical outcome of the role of institutional quality in the linkages between investment climate and agricultural output per worker in ECOWAS. The empirical models consider the fact that investment climate and institutional quality interact with one another. Following this, the study takes the partial derivative regarding the investment climate, set it equal to zero, and then derive the net effects. These effects show how investment climates affect agricultural output per worker at the average institutional quality value. At the 5% level of significance, the null hypotheses of the Hausman tests presented in the table do not disprove the premise that there is no systematic difference in the coefficients between the mean group and the aggregated mean group. It follows that the aggregated mean group is a suitable estimator for this hypothesis test.

Furthermore, six models were estimated following the investment climate metrics. The ideal lag durations for the variables were determined autonomously using the Bayesian Information Criterion (BIC), which guaranteed a sufficient degree of freedom. Among the variables, lag one is by far the most common. At the 5% level of significance, the error correction terms' coefficients are negative (see Table 4.22d). The t-statistic for the coefficients of the error correction term is less than 1%, and they are -0.101, -0.0502, -0.136, -0.121, -0.181, and -0.154, respectively. It implies that to return to the long-term equilibrium, the empirical models of agricultural exports must correct their short-run disequilibrium within a speed of adjustment of 5.02 and 18.1 percent. This provides additional proof that there is a long-term relationship between institutions, investment climate, and agricultural output per worker in ECOWAS.

Table 4.22d: Pooled Mean Group Estimates of Investment Climate, Institutional Quality, and Agricultural Output Per Worker

Variables	Property Right	Government Integrity	Business Freedom	Monetary Freedom	Trade Freedom	Investment Freedom
	Dependent Variable: Agricultural Output per Worker					
	1	2	3	4	5	6
	Short-run Estimates					
ECT(-1)	**-0.1013****	**-0.0502****	**-0.1355****	**-0.1210****	**-0.1810*****	**-0.1539****
	(0.0522)	**(0.0217)**	**(0.0615)**	**(0.0477)**	**(0.0529)**	**(0.0625)**
Δ(Investment climate)	-0.0276	-0.0035	-0.0133	**-0.0117***	**-0.0094***	-0.0029
	(0.0221)	(0.0090)	(0.0086)	**(0.0063)**	**(0.0056)**	(0.0061)
Δ(Institutional quality)	4.5001	0.1931	**1.6994***	1.0640	-0.6722	0.2384
	(3.7688)	(0.6231)	**(0.8654)**	(1.1993)	(1.1060)	(0.3374)
Δ(Investment climate × Institutional quality)	-0.1013	-0.0093	**-0.0273***	-0.0168	0.0075	-0.0040
	(0.0782)	(0.0198)	**(0.0148)**	(0.0168)	(0.0172)	(0.0075)
Δ(GDP growth rate)		**0.0031***	**0.0053****	**0.0060*****		
		(0.0019)	**(0.0024)**	**(0.0020)**		
Δ(Broad money supply (% of GDP))	**-0.0026***	-0.0017	0.00001	-0.0001	-0.0024	**-0.0065****
	(0.0014)	(0.0025)	(0.0021)	(0.0017)	(0.0018)	**(0.0025)**
Δ(Trade (% of GDP))	**-0.0016***	-0.0014	-0.0014		-0.0011	
	(0.0009)	(0.0010)	(0.0012)		(0.0011)	
Δ(External debt stock (% of GDP))	0.0004	0.0003		0.0007	0.0009	
	(0.0013)	(0.0010)		(0.0008)	(0.0011)	
Constant	**0.5278***	**0.2208****	**0.7712****	**0.2644*****	**1.1320*****	**0.9499****
	(0.2733)	**(0.0853)**	**(0.3403)**	**(0.0834)**	**(0.3204)**	**(0.3713)**
	Long-run Estimates					
Investment climate	**0.0861*****	**0.1367*****	**0.0430*****	**0.0738*****	**0.0195*****	**0.0112****
	(0.0120)	**(0.0370)**	**(0.0076)**	**(0.0195)**	**(0.0039)**	**(0.0055)**
Institutional quality	**-1.4083*****	**-3.4756*****	**-2.5964*****	**-4.7171*****	**-0.7007****	**-0.8964*****
	(0.2491)	**(1.1031)**	**(0.4198)**	**(1.5966)**	**(0.2883)**	**(0.3291)**
Investment climate × Institutional quality	**0.0607*****	**0.1293*****	**0.0436*****	**0.0675*****	**0.0168*****	**0.0167*****
	(0.0092)	**(0.0380)**	**(0.0072)**	**(0.0201)**	**(0.0045)**	**(0.0057)**
GDP growth rate		**0.0667*****	**0.0235*****	-0.0009		
		(0.0200)	**(0.0071)**	(0.0037)		
Broad money supply (% of GDP)	0.0009	-0.0007	-0.0003	**0.0084****	**0.0109*****	**0.0293*****
	(0.0011)	(0.0053)	(0.0015)	**(0.0035)**	**(0.0022)**	**(0.0026)**
Trade (% of GDP)	**-0.0043*****	**-0.0138****	**-0.0117*****		-0.0009	
	(0.0011)	**(0.0055)**	**(0.0022)**		(0.0020)	
External debt stock (% of GDP)	0.000034	-0.0018		**-0.0043*****	**-0.0038*****	
	(0.0002)	(0.0013)		**(0.0011)**	**(0.0008)**	
Log Likelihood	-489.37	-541.97	-519.90	-509.14	-502.27	-441.68
Hausman Test (Prob.)	3.06(0.682)	4.01(0.743)	3.76(0.701)	3.07(0.862)	6.10(0.391)	3.63(0.711)
Country	15	15	15	15	15	15
Observations	296	296	296	296	296	296

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10.
Source: Author's computation (2024).

The short- and long-run estimates for agricultural output per worker in ECOWAS countries, as presented in Table 4.22d, highlight significant impacts of the investment climate, institutional quality, and their interactions on agricultural productivity. The coefficient for the short-run effect of monetary freedom on agricultural output per worker is statistically significant at the 10% level. Its estimate suggests that an increase in monetary freedom has a small negative impact on agricultural output per worker in the short run. Similarly, trade freedom's short-run effect is significant at the 10% level. This implies that higher trade freedom may lead to a minor short-term decrease in agricultural output per worker. Meanwhile, the effect of government integrity is insignificant, indicating no discernible short-run impact. This points to the long-term nature of the effects of government reforms on productivity. With an insignificant coefficient, investment freedom does not appear to influence agricultural output per worker in the short run. This is due to the lag in realizing the benefits of policies aimed at enhancing investment freedom in the agricultural sector.

The interactive term of business freedom and institutional quality is significant. This suggests that while business freedom itself might not significantly impact agricultural output per worker, its interaction with institutional quality plays a critical role. A negative coefficient indicates that in contexts with higher institutional quality, the short-run marginal benefits of business freedom diminish, potentially due to conflicts or inefficiencies in implementation. However, the interaction terms for property rights, government integrity, monetary freedom, trade freedom, and investment freedom with institutional quality are also insignificant, suggesting limited short-term synergies between these specific components of the investment climate and institutional quality in driving agricultural productivity.

The table also shows the long-run estimates as it reveals the significant relationships between components of the investment climate, institutional quality, and their interaction in influencing agricultural output per worker. Each proxy for the investment climate (property rights, government integrity, business freedom, monetary freedom, trade freedom, and investment freedom) shows a positive and significant long-run coefficient. For example, the coefficients of property rights (0.0861) and government integrity (0.1367) indicate that stronger property rights and government integrity are associated with improved agricultural productivity. Similarly, business freedom (0.0430), monetary freedom (0.0738), trade freedom (0.0195), and investment freedom (0.0112) contribute significantly to long-term agricultural output per worker, suggesting that a favourable business environment and stable monetary policies provide a conducive framework for agricultural productivity. Institutional quality consistently exhibits significant negative coefficients across all models. These findings suggest that, independently, institutional quality acts as a constraining factor for agricultural output per worker. This might be due to the rigidity or inefficiencies in institutional structures that fail to translate potential benefits from reforms into measurable productivity gains.

The interaction terms between investment climate and institutional quality are uniformly positive and significant, demonstrating the synergistic effects of these two factors. For instance, the interaction term for property rights and institutional quality (0.0607) highlights that enhanced institutional frameworks amplify the positive impact of property rights on agricultural output. Similarly, the coefficients for business freedom (0.0436) and monetary freedom (0.0675) indicate that when institutional quality is high, the benefits of business and monetary freedom are more pronounced. Likewise, the parameters for government integrity (0.1293), trade freedom (0.0168) and investment freedom (0.0167) indicate that when institutional quality is high, the benefits of government, trade, and investment freedom are more pronounced.

In the short run, several variables significantly affect agricultural output per worker. The growth rate of GDP demonstrates positive and significant coefficients in models 2, 3, and 4, suggesting that short-term economic growth positively impacts agricultural productivity. Similarly, broad money supply (% of GDP) shows a significant negative effect in model, indicating that an increased money supply might initially disrupt productivity, potentially due to inflationary pressures or resource misallocation. Trade (% of GDP) is also significant but negatively affects agricultural output, reflecting transitional challenges such as exposure to global competition. Conversely, the external debt stock (% of GDP) and other components of trade and monetary policies are mostly insignificant, implying limited short-term influence on agricultural productivity. In the long run, GDP growth rate maintains a significant positive effect in models 2 and 3, with coefficients such as 0.0667, indicating that sustained economic growth bolsters agricultural output per worker over time. Broad money supply becomes a crucial positive driver in models 4, 5, and 6, highlighting its importance in long-term agricultural financing and investments. Trade (% of GDP), however, exhibits consistent negative long-run effects, suggesting that while trade liberalization can introduce competition, it might not always enhance agricultural productivity without complementary domestic policies. External debt stock shows a significant negative effect in models 4 and 5, indicating that high debt burdens can detract from long-term agricultural efficiency.

4.7 Discussion of Findings

Concerning the first objective, it analyses the empirical estimates of institutional quality's impact on various investment climate metrics within ECOWAS countries. The finding reveals the positive and significant influence of institutional quality on business freedom and monetary freedom, highlighting the short run benefits of robust institutions. This suggests that strong institutional frameworks create an environment that is conducive to business operations by reducing uncertainty, enforcing contracts, and maintaining monetary stability. The short-run effects indicate that as institutions improve, businesses benefit from a more predictable and secure operating environment, which is crucial for fostering entrepreneurship and attracting investment. However, the short-run analysis also shows that institutional quality does not have a significant immediate impact on other critical aspects of the investment climate, such as property rights, government integrity, trade freedom, and investment freedom. This finding suggests that these areas require more time and specific, targeted reforms to fully realize the benefits of improved institutional quality.

In the long run, the analysis reveals a broader and more significant impact of institutional quality on the investment climate, particularly in enhancing property rights, government integrity, trade freedom, and investment freedom. These findings suggest that over time, stronger institutions contribute to a more secure and transparent environment, which is essential for building investor confidence and facilitating economic activities. The positive impact on property rights and government integrity indicates that institutional reforms lead to better protection of assets and reduced corruption, which are crucial for long-term economic growth and stability. The findings aligned with a study that highlighted the significance of governance dynamics, particularly in relation to private investment, where strong institutions such as regulatory quality and corruption control were shown to have a direct impact on fostering a favorable investment climate across

African nations[1]. This finding is consistent with the long-run results in ECOWAS, where improvements in institutional quality, such as enhanced property rights and government integrity, were found to positively influence key investment climate metrics. Similarly, studies have demonstrated that robust institutional frameworks, including the rule of law and regulatory quality, contribute to economic stability and growth, aligning with the ECOWAS results showing that institutional quality enhances trade and investment freedom in the long term[2,3].

However, the long-run negative impact of institutional quality on business freedom and monetary freedom is particularly noteworthy. This finding likely reflects the tightening of regulatory frameworks, and the implementation of stricter controls aimed at maintaining economic stability and compliance. While these measures are essential for ensuring macroeconomic stability, they may also introduce constraints that limit the flexibility of businesses and financial markets. The negative impact of institutional quality on business freedom and monetary freedom in the long run, as observed in ECOWAS, reflect the findings of three scholars, who noted that while strong institutions can control inflation and maintain stability, they also introduce constraints that limit the flexibility of businesses and financial markets[4].

The analysis of investment climate factors on agricultural performance in ECOWAS countries was analyzed in the second objective. In the short run, the positive influence of property rights and government integrity on agricultural output highlights the critical role that secure land tenure and transparent governance play in encouraging investment in agriculture. This aligns with the findings of past studies that highlight how improved governance and secure property rights are crucial in enhancing agricultural productivity by ensuring that farmers have the necessary legal protections and governmental support to invest in and improve their land[5,6]. Specifically, in West Africa, where agricultural development is often hindered by weak institutions and insecure property rights, the enhancement of these factors is essential for promoting agricultural output. However, the negative impact of trade freedom on agricultural output in the short run, due to increased competition from imports, is consistent with the findings of a study on Ethiopian agricultural exports[7]. Their study shows how liberalizing trade can expose local producers to global competition, which may undermine domestic agricultural production in the short term. This outcome is particularly relevant in ECOWAS, where local farmers often lack the competitiveness to stand against cheaper imported goods, leading to a potential decline in agricultural output when trade barriers are reduced. The findings that agricultural employment is negatively affected by business, monetary, and investment freedom echo the concerns raised by past study regarding the shift towards more capital-intensive agricultural practices[8]. As noted in the study on South and Southeast Asia, the reallocation of resources from labor-intensive agriculture to more capital-intensive sectors can reduce employment opportunities in agriculture. This is especially significant in ECOWAS, where agriculture is a major source of employment, and such shifts can have profound socio-economic impacts, potentially exacerbating unemployment, and poverty in rural areas. Government integrity and trade freedom in the short run, have a negative and significant effect on agricultural output per worker. However, property right, business freedom, monetary freedom, and investment freedom have no significant impact on short-term agricultural output per worker.

In the long run, the analysis shows that the impacts of investment climate factors become more complex. The negative effects of property rights, government integrity, business freedom, and monetary freedom on agricultural output and employment can be interpreted in the context of the findings conducted in Iran[9]. Their study in Iran revealed that while investment in agriculture can drive growth, the broader economic and regulatory environment must be managed carefully to avoid unintended consequences, such as the diversion of resources away from agriculture or the imposition of burdensome regulations that hinder productivity. On the other hand, the consistent positive impact of trade freedom on agricultural output and exports supports the conclusions drawn by a study using the IMPACT framework[10]. Their study emphasizes the benefits of trade liberalization for boosting agricultural productivity and reducing food insecurity, particularly in regions vulnerable to climate-related challenges. This finding is crucial for ECOWAS, where trade liberalization could help integrate the region's agricultural sector into global markets, providing new opportunities for growth and development. Investment freedom's positive effect on agricultural exports further aligns with past work, who found that FDI significantly boosts agricultural exports in Arab nations[11]. In the long run, government integrity, trade freedom, and investment freedom have significant and positive effect on agricultural output per labour.

For the third objective, the study examines the analysis of institutional quality's impact on agricultural performance in ECOWAS countries. In the short run, the negative impact of institutional quality on agricultural employment in ECOWAS is consistent with the findings of a study, who observed that institutional improvements lead to a shift from informal to formal agricultural practices, reducing the need for manual labor and causing short-term employment declines[12]. This suggests that as institutions in ECOWAS become more robust, similar dynamics are at play, with the formalization of agriculture leading to reduced labor demand, particularly in informal sectors. On the other hand, it negates the findings of past studies that strong institutions should theoretically enhance agricultural performance by improving governance and reducing corruption, which are expected to boost productivity and output[13,14]. However, in the long run, the findings in ECOWAS reveal a significant negative impact on both agricultural output and employment. This contradiction is due to the specific characteristics of ECOWAS countries, where the formalization and modernization of agriculture, driven by institutional improvements, lead to capital-intensive practices that reduce reliance on labor and limit agricultural activities, as indicated by the significant declines in output and employment. Interestingly, the positive impact of institutional quality on agricultural exports in ECOWAS mirrors the findings of a study, who noted that improved institutional frameworks enhance export performance by creating stable and predictable environments conducive to international trade[15]. This suggests that while institutional quality may pose challenges for domestic agricultural production and employment, it strengthens the sector's ability to compete in global markets, thus boosting exports. Also, the statistically significant positive impact of institutional quality on agricultural output per worker in the long run suggests that stable and effective institutions are critical for sustained productivity growth in ECOWAS. In the short run, the lack of significance indicates that institutional reforms require time to yield tangible benefits, as structural changes often take longer to permeate the agricultural sector.

As regards the last objective, the study investigates if institutions act as ameliorating or deteriorating factor in the nexus between investment climates and agriculture performance in ECOWAS. In the context of agricultural output growth, institutions act as both ameliorating and deteriorating factors. When interacting with property rights, business freedom, trade freedom, and investment freedom, institutional quality amplifies the positive effects of these aspects of the investment climate, suggesting that strong institutions foster an environment conducive to agricultural growth. For instance, in Ghana, land reforms and improved property rights have been shown to positively impact agricultural productivity, especially in cocoa farming, as farmers gain more confidence in long-term investments in their land[16,17]. Similarly, Côte d'Ivoire has seen significant agricultural output improvements due to reforms that enhance business freedom and trade facilitation[18]. However, the deteriorating effect of institutional quality when interacting with monetary freedom highlights challenges posed by tight financial conditions, which can constrain agricultural investment. This is particularly relevant for Nigeria, where efforts to control inflation through monetary tightening have had mixed effects on agricultural investment and productivity, sometimes limiting growth in the sector[19].

For agricultural employment, institutions generally play an ameliorating role by enhancing the positive impact of a favorable investment climate. The positive and significant interaction effects with property rights, government integrity, business freedom, monetary freedom, and trade freedom suggest that institutional improvements lead to better employment outcomes in agriculture. For example, in Senegal, the implementation of the Plan Senegal Emergent, which focuses on improving governance and business conditions, has led to increased agricultural employment, particularly in the rice and horticulture sectors[20]. However, the negative interaction between institutional quality and investment freedom highlights the risk of resource reallocation away from labor-intensive sectors like agriculture toward more capital-intensive industries. This trend has been observed in Nigeria and Ghana, where increased investment freedom has often led to a focus on sectors like oil and mining, reducing the emphasis on agricultural employment[21,22].

Concerning agricultural exports, institutions act as an ameliorating factor in the relationship between investment climate and agricultural exports, particularly when interacting with property rights, government integrity, and investment freedom in the short run. This suggests that institutional improvements can enhance export performance by providing a stable and predictable environment for agricultural producers. For instance, Ghana's cocoa exports have benefited from strong institutional frameworks that support property rights and reduce corruption, leading to better market access and export performance[23]. However, in the long run, institutions can act as a deteriorating factor, particularly when interacting with property rights, business freedom, monetary freedom, trade freedom, and investment freedom. This negative impact may stem from the additional regulatory burdens and formalization associated with institutional improvements, which can hinder agricultural exports. For example, in Nigeria, while there have been efforts to improve institutional quality, the agricultural export sector still faces significant challenges due to complex regulations and inefficient trade policies, limiting its growth potential[24].

As to agricultural output per worker, the results reveal that the interaction between institutional quality and investment climate is pivotal in enhancing agricultural productivity, most especially in the long run effects. The significant positive coefficients for interaction terms like property rights, business freedom, and monetary freedom underscore that improvements in institutional quality magnify the benefits of these components of the investment climate, driving agricultural output per worker. However, the short-run negative coefficient for the interaction of business freedom and institutional quality suggests that implementation challenges or transitional inefficiencies hinder short-term benefits. This divergence implies that while institutional quality and the investment climate are critical to agricultural productivity, their combined effects depend on effective policy implementation and the removal of structural bottlenecks, particularly in the short term.

Endnotes

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Chapter Five

Conclusion

In this chapter, the summary of findings is presented in the first section. Afterward, the concluding remarks and recommendation are presented in the second and third sections. The last two sections accordingly are contributions to knowledge, and suggestions for further studies.

5.1 Summary of Findings

This study was motivated by the deteriorating levels of investment climate, institutional settings, and agricultural performance in ECOWAS, with the primary objective of investigating how institutions influence the relationship between the investment climate and agricultural performance, as outlined in the first chapter. The analysis focused on three key indices of agricultural performance (such as agricultural output growth, employment, and exports), alongside six critical investment climate variables: property rights, government integrity, monetary freedom, trade freedom, business freedom, and investment freedom. By examining these diverse indices, the study offers unique and distinctive insights compared to existing research. The empirical findings and discussions are based on the parameters estimated through the pooled mean group (PMG) methodology, utilizing datasets spanning 23 years from 2000 to 2022. This section presents a summary of the findings and explores their economic implications, drawing from the empirical results and robustness checks conducted in the previous chapter. The summary of findings is as follows.

In the first objective, the empirical analysis of the impact of institutional quality on various investment climate metrics within ECOWAS countries reveals both short-run and long-run dynamics. In the short run, institutional quality positively and significantly influences business freedom and monetary freedom, indicating that robust institutions create an environment conducive to business operations and monetary stability. However, institutional quality does not have a significant immediate impact on property rights, government integrity, trade freedom, and investment freedom, suggesting that these aspects of the investment climate require more time and targeted reforms to respond to improvements in institutional quality. In the long run, the impact of institutional quality is positive and significant across the metrics of investment climate except business and monetary freedom. The results show that improvements in institutional quality significantly enhance property rights, government integrity, trade freedom, and investment freedom. This suggests that stronger institutions lead to a more secure and transparent environment, promoting investor confidence and facilitating economic activities. However, the analysis also reveals that while institutional quality improves many aspects of the investment climate, it negatively impacts business freedom and monetary freedom in the long run, likely due to the introduction of stricter regulations and controls aimed at maintaining economic stability and compliance.

In the context of the second objective, the analysis of investment climate factors on agricultural performance in ECOWAS countries reveals significant short-run and long-run impacts across agricultural output, employment, and exports. In the short run, improvements in property rights and government integrity positively influence agricultural output, while trade freedom has a negative impact due to increased competition from imports. Agricultural employment is negatively affected by business, monetary, and investment freedom, which lead to a reallocation of labour to more profitable sectors and reduce the need for labour-intensive agricultural practices. Conversely, trade freedom positively impacts agricultural employment by expanding trade-related activities. In the long run, the impact of investment climate factors is more complex. Property rights, government integrity, business freedom, and monetary freedom generally have negative effects on agricultural output and employment, likely due to shifts in resource allocation away from agriculture and the effects of regulatory changes. However, trade freedom consistently shows a positive impact on agricultural output and exports, underscoring the benefits of trade liberalization in boosting the agricultural sector. Investment freedom has a positive effect on agricultural exports, suggesting that when capital flows freely, it supports export-oriented agricultural activities. Government integrity and trade freedom in the short run, have a negative and significant effect on agricultural output per worker. However, property right, business freedom, monetary freedom, and investment freedom have no significant impact on short-term agricultural output per worker. In the long run, government integrity, trade freedom, and investment freedom have significant and positive effect on agricultural output per labour.

For the third objective, the analysis of institutional quality and its impact on agricultural performance in ECOWAS countries reveals significant and varied effects across different aspects of the sector. In the short run, improvements in institutional quality, characterized by enhanced governance and reduced corruption, have a significant negative impact on agricultural employment, leading to a decline in labour demand, particularly in informal agricultural practices. This suggests that as the sector becomes more formalized and efficient; the need for labour decreases, resulting in short-term job losses. However, in the short run, institutional quality does not significantly affect agricultural output or exports, indicating that immediate changes in governance do not directly translate into productivity or export growth. In the long run, institutional quality has a significant negative impact on both agricultural output and employment. This outcome highlights the challenges associated with the formalization and modernization of the agricultural sector, where increased efficiency and capital-intensive practices reduce reliance on labour and limit the extent of agricultural activities. Despite these challenges, institutional quality positively impacts agricultural exports, suggesting that better governance and institutional frameworks enhance the sector's ability to compete in global markets. Strong institutions create a stable and predictable environment, fostering the development of export-oriented agriculture and improving the international competitiveness of ECOWAS countries. Institutional quality plays a vital role in driving agricultural output per worker in the long run, although its short-run effects are not significant.

Regarding the last objective, it reported the role of institutional quality in the relationship between investment climate and agricultural performance in ECOWAS. In the short run, the interaction between institutional quality and investment climate does not significantly influence agricultural output growth or employment, indicating that their combined effects take time to materialize. However, in the long run, strong institutional quality enhances the positive effects of favourable investment climate factors (such as property rights, business freedom, trade freedom, and investment freedom) on agricultural output growth. This suggests that robust institutions create an environment that supports and amplifies the benefits of an improved investment climate, driving substantial agricultural growth over time. On the other hand, the interaction between institutional quality and monetary freedom shows a negative impact, highlighting potential constraints on agricultural investment due to tighter financial conditions in the context of institutional reforms.

For agricultural employment, the short-run analysis shows no significant impact from changes in either the investment climate or institutional quality, underscoring the importance of sustained reforms for long-term development. In the long run, the investment climate generally promotes agricultural employment, except when it comes to investment freedom, which tends to shift resources away from labour-intensive agriculture to more capital-intensive sectors. While institutional quality generally reduces agricultural employment due to the shift toward more capital-intensive practices, the positive interaction effects with the investment climate suggest that coordinated improvements in both areas can enhance agricultural employment. However, the negative interaction between institutional quality and investment freedom suggests a tension between capital-intensive growth and the labour demands of traditional agricultural practices, potentially reducing employment in the agricultural sector.

Regarding agricultural exports, the interaction between institutional quality and various aspects of the investment climate has a significant impact on export performance. In the short run, positive interactions under property rights, government integrity, and investment freedom reinforce export performance, indicating that the benefits of improved institutional quality are amplified by a favourable investment climate. However, in the long run, most interaction terms, except for government integrity, show a negative impact on agricultural exports. This suggests that while institutional improvements are essential, they impose additional regulatory burdens on producers, complicating their ability to capitalize on a favorable investment climate for export growth.

The findings indicate that the interplay between institutional quality and the investment climate is crucial for improving agricultural output per worker, while it exhibits variations in its short-term and long-term impacts. The substantial positive link for interaction terms such as property rights, company freedom, and monetary flexibility indicate that enhancements in institutional quality amplify the advantages of these elements of the investment climate, hence boosting agricultural output per worker. The short-run negative coefficient for the relationship between business freedom and institutional quality indicates that implementation issues or transitional inefficiencies may obstruct immediate advantages. This disparity indicates that although institutional quality and the investment climate are essential for agricultural output, their combined impacts rely on efficient policy execution and the alleviation of structural impediments, especially in the short run.

5.2 Conclusion

The study examines the role of institutions in the investment climate-agricultural performance nexus in ECOWAS within the period of 2000 to 2022. First, the study concludes that institutional quality is a critical determinant of the investment climate in ECOWAS countries, with both positive and negative effects depending on the specific metric and time horizon. In the short run, stronger institutions enhance business and monetary freedom, contributing to a more favorable investment environment. In the long run, the benefits of institutional quality extend to the protection of property rights, enhancement of government integrity, and promotion of trade and investment freedom. However, the tightening of regulatory frameworks and monetary controls associated with improved institutional quality constrain business and monetary freedom, highlighting the need for a balanced approach in institutional reforms.

Second, the findings indicate that while improvements in property rights, government integrity, and trade freedom are crucial for enhancing certain aspects of agricultural performance, they also present challenges that need to be carefully managed. Strengthening institutional quality and liberalizing trade can significantly boost agricultural exports and productivity in ECOWAS countries, but these benefits may come at the cost of reduced agricultural employment and output if not accompanied by supportive policies. The results highlight the importance of balancing economic and institutional reforms with targeted interventions that sustain agricultural productivity and employment, ensuring that the agricultural sector remains competitive and inclusive.

Third, the findings underscore the dual nature of institutional quality's impact on agriculture in ECOWAS countries. While improvements in governance and institutional frameworks are essential for long-term economic stability and export growth, they also pose challenges for agricultural output and employment. The formalization of the sector leads to a decrease in labour demand and productivity, highlighting the need for balanced policies that address both the efficiency gains from better institutions and the social implications of reduced agricultural activities. To sustain and enhance the agricultural sector, it is crucial to implement strategies that mitigate the negative effects on employment and output while leveraging the positive impact on exports.

Lastly, the analysis of institutional quality's role in the relationship between investment climate and agricultural performance in ECOWAS countries reveals that, in the short run, the interaction between these factors does not significantly impact agricultural output growth, employment, or exports. However, in the long run, strong institutional quality amplifies the positive effects of a favorable investment climate on agricultural output growth but also leads to challenges in agricultural employment due to shifts toward more capital-intensive practices. For agricultural exports, while improved institutional quality and investment climate can enhance performance in the short term, their long-term interaction introduces regulatory burdens that hinder export growth. Finally, the findings emphasize that institutional quality and an amplifying investment climate are interdependent drivers of agricultural productivity, with long-term synergies outweighing short-term challenges

5.3 Recommendations

To ensure enhanced agricultural output growth, employment, exports, and output per worker in ECOWAS, the following policy measures are recommended to sustain both the investment climate and institutional quality:

i. The study recommends that ECOWAS governments pursue institutional reforms such as Land reforms, governance reforms that balance the need for stronger regulatory frameworks and monetary controls with the preservation of business and monetary freedom. This would be achieved by implementing flexible policies that protect property rights and enhance government integrity while avoiding overly restrictive measures that could stifle economic activity.

ii. Furthermore, policymakers should focus on long-term strategies that strengthen institutional quality around regulatory framework, good governance, and rule of law across all sectors, particularly in trade and investment, while ensuring that reforms do not unintentionally constrain business operations. By adopting a measured approach to institutional improvements, governments would foster a more conducive investment climate that promotes sustained output growth, employment, and exports in the agricultural sector.

iii. To mitigate the negative effects of increased business, monetary, and investment freedom on agricultural employment, the study suggests implementing policies that support labour-intensive agricultural practices and provide retraining programs for agricultural workers. Such measures should include subsidies for smallholder farmers and incentives for employing rural labour, thereby sustaining employment levels while enhancing productivity.

iv. The governments of the region should promote inclusive trade policies that protect domestic agricultural producers from excessive competition by implementing safeguard measures, such as temporary tariffs or quotas, targeted support programs for domestic farmers, trade defense mechanisms, and adjustments to import policies. Additionally, investing in trade-related infrastructure, like logistics and transportation networks, help domestic producers compete more effectively in global markets.

v. The study recommends that ECOWAS governments implement policies that support labour-intensive agricultural practices, ensuring that the formalization of the sector does not lead to significant job losses. This can be achieved through incentives for smallholder farmers and promoting subsistence farming, where farmers rely on their own labor to produce food for their families, and certain specialty crops where hand-picking and processing are essential. Additionally, the study suggests that policymakers develop targeted strategies to boost agricultural output alongside the positive impacts of improved institutional quality on exports. This includes measures to increase efficiency in agricultural practices while safeguarding the livelihoods of those dependent on agriculture, thereby achieving a balanced approach to sector growth and stability.

vi. Also, ECOWAS governments should focus on designing institutional reforms that support both agricultural output growth and employment by promoting policies that balance capital-intensive practices with the needs of the labour force. This reform will include shifting to individual land use, promoting farm restructuring, strengthening research and extension services and implementing overall economic reforms supported by democratic institutions. In addition, policymakers should carefully manage the regulatory environment to avoid long-term burdens that could hinder agricultural export growth. This includes streamlining regulations and providing support to exporters to navigate institutional improvements without facing excessive compliance costs, thereby sustaining export performance.

5.4 Contribution to Knowledge

This study makes several key contributions to the existing literature on investment climate, institutions, and agricultural performance:

i. The study advances the literature by creating a comprehensive index of agricultural performance that integrates all four indicators. This approach offers a more holistic understanding of agricultural performance (consisting agriculture output growth, employment, exports, and output per worker), which has not been jointly considered in existing research.

ii. This study addresses this gap by developing a conceptual framework that elucidates the interrelationships among investment climate, institutions, and agricultural performance, unlike previous research.

iii. Another novel contribution to the literature is that this study innovates by disaggregating the investment climate into specific factors (property rights, government integrity, monetary freedom, trade freedom, business freedom, and investment freedom), and examines their distinct impacts on agricultural performance

iv. The study offers a more focused contribution by specifically estimating the role of institutions in the relationship between investment climate and agricultural performance within ECOWAS countries which provides new insights into the investment-agricultural performance nexus

5.5 Suggestions for Further Studies

The limitations in the scope of data encountered in this study have influenced the interpretation and generalization of the empirical findings. Despite these limitations, the study offers valuable insights and provides guidance for policymakers. Future research could clarify the evidence presented here by employing other non-linear estimation approaches, such as an asymmetric bounds test, which could further enhance the reliability of the findings for policy formulation.

In addition, there is a need for more comprehensive and up-to-date data collection on this subject, which should be an area of focus for future research. The empirical analysis in this study has primarily relied on cross-sectional data at a relatively high level of aggregation, which limits the ability to conduct in-depth analyses of country-specific issues, such as unique macroeconomic structures that may be crucial for greater clarity and precision in empirical studies. To supplement the findings of this study, further research should involve detailed, country-specific analyses using a unified analytical approach. Moreover, disaggregated estimates of panel regression models are required to determine the contribution of individual components of institutions and investment climate indices to agricultural performance, providing a more granular understanding of these relationships.

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Appendix

Table 1.1: Average of key agricultural and institutional metrics within 2000-2022

Regions	Agricultural raw materials exports (% of merchandise exports)	Agriculture, forestry, and fishing, value added (% of GDP)	Agriculture, forestry, and fishing, value added (annual % growth)	Agriculture, forestry, and fishing, value added per worker (constant 2015 US$)	Employment in agriculture (% of total employment) (modeled ILO estimate)	Average Governance index for 2022
Arab World	0.19	6.45	1.97	5406.85	22.83	-0.69
European Union	1.50	1.76	0.40	18915.04	5.97	-
Latin America & Caribbean	2.22	5.25	2.49	5329.59	16.49	-0.10
Middle East & North Africa	0.23	5.66	2.49	6380.17	19.53	-0.51
North America	2.83	1.12	1.52	83184.31	1.77	1.20
OECD members	1.63	1.54	0.96	20033.31	5.72	1.22
Sub-Saharan Africa	3.75	16.32	4.01	1234.14	56.64	-0.72
ECOWAS	12.69	28.32	3.90	1660.22	51.70	-0.85

Source: Author's computation based on data from World Development Indicators (2022)

Appendix I: Data of Investment Climate, Institutional Quality, and Agricultural Performance

c_id	Country	Year	agpf1	agpf2	agpf3	agpf4	prt	gint	bfr	mfr	tfr	ifr	inst	gdpg	bm	inf	topn	exdt
1	Benin	2000	23.5412	51.842	69.6668	1129	50	30	70	75.6	59	50	-0.36002	5.85771	19.1893	4.1654	47.3482	40.1509
1	Benin	2001	25.0482	51.0373	59.5881	1205.7	30	30	70	81.2	61	50	-0.36002	5.33314	17.9978	3.9843	48.2572	40.4938
1	Benin	2002	25.3827	50.5743	56.0039	1217.77	30	30	55	78.3	61	50	-0.55161	4.64303	14.641	2.48916	43.7684	38.8223
1	Benin	2003	24.454	49.7889	74.1668	1216.25	30	30	55	77.8	61	50	-0.54837	3.44358	16.788	1.48724	41.6162	27.939
1	Benin	2004	26.5208	49.4368	72.4137	1277.24	30	30	55	79	57	50	-0.54692	4.42968	14.0338	0.873891	39.903	26.2963
1	Benin	2005	26.6894	48.9908	64.3252	1262.78	30	30	55	81.1	54	30	-0.67649	1.71316	15.46	5.36452	39.0959	23.7836
1	Benin	2006	26.6318	48.424	42.8978	1325.82	30	32	48	83.1	59.6	30	-0.55803	3.94374	18.5348	3.78218	39.7747	9.42608
1	Benin	2007	26.9711	47.4588	47.8813	1390.54	30	29	48.5	82.4	64.6	30	-0.5097	5.98635	20.711	1.29807	49.1138	11.116
1	Benin	2008	26.8262	46.5137	38.3899	1400.41	30	25	48.1	77.5	65.2	40	-0.52444	4.89658	23.2666	7.9473	47.7754	10.2101
1	Benin	2009	26.979	45.8003	31.4117	1478.98	30	27	43.8	79.6	67.4	40	-0.56975	2.31929	23.9524	0.896072	44.7026	13.6555
1	Benin	2010	25.8411	45.1386	26.7384	1438.27	30	31	42.3	74.6	57	60	-0.58875	2.11406	25.5234	2.20784	51.4309	16.8375
1	Benin	2011	25.797	43.6134	39.7155	1480.09	30	29	43	78.2	58.8	60	-0.55436	2.96375	26.1382	2.70424	47.217	17.4606
1	Benin	2012	25.769	41.5818	48.5027	1605.33	30	28	42.9	79.7	59.3	60	-0.59125	4.81122	24.8832	6.74468	50.7367	15.1082
1	Benin	2013	25.2754	39.2901	49.1352	1766.36	30	30	45.4	79.9	59.3	70	-0.56019	7.19143	26.862	0.428889	59.2002	16.0462
1	Benin	2014	25.6185	37.2346	45.2336	1985.36	30	29.5	51	75.4	60	70	-0.56547	6.35768	29.9654	-0.54876	65.2683	15.4375
1	Benin	2015	26.3921	35.965	49.7994	2048	30	36	55.2	79.9	58.4	70	-0.58151	1.77815	30.9848	0.218786	56.7563	19.2158
1	Benin	2016	27.7536	34.4543	50.0336	2312.28	30	39	51.3	82.2	58.8	75	-0.57099	3.33967	29.8321	-0.79405	58.9869	19.2703
1	Benin	2017	28.489	32.4868	54.4213	2607.55	36	31.3	51.9	85.4	68.7	80	-0.58951	5.67156	28.631	1.76941	61.4766	22.2807
1	Benin	2018	28.0648	30.6131	56.4464	2933	35.5	30.2	60.7	84.7	55.6	80	-0.50897	6.69726	27.9318	0.644804	61.7952	25.4475
1	Benin	2019	26.8758	29.4476	64.5573	3096.14	37.2	28.1	62.4	86.4	61.8	70	-0.46772	6.86569	27.8216	-0.70503	63.6813	27.5118
1	Benin	2020	27.1092	28.874	64.6438	3105.8	41.3	29.6	58	84.3	49.4	60	-0.37257	3.84879	30.5466	3.02272	44.8332	34.2453
1	Benin	2021	28.5289	28.1495	74.8808	3269.97	42.5	32.3	54.6	83.7	60.4	50	-0.34659	7.15545	32.7282	1.73354	48.0549	38.9991
1	Benin	2022	26.8964	28.1495	76.8391	3325.65	44.3	40.3	47.7	80.4	61.4	50	-0.34659	6.25324	33.4263	1.35078	50.9335	38.9991
2	Burkina Faso	2000	24.914	85.2821	58.0196	400.417	50	10	55	76.6	55	70	-0.38698	1.88847	18.629	-0.30421	35.1229	48.7864
2	Burkina Faso	2001	26.9204	84.6333	55.6264	425.923	30	10	55	84.6	61	70	-0.38698	6.61341	16.284	5.00743	31.6582	47.6988
2	Burkina Faso	2002	26.3724	84.0264	61.466	415.553	30	30	55	89.4	61	70	-0.41595	4.35296	14.6848	2.17569	31.3125	43.6037
2	Burkina Faso	2003	25.961	83.2192	72.4527	446.685	30	30	55	78.8	61	70	-0.47683	7.80249	22.6947	2.03457	30.3682	37.5118
2	Burkina Faso	2004	23.3814	82.4153	75.4446	421.046	30	30	55	79.7	64.8	50	-0.42738	4.47845	20.76	-0.40023	35.4809	35.9675
2	Burkina Faso	2005	26.7709	81.539	74.716	469.322	30	30	55	80.4	62.6	50	-0.41577	8.66187	17.9642	6.41504	34.1722	33.0687

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2	Burkina Faso	2006	25.229	80.6062	74.716	471.132	30	30	39.2	85.9	62.2	50	-0.48511	6.25316	18.7748	2.33311	35.1065	17.5059
2	Burkina Faso	2007	21.8395	80.099	54.3458	439.752	30	34	43.8	76.8	67.2	40	-0.45204	4.11138	18.9953	-0.23063	33.7797	25.8555
2	Burkina Faso	2008	27.3143	79.961	33.4509	505.028	30	32	50.7	78.8	66.6	40	-0.35259	5.79999	20.8827	10.6598	35.3853	28.3527
2	Burkina Faso	2009	23.2048	79.578	25.5723	449.246	30	29	58.7	83.7	70.4	40	-0.32687	2.96195	24.4506	2.60818	40.296	39.8141
2	Burkina Faso	2010	24.1434	79.1534	16.6146	508.897	30	35	60	73	71.3	50	-0.33685	8.44628	25.6262	-0.76423	49.0732	48.9407
2	Burkina Faso	2011	23.0436	78.6882	11.2206	492.57	30	36	61.5	76.8	76.2	55	-0.37509	6.62256	25.7565	2.75977	57.4973	51.5251
2	Burkina Faso	2012	23.756	78.1804	13.2682	528.671	30	31	62.8	81.4	72.5	55	-0.4198	6.45267	26.4212	3.81815	61.2386	60.7241
2	Burkina Faso	2013	23.6411	77.5865	18.8383	557.633	30	30	61.2	80.6	72.5	55	-0.47961	5.79258	28.2873	0.533738	64.0359	68.3591
2	Burkina Faso	2014	23.6938	77.2311	17.849	577.053	30	31.3	60.7	78.8	67.8	60	-0.48604	4.32685	30.2894	-0.25809	58.8236	77.211
2	Burkina Faso	2015	22.6465	76.7874	13.5185	546.475	25	38	49.6	80	68.2	65	-0.4627	3.92123	35.5971	0.724839	59.0892	111.552
2	Burkina Faso	2016	21.7147	76.2326	16.9946	555.988	30	38	46.3	84.9	68.2	65	-0.40454	5.95798	36.5626	0.441041	57.8932	83.5804
2	Burkina Faso	2017	20.5856	75.5937	12.6878	541.797	38.2	31.7	46.4	84.6	69.2	70	-0.39486	6.20349	41.1011	1.483	59.2688	94.0402
2	Burkina Faso	2018	20.9975	75.1405	9.82395	574.192	42.1	31.8	51.5	84.5	65.8	65	-0.38807	6.60457	42.1282	1.95594	60.5956	69.0244
2	Burkina Faso	2019	18.3761	74.3768	10.8698	558.522	49.1	36.6	51.6	86.2	65.2	65	-0.45096	5.68812	42.7938	-3.23339	58.6642	59.7449
2	Burkina Faso	2020	18.3981	73.8144	6.03079	550.341	46.9	34.1	47.6	82.4	61.8	65	-0.42111	1.93032	46.2997	1.88444	58.6642	58.5489
2	Burkina Faso	2021	17.4607	73.2673	9.00846	493.306	45.1	34.5	44.8	74.7	61	65	-0.42278	6.90634	51.0282	3.65353	58.6642	55.0103
2	Burkina Faso	2022	20.4	73.2673	9.00846	504.683	47	41.4	41.9	75.6	61	65	-0.42278	1.4793	48.5325	14.2902	58.6642	55.0103
3	Cabo Verde	2000	12.8718	26.2966	0.031904	1656.86	70	30	55	70.1	45	70	0.255721	14.2849	64.3693	-2.47746	87.5206	60.8757
3	Cabo Verde	2001	11.4158	25.3678	0.031904	1512.74	70	30	70	71.2	39.4	70	0.255721	2.23165	65.6969	3.34996	92.1637	62.0581
3	Cabo Verde	2002	10.3515	24.3363	0.000396	1469.6	50	30	70	87.2	46.8	70	0.058327	5.25089	71.5559	1.88453	101.09	63.983
3	Cabo Verde	2003	10.1437	23.4736	5.90213	1500.27	50	30	85	81.1	58.4	50	0.042474	4.17626	71.0956	1.18817	98.7684	55.2141
3	Cabo Verde	2004	9.86347	22.3817	5.90213	1612.32	50	30	85	86.4	38	50	-0.03225	10.1971	76.1677	-1.89082	101.567	51.2268
3	Cabo Verde	2005	9.00119	21.3845	0	1567.1	50	30	85	87.1	23	50	0.09089	6.91246	83.9927	0.418892	104.344	50.8869
3	Cabo Verde	2006	8.31871	20.4254	0	1590.52	70	30	55.7	89.3	36.2	50	0.290083	7.98375	87.7357	5.36908	117.817	49.314
3	Cabo Verde	2007	6.09469	19.3449	0	2160.36	70	30	55.7	88.1	41.2	50	0.372069	15.1707	71.1488	4.411	94.2062	39.1613
3	Cabo Verde	2008	5.31578	18.5496		2154.2	70	40	55.3	78.7	41.2	60	0.313363	7.03901	68.945	6.77444	90.9664	35.9389
3	Cabo Verde	2009	6.02632	18.1523	0.042841	2485.81	70	49	57.1	76.9	65.4	60	0.321646	-1.50359	71.0322	0.991103	80.461	43.4284
3	Cabo Verde	2010	5.82909	17.7001	0	2407.48	65	51	63.3	74.5	65.5	60	0.273255	1.83642	73.0436	2.07866	85.5484	55.5949
3	Cabo Verde	2011	5.39925	17.2301	0.000467	2468.22	65	51	64.8	79.2	67.6	60	0.377554	3.92472	71.5421	4.47388	90.5564	58.0792

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3	Cabo Verde	2012	5.79089	16.8963	0.032785	2825.59	65	51	59	80.5	66.9	65	0.368164	1.08365	74.7308	2.5404	90.6499	74.8894
3	Cabo Verde	2013	5.82359	16.5133	0.022695	2942.28	70	55	58.9	78	66.9	65	0.332341	0.632137	81.5744	1.50654	86.1699	83.5817
3	Cabo Verde	2014	5.73507	16.1176	0.000224	3073.38	70	54.9	63.8	79.1	69.6	70	0.357228	0.696667	87.1222	-0.23878	91.3039	87.7445
3	Cabo Verde	2015	6.40829	15.7616	0.004892	3486.69	75	58	61.8	81	69.6	70	0.39888	0.936027	90.2355	0.131188	94.0085	100.809
3	Cabo Verde	2016	6.31352	14.726	0.004892	3924.63	75	57	61.3	84.5	68.2	70	0.279572	4.28071	92.213	-1.40782	95.3781	96.7676
3	Cabo Verde	2017	5.37534	13.6167	0.000018	3653.47	42.6	41.8	65.5	86.7	68.2	75	0.329659	4.55131	92.7339	0.784415	100.052	104.754
3	Cabo Verde	2018	4.52277	11.8383	0.000018	3814.77	42.1	42.8	64.6	83.5	68.2	80	0.381823	3.70696	89.1468	1.257	105.868	92.0673
3	Cabo Verde	2019	3.82677	10.6046	0.000092	4035.68	44.1	43.7	65.2	84.1	68.2	80	0.40472	7.63608	89.1964	1.10667	103.251	93.8927
3	Cabo Verde	2020	4.69955	11.2903	0.000428	4817.62	47.5	46.1	58.5	83.1	68.2	80	0.430159	-19.3028	113.653	0.605796	77.8104	124.58
3	Cabo Verde	2021	4.52835	10.9782	0.000428	4425.47	44.5	48.7	60.6	83.3	68	80	0.425275	6.81118	109.187	1.86215	76.9679	108.498
3	Cabo Verde	2022	3.6884	10.9782	0.000428	3709.89	66.1	60.9	59.8	84.4	66	80	0.425275	17.7142	92.2228	1.86215	95.4987	108.498
4	Cote d'Ivoire	2000	16.1952	50.7022	13.8374		30	31	55	76.8	34	50	-0.8967	-0.26579	13.9828	2.53078	54.964	123.828
4	Cote d'Ivoire	2001	17.2771	50.7793	11.0916		30	26	55	86	61	50	-0.8967	-2.15401	13.9806	4.36153	53.1141	117.136
4	Cote d'Ivoire	2002	18.7373	50.8477	8.34473		30	27	55	85.4	61	50	-0.87308	-2.73053	17.8359	3.07726	55.9019	107.838
4	Cote d'Ivoire	2003	20.776	51.0414	9.05922		30	24	55	78.1	61	50	-1.06195	-4.72587	13.1091	3.29681	53.2601	89.5264
4	Cote d'Ivoire	2004	16.64	50.4825	9.00625		30	27	55	78.4	65.8	50	-1.2429	3.18504	14.0168	1.45799	58.1183	89.1088
4	Cote d'Ivoire	2005	16.0652	50.1231	8.2492		30	21	55	78.4	61	50	-1.27235	0.996066	13.6877	3.88583	62.8209	73.0604
4	Cote d'Ivoire	2006	15.9448	49.7517	7.99778		30	20	46.4	80.9	63.6	50	-1.18897	2.81558	14.8636	2.46719	63.6904	79.7593
4	Cote d'Ivoire	2007	15.5787	49.3812	8.83268		30	19	48.1	78.6	63.6	40	-1.16593	1.10143	18.8465	1.89201	61.4309	73.5409
4	Cote d'Ivoire	2008	16.1855	48.8571	8.66887	2084.39	30	21	47.3	80.7	59.8	40	-1.18429	4.78267	18.4376	6.30853	61.9406	55.3661
4	Cote d'Ivoire	2009	15.2496	48.2325	5.54739	2002.48	30	21	45.8	79.1	70.4	40	-1.11609	3.60332	21.3065	1.0195	66.6729	63.5577
4	Cote d'Ivoire	2010	17.4889	47.5707	9.47653	1904.71	30	20	43.7	76	64.3	35	-1.15707	6.84805	23.3989	1.22646	67.4729	48.7732
4	Cote d'Ivoire	2011	18.4867	47.4459	12.7551	2006.31	30	21	43.3	80.2	72.2	35	-1.09462	-5.37045	25.9681	4.91243	64.7159	52.368
4	Cote d'Ivoire	2012	16.3752	46.3299	10.7829	1966.4	20	22	42.7	81.7	70.3	35	-0.95478	7.62041	25.4037	1.30451	70.3011	36.8085
4	Cote d'Ivoire	2013	15.3429	45.1702	8.56925	1996.47	25	22	43.3	77.8	70.3	40	-0.83656	10.7602	24.8226	2.58117	58.3527	33.003
4	Cote d'Ivoire	2014	15.2418	44.2788	8.58547	2277.05	30	22.1	55.1	80.6	71.4	50	-0.62241	9.372	24.8195	0.448682	53.6804	20.457
4	Cote d'Ivoire	2015	18.362	43.5015	6.74667	2304.6	35	27	65.4	75	71.4	55	-0.58261	7.19495	26.1101	1.2515	52.7129	25.4149
4	Cote d'Ivoire	2016	17.8637	42.7547	7.60237	2327.67	30	32	62.2	73.5	71.8	70	-0.57445	7.17276	27.3749	0.723178	47.5656	24.4354
4	Cote d'Ivoire	2017	17.3143	41.8913	9.05191	2656.38	42.6	34.3	62.1	73.2	72.3	75	-0.58349	7.41076	28.1221	0.685881	48.6625	26.8703
4	Cote d'Ivoire	2018	18.2263	43.9544	9.48366	2720.03	39.4	36.5	62.1	73.6	73.7	75	-0.489	4.84315	29.9133	0.359409	46.0375	29.0232

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4	Cote d'Ivoire	2019	17.4971	45.9449	10.4983	2355.34	40.9	38.1	61	74.2	73.6	75	-0.48622	6.51829	30.688	-1.10686	44.5275	34.807
4	Cote d'Ivoire	2020	19.0941	45.5665	11.162	2363.85	48.5	25.5	62.3	75.7	69.4	75	-0.50643	1.73762	35.9775	2.42501	41.1095	42.217
4	Cote d'Ivoire	2021	17.4665	45.0374	11.162	2480.06	42.8	27	60.8	74.7	73.8	75	-0.44099	7	38.8921	4.09195	45.1243	43.9782
4	Cote d'Ivoire	2022	16.7154	45.0374	11.162	2519.39	45.4	33.8	61	71.3	73.6	75	-0.44099	6.74133	38.6461	5.27617	52.3357	43.9782
5	Gambia, The	2000	24.5323	53.9087	1.32388	1205.22	50	10	55	77.2	59.4	30	-0.36678	5.5	19.8005	0.84497	56.3598	65.1186
5	Gambia, The	2001	25.4256	53.4405	3.58261	1285.8	50	10	55	73.9	57.4	50	-0.36678	5.8	21.953	4.4926	46.9293	75.3613
5	Gambia, The	2002	24.1249	54.228	1.4139	1026.22	50	10	55	81.9	65.6	50	-0.39014	-3.25	27.8065	8.60913	59.643	107.058
5	Gambia, The	2003	26.7483	53.8509	10.8818	1205.97	50	10	55	78.1	55.4	50	-0.22683	6.87	32.8986	17.0329	68.8588	138.564
5	Gambia, The	2004	31.5026	53.3173	1.65223	1268.34	50	10	55	73.4	56.2	50	-0.50572	7.05	19.3787	14.2067	49.9343	72.2099
5	Gambia, The	2005	32.0906	54.0325	1.65089	1196.84	30	25	55	66.5	59.6	50	-0.62236	-2.35173	20.5957	4.83862	50.0187	65.8283
5	Gambia, The	2006	25.6002	53.6309	2.72799	979.392	30	28	59.4	66	59.6	50	-0.57859	-0.55558	25.8918	2.0565	50.3745	68.931
5	Gambia, The	2007	23.5662	53.1088	3.63949	922.344	30	27	59.4	68.1	64.6	50	-0.5358	3.04325	25.6959	5.36913	44.2938	55.096
5	Gambia, The	2008	29.7757	53.0412	1.68235	1180.74	30	25	57.5	73.9	62.6	50	-0.60061	6.25591	27.8833	4.44366	39.0891	25.4576
5	Gambia, The	2009	31.7342	52.4495	0.195135	1330.08	30	23	59.9	71.9	59.6	50	-0.55811	6.66572	28.7203	4.56151	41.7774	37.3132
5	Gambia, The	2010	35.1932	52.104	0.114525	1460.47	25	19	58.5	71.6	60.6	55	-0.59653	5.90834	30.2488	5.04968	41.0125	35.8958
5	Gambia, The	2011	27.2024	52.7697	2.37509	1025.98	30	29	57.8	71.4	60.4	55	-0.52464	-8.13044	35.0122	4.79588	42.6397	37.3688
5	Gambia, The	2012	27.3936	52.1991	6.62737	1075.35	30	32	56.3	71	60.5	60	-0.52161	5.24157	34.3647	4.25432	47.7007	40.4656
5	Gambia, The	2013	26.2221	51.8133	0.800657	1015.13	30	35	59.5	71.1	60.5	65	-0.61824	2.87277	36.1417	5.69913	45.4619	42.7669
5	Gambia, The	2014	22.4588	51.9305	46.4517	851.166	30	31.7	57.4	71.3	65	65	-0.65226	-1.40738	37.979	5.948	58.2579	45.9882
5	Gambia, The	2015	22.2089	51.7723	17.0305	858.635	25	28	55.7	70.8	65	65	-0.7622	4.05807		6.80845	52.9375	43.0252
5	Gambia, The	2016	21.8614	51.8768	12.0541	826.821	25	29	53.4	64.7	65	65	-0.77434	1.94336		7.22879	46.0214	38.5312
5	Gambia, The	2017	21.0019	50.8619	15.0308	767.208	39.1	38.2	52.8	63.8	65	75	-0.57242	4.82261	38.284	8.03419	53.3191	47.0615
5	Gambia, The	2018	19.8716	49.6068	0.246749	772.483	34.4	36.8	54.2	63.2	64.7	75	-0.57704	7.23489	39.4721	6.52097	63.1091	44.0726
5	Gambia, The	2019	20.004	48.7056	35.4889	762.035	39.9	41.2	54	62.4	61.6	65	-0.55435	6.22205	44.42	7.11568	53.2697	44.9439
5	Gambia, The	2020	21.244	49.03	0.524684	831.915	43.9	39.2	53.5	63.3	64.6	65	-0.56909	0.591487	52.9394	5.93128	47.5004	51.0788
5	Gambia, The	2021	22.4187	48.5219	0.214007	916.548	41.8	35.2	56	63.2	66.6	65	-0.56394	4.26549	57.3144	7.37035	42.0928	52.9739
5	Gambia, The	2022	22.5503	48.5219	0.214007	924.812	47.6	38.1	50.5	64.1	63.8	65	-0.56394	4.92373	53.6005	11.5131	35.3377	52.9739
6	Ghana	2000	35.2715	53.1267	6.48889		50	33	55	71	61	50	0.003616	3.7	28.1662	40.2409	116.048	139.439
6	Ghana	2001	35.2418	53.56	5.25249		50	33	55	65.9	56	50	0.003616	4	31.4453	41.5095	110.046	131.769
6	Ghana	2002	35.1484	53.9247	5.25249		50	35	55	55.8	55.6	50	-0.22909	4.5	34.1082	9.36093	97.4892	126.56

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6	Ghana	2003	36.5454	54.2499	6.37765		50	34	70	55.8	62.6	50	-0.22015	5.2	31.0459	29.773	97.2871	111.163
6	Ghana	2004	37.9524	54.5206	3.36806		50	39	70	61.6	65.6	50	-0.28562	5.6	32.7226	18.0427	99.6703	83.3764
6	Ghana	2005	37.453	54.6734	5.178		50	33	70	58.8	66	50	-0.22551	5.9	32.11	15.439	98.1715	69.1079
6	Ghana	2006	28.3331	54.8965	2.7609	1401.6	50	36	50	64.5	55.4	50	-0.01007	6.39991	22.7693	11.6792	64.5191	18.2146
6	Ghana	2007	27.2941	51.8922	5.80608	1422.98	50	40	54.9	70.1	63	50	0.012682	4.34682	25.7168	10.7343	65.3543	17.4103
6	Ghana	2008	29.4081	48.6171	4.93166	1593.87	50	33	53.4	68	63	50	-0.07106	9.1498	27.4615	16.4946	69.5142	16.5201
6	Ghana	2009	30.9934	45.3977	2.37896	1791.37	50	37	56.7	69.6	63	50	-0.03569	4.84449	28.247	19.2469	71.5947	25.4685
6	Ghana	2010	28.0387	41.9954	2.58336	1995.44	50	39	56.8	65.9	65.3	65	-0.01774	7.89971	29.6192	10.7334	75.3778	26.4195
6	Ghana	2011	23.6637	42.9755	3.64626	1908.64	50	39	63.4	63.3	67.8	65	-0.01087	14.0471	30.549	8.72846	86.2955	27.3171
6	Ghana	2012	22.1312	44.2058	1.65998	1834.93	50	41	62.9	66.9	67.8	65	-0.02597	9.29279	30.3617	11.1863	93.168	30.613
6	Ghana	2013	20.3698	45.3795	2.49813	1838.99	50	39	61.5	64.8	67.8	70	-0.00436	7.31252	21.9528	11.6662	60.7593	26.387
6	Ghana	2014	19.5838	40.4218	2.15979	2088.14	50	40.4	62.6	65.8	64.8	70	-0.12262	2.85624	23.6425	15.4896	63.8366	34.3583
6	Ghana	2015	19.9827	35.1776	1.66541	2463.66	50	46	62.5	69.2	64.8	65	-0.10656	2.12076	25.6703	17.15	76.5213	41.9017
6	Ghana	2016	20.8443	38.7121	4.98355	2207.68	50	48	61.5	66.5	65	60	-0.15417	3.37347	26.2808	17.4546	67.877	39.5155
6	Ghana	2017	19.5617	42.0184	1.57962	2061.99	51.6	35.5	59.6	64.5	65.1	70	-0.10873	8.12889	25.4883	12.3719	70.5484	39.2109
6	Ghana	2018	18.1366	41.0319	1.38141	2152.31	48.9	32.9	59.5	63.7	65.1	70	-0.11872	6.20008	25.1274	7.80876	67.9585	36.6813
6	Ghana	2019	17.3232	40.2156	1.104	2249.28	49.1	35.5	56.5	66.3	63.4	70	-0.12129	6.50777	26.3917	7.14364	76.8248	41.3287
6	Ghana	2020	18.8538	39.9963	1.104	2363.05	52.5	32.2	58.4	68.9	63.8	70	-0.10996	0.513942	30.8173	9.88729	38.5169	45.0305
6	Ghana	2021	19.7088	39.4932	1.104	2514.1	49.3	32.3	62.9	71.7	62.4	70	-0.13421	5.35648	29.5799	9.97109	58.43	47.8356
6	Ghana	2022	18.7818	39.4932	1.104	2568.73	60.7	45.4	60.9	70.8	63	70	-0.13421	3.23971	29.4369	31.2559	52.5505	47.8356
7	Guinea	2000	20.9818	71.3391	2.43758	423.481	30	30	55	77.1	71	50	-1.03513	2.50306	11.6813		53.4817	105.218
7	Guinea	2001	21.7407	70.7685	0.173142	448.856	30	30	55	76.6	70.2	50	-1.03513	3.65835	12.4981		58.5969	106.188
7	Guinea	2002	21.6316	70.4504	0.627479	464.016	30	25	55	74.4	28	50	-0.9802	5.16461	14.1621		55.4482	108.463
7	Guinea	2003	20.78	68.851	0.627479	482.153	30	25	55	79.9	19	50	-0.94398	1.2486	16.0699		51.1421	99.1861
7	Guinea	2004	23.3142	68.6972	1.68147	493.627	30	25	55	82.5	52.2	30	-1.02702	2.34012	18.3897		50.4422	95.5265
7	Guinea	2005	22.2811	68.3922	1.96609	498.436	30	25	55	75.2	57.2	30	-1.14797	2.99727	18.6901	31.3733	69.8967	115.966
7	Guinea	2006	15.5846	68.4863	3.38345	508.62	30	25	43.8	70.4	47.8	30	-1.23886	1.1896	17.8969	34.6953	69.3863	75.5822
7	Guinea	2007	16.8197	67.5351	1.36304	514.001	30	30	40.9	57.5	59.6	30	-1.29565	6.81747	12.9342	18.1756	71.121	53.1517
7	Guinea	2008	15.98	67.1507	3.34043	529.622	30	19	45.9	54.3	59.6	40	-1.27339	4.13302	14.732	23.0656	64.1842	46.5353
7	Guinea	2009	16.3606	67.2238	3.34043	488.839	20	19	45.2	57.4	59.6	40	-1.20477	-1.12264	17.3686	4.68439	69.8154	49.3536

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7	Guinea	2010	17.4849	66.7123	3.34043	577.872	20	16	43.7	57.4	60	40	-1.2238	4.81336	26.4414	15.0503	73.5466	47.8923
7	Guinea	2011	16.0697	65.7013	3.34043	611.221	20	18	40.8	70.3	61.2	40	-1.18188	5.61211	27.1582	21.3169	85.9547	48.249
7	Guinea	2012	16.8317	65.0059	3.34043	632.374	20	20	38.5	67.1	61.2	45	-1.18473	5.91529	20.8563	15.2263	86.6743	17.8545
7	Guinea	2013	17.5453	64.2554	1.55683	670.334	20	21	46.1	62.8	61.2	45	-1.158	3.94569	21.8121	11.8876	80.4264	21.0955
7	Guinea	2014	17.5238	63.7244	1.90186	687.33	20	19.2	51.8	64.1	61.2	50	-1.18705	3.69655	23.3998	6.15051	76.772	21.7118
7	Guinea	2015	18.4782	62.9222	2.03969	737.328	15	24	51.6	66.7	61.2	40	-1.05106	3.82591	24.8648	11.7801	72.4427	23.6064
7	Guinea	2016	17.5899	61.7643	1.75798	766.238	20	25	51.4	69.2	61.2	45	-1.01815	10.8206	23.9664	8.17268	111.839	26.3169
7	Guinea	2017	20.5285	61.0538	1.75798	898.973	15.6	27.5	55.8	71.1	61.2	50	-1.04253	10.3	23.0186	8.91436	101.252	23.304
7	Guinea	2018	22.94	60.2945	1.75798	944.632	32.4	26.9	54.1	71.8	61.2	50	-1.01344	6.35849	22.2025	9.82762	88.9841	22.6645
7	Guinea	2019	26.4273	59.5987	1.75798	1089.71	34.7	25.5	54.6	66.4	63.2	50	-0.93515	5.61691	23.7124	9.47001	78.4153	23.5114
7	Guinea	2020	26.1379	59.7626	1.75798	1076.42	38.7	16.1	55.4	70.6	60.4	50	-1.0061	4.92027	26.5086	10.6016	115.037	32.3731
7	Guinea	2021	27.3199	59.1877	1.75798	1137.62	32.3	22	47.1	70.5	66.4	50	-1.00165	3.9	24.8653	12.5973	105.803	33.6083
7	Guinea	2022	27.3199	59.1877	1.75798	1155.26	21.4	25.6	45.4	69.7	66.4	50	-1.00165	4.7		10.493	107.478	33.6083
8	Guinea-Bissau	2000	41.7287	60.8965		1119.89	10	10	40	50.4	29.4	30	-1.06193	5.42699	24.8672	8.63632	54.8734	265.383
8	Guinea-Bissau	2001	37.508	60.1455		1133.17	10	10	40	70.9	64.8	30	-1.06193	2.18891	19.7396	3.34812	48.0176	240.527
8	Guinea-Bissau	2002	41.832	61.202		1100.7	10	10	40	74.6	61	30	-1.02342	-0.98518	24.6228	3.30012	41.1844	239.824
8	Guinea-Bissau	2003	42.3459	61.1605	1.1043	1124.47	10	10	40	77.2	61	50	-1.09826	0.56851	10.9372	-3.50259	43.2716	229.069
8	Guinea-Bissau	2004	41.9917	60.7242	0.10568	1119.51	10	10	40	77.7	56.4	50	-1.25216	2.7614	15.3203	0.883303	44.8451	214.233
8	Guinea-Bissau	2005	44.3583	60.3424	0.214107	1279.55	10	10	40	83	56.4	50	-1.23119	4.2661	16.4641	3.3292	41.3184	178.194
8	Guinea-Bissau	2006	42.2604	59.7793	0.214107	1259.57	10	10	27.2	89	57.8	50	-1.11579	2.30936	17.1776	1.95474	40.4492	179.008
8	Guinea-Bissau	2007	43.1757	59.4174	0.214107	1239.53	20	10	27.2	80.7	57.8	40	-1.19258	3.26296	20.1764	4.61744	54.1418	157.963
8	Guinea-Bissau	2008	46.6677	59.543	0.214107	1280.34	20	10	24.8	75.7	56.8	30	-1.21705	3.20357	22.5492	10.4601	52.642	129.103
8	Guinea-Bissau	2009	43.9999	58.722	0.214107	1320.11	20	22	24.2	73.5	66.8	30	-1.20273	3.36897	23.9813	-1.6514	54.0719	138.097
8	Guinea-Bissau	2010	45.088	58.2824	0.214107	1328	20	19	23.4	67	58.2	30	-1.17319	4.61097	26.6158	2.51785	50.1304	129.6
8	Guinea-Bissau	2011	45.0225	57.0162	0.214107	1417.58	20	19	25.5	72.2	63.6	30	-1.17748	8.08478	31.4253	5.0461	56.621	25.2868
8	Guinea-Bissau	2012	46.8925	57.7428	0.214107	1370.75	20	21	40.5	75.9	65.3	35	-1.33923	-1.71268	30.5091	2.13055	41.173	27.9513
8	Guinea-Bissau	2013	44.1356	56.9927	0.214107	1410.51	20	22	41.3	72.7	65.3	35	-1.42489	3.2559	31.3149	1.20713	44.0804	28.4321
8	Guinea-Bissau	2014	41.1323	56.4514	0.214107	1271.49	20	20.2	40.5	74.4	61.4	30	-1.43807	0.964561	46.2134	-1.50924	51.593	30.1814
8	Guinea-Bissau	2015	46.7881	56.4862	0.214107	1319.71	20	19	39.5	77.5	65.4	30	-1.40517	6.13408	49.404	1.47672	59.7815	36.8698
8	Guinea-Bissau	2016	46.3484	55.5448	0.214107	1382.76	20	19	36.7	78.5	59.4	30	-1.50141	6.26281	47.913	1.50312	57.8122	32.0566

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8	Guinea-Bissau	2017	49.1578	55.21	0.214107	1408.76	33.8	28.7	46.7	77.7	65.2	30	-1.50876	5.91918	43.9022	1.69111	60.847	36.935
8	Guinea-Bissau	2018	30.7237	51.8791	0.214107	1391.34	31.1	27.3	47.8	77.4	65.2	30	-1.38367	1.28374	43.6775	0.381325	56.0181	40.8469
8	Guinea-Bissau	2019	30.3966	51.0249	0.214107	1446	32.6	25.3	35.9	78.1	55.6	30	-1.39245	4.5	43.3853	0.2466	55.3726	47.0551
8	Guinea-Bissau	2020	30.8632	50.927	0.214107	1466.68	41.3	14.8	39.1	82.7	49	30	-1.35922	-2.4	48.4444	1.14001	43.6358	62.9545
8	Guinea-Bissau	2021	30.8632	50.3384	0.214107	1499.8	39.5	20.2	37.9	86.7	55.8	30	-1.35507	3.8	53.119	2.24249	43.6358	67.7678
8	Guinea-Bissau	2022	30.8632	50.3384	0.214107	1552.34	29.1	15.9	31.5	83.4	55.8	30	-1.35507	3.50005	49.0221	9.39384	43.6358	67.7678
9	Liberia	2000	76.0745	50.682	1.80968	1011.12							-1.62664		7.05417		70.31339	367.108
9	Liberia	2001	76.5336	51.5857	1.6824	1036.78							-1.62664	2.92027	6.45712		65.39155	405.066
9	Liberia	2002	79.0424	51.2444	1.6867	997.646							-1.45057	3.76302	5.21006	14.1596	73.13628	431.582
9	Liberia	2003	72.2404	54.1093	1.68917	675.342							-1.43629	-30.1451	7.35163	10.3303	71.92067	610.452
9	Liberia	2004	65.0474	53.1704	1.64142	577.273							-1.54294	2.61985	9.66068	7.82909	290.4993	528.6
9	Liberia	2005	66.0327	51.9336	1.55491	578.744							-1.38472	5.28121	11.7717	10.8344	270.3636	497.93
9	Liberia	2006	63.818	50.7651	1.506	579.335							-1.04388	8.04391	13.2211	7.34145	277.1386	433.484
9	Liberia	2007	65.5982	49.6652	1.51514	602.511							-0.91828	9.53528	13.4399	11.3919	311.3541	309.974
9	Liberia	2008	65.1746	48.9319	1.39874	649.361							-1.10147	7.14569	14.7209	17.4894	179.121	201.789
9	Liberia	2009	58.0357	48.4201	1.37512	1230.34	25	21	40.2	70.1	53.8	30	-1.00217	5.30054	18.0591	7.42764	110.2117	113.976
9	Liberia	2010	44.8	47.3061	1.55711	1263.98	25	24	52.8	65.4	53.8	20	-0.96254	6.09983	20.5225	7.28993	111.7738	23.0315
9	Liberia	2011	44.3005	46.0022	1.67825	1282.8	30	31	51.8	69.5	53.8	20	-0.98532	8.20077	22.2528	8.48817	116.2676	19.7277
9	Liberia	2012	46.7127	44.356	1.57302	1293.09	30	33	55.9	71.8	53.8	20	-0.92813	7.99381	19.5362	6.83179	122.1665	19.2578
9	Liberia	2013	39.53	42.6072	1.51995	1352.03	30	32	56.5	72	61.4	20	-0.97412	8.68729	21.0523	7.57731	130.9931	18.4573
9	Liberia	2014	36.4991	42.0647	1.45739	1310.61	30	33.8	62.3	72.9	64.1	40	-0.95227	0.701393	19.0869	9.86111	136.9687	23.5589
9	Liberia	2015	34.4038	41.3415	1.47137	1329.41	25	38	60.1	72.7	74.4	40	-0.93215	-0.01857	20.7403	7.7487	126.0177	28.4158
9	Liberia	2016	35.9187	41.6494	1.48007	1380.56	25	37	55.1	71	72.8	45	-0.98248	-1.55496	18.0935	8.83425	121.6764	30.4846
9	Liberia	2017	35.9426	40.6169	1.45741	1424.45	33.6	31.4	53.1	71.8	60.1	50	-0.98263	2.45516	20.064	12.4196	122.9899	36.2107
9	Liberia	2018	35.4967	40.1958	1.43262	1428.99	28.2	32	53.1	71.4	72.8	55	-1.03031	1.15758	20.4788	23.5635	120.3431	38.7699
9	Liberia	2019	36.4372	40.7148	1.35093	1397.08	26.7	24.2	50.6	68.9	60.1	55	-1.06248	-2.4673	19.5527	23.5635	127.4523	42.7115
9	Liberia	2020	41.052	41.2286	1.36344	1418.12	31.1	23.8	48.2	62.1	60.6	55	-1.08927	-2.98249	21.8644	23.5635	123.1463	50.4652
9	Liberia	2021	36.9621	40.6454	1.41038	1406.08	29.5	27	48.9	58.5	60.8	55	-1.04229	4.98671		23.5635		56.3805
9	Liberia	2022	36.1905	40.6454	1.28346	1470.06	32.2	25.1	34.8	61.7	60.8	55	-1.04229	4.80811		23.5635		56.3805
10	Mali	2000	32.9019	67.0329	36.0703	849.297	50	10	70	83.7	65	70	-0.62695	-0.06084	19.42	-0.67766	55.4226	101.7

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10	Mali	2001	32.8136	65.3014	13.8804	931.391	50	10	70	87.6	61	70	-0.62695	15.3762	19.3569	5.18701	60.2008	87.1571
10	Mali	2002	32.7142	65.1003	18.1152	872.617	50	10	70	86	61	70	-0.56637	3.10631	22.7874	5.03282	57.8293	75.6599
10	Mali	2003	29.8766	63.7357	34.8216	980.748	50	10	70	83.7	61	50	-0.50758	9.11904	27.4793	-1.34673	58.6281	67.1706
10	Mali	2004	30.0155	63.9749	35.9355	930.426	50	10	70	81.5	66.2	50	-0.55073	1.56	25.1777	-3.09978	55.3116	62.0801
10	Mali	2005	32.3785	63.7416	24.4722	995.092	30	30	70	84.2	62.2	50	-0.48145	6.53478	24.5682	6.39788	54.1253	52.6366
10	Mali	2006	29.7905	63.5076	16.6914	1018.7	30	32	35.3	81.2	63.8	50	-0.49782	4.66219	24.6376	1.54353	60.9767	23.8952
10	Mali	2007	31.3529	65.0734	13.8318	987.549	30	29	38.1	78.4	68.6	50	-0.44125	3.49362	22.4841	1.412	56.6497	23.3495
10	Mali	2008	32.9703	66.4336	10.6359	1040.92	30	28	42.1	79.9	68.6	50	-0.5182	4.77315	17.3938	9.17099	63.476	21.4148
10	Mali	2009	31.7357	67.9004	10.6359	1013.68	30	27	42.2	79.6	73	50	-0.56378	4.80632	22.543	2.46375	50.5192	22.475
10	Mali	2010	33.0168	68.9814	8.74666	1049.76	35	31	47.5	73.8	69.6	50	-0.61522	5.31394	23.8599	1.10893	57.9853	23.7465
10	Mali	2011	34.5586	70.2495	9.37879	967.342	30	28	51.2	77.6	73.2	50	-0.58876	3.21313	23.2687	2.95564	53.9136	23.1987
10	Mali	2012	38.1141	72.3422	15.775	1005.86	30	27	50.8	80.7	73.2	50	-0.72676	-0.83674	25.9058	5.32313	59.1206	25.6248
10	Mali	2013	36.7528	73.4953	15.775	934.241	30	28	50.1	79.9	73.2	45	-0.73941	2.29507	27.2228	-0.60674	64.8177	27.1964
10	Mali	2014	37.4568	66.7015	15.775	1099.29	20	27.7	48	76.7	73.2	55	-0.77706	7.08468	26.5574	0.883815	60.6387	25.1908
10	Mali	2015	37.7233	62.2659	15.775	1214.72	25	28	47.2	81.1	73.2	60	-0.73874	6.1718	26.8393	1.45069	63.6396	29.2532
10	Mali	2016	37.4037	64.9027	10.0342	1224.94	25	32	46.3	83	70.2	65	-0.76619	5.8523	27.7054	-1.79965	63.7633	28.1858
10	Mali	2017	37.4324	63.1261	7.85776	1295.31	36.7	34.3	44.2	83	70.1	65	-0.74031	5.30546	26.927	1.75986	58.0684	29.1041
10	Mali	2018	37.6124	63.0029	13.3171	1347.53	31.9	31.4	52.8	81.9	68.7	65	-0.76883	4.74648	28.5064	0.299547	60.1448	27.8021
10	Mali	2019	37.3078	65.6699	11.9514	1328	33.7	29.6	53.8	81.6	69.8	65	-0.80386	4.75616	27.8623	-1.65827	63.6587	30.2035
10	Mali	2020	36.188	68.0618	11.9514	1217.78	35.1	20.7	49.2	81.6	65	65	-0.88551	-1.23545	31.502	0.438089	66.9906	34.878
10	Mali	2021	35.6818	67.7325	11.9514	1173.47	34.5	23.6	46.5	83.7	64	65	-0.90347	3.05261	40.3445	3.9256	67.2099	34.7747
10	Mali	2022	36.4213	67.7325	11.9514	1161.67	34	28.3	44.2	82.8	64	65	-0.90347	3.68748	40.7292	3.9256	68.8282	34.7747
11	Niger	2000	36.5756	78.684	3.28358	364.288	30	10	55	72.1	48	30	-0.90807	-1.20848	6.559	2.90015	34.7128	73.6637
11	Niger	2001	40.1819	78.6617	3.4571	398.278	30	10	55	87.4	61	30	-0.90807	7.26814	8.65316	4.00551	33.0137	63.7523
11	Niger	2002	41.3669	78.5869	3.64156	416.192	30	10	55	81.6	61	30	-0.81587	4.91847	6.55624	2.62887	30.8344	63.2241
11	Niger	2003	41.1955	78.7214	3.33792	425.568	30	10	55	78.7	61	50	-0.70802	2.17061	9.29998	-1.61441	33.3828	60.466
11	Niger	2004	37.3717	78.8078	3.69803	383.078	30	10	55	79.1	58.6	50	-0.74884	0.363802	10.05	0.262544	36.9641	49.487
11	Niger	2005	39.2805	78.4844	4.31161	423.64	30	10	55	88.3	56.8	50	-0.66262	7.33187	9.03432	7.7975	38.3477	42.1241
11	Niger	2006	39.7451	78.187	4.54841	451.123	30	22	28.8	87.9	57.6	50	-0.70899	5.93105	9.38447	0.040486	36.5314	15.0561
11	Niger	2007	37.0945	78.0804	3.98485	454.963	30	24	38.4	80.6	62.4	50	-0.68395	3.14272	12.4276	0.053959	35.5028	17.9747

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11	Niger	2008	38.775	77.7856	2.97604	509.368	30	23	36.2	86	64.4	50	-0.65351	7.73141	11.4575	11.3051	39.7112	12.3262
11	Niger	2009	34.7848	77.6072	1.82992	445.555	30	26	36.9	89.5	70.4	50	-0.5838	1.9626	13.0169	0.582907	49.5123	16.1011
11	Niger	2010	35.8214	77.1924	2.3591	495.713	30	28	37.2	77.6	75.7	50	-0.60696	8.57817	14.2058	0.804073	51.946	18.5157
11	Niger	2011	33.6468	77.0607	2.31789	463.615	30	29	36.9	80	71.8	55	-0.5707	2.35776	14.2615	2.94239	50.2464	23.7263
11	Niger	2012	33.681	74.5476	2.93633	552.223	30	26	35.9	86.4	71.7	55	-0.65506	10.5489	16.1357	0.45509	45.086	18.3017
11	Niger	2013	32.235	74.0483	1.56303	542.456	30	25	35.2	85.4	71.7	55	-0.65083	5.31513	16.8764	2.29723	46.2952	18.6548
11	Niger	2014	33.429	73.4244	1.44767	581.136	30	26	35.2	88.3	65.6	55	-0.70136	6.64214	19.8483	-0.93029	45.7416	17.6429
11	Niger	2015	32.417	73.0475	1.46363	573.281	30	34	39.2	81.3	65.6	55	-0.6698	4.39265	19.4475	-0.57609	44.7274	21.9308
11	Niger	2016	35.263	72.7329	1.0735	649.029	30	35	39.6	83	64.6	55	-0.67371	5.74089	19.6343	1.65389	36.4881	23.5217
11	Niger	2017	35.8169	72.4056	0.90821	661.566	33.8	35	39.1	83.3	66.4	55	-0.69949	5.00136	17.713	2.79637	39.5593	26.2911
11	Niger	2018	37.6617	71.87	0.601359	691.888	37.4	30.4	45.5	83.5	61.5	55	-0.65721	7.2108	15.8296	2.9676	38.1341	23.7998
11	Niger	2019	36.9149	71.3102	0.727896	693.592	37.2	34.1	56.3	76.7	65.8	55	-0.64782	5.9414	17.122	-2.48979	37.7144	26.6951
11	Niger	2020	38.3769	71.1387	0.150468	726.816	45.6	33.4	55.4	74.8	61.2	55	-0.64773	3.55023	19.1664	2.89819	36.0619	34.7163
11	Niger	2021	36.481	70.716	0.406599	668.322	38.8	31.8	52.5	75.3	61	55	-0.57789	1.38713	20.116	3.83787	37.5111	32.817
11	Niger	2022	36.481	70.716	0.83261	863.09	37.4	32.5	35.2	74.6	62.6	55	-0.57789	11.5	21.3701	4.22622	38.7637	32.817
12	Nigeria	2000	21.3572	49.2726	0.005946	1548.28	30	19	55	73.5	45	70	-1.08287	5.01593	14.6696	6.93329	48.9956	52.9445
12	Nigeria	2001	24.4754	48.565	0.006176	1590.53	30	16	55	78.9	27	50	-1.08287	5.91768	15.901	18.8736	49.6805	48.2576
12	Nigeria	2002	36.9651	47.9255	0.281333	2447.48	30	12	55	77.1	45	50	-1.29911	15.3292	13.527	12.8766	40.0352	40.302
12	Nigeria	2003	33.8271	46.8777	0.009263	2604.74	30	10	55	65.4	45	50	-1.27057	7.3472	13.0266	14.0318	49.335	42.2765
12	Nigeria	2004	27.2305	45.5552	0.009263	2777.07	30	16	55	66.3	45	50	-1.26414	9.25056	11.7588	14.998	31.8959	35.2174
12	Nigeria	2005	26.0893	44.8723	0.009263	2944.44	30	14	55	66.2	53.4	30	-1.05732	6.43852	11.3005	17.8635	33.0595	17.8778
12	Nigeria	2006	24.735	44.1769	0.361642	3130.85	30	16	50	65.8	51.2	30	-1.03038	6.05943	11.729	8.22522	42.5666	5.60002
12	Nigeria	2007	24.6626	43.5011	0.76228	3334.01	30	19	58.6	69.1	61.6	30	-1.01557	6.59113	19.2911	5.38801	39.3369	5.87189
12	Nigeria	2008	25.2798	42.8557	0.928697	3502.46	30	22	52.9	73.8	63.4	30	-0.93752	6.76447	23.8119	11.5811	40.7968	5.08084
12	Nigeria	2009	26.7489	42.1673	1.13722	3679.03	30	22	55.1	77.9	61.8	30	-1.04075	8.03693	25.1442	12.5378	36.0587	6.88061
12	Nigeria	2010	23.8937	41.3431	1.63181	3860.23	30	27	53.2	75.4	67.2	40	-1.03082	8.00566	21.3558	13.7401	43.3208	5.50267
12	Nigeria	2011	22.2347	40.5818	6.12951	3940.4	30	25	51.6	73.5	65	40	-1.0435	5.30792	22.479	10.8261	53.278	5.491
12	Nigeria	2012	21.86	39.4639	7.26834	4224.04	30	24	55.6	72	63.9	40	-1.01016	4.23006	24.9282	12.2242	44.5324	4.95082
12	Nigeria	2013	20.7586	38.2707	3.20508	4381.81	30	24	55.7	73.3	63.9	40	-1.00702	6.67134	25.448	8.49552	31.0489	5.06375
12	Nigeria	2014	19.9903	37.523	0.434799	4501.02	30	22.7	48	73.1	63.8	40	-1.09182	6.30972	22.6896	8.04741	30.8852	5.41766

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12	Nigeria	2015	20.6319	37.0064	0.309646	4580.74	30	25	48.3	70.4	63.8	40	-0.96907	2.65269	22.3668	9.00943	21.3327	6.83832
12	Nigeria	2016	20.9831	36.6759	0.16018	4642.83	30	27	48.7	71.5	64.8	40	-1.01854	-1.61687	27.3788	15.6968	20.7225	9.02075
12	Nigeria	2017	20.8466	36.2975	0.232204	4669.29	35.3	12.2	48.9	71.3	62.3	40	-0.96853	0.805887	24.7814	16.5023	26.3476	12.5682
12	Nigeria	2018	21.2038	35.9185	0.133974	4648.36	38	14.4	49.3	66.9	65.5	45	-0.98241	1.92276	25.3625	12.0951	33.0078	14.3065
12	Nigeria	2019	21.9063	35.519	0.114395	4645.89	36.5	20.5	51.2	65	62.4	45	-1.02793	2.20843	23.9296	11.3964	34.0239	13.8519
12	Nigeria	2020	24.1433	35.7592	0.155382	4657.92	38.1	22.3	54.7	61.7	62.4	45	-1.00851	-1.79425	25.2216	13.246	16.3522	16.9317
12	Nigeria	2021	23.3571	35.2051	0.264813	4613.4	36.8	23.5	60	68	68.4	45	-0.96361	3.64719	24.8862	16.9528	22.5765	17.9824
12	Nigeria	2022	23.6919	35.2051	0.264813	4540.77	22.1	22.7	41.2	67.5	68.6	45	-0.96361	3.25168		18.8472	22.5765	17.9824
13	Senegal	2000	16.4392	49.2818	1.74668	1431.19	50	33	55	77.4	65	50	-0.09378	3.88721	18.5017	0.731982	48.6801	61.6895
13	Senegal	2001	16.2524	48.4937	2.32972	1443.31	50	34	55	78.8	61	50	-0.09378	4.31085	15.148	2.9745	49.7206	57.5583
13	Senegal	2002	13.3808	46.9777	3.33403	1120.67	50	35	55	79.4	61	50	0.00504	0.068697	15.939	2.3373	53.1443	59.6555
13	Senegal	2003	15.4911	45.2907	3.44859	1355.07	50	29	55	80.4	61	50	-0.2242	5.59395	20.2692	-0.052	50.8212	50.6997
13	Senegal	2004	14.2018	43.2949	2.7749	1442.36	50	31	55	80.4	68	50	-0.15674	4.64329	22.2624	0.514782	53.6592	39.456
13	Senegal	2005	15.1804	41.6457	2.10516	1648.7	50	32	55	84.3	68.2	50	-0.13538	4.31024	22.2803	1.71133	54.9032	35.3658
13	Senegal	2006	13.3952	39.8434	5.15485	1550.69	50	30	55.1	90.4	66.6	50	-0.33271	2.33077	23.7554	2.11229	54.1362	16.6447
13	Senegal	2007	12.2459	39.3519	2.91533	1433.92	50	32	56.4	82.9	71.6	50	-0.4123	2.82712	24.4766	5.8533	59.2713	18.5756
13	Senegal	2008	14.6866	39.1139	1.55414	1729.61	50	33	55.5	81.4	71.6	50	-0.33578	3.70317	23.8672	7.3472	62.7618	16.9639
13	Senegal	2009	16.1077	38.861	0.996837	1957.76	50	36	65	76.5	71.2	40	-0.43399	2.7521	26.7484	-2.24802	52.3073	23.2913
13	Senegal	2010	15.9453	38.1884	1.33906	2054.41	45	34	63.1	75.2	69.7	35	-0.48804	3.39089	28.3707	1.22868	52.4579	29.1136
13	Senegal	2011	12.9471	37.3075	1.4349	1742.37	40	30	62.3	79.7	73.2	45	-0.42572	1.33409	28.9786	3.40323	57.5769	33.11
13	Senegal	2012	14.0977	36.1515	1.73307	1924.08	40	29	58.4	81.6	72.2	45	-0.28176	4.003	28.6514	1.41823	61.9753	40.9474
13	Senegal	2013	13.7249	34.8647	2.39024	1982.2	40	29	56.7	79.6	72.2	55	-0.23163	2.41239	29.8713	0.710245	60.6268	43.9931
13	Senegal	2014	13.3688	32.9477	2.28555	2068.23	40	29.5	47.5	81.8	73.2	60	-0.17166	6.22407	31.729	-1.09026	58.4425	55.4462
13	Senegal	2015	14.2726	31.2613	1.93211	2345.86	40	41	54.6	83	74	60	-0.18547	6.36704	35.2898	0.135212	58.1103	60.5264
13	Senegal	2016	14.414	34.3121	1.9456	1936.59	40	43	49.1	84.9	73.8	60	-0.19568	6.35607	37.3775	0.837285	54.1082	61.8393
13	Senegal	2017	14.982	28.1036	1.8059	2774.3	44	42.1	50.8	86	73.1	60	-0.18949	7.40749	37.7934	1.31815	57.7053	69.8012
13	Senegal	2018	14.9875	22.245	1.82892	3409.56	41.3	42.6	51.5	84.7	66.7	60	-0.16861	6.20924	40.9628	0.460986	61.7898	84.3058
13	Senegal	2019	14.8963	22.9897	1.07929	3218.29	47.8	40.3	53.3	78.2	72	60	-0.11493	4.61363	41.5089	1.76011	64.2363	84.442
13	Senegal	2020	16.1488	22.59	1.37291	3552.07	52.4	40.6	50.4	79.7	65.4	60	-0.14846	1.34207	45.2872	2.54315	60.0469	97.4294
13	Senegal	2021	15.4687	21.6117	1.23142	3546.1	50.3	43.6	53.5	79	66.4	60	-0.13971	6.53967	48.242	2.18032	69.1248	106.988

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13	Senegal	2022	15.7434	21.6117	1.23142	3570.51	58	47.8	57.9	76.1	65.8	60	-0.13971	4.15386	51.9216	9.69682	80.6477	106.988
14	Sierra Leone	2000	55.0142	69.2194	0.735356	1318.12	30	10	55	50.7	48.4	30	-1.30099	6.65273	16.3575		57.53	202.624
14	Sierra Leone	2001	45.791	69.65	0.735356	771.061							-1.30099	-6.34546	13.375		35.9382	118.193
14	Sierra Leone	2002	46.8537	67.4319	0.788398	996.139							-1.27763	26.5241	14.205		38.9169	115.132
14	Sierra Leone	2003	46.9023	66.6406	0.788398	1057.54	10	10	40	81.9	31.8	30	-1.15638	9.48363	13.986		46.4464	115.966
14	Sierra Leone	2004	49.1071	68.4618	0.788398	1052.09	10	10	40	86.6	43	30	-1.06526	6.47885	13.9877		46.172	118.844
14	Sierra Leone	2005	50.1029	68.4632	0.788398	1118.88	10	22	40	81.7	53.2	30	-1.17295	4.3535	15.0743		47.548	111.914
14	Sierra Leone	2006	50.9152	68.3636	0.788398	1185.6	10	23	50.8	74	58.4	30	-1.0668	4.28311	15.6332		42.4304	82.7285
14	Sierra Leone	2007	52.9566	67.5213	0.788398	1348.59	10	24	50.5	72.9	55.2	30	-1.04122	7.97657	15.9054	11.65	40.8982	24.3369
14	Sierra Leone	2008	54.0905	66.8061	0.788398	1440.62	10	22	49.5	74.4	60.2	30	-1.01586	5.43589	17.4784	8.21112	40.0701	23.4693
14	Sierra Leone	2009	56.0578	66.4005	0.788398	1493.36	10	21	57	73.8	66	30	-0.96588	3.20943	20.9884	7.46902	42.0341	32.1524
14	Sierra Leone	2010	52.9399	65.2157	0.788398	1552.97	10	19	54.6	71.7	62.8	40	-0.92596	6.63749	20.8084	7.18566	51.2749	35.7238
14	Sierra Leone	2011	54.7847	64.0886	0.788398	1634.46	10	22	54.9	74.2	62.8	45	-0.91259	6.00983	21.6926	6.79138	72.3496	36.2041
14	Sierra Leone	2012	50.7605	61.678	0.788398	1720.99	10	24	51.8	70.1	62.8	45	-0.9406	15.2017	20.5012	6.58776	85.5116	34.0282
14	Sierra Leone	2013	47.9833	59.1561	0.788398	1828.21	10	25	51.5	68.5	70.2	55	-0.93114	21.079	17.5206	5.52413	87.4528	28.604
14	Sierra Leone	2014	51.7923	57.6493	0.018816	1867.69	15	24.6	55.3	70.2	70.2	55	-0.98984	4.55925	20.3978	4.63931	83.1854	29.2726
14	Sierra Leone	2015	58.7561	56.9692	0.731767	1960.01	10	30	53.4	68.5	70.2	55	-0.95557	-20.4911	23.9642	6.68944	66.2794	37.4399
14	Sierra Leone	2016	57.7467	52.8638	1.22169	2128.27	10	31	49.9	70.8	69.4	55	-0.93425	6.34673	25.0908	10.8861	75.5523	49.6538
14	Sierra Leone	2017	60.6099	49.1709	14.0415	2319.33	37.4	18.9	49.6	71.1	69.4	60	-0.87147	3.7538	23.7469	18.2215	74.4863	48.2935
14	Sierra Leone	2018	58.9344	46.1947	9.43289	2502.24	33.6	22	51.3	69.5	69.4	60	-0.83285	3.4729	23.0385	16.0295	56.6958	46.2612
14	Sierra Leone	2019	58.1545	44.479	9.43289	2642.47	35.5	26.2	44.9	65	69.4	60	-0.8166	5.25375	23.2312	14.805	56.1906	46.1054
14	Sierra Leone	2020	59.4874	43.6498	9.43289	2656.76	40.7	21.8	50.1	64.2	69.4	60	-0.76417	-1.96849	29.523	13.4469	51.5579	52.9256
14	Sierra Leone	2021	57.4488	42.7139	9.43289	2682.09	42.3	30.5	49.6	65.1	64.6	60	-0.83232	4.1047	32.4418	11.874	58.3908	60.4552
14	Sierra Leone	2022	57.4488	42.7139	9.43289	2687.53	43.1	32.4	34.4	65.1	63.6	60	-0.83232	3.50074		27.2083	58.3908	60.4552
15	Togo	2000	26.8619	56.811	23.4417	785.752	30	10	40	73.8	63	30	-0.82183	-0.78348	17.1224	1.86261	50.5298	98.8465
15	Togo	2001	29.8222	56.4126	11.1693	810.524	30	10	40	78.9	61	30	-0.82183	0.823439	15.1949	3.91959	53.427	97.9243
15	Togo	2002	29.1408	56.058	16.2767	798.627	30	10	40	82.7	61	30	-0.8932	3.82662	13.5602	3.05982	53.6285	95.0702
15	Togo	2003	24.9436	54.6387	16.9034	779.936	30	10	40	78.9	61	30	-0.95774	6.72017	14.8207	-0.93	57.5588	82.7749
15	Togo	2004	27.3455	54.1797	15.627	789.825	30	10	40	78.7	59.8	30	-1.07412	-0.97867	18.108	0.393079	60.1336	82.571
15	Togo	2005	32.1254	54.7424	8.92098	846.994	30	10	40	85.8	62	30	-1.05995	-4.6663	18.4071	6.78293	63.856	75.1001

c_id	Country	Year	agpf1	agpf2	agpf3	agpf4	prt	gint	bfr	mfr	tfr	ifr	inst	gdpg	bm	inf	topn	exdt
15	Togo	2006	29.5706	53.7471	8.92098	792.925	30	10	37.3	86.5	57	30	-1.10377	2.65013	22.3277	2.22898	64.0258	77.5572
15	Togo	2007	25.6121	50.758	9.29988	826.75	30	30	37.5	76.5	68.4	30	-1.10934	-1.17512	23.8063	0.945673	63.1977	74.7326
15	Togo	2008	34.1927	48.0144	6.60661	819.629	30	24	36.4	78.2	69.2	30	-1.06831	4.06225	25.5593	8.69483	62.2912	49.5311
15	Togo	2009	27.1853	43.5413	3.3804	981.602	30	23	36.6	81.5	70.6	30	-1.04253	5.53791	27.2739	3.71361	63.1094	51.2821
15	Togo	2010	25.2602	39.9271	3.87964	1080.39	30	27	36.8	74.5	62.8	25	-1.04549	6.09926	29.3082	1.44595	67.1147	37.5545
15	Togo	2011	26.2585	37.0462	7.59155	1120.9	30	28	36.8	78.1	62.2	25	-1.07993	6.3982	31.9595	3.56351	79.5533	15.2163
15	Togo	2012	37.3761	37.072	9.42562	1175.82	30	24	34.8	78.3	61.7	25	-1.02868	6.54351	32.4799	2.57718	76.8336	19.3191
15	Togo	2013	32.9734	36.8663	7.79113	1087.27	30	24	39.9	78.5	56.7	35	-1.06364	6.11234	35.1904	1.82539	82.9783	21.2937
15	Togo	2014	22.5755	36.691	9.06429	1225.88	30	23.8	43.3	79.3	62.8	35	-0.96863	5.92059	34.4558	0.190875	71.7219	22.1253
15	Togo	2015	21.4233	36.424	10.8086	1195.45	30	29	51.9	80.4	67.8	50	-0.89552	5.74287	38.0318	2.585	68.9221	25.3927
15	Togo	2016	20.758	35.2076	9.47171	1253.05	30	29	51.4	79.5	71.2	50	-0.81097	5.55908	40.1669	1.28545	66.8806	20.0489
15	Togo	2017	20.6386	33.7923	9.48292	1370.55	33.8	36.8	50.3	77.5	71.3	60	-0.84803	4.34775	42.5109	-0.98189	58.1356	25.7977
15	Togo	2018	19.6496	32.7691	11.7863	1440.17	32.7	31.4	49.7	78.5	67.2	65	-0.77369	5.13847	44.2081	0.927755	57.956	24.1882
15	Togo	2019	19.5147	31.8253	12.6147	1527.08	35.5	28.1	50.4	79.1	69.4	65	-0.74055	4.92293	44.0378	0.674653	56.7305	27.7938
15	Togo	2020	18.895	31.5183	8.63382	1557.22	41.6	31.2	55	79.5	63.2	65	-0.67591	1.97574	47.3358	1.69928	56.2102	33.3873
15	Togo	2021	18.5421	30.8987	8.12959	1578.15	44.5	32.2	60.6	79.7	65.4	60	-0.62696	5.99157	48.9131	4.18621	55.2131	41.1005
15	Togo	2022	18.3225	30.8987	4.40908	1628.54	36.8	28.8	51.5	77.3	65.6	60	-0.62696	5.81054	51.4462	7.96757	59.8127	41.1005

Source: Index of Economic Freedom, World Development Indicators, and World Governance Indicators (2023).

Appendix II

Unit toot test results

Panel unit root test: Summary
Series: AGPF1
Date: 08/20/24 Time: 10:11
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 2
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	2.87673	0.9980	15	300
Breitung t-stat	-1.39794	0.0811	15	285
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.93650	0.8255	15	300
ADF - Fisher Chi-square	17.7019	0.9632	15	300
PP - Fisher Chi-square	50.9070	0.0100	15	330

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: D(AGPF1)
Date: 08/20/24 Time: 10:12
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 2
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2.22340	0.0131	15	285
Breitung t-stat	-4.72388	0.0000	15	270
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-5.65684	0.0000	15	285
ADF - Fisher Chi-square	80.2758	0.0000	15	285
PP - Fisher Chi-square	489.386	0.0000	15	315

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: AGPF2
Date: 08/20/24 Time: 12:05
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 4
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	0.26718	0.6053	15	315
Breitung t-stat	4.31311	1.0000	15	300
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.34604	0.6353	15	315
ADF - Fisher Chi-square	24.7992	0.7347	15	315
PP - Fisher Chi-square	14.0506	0.9941	15	330

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: D(AGPF2)
Date: 08/20/24 Time: 12:07
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 2
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-7.44848	0.0000	15	310
Breitung t-stat	-3.88905	0.0001	15	295
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-5.83113	0.0000	15	310
ADF - Fisher Chi-square	89.7224	0.0000	15	310
PP - Fisher Chi-square	94.4440	0.0000	15	315

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: AGPF3
Date: 08/20/24 Time: 12:09
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 6
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	6.55656	1.0000	13	208
Breitung t-stat	-1.97112	0.0244	13	195
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0.47419	0.3177	13	208
ADF - Fisher Chi-square	19.4696	0.8160	13	208
PP - Fisher Chi-square	63.9982	0.0000	13	286

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: D(AGPF3)
Date: 08/20/24 Time: 12:11
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 4
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-15.7409	0.0000	14	279
Breitung t-stat	-6.93917	0.0000	14	265
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-13.8182	0.0000	14	279
ADF - Fisher Chi-square	186.931	0.0000	14	279
PP - Fisher Chi-square	505.292	0.0000	14	291

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: PRT
Date: 08/20/24 Time: 12:13
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 4
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	3.27246	0.9995	15	295
Breitung t-stat	4.11643	1.0000	15	280
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0.72382	0.2346	15	295
ADF - Fisher Chi-square	63.9871	0.0003	15	295
PP - Fisher Chi-square	51.9450	0.0077	15	318

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: D(PRT)
Date: 08/20/24 Time: 12:14
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 4
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-4.80214	0.0000	15	280
Breitung t-stat	-4.44100	0.0000	15	265
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-11.8914	0.0000	15	280
ADF - Fisher Chi-square	203.944	0.0000	15	280
PP - Fisher Chi-square	459.141	0.0000	15	303

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: GINT
Date: 08/20/24 Time: 12:17
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 2
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	0.42179	0.6634	15	288
Breitung t-stat	-0.47985	0.3157	15	273
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0.77187	0.2201	15	288
ADF - Fisher Chi-square	27.5792	0.5927	15	288
PP - Fisher Chi-square	53.5597	0.0051	15	318

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: D(GINT)
Date: 08/20/24 Time: 12:18
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 4
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-10.5749	0.0000	15	291
Breitung t-stat	-4.99687	0.0000	15	276
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-9.63395	0.0000	15	291
ADF - Fisher Chi-square	135.115	0.0000	15	291
PP - Fisher Chi-square	163.644	0.0000	15	303

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: BFR
Date: 08/20/24 Time: 12:20
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 2
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-0.91140	0.1810	15	312
Breitung t-stat	0.95403	0.8300	15	297
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0.88071	0.1892	15	312
ADF - Fisher Chi-square	37.5836	0.1607	15	312
PP - Fisher Chi-square	28.3829	0.5502	15	318

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: D(BFR)
Date: 08/20/24 Time: 12:20
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 4
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-8.00006	0.0000	15	296
Breitung t-stat	-2.62101	0.0044	15	281
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-10.6990	0.0000	15	296
ADF - Fisher Chi-square	144.734	0.0000	15	296
PP - Fisher Chi-square	163.250	0.0000	15	303

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: MFR
Date: 08/20/24 Time: 22:05
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 3
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-4.31016	0.0000	15	311
Breitung t-stat	-2.37208	0.0088	15	296
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-4.01878	0.0000	15	311
ADF - Fisher Chi-square	69.9971	0.0000	15	311
PP - Fisher Chi-square	69.7594	0.0001	15	318

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: TFR
Date: 08/20/24 Time: 22:03
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 3
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-5.51408	0.0000	15	308
Breitung t-stat	-1.87686	0.0303	15	293
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-4.42640	0.0000	15	308
ADF - Fisher Chi-square	98.2853	0.0000	15	308
PP - Fisher Chi-square	109.418	0.0000	15	318

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: IFR
Date: 08/20/24   Time: 22:07
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 4
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-4.67057	0.0000	15	307
Breitung t-stat	-1.66860	0.0476	15	292
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-3.64106	0.0001	15	307
ADF - Fisher Chi-square	61.7286	0.0006	15	307
PP - Fisher Chi-square	33.6033	0.2970	15	318

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: INST
Date: 08/20/24   Time: 22:08
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 4
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2.33920	0.0097	15	317
Breitung t-stat	-0.28575	0.3875	15	302
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.14391	0.1263	15	317
ADF - Fisher Chi-square	36.6055	0.1889	15	317
PP - Fisher Chi-square	23.6511	0.7876	15	330

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: D(INST)
Date: 08/20/24 Time: 22:21
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-5.25100	0.0000	15	300
Breitung t-stat	-7.89107	0.0000	15	285
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-6.45002	0.0000	15	300
ADF - Fisher Chi-square	95.4502	0.0000	15	300
PP - Fisher Chi-square	187.442	0.0000	15	315

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: GDPG
Date: 08/20/24 Time: 22:22
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 4
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-7.05477	0.0000	15	320
Breitung t-stat	-6.24685	0.0000	15	305
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-10.4953	0.0000	15	320
ADF - Fisher Chi-square	146.098	0.0000	15	320
PP - Fisher Chi-square	171.074	0.0000	15	329

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: BM
Date: 08/20/24 Time: 22:23
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-3.09422	0.0010	15	318
Breitung t-stat	-0.70562	0.2402	15	303
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-2.28559	0.0111	15	318
ADF - Fisher Chi-square	50.3504	0.0114	15	318
PP - Fisher Chi-square	43.7305	0.0504	15	322

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: D(BM)
Date: 08/20/24 Time: 22:24
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 3
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-9.05938	0.0000	15	291
Breitung t-stat	-4.90224	0.0000	15	276
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-9.15776	0.0000	15	291
ADF - Fisher Chi-square	128.481	0.0000	15	291
PP - Fisher Chi-square	178.015	0.0000	15	306

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: INF
Date: 08/20/24 Time: 22:26
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-5.60122	0.0000	15	314
Breitung t-stat	-0.74705	0.2275	15	299
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-5.25758	0.0000	15	314
ADF - Fisher Chi-square	79.4313	0.0000	15	314
PP - Fisher Chi-square	98.0007	0.0000	15	316

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: D(INF)
Date: 08/20/24 Time: 22:26
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 4
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-11.6507	0.0000	15	289
Breitung t-stat	-3.28833	0.0005	15	274
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-13.6349	0.0000	15	289
ADF - Fisher Chi-square	190.603	0.0000	15	289
PP - Fisher Chi-square	863.978	0.0000	15	301

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: TOPN
Date: 08/20/24 Time: 22:28
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 4
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2.84932	0.0022	15	313
Breitung t-stat	-1.64685	0.0498	15	298
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-4.52244	0.0000	15	313
ADF - Fisher Chi-square	72.9531	0.0000	15	313
PP - Fisher Chi-square	67.7440	0.0001	15	328

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: EXDT
Date: 08/20/24 Time: 22:29
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 4
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2.65408	0.0040	15	318
Breitung t-stat	3.53407	0.9998	15	303
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.98714	0.8382	15	318
ADF - Fisher Chi-square	34.6906	0.2541	15	318
PP - Fisher Chi-square	11.9441	0.9987	15	330

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: D(EXDT)
Date: 08/20/24 Time: 22:29
Sample: 2000 2022
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 4
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-8.34784	0.0000	15	302
Breitung t-stat	-7.52785	0.0000	15	287
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-11.1495	0.0000	15	302
ADF - Fisher Chi-square	154.236	0.0000	15	302
PP - Fisher Chi-square	169.914	0.0000	15	315

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Cross-section Dependency

Objective 1

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 317
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	463.8993	105	0.0000
Pesaran scaled LM	24.76640		0.0000
Pesaran CD	7.481730		0.0000

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 317
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	272.8061	105	0.0000
Pesaran scaled LM	11.57972		0.0000
Pesaran CD	2.654285		0.0079

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 317
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	357.9033	105	0.0000
Pesaran scaled LM	17.45199		0.0000
Pesaran CD	3.980978		0.0001

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 317
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	339.9784	105	0.0000
Pesaran scaled LM	16.21505		0.0000
Pesaran CD	5.139738		0.0000

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 317
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	350.4203	105	0.0000
Pesaran scaled LM	16.93561		0.0000
Pesaran CD	0.512359		0.6084

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 317
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	315.3631	105	0.0000
Pesaran scaled LM	14.51643		0.0000
Pesaran CD	5.392593		0.0000

Objective 2

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 317
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	380.1344	105	0.0000
Pesaran scaled LM	18.98608		0.0000
Pesaran CD	4.053857		0.0001

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 317
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	429.3728	105	0.0000
Pesaran scaled LM	22.38385		0.0000
Pesaran CD	6.015864		0.0000

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 313
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	357.0250	105	0.0000
Pesaran scaled LM	17.39138		0.0000
Pesaran CD	0.276976		0.7818

Objective 3

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 324
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	294.7438	105	0.0000
Pesaran scaled LM	13.09357		0.0000
Pesaran CD	1.435668		0.1511

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 324
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	373.7076	105	0.0000
Pesaran scaled LM	18.54259		0.0000
Pesaran CD	10.73494		0.0000

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 320
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	345.3468	105	0.0000
Pesaran scaled LM	16.58550		0.0000
Pesaran CD	7.219929		0.0000

Objective 4

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 317
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	340.3207	105	0.0000
Pesaran scaled LM	16.23867		0.0000
Pesaran CD	2.314786		0.0206

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 317
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	301.9155	105	0.0000
Pesaran scaled LM	13.58846		0.0000
Pesaran CD	2.700669		0.0069

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 317
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	315.6819	105	0.0000
Pesaran scaled LM	14.53843		0.0000
Pesaran CD	4.128756		0.0000

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 317
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	331.8414	105	0.0000
Pesaran scaled LM	15.65354		0.0000
Pesaran CD	2.173988		0.0297

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 317
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	375.1057	105	0.0000
Pesaran scaled LM	18.63907		0.0000
Pesaran CD	1.848738		0.0645

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 317
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	293.5875	105	0.0000
Pesaran scaled LM	13.01377		0.0000
Pesaran CD	2.430384		0.0151

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 317
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	318.5634	105	0.0000
Pesaran scaled LM	14.73728		0.0000
Pesaran CD	2.991693		0.0028

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 317
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	395.6622	105	0.0000
Pesaran scaled LM	20.05760		0.0000
Pesaran CD	5.929090		0.0000

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 317
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	282.2493	105	0.0000
Pesaran scaled LM	12.23137		0.0000
Pesaran CD	0.297712		0.7659

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 317
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	475.8847	105	0.0000
Pesaran scaled LM	25.59348		0.0000
Pesaran CD	2.929678		0.0034

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 317
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	447.2997	105	0.0000
Pesaran scaled LM	23.62092		0.0000
Pesaran CD	8.516000		0.0000

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 317
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	405.8560	105	0.0000
Pesaran scaled LM	20.76104		0.0000
Pesaran CD	10.82253		0.0000

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 313
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	281.6545	105	0.0000
Pesaran scaled LM	12.19032		0.0000
Pesaran CD	1.083168		0.2787

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 313
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	277.2012	105	0.0000
Pesaran scaled LM	11.88301		0.0000
Pesaran CD	7.205429		0.0000

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 313
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	248.3915	105	0.0000
Pesaran scaled LM	9.894952		0.0000
Pesaran CD	1.226016		0.2202

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 313
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	312.7346	105	0.0000
Pesaran scaled LM	14.33505		0.0000
Pesaran CD	5.742652		0.0000

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 313
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	352.7751	105	0.0000
Pesaran scaled LM	17.09811		0.0000
Pesaran CD	5.378975		0.0000

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 23
Cross-sections included: 15
Total panel (unbalanced) observations: 313
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	350.9415	105	0.0000
Pesaran scaled LM	16.97158		0.0000
Pesaran CD	2.917166		0.0035

Co-integration test results

Objective 1

Kao Residual Cointegration Test
Series: PRT INST GDPG BM INF TOPN EXDT
Date: 08/21/24 Time: 00:01
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-2.105253	0.0176
Residual variance	26.42162	
HAC variance	23.23099	

Kao Residual Cointegration Test
Series: GINT INST GDPG BM INF TOPN EXDT
Date: 08/21/24 Time: 00:03
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-4.511839	0.0000
Residual variance	20.25771	
HAC variance	17.38582	

Kao Residual Cointegration Test
Series: BFR INST GDPG BM INF TOPN EXDT
Date: 08/21/24 Time: 00:05
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-3.446018	0.0003
Residual variance	27.86247	
HAC variance	24.30040	

Kao Residual Cointegration Test
Series: MFR INST GDPG BM INF TOPN EXDT
Date: 08/21/24   Time: 00:07
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-5.220395	0.0000
Residual variance	16.29776	
HAC variance	12.47441	

Kao Residual Cointegration Test
Series: TFR INST GDPG BM INF TOPN EXDT
Date: 08/21/24   Time: 00:07
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-3.304805	0.0005
Residual variance	29.98829	
HAC variance	24.94816	

Kao Residual Cointegration Test
Series: IFR INST GDPG BM INF TOPN EXDT
Date: 08/21/24   Time: 00:08
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-3.096441	0.0010
Residual variance	28.14708	
HAC variance	31.26944	

Objective 2

Kao Residual Cointegration Test
Series: AGPF1 PRT GINT BFR MFR TFR IFR GDPG BM INF TOPN EXDT
Date: 08/21/24 Time: 00:42
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-2.423407	0.0077
Residual variance	7.710661	
HAC variance	6.608224	

Kao Residual Cointegration Test
Series: AGPF2 PRT GINT BFR MFR TFR IFR GDPG BM INF TOPN EXDT
Date: 08/21/24 Time: 00:42
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-1.701775	0.0444
Residual variance	1.803316	
HAC variance	2.888058	

Kao Residual Cointegration Test
Series: AGPF3 PRT GINT BFR MFR TFR IFR GDPG BM INF TOPN EXDT
Date: 08/21/24 Time: 00:47
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-1.658080	0.0475
Residual variance	1.658493	
HAC variance	2.525408	

Objective 3

Kao Residual Cointegration Test
Series: AGPF1 INST GDPG BM INF TOPN EXDT
Date: 08/21/24 Time: 10:59
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 3
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-2.798754	0.0026
Residual variance	7.690341	
HAC variance	5.838878	

Kao Residual Cointegration Test
Series: AGPF2 INST GDPG BM INF TOPN EXDT
Date: 08/21/24 Time: 11:00
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-2.375777	0.0088
Residual variance	1.861302	
HAC variance	3.820134	

Kao Residual Cointegration Test
Series: AGPF3 INST GDPG BM INF TOPN EXDT
Date: 08/21/24 Time: 11:03
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-2.351453	0.0093
Residual variance	1.633840	
HAC variance	2.534635	

Objective 4

Kao Residual Cointegration Test
Series: AGPF1 PRT INST PRT*INST GDPG INF TOPN EXDT
Date: 08/24/24 Time: 22:45
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-2.689959	0.0036
Residual variance	7.300447	
HAC variance	5.824896	

Kao Residual Cointegration Test
Series: AGPF1 GINT INST GINT*INST GDPG BM TOPN EXDT
Date: 08/24/24 Time: 22:46
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-3.644240	0.0001
Residual variance	7.540604	
HAC variance	5.814805	

Kao Residual Cointegration Test
Series: AGPF1 BFR INST BFR*INST GDPG BM INF EXDT
Date: 08/24/24 Time: 22:47
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-2.720429	0.0033
Residual variance	7.632444	
HAC variance	6.381950	

Kao Residual Cointegration Test
Series: AGPF1 MFR INST MFR*INST GDPG INF EXDT
Date: 08/24/24 Time: 22:47
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-2.272844	0.0115
Residual variance	7.352556	
HAC variance	6.073688	

Kao Residual Cointegration Test
Series: AGPF1 TFR INST TFR*INST GDPG BM TOPN EXDT
Date: 08/24/24 Time: 22:48
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-3.737880	0.0001
Residual variance	7.707508	
HAC variance	6.131681	

Kao Residual Cointegration Test
Series: AGPF1 IFR INST IFR*INST GDPG BM TOPN
Date: 08/24/24 Time: 22:48
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-4.135310	0.0000
Residual variance	8.010467	
HAC variance	7.399985	

Kao Residual Cointegration Test
Series: AGPF2 PRT INST PRT*INST BM INF EXDT
Date: 08/24/24 Time: 22:52
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-2.041882	0.0206
Residual variance	1.920939	
HAC variance	2.754580	

Kao Residual Cointegration Test
Series: AGPF2 GINT INST GINT*INST INF EXDT
Date: 08/24/24 Time: 22:53
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-1.764706	0.0388
Residual variance	1.929079	
HAC variance	2.754235	

Kao Residual Cointegration Test
Series: AGPF2 BFR INST BFR*INST BM INF EXDT
Date: 08/24/24 Time: 22:54
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-2.006508	0.0224
Residual variance	1.941007	
HAC variance	2.856456	

Kao Residual Cointegration Test
Series: AGPF2 MFR INST MFR*INST BM INF EXDT
Date: 08/24/24 Time: 22:54
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-2.183340	0.0145
Residual variance	1.931943	
HAC variance	2.787978	

Kao Residual Cointegration Test
Series: AGPF2 TFR INST TFR*INST BM TOPN EXDT
Date: 08/24/24 Time: 22:55
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-1.739738	0.0410
Residual variance	1.871691	
HAC variance	2.530978	

Kao Residual Cointegration Test
Series: AGPF2 IFR INST IFR*INST INF TOPN EXDT
Date: 08/24/24 Time: 22:56
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-1.875151	0.0304
Residual variance	1.906748	
HAC variance	3.014299	

Kao Residual Cointegration Test
Series: AGPF3 PRT INST PRT*INST GDPG BM
Date: 08/24/24 Time: 22:58
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-1.735355	0.0410
Residual variance	1.709102	
HAC variance	3.471980	

Kao Residual Cointegration Test
Series: AGPF3 GINT INST GINT*INST BM INF TOPN EXDT
Date: 08/24/24 Time: 22:59
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-1.784871	0.0332
Residual variance	1.590327	
HAC variance	3.474858	

Kao Residual Cointegration Test
Series: AGPF3 BFR INST BFR*INST GDPG BM INF
Date: 08/24/24 Time: 23:00
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-1.745698	0.0392
Residual variance	1.857708	
HAC variance	3.232758	

Kao Residual Cointegration Test
Series: AGPF3 MFR INST MFR*INST GDPG BM TOPN EXDT
Date: 08/24/24 Time: 23:01
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-1.886851	0.0305
Residual variance	1.555723	
HAC variance	3.247381	

Kao Residual Cointegration Test
Series: AGPF3 TFR INST TFR*INST INF TOPN EXDT
Date: 08/24/24 Time: 23:03
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-1.825191	0.0325
Residual variance	1.560516	
HAC variance	3.444860	

Kao Residual Cointegration Test
Series: AGPF3 IFR INST IFR*INST BM INF TOPN
Date: 08/24/24 Time: 23:06
Sample: 2000 2022
Included observations: 345
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-1.887416	0.0297
Residual variance	1.716115	
HAC variance	3.568390	

Estimation Results

Objective 1

```
. xtpmg d.prt d.inst d.gdpg d.bm d.inf d.exdt, lr(l.prt inst gdpg bm inf exdt) ec(ECT) replace
> mg

------------------------------------------------------------------------------
Mean Group Estimation: Error Correction Form
(Estimate results saved as mg)
------------------------------------------------------------------------------
------------------------------------------------------------------------------
       D.prt |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ECT          |
        inst |   28.93935   12.02411     2.41   0.016     5.372526    52.50617
        gdpg |   .4933288   .5573921     0.89   0.376    -.5991397    1.585797
          bm |   .1488598   .3080277     0.48   0.629    -.4548634     .752583
         inf |   .0167244   .4555852     0.04   0.971    -.8762061    .9096549
        exdt |  -.0123706   .1226053    -0.10   0.920    -.2526727    .2279315
-------------+----------------------------------------------------------------
SR           |
         ECT |   -.779518   .1454067    -5.36   0.000     -1.06451   -.4945262
             |
        inst |
         D1. |  -17.84334   6.917849    -2.58   0.010    -31.40207   -4.284603
             |
        gdpg |
         D1. |  -.2398597   .1176927    -2.04   0.042    -.4705332   -.0091861
             |
          bm |
         D1. |   -.077237   .1217163    -0.63   0.526    -.3157966    .1613227
             |
         inf |
         D1. |   .0444977   .0735772     0.60   0.545    -.0997109    .1887063
             |
        exdt |
         D1. |   .1184234   .0550706     2.15   0.032     .0104871    .2263597
             |
       _cons |   30.53217   8.332588     3.66   0.000      14.2006    46.86374
------------------------------------------------------------------------------
```

```
.
. xtpmg d.prt d.inst d.gdpg d.bm d.inf d.exdt, lr(l.prt inst gdpg bm inf exdt) ec(ECT) replace
> pmg

Iteration 0:   log likelihood = -763.20324  (not concave)
Iteration 1:   log likelihood =   -760.892  (not concave)
Iteration 2:   log likelihood =  -757.2926  (not concave)
Iteration 3:   log likelihood = -752.84476
Iteration 4:   log likelihood = -748.50872  (backed up)
Iteration 5:   log likelihood = -747.19883
Iteration 6:   log likelihood = -746.65335
Iteration 7:   log likelihood = -746.65239
Iteration 8:   log likelihood = -746.65239

Pooled Mean Group Regression
(Estimate results saved as pmg)

Panel Variable (i): c_id                    Number of obs      =       301
Time Variable (t): year                     Number of groups   =        15
                                   Obs per group: min =        11
                                                  avg =      20.1
                                                  max =        22

                                   Log Likelihood      = -746.6524
------------------------------------------------------------------------------
       D.prt |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ECT          |
        inst |   14.92899   3.359431     4.44   0.000     8.344624    21.51335
        gdpg |   .5098476   .0785498     6.49   0.000     .3558929    .6638024
          bm |   .3358289   .0712471     4.71   0.000     .1961872    .4754706
         inf |   .0661301   .0567081     1.17   0.244    -.0450157    .1772759
        exdt |    .152903   .0264474     5.78   0.000      .101067    .2047389
-------------+----------------------------------------------------------------
SR           |
         ECT |  -.4312036   .1237235    -3.49   0.000    -.6736971   -.1887101
             |
        inst |
         D1. |  -2.044712   4.353367    -0.47   0.639    -10.57715     6.48773
             |
        gdpg |
         D1. |  -.2231006   .0580135    -3.85   0.000     -.336805   -.1093963
             |
          bm |
         D1. |   .2208613   .2427548     0.91   0.363    -.2549294     .696652
             |
```

```
        inf |
        D1. |   .293804   .2165061     1.36   0.175    -.1305402    .7181482
            |
       exdt |
        D1. |  -.1186282   .1293626    -0.92   0.359    -.3721743    .1349179
            |
      _cons |   11.84107   3.501328     3.38   0.001     4.978591    18.70354
------------------------------------------------------------------------------

.
. hausman mg pmg, sigmamore

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       mg          pmg         Difference          S.E.
-------------+----------------------------------------------------------------
        inst |    28.93935     14.92899        14.01036        18.15398
        gdpg |    .4933288     .5098476       -.0165189         .852225
          bm |    .1488598     .3358289       -.1869691        .4675582
         inf |    .0167244     .0661301       -.0494057        .6972174
        exdt |   -.0123706      .152903       -.1652736        .1863851
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtpmg
            B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        2.35
                Prob>chi2 =      0.7996
```

```
. xtpmg d.prt d.inst d.gdpg d.bm d.inf d.exdt, lr(l.prt inst gdpg bm inf exdt) ec(ECT) replace
> mg

------------------------------------------------------------------------------
Mean Group Estimation: Error Correction Form
(Estimate results saved as mg)
------------------------------------------------------------------------------
------------------------------------------------------------------------------
       D.prt |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ECT          |
        inst |   28.93935   12.02411     2.41   0.016     5.372526    52.50617
        gdpg |   .4933288   .5573921     0.89   0.376    -.5991397    1.585797
          bm |   .1488598   .3080277     0.48   0.629    -.4548634     .752583
         inf |   .0167244   .4555852     0.04   0.971    -.8762061    .9096549
        exdt |  -.0123706   .1226053    -0.10   0.920    -.2526727    .2279315
-------------+----------------------------------------------------------------
SR           |
         ECT |   -.779518   .1454067    -5.36   0.000     -1.06451   -.4945262
             |
        inst |
         D1. |  -17.84334   6.917849    -2.58   0.010    -31.40207   -4.284603
             |
        gdpg |
         D1. |  -.2398597   .1176927    -2.04   0.042    -.4705332   -.0091861
             |
          bm |
         D1. |   -.077237   .1217163    -0.63   0.526    -.3157966    .1613227
             |
         inf |
         D1. |   .0444977   .0735772     0.60   0.545    -.0997109    .1887063
             |
        exdt |
         D1. |   .1184234   .0550706     2.15   0.032     .0104871    .2263597
             |
       _cons |   30.53217   8.332588     3.66   0.000      14.2006    46.86374
------------------------------------------------------------------------------

.
. outreg2 using ruftestobj1, bdec(3) tdec(3) rdec(3) adec(3) alpha (0.01, 0.05, 0.10) addstat(A
> dj. R-squared, e(r2_a)) excel append
check eret list for the existence of e(r2_a)
ruftestobj1.xml
dir : seeout
```

```
.
. xtpmg d.prt d.inst d.gdpg d.bm d.inf d.exdt, lr(l.prt inst gdpg bm inf exdt) ec(ECT) replace
> pmg

Iteration 0:   log likelihood = -763.20324  (not concave)
Iteration 1:   log likelihood =   -760.892  (not concave)
Iteration 2:   log likelihood =  -757.2926  (not concave)
Iteration 3:   log likelihood = -752.84476
Iteration 4:   log likelihood = -748.50872  (backed up)
Iteration 5:   log likelihood = -747.19883
Iteration 6:   log likelihood = -746.65335
Iteration 7:   log likelihood = -746.65239
Iteration 8:   log likelihood = -746.65239

Pooled Mean Group Regression
(Estimate results saved as pmg)

Panel Variable (i): c_id                    Number of obs      =       301
Time Variable (t): year                     Number of groups   =        15
                                    Obs per group: min =        11
                                                   avg =      20.1
                                                   max =        22

                                    Log Likelihood       = -746.6524
------------------------------------------------------------------------------
       D.prt |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ECT          |
        inst |   14.92899   3.359431     4.44   0.000     8.344624    21.51335
        gdpg |   .5098476   .0785498     6.49   0.000     .3558929    .6638024
          bm |   .3358289   .0712471     4.71   0.000     .1961872    .4754706
         inf |   .0661301   .0567081     1.17   0.244    -.0450157    .1772759
        exdt |    .152903   .0264474     5.78   0.000      .101067    .2047389
-------------+----------------------------------------------------------------
SR           |
         ECT |  -.4312036   .1237235    -3.49   0.000    -.6736971   -.1887101
             |
        inst |
         D1. |  -2.044712   4.353367    -0.47   0.639    -10.57715     6.48773
             |
        gdpg |
         D1. |  -.2231006   .0580135    -3.85   0.000     -.336805   -.1093963
             |
          bm |
         D1. |   .2208613   .2427548     0.91   0.363    -.2549294     .696652
             |
```

```
        inf |
         D1. |   .293804   .2165061     1.36   0.175    -.1305402    .7181482
             |
        exdt |
         D1. |  -.1186282   .1293626    -0.92   0.359    -.3721743    .1349179
             |
       _cons |   11.84107   3.501328     3.38   0.001     4.978591    18.70354
------------------------------------------------------------------------------

.
. outreg2 using ruftestobj1, bdec(3) tdec(3) rdec(3) adec(3) alpha (0.01, 0.05, 0.10) addstat(A
> dj. R-squared, e(r2_a)) excel append
check eret list for the existence of e(r2_a)
ruftestobj1.xml
dir : seeout

.
. hausman mg pmg, sigmamore

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       mg          pmg         Difference          S.E.
-------------+----------------------------------------------------------------
        inst |    28.93935     14.92899        14.01036        18.15398
        gdpg |    .4933288     .5098476       -.0165189         .852225
          bm |    .1488598     .3358289       -.1869691        .4675582
         inf |    .0167244     .0661301       -.0494057        .6972174
        exdt |   -.0123706      .152903       -.1652736        .1863851
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtpmg
            B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        2.35
                Prob>chi2 =      0.7996

.
```

```
.
. xtpmg d.gint d.inst d.gdpg d.bm d.inf d.exdt, lr(l.gint inst gdpg bm inf exdt) ec(ECT) replac
> e mg

------------------------------------------------------------------------------
Mean Group Estimation: Error Correction Form
(Estimate results saved as mg)
------------------------------------------------------------------------------
------------------------------------------------------------------------------
      D.gint |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ECT          |
        inst |   29.57348   23.93816     1.24   0.217    -17.34444    76.49141
        gdpg |   .0425977   .4089146     0.10   0.917    -.7588601    .8440555
          bm |  -.7816689   1.159605    -0.67   0.500    -3.054452    1.491114
         inf |   .0470683   .2510747     0.19   0.851     -.445029    .5391656
        exdt |  -.2752759   .1530108    -1.80   0.072    -.5751715    .0246198
-------------+----------------------------------------------------------------
SR           |
         ECT |  -.5275849   .1141383    -4.62   0.000    -.7512918    -.303878
             |
        inst |
         D1. |  -3.088254   8.508565    -0.36   0.717    -19.76474    13.58823
             |
        gdpg |
         D1. |  -.1625473   .1012605    -1.61   0.108    -.3610141    .0359195
             |
          bm |
         D1. |  -.6299128   .3269288    -1.93   0.054    -1.270681    .0108559
             |
         inf |
         D1. |   -.185389   .1341444    -1.38   0.167    -.4483073    .0775293
             |
        exdt |
         D1. |  -.0349462   .0628001    -0.56   0.578    -.1580321    .0881396
             |
       _cons |  -1.050247    19.9797    -0.05   0.958    -40.20975    38.10925
------------------------------------------------------------------------------

.
. outreg2 using ruftestobj1, bdec(3) tdec(3) rdec(3) adec(3) alpha (0.01, 0.05, 0.10) addstat(A
> dj. R-squared, e(r2_a)) excel append
check eret list for the existence of e(r2_a)
ruftestobj1.xml
dir : seeout
```

```
.
. xtpmg d.gint d.inst d.gdpg d.bm d.inf d.exdt, lr(l.gint inst gdpg bm inf exdt) ec(ECT) replac
> e pmg

Iteration 0:   log likelihood = -790.52613  (not concave)
Iteration 1:   log likelihood = -783.84861  (not concave)
Iteration 2:   log likelihood = -773.15962
Iteration 3:   log likelihood = -769.30921
Iteration 4:   log likelihood =  -768.4001
Iteration 5:   log likelihood = -768.36138
Iteration 6:   log likelihood = -768.36123
Iteration 7:   log likelihood = -768.36123

Pooled Mean Group Regression
(Estimate results saved as pmg)

Panel Variable (i): c_id                    Number of obs      =       301
Time Variable (t): year                     Number of groups   =        15
                                  Obs per group: min =        11
                                                 avg =      20.1
                                                 max =        22

                                  Log Likelihood     = -768.3612
------------------------------------------------------------------------------
     D.gint |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ECT          |
       inst |    19.4235   4.800608     4.05   0.000     10.01448    28.83252
       gdpg |  -.6291918   .1264121    -4.98   0.000    -.8769551   -.3814286
         bm |   .4377122    .088698     4.93   0.000     .2638673    .6115571
        inf |  -.6215851   .0966986    -6.43   0.000    -.8111109   -.4320594
       exdt |  -.0509617   .0287514    -1.77   0.076    -.1073134    .0053899
-------------+----------------------------------------------------------------
SR           |
        ECT |  -.4173844   .0631683    -6.61   0.000    -.5411919   -.2935769
             |
       inst |
        D1. |  -5.760371   5.454763    -1.06   0.291    -16.45151    4.930769
             |
       gdpg |
        D1. |  -.0031995    .063177    -0.05   0.960    -.1270241    .1206251
             |
         bm |
        D1. |  -.2869509   .1148456    -2.50   0.012    -.5120441   -.0618577
             |
        inf |
```

```
         D1. |  -.1190841   .1121518    -1.06   0.288    -.3388976    .1007294
             |
        exdt |
         D1. |   -.03585   .0518724    -0.69   0.489    -.1375181    .0658182
             |
       _cons |   16.83943   3.236847     5.20   0.000     10.49532    23.18353
------------------------------------------------------------------------------

.
. outreg2 using ruftestobj1, bdec(3) tdec(3) rdec(3) adec(3) alpha (0.01, 0.05, 0.10) addstat(A
> dj. R-squared, e(r2_a)) excel append
check eret list for the existence of e(r2_a)
ruftestobj1.xml
dir : seeout

.
. hausman mg pmg, sigmamore

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       mg          pmg         Difference          S.E.
-------------+----------------------------------------------------------------
        inst |    29.57348      19.4235        10.14998        35.45237
        gdpg |    .0425977    -.6291918        .6717895        .5979115
          bm |   -.7816689     .4377122       -1.219381        1.730774
         inf |    .0470683    -.6215851        .6686534        .3625609
        exdt |   -.2752759    -.0509617       -.2243142        .2268622
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtpmg
            B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        2.96
                Prob>chi2 =      0.7354
```

```
.
. xtpmg d.bfr d.inst d.gdpg d.bm d.inf d.topn d.exdt, lr(l.bfr inst gdpg bm inf topn exdt) ec(E
> CT) replace mg

------------------------------------------------------------------------------
Mean Group Estimation: Error Correction Form
(Estimate results saved as mg)
------------------------------------------------------------------------------
------------------------------------------------------------------------------
       D.bfr |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ECT          |
        inst |   16.64283   33.95909     0.49   0.624    -49.91576    83.20142
        gdpg |  -1.430422   1.117329    -1.28   0.200    -3.620348    .7595033
          bm |  -.7041498   .3385344    -2.08   0.038    -1.367665   -.0406347
         inf |  -1.498496   .7945419    -1.89   0.059     -3.05577    .0587777
        topn |  -.0166642   .2000334    -0.08   0.934    -.4087224     .375394
        exdt |   .5177978   .4049506     1.28   0.201    -.2758908    1.311486
-------------+----------------------------------------------------------------
SR           |
         ECT |  -.5640549   .2176884    -2.59   0.010    -.9907163   -.1373936
             |
        inst |
         D1. |   32.84179   19.58753     1.68   0.094    -5.549066    71.23264
             |
        gdpg |
         D1. |   -.265372   .1770891    -1.50   0.134    -.6124602    .0817162
             |
          bm |
         D1. |    .399693   .3497589     1.14   0.253    -.2858217    1.085208
             |
         inf |
         D1. |  -.2899714   .4395476    -0.66   0.509    -1.151469    .5715262
             |
        topn |
         D1. |  -.0174951   .1005247    -0.17   0.862    -.2145199    .1795297
             |
        exdt |
         D1. |   .3962177   .2410879     1.64   0.100     -.076306    .8687413
             |
       _cons |   21.33392   40.71828     0.52   0.600    -58.47245    101.1403
------------------------------------------------------------------------------
. outreg2 using ruftestobj1, bdec(3) tdec(3) rdec(3) adec(3) alpha (0.01, 0.05, 0.10) addstat(A
> dj. R-squared, e(r2_a)) excel append
check eret list for the existence of e(r2_a)
ruftestobj1.xml
```

```
.
. xtpmg d.bfr d.inst d.gdpg d.bm d.inf d.topn d.exdt, lr(l.bfr inst gdpg bm inf topn exdt) ec(E
> CT) replace pmg

Iteration 0:   log likelihood = -799.60665  (not concave)
Iteration 1:   log likelihood =  -788.9486  (not concave)
Iteration 2:   log likelihood = -787.82977  (not concave)
Iteration 3:   log likelihood = -779.44096  (not concave)
Iteration 4:   log likelihood = -773.95735  (not concave)
Iteration 5:   log likelihood = -769.97431  (not concave)
Iteration 6:   log likelihood = -767.51791
Iteration 7:   log likelihood = -765.84193
Iteration 8:   log likelihood = -765.42744
Iteration 9:   log likelihood = -765.39155
Iteration 10:  log likelihood = -765.39153

Pooled Mean Group Regression
(Estimate results saved as pmg)

Panel Variable (i): c_id                    Number of obs      =       301
Time Variable (t): year                     Number of groups   =        15
                                    Obs per group: min =        11
                                                   avg =      20.1
                                                   max =        22

                                    Log Likelihood      = -765.3915
------------------------------------------------------------------------------
       D.bfr |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ECT          |
        inst |  -48.4106   6.358355    -7.61   0.000    -60.87275   -35.94845
        gdpg |   .5674453   .1935632     2.93   0.003     .1880683    .9468223
          bm |  -.2702687   .0801545    -3.37   0.001    -.4273686   -.1131689
         inf |   -.957788   .1242336    -7.71   0.000    -1.201281   -.7142946
        topn |   .1232456   .0673321     1.83   0.067    -.0087228     .255214
        exdt |    .176032   .0389592     4.52   0.000     .0996735    .2523906
-------------+----------------------------------------------------------------
SR           |
         ECT |  -.2788438   .0863376    -3.23   0.001    -.4480625   -.1096251
             |
        inst |
         D1. |   20.81256   6.826627     3.05   0.002     7.432615     34.1925
             |
        gdpg |
         D1. |  -.2209114   .1256568    -1.76   0.079    -.4671942    .0253714
             |
```

```
          bm |
         D1. |   .1633185   .1268215     1.29   0.198    -.0852471    .4118841
             |
         inf |
         D1. |   .1118319    .078151     1.43   0.152    -.0413412     .265005
             |
        topn |
         D1. |   .0457234   .0511908     0.89   0.372    -.0546087    .1460555
             |
        exdt |
         D1. |   .1098039   .0785512     1.40   0.162    -.0441536    .2637613
             |
       _cons |    10.1441   6.249637     1.62   0.105    -2.104962    22.39317
------------------------------------------------------------------------------

.
. outreg2 using ruftestobj1, bdec(3) tdec(3) rdec(3) adec(3) alpha (0.01, 0.05, 0.10) addstat(A
> dj. R-squared, e(r2_a)) excel append
check eret list for the existence of e(r2_a)
ruftestobj1.xml
dir : seeout

.
. hausman mg pmg, sigmamore

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       mg          pmg         Difference          S.E.
-------------+----------------------------------------------------------------
        inst |    16.64283     -48.4106        65.05343        74.55552
        gdpg |   -1.430422     .5674453       -1.997867        2.454326
          bm |   -.7041498    -.2702687       -.4338811        .7416145
         inf |   -1.498496     -.957788        -.540708        1.746297
        topn |   -.0166642     .1232456       -.1399098        .4355843
        exdt |    .5177978      .176032        .3417657        .8914255
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtpmg
            B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        8.18
                Prob>chi2 =      0.2250
```

```
.
. xtpmg d.mfr d.inst d.gdpg d.inf d.topn d.exdt, lr(l.mfr inst gdpg inf topn exdt) ec(ECT) repl
> ace mg

------------------------------------------------------------------------------
Mean Group Estimation: Error Correction Form
(Estimate results saved as mg)
------------------------------------------------------------------------------
------------------------------------------------------------------------------
      D.mfr |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ECT          |
        inst |  -12.33862   11.90659    -1.04   0.300    -35.67511    10.99786
        gdpg |  -.1479514   .3211285    -0.46   0.645    -.7773518    .4814489
         inf |   .1682899   .2224244     0.76   0.449     -.267654    .6042338
        topn |     .06168   .0847981     0.73   0.467    -.1045213    .2278813
        exdt |  -.1025663   .1980927    -0.52   0.605    -.4908209    .2856884
-------------+----------------------------------------------------------------
SR           |
         ECT |  -.7144208    .070583   -10.12   0.000     -.852761   -.5760806
             |
        inst |
         D1. |   14.20752   7.215591     1.97   0.049     .0652214    28.34982
             |
        gdpg |
         D1. |   .0217665   .1625347     0.13   0.893    -.2967956    .3403285
             |
         inf |
         D1. |  -.0187364   .1263391    -0.15   0.882    -.2663565    .2288837
             |
        topn |
         D1. |  -.0115174   .0656669    -0.18   0.861    -.1402221    .1171874
             |
        exdt |
         D1. |  -.0345176   .0268691    -1.28   0.199    -.0871801    .0181449
             |
       _cons |   40.00034    10.1709     3.93   0.000     20.06573    59.93494
------------------------------------------------------------------------------

.
. outreg2 using ruftestobj1, bdec(3) tdec(3) rdec(3) adec(3) alpha (0.01, 0.05, 0.10) addstat(A
> dj. R-squared, e(r2_a)) excel append
check eret list for the existence of e(r2_a)
ruftestobj1.xml
dir : seeout
```

```
.
. xtpmg d.mfr d.inst d.gdpg d.inf d.topn d.exdt, lr(l.mfr inst gdpg inf topn exdt) ec(ECT) repl
> ace pmg

Iteration 0:   log likelihood = -767.17705  (not concave)
Iteration 1:   log likelihood = -752.50085  (not concave)
Iteration 2:   log likelihood = -748.78007  (not concave)
Iteration 3:   log likelihood = -739.43799  (not concave)
Iteration 4:   log likelihood =  -731.2128  (not concave)
Iteration 5:   log likelihood = -726.05427
Iteration 6:   log likelihood = -722.03699
Iteration 7:   log likelihood = -721.26978
Iteration 8:   log likelihood = -721.08046
Iteration 9:   log likelihood = -721.08035
Iteration 10:  log likelihood = -721.08035

Pooled Mean Group Regression
(Estimate results saved as pmg)

Panel Variable (i): c_id                    Number of obs      =       307
Time Variable (t): year                     Number of groups   =        15
                                   Obs per group: min =        11
                                                  avg =      20.5
                                                  max =        22

                                   Log Likelihood     = -721.0804
------------------------------------------------------------------------------
       D.mfr |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ECT          |
        inst |  -6.522251   1.988436    -3.28   0.001    -10.41951   -2.624988
        gdpg |  -.3502911    .137213    -2.55   0.011    -.6192236   -.0813586
         inf |  -.5804957   .1244683   -4.66   0.000     -.824449   -.3365425
        topn |  -.0659186   .0393598    -1.67   0.094    -.1430623    .0112251
        exdt |    .039466   .0137427     2.87   0.004     .0125309    .0664012
-------------+----------------------------------------------------------------
SR           |
         ECT |  -.4970942   .0703685    -7.06   0.000    -.6350139   -.3591745
             |
        inst |
         D1. |   7.967192   3.300756     2.41   0.016     1.497829    14.43655
             |
        gdpg |
         D1. |   .1086475   .0945514     1.15   0.251    -.0766699    .2939649
             |
         inf |
```

```
        D1. |  .2625379   .0637879     4.12   0.000     .1375158    .3875599
            |
       topn |
        D1. |  .0565665   .0387753     1.46   0.145    -.0194317    .1325647
            |
       exdt |
        D1. | -.0413443   .0276291    -1.50   0.135    -.0954963    .0128076
            |
      _cons |  39.21419   5.706631     6.87   0.000      28.0294    50.39898
------------------------------------------------------------------------------

.
. outreg2 using ruftestobj1, bdec(3) tdec(3) rdec(3) adec(3) alpha (0.01, 0.05, 0.10) addstat(A
> dj. R-squared, e(r2_a)) excel append
check eret list for the existence of e(r2_a)
ruftestobj1.xml
dir : seeout

.
. hausman mg pmg, sigmamore

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       mg          pmg         Difference          S.E.
-------------+----------------------------------------------------------------
        inst |   -12.33862    -6.522251       -5.816373        24.68818
        gdpg |   -.1479514    -.3502911        .2023397        .6537687
         inf |    .1682899    -.5804957        .7487856         .445632
        topn |      .06168    -.0659186        .1275986        .1719501
        exdt |   -.1025663      .039466       -.1420323        .4118439
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtpmg
            B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       10.11
                Prob>chi2 =      0.0721
```

```
. xtpmg d.tfr d.inst d.gdpg d.bm d.inf d.topn d.exdt, lr(l.tfr inst gdpg bm inf topn exdt) ec(E
> CT) replace mg

------------------------------------------------------------------------------
Mean Group Estimation: Error Correction Form
(Estimate results saved as mg)
------------------------------------------------------------------------------
------------------------------------------------------------------------------
       D.tfr |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ECT          |
        inst |   .2371249   7.232502     0.03   0.974    -13.93832    14.41257
        gdpg |  -.3818718   .4143409    -0.92   0.357    -1.193965    .4302214
          bm |  -.2783781    .382892    -0.73   0.467    -1.028833    .4720764
         inf |   .0167376   .2531509     0.07   0.947    -.4794291    .5129043
        topn |   .1076862   .1021095     1.05   0.292    -.0924447    .3078171
        exdt |  -.0306998   .2323505    -0.13   0.895    -.4860983    .4246987
-------------+----------------------------------------------------------------
SR           |
         ECT |  -1.310462   .2452549    -5.34   0.000    -1.791153   -.8297714
             |
        inst |
         D1. |  -12.33489   18.77188    -0.66   0.511    -49.12711    24.45732
             |
        gdpg |
         D1. |   .4622392   .4789824     0.97   0.335    -.4765491    1.401027
             |
          bm |
         D1. |   .5734396   .9620697     0.60   0.551    -1.312182    2.459061
             |
         inf |
         D1. |   .3413998   .6013784     0.57   0.570    -.8372801     1.52008
             |
        topn |
         D1. |  -.1280309   .1139308    -1.12   0.261    -.3513311    .0952693
             |
        exdt |
         D1. |  -.3090121   .3483581    -0.89   0.375    -.9917814    .3737571
             |
       _cons |   90.09319   36.30249     2.48   0.013     18.94162    161.2448
------------------------------------------------------------------------------
. outreg2 using ruftestobj1, bdec(3) tdec(3) rdec(3) adec(3) alpha (0.01, 0.05, 0.10) addstat(A
> dj. R-squared, e(r2_a)) excel append
check eret list for the existence of e(r2_a)
ruftestobj1.xml
```

```
.
. xtpmg d.tfr d.inst d.gdpg d.bm d.inf d.topn d.exdt, lr(l.tfr inst gdpg bm inf topn exdt) ec(E
> CT) replace pmg

Iteration 0:   log likelihood = -780.72913  (not concave)
Iteration 1:   log likelihood = -769.48676  (not concave)
Iteration 2:   log likelihood = -756.29376  (not concave)
Iteration 3:   log likelihood = -750.76946  (not concave)
Iteration 4:   log likelihood =  -743.8555  (not concave)
Iteration 5:   log likelihood =  -728.6221  (not concave)
Iteration 6:   log likelihood =  -726.4735
Iteration 7:   log likelihood = -726.42106
Iteration 8:   log likelihood = -726.07299
Iteration 9:   log likelihood = -726.06933
Iteration 10:  log likelihood = -726.06933

Pooled Mean Group Regression
(Estimate results saved as pmg)

Panel Variable (i): c_id                    Number of obs      =       301
Time Variable (t): year                     Number of groups   =        15
                                     Obs per group: min =         11
                                                    avg =       20.1
                                                    max =         22

                                     Log Likelihood      = -726.0693
------------------------------------------------------------------------------
      D.tfr |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ECT          |
       inst |   10.74541  2.252908     4.77   0.000    -1.286014    5.132653
       gdpg |   0.162248   .124520     1.30   0.194    -.0543431    .3506869
         bm |  -0.103940   .053637    -1.94   0.054     .0905814    .2115068
        inf |   -.154022   .094340    -1.63   0.104    -.3193474   -.0216507
       topn |    .162807   .040418     4.03   0.000     .0550038    .2534258
       exdt |   -.040942   .011052    -3.71   0.000    -.0355514    .0105263
-------------+----------------------------------------------------------------
SR           |
        ECT |   -.508586   .085388    -5.96   0.000    -.8176399   -.4696319
             |
       inst |
        D1. |  -4.756957  6.386628    -0.75   0.457    -11.78575    8.758345
             |
       gdpg |
        D1. |    .046277   .098026     0.47   0.637    -.1912449    .1496582
             |
```

```
         bm |
        D1. |  -.016555   .077074     -0.22   0.830   -.2664693    .0324899
            |
        inf |
        D1. |  -.147134   .103675     -1.42   0.158   -.3704246     .092424
            |
       topn |
        D1. |  -.082407   .080532     -1.02   0.308   -.2003769    .1257319
            |
       exdt |
        D1. |   .062689   .038084      1.65   0.101   -.0539675    .1156082
            |
      _cons |  34.03287  5.831009      5.84   0.000    29.38365    50.28206
------------------------------------------------------------------------------

.
. outreg2 using ruftestobj1, bdec(3) tdec(3) rdec(3) adec(3) alpha (0.01, 0.05, 0.10) addstat(A
> dj. R-squared, e(r2_a)) excel append
check eret list for the existence of e(r2_a)
ruftestobj1.xml
dir : seeout

.
. hausman mg pmg, sigmamore

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       mg          pmg         Difference          S.E.
-------------+----------------------------------------------------------------
        inst |    .2371249      1.92332       -1.686195        20.77883
        gdpg |   -.3818718     .1481719       -.5300438        1.189604
          bm |   -.2783781     .1510441       -.4294222         1.10302
         inf |    .0167376     -.170499        .1872367        .7255885
        topn |    .1076862     .0009188        .1067674        .2929712
        exdt |   -.0306998    -.0125126       -.0181872        .6695043
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtpmg
            B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        0.96
                Prob>chi2 =      0.9872
```

```
.
. xtpmg d.ifr d.inst d.gdpg d.bm d.inf d.exdt, lr(l.ifr inst gdpg bm inf exdt) ec(ECT) replace
> mg

------------------------------------------------------------------------------
Mean Group Estimation: Error Correction Form
(Estimate results saved as mg)
------------------------------------------------------------------------------
------------------------------------------------------------------------------
       D.ifr |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ECT          |
        inst |   8.349338   34.90605     0.24   0.811    -60.06525    76.76393
        gdpg |   -.402359   .7807749    -0.52   0.606     -1.93265    1.127932
          bm |  -1.114566   .9138927    -1.22   0.223    -2.905762    .6766311
         inf |  -1.472007   1.283127    -1.15   0.251     -3.98689    1.042876
        exdt |   .7239936   .8100518     0.89   0.371    -.8636787    2.311666
-------------+----------------------------------------------------------------
SR           |
         ECT |  -.5897932   .1189349    -4.96   0.000    -.8229014   -.3566851
             |
        inst |
         D1. |  -1.916394   14.20128    -0.13   0.893    -29.75039     25.9176
             |
        gdpg |
         D1. |   .1124658   .1975342     0.57   0.569    -.2746942    .4996257
             |
          bm |
         D1. |   .0129368   .3157913     0.04   0.967    -.6060028    .6318763
             |
         inf |
         D1. |   .2797011   .1160552     2.41   0.016     .0522371     .507165
             |
        exdt |
         D1. |   .0068016   .0570827     0.12   0.905    -.1050783    .1186816
             |
       _cons |    35.2497   15.92547     2.21   0.027     4.036349    66.46305
------------------------------------------------------------------------------

.
. outreg2 using ruftestobj1, bdec(3) tdec(3) rdec(3) adec(3) alpha (0.01, 0.05, 0.10) addstat(A
> dj. R-squared, e(r2_a)) excel append
check eret list for the existence of e(r2_a)
ruftestobj1.xml
dir : seeout
```

.

```
. xtpmg d.ifr d.inst d.gdpg d.bm d.inf d.exdt, lr(l.ifr inst gdpg bm inf exdt) ec(ECT) replace
> pmg

Iteration 0:   log likelihood = -829.86377  (not concave)
Iteration 1:   log likelihood = -819.04245  (not concave)
Iteration 2:   log likelihood = -817.88327  (not concave)
Iteration 3:   log likelihood = -816.65192  (not concave)
Iteration 4:   log likelihood = -805.65696
Iteration 5:   log likelihood =  -804.7888
Iteration 6:   log likelihood = -803.95946
Iteration 7:   log likelihood = -803.89173
Iteration 8:   log likelihood = -803.89155
Iteration 9:   log likelihood = -803.89155

Pooled Mean Group Regression
(Estimate results saved as pmg)

Panel Variable (i): c_id                 Number of obs      =      301
Time Variable (t): year                  Number of groups   =       15
                                 Obs per group: min =       11
                                                avg =     20.1
                                                max =       22

                                 Log Likelihood      = -803.8915
------------------------------------------------------------------------------
       D.ifr |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ECT          |
        inst |   16.29947  3.946115     4.13    0.000     16.36692    18.69817
        gdpg |    .108444   .195931    -0.55    0.581    -.4967011    .8100859
          bm |    .419612   .086560     4.85    0.000     .1433546    .5384713
         inf |   -.424135   .120279-3.53   0.001    -3.240772   -1.454677
        exdt |   -.091878   .033215    -2.77    0.006     -.064858    .0522173
-------------+----------------------------------------------------------------
SR           |
         ECT |  -0.316208   .101203    -3.13    0.002    -.2985925   -.1290193
             |
        inst |
         D1. |  -5.826329  6.691889    -0.87    0.385    -23.96197    4.549869
             |
        gdpg |
         D1. |   -.041161   .124438    -0.33    0.741    -.2532644    .2064318
             |
          bm |
         D1. |   -.189249   .150056    -1.26    0.209    -.4126658    .1188484
```

```
         |
     inf |
     D1. |   .197868    .089524      2.21   0.028    .1325344   .5588361
         |
    exdt |
     D1. |   .130712    .039630      3.30   0.001   -.0101819   .1630708
         |
   _cons |   18.93645  6.333009     2.99    0.003    12.09852   25.07388
------------------------------------------------------------------------------

.
. outreg2 using ruftestobj1, bdec(3) tdec(3) rdec(3) adec(3) alpha (0.01, 0.05, 0.10) addstat(A
> dj. R-squared, e(r2_a)) excel append
check eret list for the existence of e(r2_a)
ruftestobj1.xml
dir : seeout

.
. hausman mg pmg, sigmamore

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       mg          pmg         Difference          S.E.
-------------+----------------------------------------------------------------
        inst |    8.349338     62.53254       -54.18321        64.17544
        gdpg |    -.402359     .1566924       -.5590514        1.408359
          bm |   -1.114566     .3409129       -1.455479        1.691028
         inf |   -1.472007    -2.347725        .8757181        2.334405
        exdt |    .7239936    -.0063204         .730314        1.501248
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtpmg
            B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        4.83
                Prob>chi2 =      0.4367
```

Objective 2

agpf1 prt gint bfr mfr tfr ifr gdpg exdt
Dependent Variable: D(AGPF1)
Method: ARDL
Date: 08/22/24 Time: 13:06
Sample: 2001 2022
Included observations: 318
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): PRT GINT BFR MFR TFR IFR GDPG EXDT
Fixed regressors: C
Number of models evalulated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
PRT	-0.190117	0.087776	-2.165934	0.0317
GINT	-0.070164	0.103591	-0.677314	0.4991
BFR	-0.413338	0.091671	-4.508919	0.0000
MFR	-0.562506	0.141522	-3.974704	0.0001
TFR	0.318801	0.105618	3.018429	0.0029
IFR	-0.127254	0.050458	-2.522002	0.0126
GDPG	-1.079693	0.237647	-4.543260	0.0000
EXDT	-0.026223	0.021002	-1.248619	0.2135
Short Run Equation				
COINTEQ01	-0.174144	0.068926	-2.526544	0.0124
D(PRT)	0.105140	0.052338	2.008856	0.0461
D(GINT)	0.013931	0.037267	0.373826	0.7090
D(BFR)	0.102486	0.065011	1.576438	0.1167
D(MFR)	0.110576	0.072143	1.532731	0.1271
D(TFR)	-0.071607	0.043323	-1.652875	0.1001
D(IFR)	-0.078612	0.049662	-1.582927	0.1152
D(GDPG)	0.149939	0.082513	1.817164	0.0709
D(EXDT)	0.035454	0.029133	1.216983	0.2252
C	16.24626	6.239691	2.603696	0.0100

Mean dependent var	-0.149671	S.D. dependent var	2.755285
S.E. of regression	2.310614	Akaike info criterion	4.082970
Sum squared resid	939.6530	Schwarz criterion	5.885845
Log likelihood	-523.8560	Hannan-Quinn criter.	4.801801

*Note: p-values and any subsequent tests do not account for model selection.

agpf1 prt gint bfr mfr tfr ifr gdpg inf exdt
Dependent Variable: D(AGPF1)
Method: ARDL
Date: 08/22/24 Time: 13:07
Sample: 2001 2022
Included observations: 309
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): PRT GINT BFR MFR TFR IFR GDPG INF EXDT
Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
PRT	-0.701743	0.070058	-10.01660	0.0000
GINT	-0.529008	0.104085	-5.082468	0.0000
BFR	-0.404995	0.076063	-5.324487	0.0000
MFR	-0.081313	0.108226	-0.751330	0.4536
TFR	-0.003667	0.116961	-0.031354	0.9750
IFR	-0.177186	0.055990	-3.164610	0.0019
GDPG	1.392435	0.233097	5.973634	0.0000
INF	1.650175	0.267511	6.168622	0.0000
EXDT	-0.042693	0.009713	-4.395302	0.0000
	Short Run Equation			
COINTEQ01	-0.133251	0.057796	-2.305522	0.0225
D(PRT)	0.230433	0.120166	1.917614	0.0571
D(GINT)	0.089533	0.049615	1.804566	0.0731
D(BFR)	0.012450	0.066593	0.186961	0.8519
D(MFR)	0.022722	0.067344	0.337397	0.7363
D(TFR)	-0.023369	0.059859	-0.390410	0.6968
D(IFR)	-0.054255	0.051242	-1.058815	0.2914
D(GDPG)	-0.012729	0.076071	-0.167336	0.8673
D(INF)	0.070256	0.101131	0.694705	0.4883
D(EXDT)	0.101149	0.047377	2.134983	0.0344
C	11.40856	4.952727	2.303490	0.0226

Mean dependent var	-0.177829	S.D. dependent var	2.782369
S.E. of regression	1.745349	Akaike info criterion	3.776324
Sum squared resid	456.9365	Schwarz criterion	5.806724
Log likelihood	-437.7646	Hannan-Quinn criter.	4.586748

*Note: p-values and any subsequent tests do not account for model selection.

agpf2 prt gint bfr mfr tfr ifr gdpg
Dependent Variable: D(AGPF2)
Method: ARDL
Date: 08/22/24 Time: 13:07
Sample: 2001 2022
Included observations: 318
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): PRT GINT BFR MFR TFR IFR GDPG

Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
PRT	-0.178458	0.061494	-2.902030	0.0041
GINT	-0.802477	0.066720	-12.02762	0.0000
BFR	-0.141354	0.063523	-2.225239	0.0272
MFR	-0.772971	0.129514	-5.968252	0.0000
TFR	0.083203	0.100690	0.826326	0.4096
IFR	0.004309	0.040558	0.106235	0.9155
GDPG	-1.643972	0.180677	-9.098931	0.0000
Short Run Equation				
COINTEQ01	-0.058813	0.029181	-2.015419	0.0453
D(PRT)	0.010708	0.017585	0.608948	0.5433
D(GINT)	0.017758	0.015672	1.133100	0.2586
D(BFR)	-0.034747	0.015396	-2.256964	0.0251
D(MFR)	0.008672	0.015884	0.545946	0.5857
D(TFR)	0.022516	0.021311	1.056504	0.2921
D(IFR)	-0.035292	0.017776	-1.985409	0.0485
D(GDPG)	0.003601	0.030869	0.116654	0.9073
C	8.105150	4.186215	1.936152	0.0543

Mean dependent var	-0.644780	S.D. dependent var	1.241394
S.E. of regression	1.178440	Akaike info criterion	2.176594
Sum squared resid	266.6344	Schwarz criterion	3.796899
Log likelihood	-221.4912	Hannan-Quinn criter.	2.822632

*Note: p-values and any subsequent tests do not account for model selection.

agpf2 prt gint bfr mfr tfr ifr exdt
Dependent Variable: D(AGPF2)
Method: ARDL
Date: 08/22/24 Time: 13:07
Sample: 2001 2022
Included observations: 318
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): PRT GINT BFR MFR TFR IFR EXDT

Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
PRT	-0.320643	0.115591	-2.773945	0.0061
GINT	-1.134410	0.174064	-6.517207	0.0000
BFR	0.541498	0.139562	3.879979	0.0001
MFR	-0.042266	0.199593	-0.211759	0.8325
TFR	-0.801835	0.222455	-3.604478	0.0004
IFR	-0.046388	0.078205	-0.593162	0.5538
EXDT	0.002243	0.027455	0.081701	0.9350
	Short Run Equation			
COINTEQ01	-0.035796	0.021256	-1.684046	0.0938
D(PRT)	0.007326	0.018857	0.388494	0.6981
D(GINT)	0.025552	0.019796	1.290761	0.1983
D(BFR)	-0.062099	0.022254	-2.790437	0.0058
D(MFR)	-0.031097	0.019174	-1.621821	0.1065
D(TFR)	0.043676	0.025962	1.682275	0.0941
D(IFR)	-0.031161	0.016262	-1.916201	0.0568
D(EXDT)	-0.000880	0.010514	-0.083685	0.9334
C	3.630435	2.559257	1.418551	0.1577

Mean dependent var	-0.644780	S.D. dependent var	1.241394
S.E. of regression	1.175643	Akaike info criterion	2.289605
Sum squared resid	265.3704	Schwarz criterion	3.909910
Log likelihood	-240.3640	Hannan-Quinn criter.	2.935643

*Note: p-values and any subsequent tests do not account for model selection.

agpf3 prt gint bfr mfr tfr ifr inf
Dependent Variable: D(AGPF3)
Method: ARDL
Date: 08/22/24 Time: 13:21
Sample: 2001 2022
Included observations: 304
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): PRT GINT BFR MFR TFR IFR INF

Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
PRT	0.080628	0.055389	1.455679	0.1472
GINT	-0.452805	0.048961	-9.248340	0.0000
BFR	0.051941	0.053723	0.966836	0.3349
MFR	-0.218981	0.099538	-2.199977	0.0291
TFR	0.202147	0.062589	3.229761	0.0015
IFR	0.043556	0.030856	1.411586	0.1598
INF	-1.017770	0.152253	-6.684744	0.0000
	Short Run Equation			
COINTEQ01	-0.294260	0.105237	-2.796163	0.0057
D(PRT)	0.074470	0.079120	0.941222	0.3479
D(GINT)	0.051213	0.038839	1.318588	0.1890
D(BFR)	-0.142206	0.112453	-1.264588	0.2077
D(MFR)	-0.117085	0.112429	-1.041409	0.2991
D(TFR)	0.081913	0.086088	0.951502	0.3426
D(IFR)	-0.164076	0.082561	-1.987340	0.0484
D(INF)	0.130487	0.070108	1.861228	0.0644
C	6.903309	2.390615	2.887671	0.0044
Log likelihood	-482.1885			

*Note: p-values and any subsequent tests do not account for model selection.

agpf3 prt gint bfr mfr tfr ifr exdt
Dependent Variable: D(AGPF3)
Method: ARDL
Date: 08/22/24 Time: 13:20
Sample: 2001 2022
Included observations: 313
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): PRT GINT BFR MFR TFR IFR EXDT

Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
PRT	0.000295	0.000146	2.027705	0.0440
GINT	-5.70E-05	0.000245	-0.232319	0.8165
BFR	-0.000483	5.08E-05	-9.508565	0.0000
MFR	0.000228	9.46E-05	2.410777	0.0169
TFR	0.000734	0.000266	2.763691	0.0063
IFR	0.000168	8.61E-05	1.953474	0.0522
EXDT	-3.74E-05	7.81E-06	-4.790132	0.0000
	Short Run Equation			
COINTEQ01	-0.511204	0.082780	-6.175433	0.0000
D(PRT)	0.077449	0.073434	1.054669	0.2929
D(GINT)	-0.047712	0.044163	-1.080361	0.2814
D(BFR)	-0.113923	0.115873	-0.983171	0.3268
D(MFR)	-0.166643	0.120733	-1.380253	0.1691
D(TFR)	0.096046	0.080480	1.193411	0.2342
D(IFR)	-0.150554	0.074657	-2.016612	0.0452
D(EXDT)	0.010610	0.030897	0.343409	0.7317
C	2.722665	0.894300	3.044465	0.0027

Log likelihood -407.0401
*Note: p-values and any subsequent tests do not account for model selection.

Objective 3

```
xtpmg d.agpfl d.inst d.gdpg d.bm d.inf d.topn, lr(l.agpfl inst gdpg bm inf topn) ec(ECT) repl
> ace mg

----------------------------------------------------------------------------
Mean Group Estimation: Error Correction Form
(Estimate results saved as mg)
----------------------------------------------------------------------------
----------------------------------------------------------------------------
    D.agpfl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+--------------------------------------------------------------
ECT          |
        inst |    -8.8646   8.846441    -1.00   0.316    -26.20331    8.474106
        gdpg |  -.2363903   .5014135    -0.47   0.637    -1.219143    .7463622
          bm |  -.0707164    .177239    -0.40   0.690    -.4180984    .2766656
         inf |   .4733348   .2009424     2.36   0.018     .0794949    .8671746
        topn |  -.1297947   .1257456    -1.03   0.302    -.3762514    .1166621
-------------+--------------------------------------------------------------
SR           |
         ECT |   -.499643   .1138255    -4.39   0.000    -.7227369   -.2765491
             |
        inst |
         D1. |  -4.436829   3.096422    -1.43   0.152    -10.50571    1.632047
             |
        gdpg |
         D1. |   .0395775   .0379233     1.04   0.297    -.0347508    .1139057
             |
          bm |
         D1. |   .0388233   .0759955     0.51   0.609    -.1101252    .1877719
             |
         inf |
         D1. |  -.0457052   .0444697    -1.03   0.304    -.1328643    .0414539
             |
        topn |
         D1. |  -.0148185    .027218    -0.54   0.586    -.0681648    .0385279
             |
       _cons |    14.1839   4.764556     2.98   0.003     4.845542    23.52226
----------------------------------------------------------------------------

.
. outreg2 using ruftestobj3, bdec(3) tdec(3) rdec(3) adec(3) alpha (0.01, 0.05, 0.10) addstat(A
> dj. R-squared, e(r2_a)) excel append
check eret list for the existence of e(r2_a)
ruftestobj3.xml
dir : seeout
```

```
.
. xtpmg d.agpf1 d.inst d.gdpg d.bm d.inf d.topn, lr(l.agpf1 inst gdpg bm inf topn) ec(ECT) repl
> ace pmg

Iteration 0:   log likelihood = -548.20066  (not concave)
Iteration 1:   log likelihood =    -540.18
Iteration 2:   log likelihood = -537.17099  (not concave)
Iteration 3:   log likelihood = -533.60722  (not concave)
Iteration 4:   log likelihood = -531.16372
Iteration 5:   log likelihood = -529.42615
Iteration 6:   log likelihood = -529.10014
Iteration 7:   log likelihood = -529.00254  (not concave)
Iteration 8:   log likelihood = -529.00162  (not concave)
Iteration 9:   log likelihood = -529.00146  (not concave)
Iteration 10:  log likelihood = -529.00141  (not concave)
Iteration 11:  log likelihood = -529.00135  (not concave)
Iteration 12:  log likelihood = -529.00126  (not concave)
Iteration 13:  log likelihood = -529.00119  (not concave)
Iteration 14:  log likelihood = -529.00112  (not concave)
Iteration 15:  log likelihood = -529.00102  (not concave)
Iteration 16:  log likelihood =  -529.0009  (not concave)
Iteration 17:  log likelihood = -529.00085  (not concave)
Iteration 18:  log likelihood = -529.00074  (not concave)
Iteration 19:  log likelihood = -529.00066  (not concave)
Iteration 20:  log likelihood =  -529.0006  (not concave)
Iteration 21:  log likelihood = -529.00054  (not concave)
Iteration 22:  log likelihood =  -529.0004  (not concave)
Iteration 23:  log likelihood = -529.00015  (not concave)
Iteration 24:  log likelihood = -528.99997  (not concave)
Iteration 25:  log likelihood = -528.99974  (not concave)
Iteration 26:  log likelihood = -528.99964  (not concave)
Iteration 27:  log likelihood = -528.99954  (not concave)
Iteration 28:  log likelihood = -528.99944  (not concave)
Iteration 29:  log likelihood = -528.99925  (not concave)
Iteration 30:  log likelihood = -528.99869  (not concave)
Iteration 31:  log likelihood = -528.99794  (not concave)
Iteration 32:  log likelihood = -528.99775  (not concave)
Iteration 33:  log likelihood = -528.99751  (not concave)
Iteration 34:  log likelihood = -528.99718  (not concave)
Iteration 35:  log likelihood = -528.99693  (not concave)
Iteration 36:  log likelihood = -528.99668  (not concave)
Iteration 37:  log likelihood =  -528.1235  (not concave)
Iteration 38:  log likelihood = -526.83842
Iteration 39:  log likelihood = -526.27462
Iteration 40:  log likelihood =  -526.1622
Iteration 41:  log likelihood = -526.16185
```

```
Iteration 42:  log likelihood = -526.16185

Pooled Mean Group Regression
(Estimate results saved as pmg)

Panel Variable (i): c_id                    Number of obs      =      308
Time Variable (t): year                     Number of groups   =       15
                               Obs per group: min =       14
                                              avg =      20.5
                                              max =        22

                               Log Likelihood     = -526.1618
------------------------------------------------------------------------------
    D.agpf1 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ECT          |
        inst |   2.891772    1.22383     2.36   0.018     .4931095    5.290433
        gdpg |  -.2255001   .0248548    -9.07   0.000    -.2742146   -.1767856
          bm |   .0348863   .0373751     0.93   0.351    -.0383676    .1081403
         inf |   .5366607   .0354498    15.14   0.000     .4671803    .6061411
        topn |  -.0152916   .0116184    -1.32   0.188    -.0380633    .0074801
-------------+----------------------------------------------------------------
SR           |
         ECT |  -.2318668   .0961865    -2.41   0.016    -.4203888   -.0433448
             |
        inst |
         D1. |  -5.765802   3.204968    -1.80   0.072    -12.04742    .5158194
             |
        gdpg |
         D1. |   .1452079   .0310261     4.68   0.000     .0843979    .2060179
             |
          bm |
         D1. |  -.0375319   .0614924    -0.61   0.542    -.1580548     .082991
             |
         inf |
         D1. |   .0923702   .0606074     1.52   0.127    -.0264181    .2111585
             |
        topn |
         D1. |  -.0503674   .0200169    -2.52   0.012    -.0895998    -.011135
             |
       _cons |   8.105825   4.634395     1.75   0.080    -.9774225    17.18907
------------------------------------------------------------------------------
```

```
. hausman mg pmg, sigmamore

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       mg          pmg         Difference          S.E.
-------------+----------------------------------------------------------------
        inst |     -8.8646     2.891772       -11.75637        15.05954
        gdpg |   -.2363903    -.2255001       -.0108902        .8560233
          bm |   -.0707164     .0348863       -.1056027        .3003973
         inf |    .4733348     .5366607       -.0633259        .3413617
        topn |   -.1297947    -.0152916        -.114503        .2144513
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtpmg
            B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        2.63
                Prob>chi2 =      0.7566

.
. xtpmg d.agpf2 d.inst d.gdpg d.bm d.inf d.topn, lr(l.agpf2 inst gdpg bm inf topn) ec(ECT) repl
> ace mg


------------------------------------------------------------------------------
Mean Group Estimation: Error Correction Form
(Estimate results saved as mg)
------------------------------------------------------------------------------
------------------------------------------------------------------------------
     D.agpf2 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ECT          |
        inst |   6.034429   13.15583     0.46   0.646    -19.75052    31.81938
        gdpg |  -.4797306   .3354329    -1.43   0.153    -1.137167    .1777058
          bm |  -.4291231   .2144199    -2.00   0.045    -.8493783   -.0088679
         inf |  -.3296188   .3204783    -1.03   0.304    -.9577447    .2985071
        topn |  -.0310745   .1710829    -0.18   0.856    -.3663908    .3042419
-------------+----------------------------------------------------------------
SR           |
         ECT |  -.1238708   .0518466    -2.39   0.017    -.2254883   -.0222532
             |
        inst |
         D1. |  -.3404739   1.253937    -0.27   0.786    -2.798146    2.117198
             |
        gdpg |
         D1. |   .0572298   .0367288     1.56   0.119    -.0147572    .1292168
```

```
         |
      bm |
     D1. |   .0155065   .0267614     0.58   0.562    -.0369449     .067958
         |
     inf |
     D1. |  -.0024246   .0281355    -0.09   0.931    -.0575692    .0527199
         |
    topn |
     D1. |  -.0124968   .0285154    -0.44   0.661    -.0683859    .0433923
         |
   _cons |   9.835348   3.853238     2.55   0.011     2.283141    17.38755
------------------------------------------------------------------------------
.
. xtpmg d.agpf2 d.inst d.gdpg d.bm d.inf d.topn, lr(l.agpf2 inst gdpg bm inf topn) ec(ECT) repl
> ace pmg

Iteration 0:   log likelihood = -257.80759  (not concave)
Iteration 1:   log likelihood =  -248.1088  (not concave)
Iteration 2:   log likelihood = -245.03535  (not concave)
Iteration 3:   log likelihood =  -241.5257
Iteration 4:   log likelihood = -240.23534  (not concave)
Iteration 5:   log likelihood = -238.73848
Iteration 6:   log likelihood = -237.58323
Iteration 7:   log likelihood = -237.37817
Iteration 8:   log likelihood = -237.37102
Iteration 9:   log likelihood = -237.37099
Iteration 10:  log likelihood = -237.37099

Pooled Mean Group Regression
(Estimate results saved as pmg)

Panel Variable (i): c_id                    Number of obs      =       308
Time Variable (t): year                     Number of groups   =        15
                                  Obs per group: min =        14
                                                 avg =      20.5
                                                 max =        22

                                  Log Likelihood     =  -237.371
------------------------------------------------------------------------------
    D.agpf2 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ECT          |
       inst |  -48.30525    12.9513    -3.73   0.000    -73.68933   -22.92118
       gdpg |   .9376769   .3941907     2.38   0.017     .1650773    1.710276
         bm |  -.2036339   .0722556    -2.82   0.005    -.3452522   -.0620156
        inf |  -.5803207   .3065598    -1.89   0.058    -1.181167    .0205255
```

```
        topn |   .7113544   .1989865     3.57   0.000     .3213481    1.101361
-------------+----------------------------------------------------------------
SR           |
         ECT |   .0071913   .0121345     0.59   0.553    -.0165918    .0309744
             |
        inst |
         D1. |  -1.740649   .9289107    -1.87   0.061    -3.561281    .0799826
             |
        gdpg |
         D1. |   -.021908   .0219789    -1.00   0.319     -.064986    .0211699
             |
          bm |
         D1. |   .0067646    .013195     0.51   0.608    -.0190971    .0326264
             |
         inf |
         D1. |   .0091419   .0293935     0.31   0.756    -.0484684    .0667522
             |
        topn |
         D1. |  -.0158984    .022031    -0.72   0.471    -.0590783    .0272816
             |
       _cons |  -.4403956   .1607651    -2.74   0.006    -.7554893   -.1253018
------------------------------------------------------------------------------

.
. hausman mg pmg, sigmamore

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       mg          pmg         Difference          S.E.
-------------+----------------------------------------------------------------
        inst |    6.034429    -48.30525        54.33968        21.50302
        gdpg |   -.4797306     .9376769       -1.417407        .5042292
          bm |   -.4291231    -.2036339       -.2254892        .4026949
         inf |   -.3296188    -.5803207        .2507019        .5290966
        topn |   -.0310745     .7113544       -.7424289        .2587762
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtpmg
            B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =    -8.12    chi2<0 ==> model fitted on these
                Prob>chi2 =      0.1534
```

```
. xtpmg d.agpf3 d.inst d.gdpg d.bm d.inf d.topn, lr(l.agpf3 inst gdpg bm inf topn) ec(ECT) repl
> ace mg

------------------------------------------------------------------------------
Mean Group Estimation: Error Correction Form
(Estimate results saved as mg)
------------------------------------------------------------------------------
------------------------------------------------------------------------------
    D.agpf3 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ECT          |
       inst |  -16.96393   19.76279    -0.86   0.391    -55.69828    21.77042
       gdpg |   .7550597   .6570774     1.15   0.251    -.5327884    2.042908
         bm |   .1833187   .1121709     1.63   0.102    -.0365322    .4031696
        inf |  -.7911428   .5468868    -1.45   0.148    -1.863021    .2807357
       topn |  -.1746965   .2133276    -0.82   0.413    -.5928109    .2434179
-------------+----------------------------------------------------------------
SR           |
        ECT |  -.8533696    .098435    -8.67   0.000    -1.046299   -.6604405
             |
       inst |
        D1. |    .092614    3.45038     0.03   0.979    -6.670007    6.855235
             |
       gdpg |
        D1. |  -.0890721   .0769627    -1.16   0.247    -.2399161     .061772
             |
         bm |
        D1. |  -.1580695   .1079778    -1.46   0.143     -.369702    .0535631
             |
        inf |
        D1. |   .3135396   .1929183     1.63   0.104    -.0645734    .6916526
             |
       topn |
        D1. |  -.0280388   .0733123    -0.38   0.702    -.1717284    .1156507
             |
      _cons |  -2.616795   10.27353    -0.25   0.799    -22.75254    17.51895
------------------------------------------------------------------------------

.
. outreg2 using ruftestobj3, bdec(3) tdec(3) rdec(3) adec(3) alpha (0.01, 0.05, 0.10) addstat(A
> dj. R-squared, e(r2_a)) excel append
check eret list for the existence of e(r2_a)
ruftestobj3.xml
dir : seeout
```

```
.
. xtpmg d.agpf3 d.inst d.gdpg d.bm d.inf d.topn, lr(l.agpf3 inst gdpg bm inf topn) ec(ECT) repl
> ace pmg

Iteration 0:   log likelihood = -545.72368  (not concave)
Iteration 1:   log likelihood = -538.08047  (not concave)
Iteration 2:   log likelihood = -536.45362  (not concave)
Iteration 3:   log likelihood = -534.08073  (not concave)
Iteration 4:   log likelihood = -528.80467  (not concave)
Iteration 5:   log likelihood = -521.78266  (not concave)
Iteration 6:   log likelihood = -515.25733  (not concave)
Iteration 7:   log likelihood = -505.75756  (not concave)
Iteration 8:   log likelihood = -490.58943  (not concave)
Iteration 9:   log likelihood = -477.02102  (not concave)
Iteration 10:  log likelihood = -465.88301  (not concave)
Iteration 11:  log likelihood = -458.83696  (not concave)
Iteration 12:  log likelihood =  -454.2907  (not concave)
Iteration 13:  log likelihood = -449.88119
Iteration 14:  log likelihood = -449.17413
Iteration 15:  log likelihood = -446.14009
Iteration 16:  log likelihood = -445.52678
Iteration 17:  log likelihood = -445.51388
Iteration 18:  log likelihood = -445.51388

Pooled Mean Group Regression
(Estimate results saved as pmg)

Panel Variable (i): c_id                    Number of obs      =       303
Time Variable (t): year                     Number of groups   =        15
                                   Obs per group: min =        14
                                                  avg =      20.2
                                                  max =        22

                                   Log Likelihood      = -445.5139
------------------------------------------------------------------------------
    D.agpf3 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ECT          |
        inst |   .0195134   .0083047     2.35   0.019     .0032366    .0357902
        gdpg |  -.0005621   .0004001    -1.40   0.160    -.0013462     .000222
          bm |   .0002276   .0000674     3.38   0.001     .0000955    .0003598
         inf |   .0000917   .0002831     0.32   0.746    -.0004632    .0006466
        topn |   .0001724    .000106     1.63   0.104    -.0000353    .0003801
-------------+----------------------------------------------------------------
SR           |
         ECT |  -.4582998   .1011242    -4.53   0.000    -.6564997      -.2601
```

```
             |
        inst |
         D1. |  -8.941667   6.837133    -1.31   0.191    -22.3422    4.458867
             |
        gdpg |
         D1. |   .0393408   .0715595     0.55   0.582   -.1009132    .1795948
             |
          bm |
         D1. |   -.009939   .0650382    -0.15   0.879   -.1374115    .1175335
             |
         inf |
         D1. |   .0554745   .0872838     0.64   0.525   -.1155987    .2265477
             |
        topn |
         D1. |   -.030988   .0438793    -0.71   0.480   -.1169898    .0550138
             |
       _cons |   2.619917    .889841     2.94   0.003    .8758608    4.363973
------------------------------------------------------------------------------


. hausman mg pmg, sigmamore

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       mg          pmg         Difference          S.E.
-------------+----------------------------------------------------------------
        inst |   -16.96393     .0195134       -16.98345        37.15292
        gdpg |    .7550597    -.0005621        .7556218        1.235269
          bm |    .1833187     .0002276        .1830911        .2108749
         inf |   -.7911428     .0000917       -.7912345        1.028116
        topn |   -.1746965     .0001724       -.1748689        .4010439
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtpmg
            B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        3.10
                Prob>chi2 =      0.6848
```

Objective 4

Dependent Variable: D(AGPF1)
Method: ARDL
Date: 08/24/24 Time: 15:59
Sample: 2001 2022
Included observations: 307
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): PRT INST PRT*INST GDPG INF TOPN EXDT
Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
PRT	0.319056	0.059118	5.396978	0.0000
INST	-38.67661	5.531010	-6.992685	0.0000
PRT*INST	0.744501	0.114694	6.491170	0.0000
GDPG	0.418113	0.106600	3.922259	0.0001
INF	0.196864	0.102155	1.927111	0.0555
TOPN	-0.077038	0.031062	-2.480132	0.0141
EXDT	0.028267	0.009835	2.874136	0.0045
Short Run Equation				
COINTEQ01	-0.275493	0.080453	-3.424298	0.0008
D(PRT)	0.263313	0.380024	0.692885	0.4893
D(INST)	-81.63437	83.53785	-0.977214	0.3298
D(INST*PRT)	1.607603	1.677045	0.958592	0.3390
D(GDPG)	0.054187	0.041295	1.312177	0.1911
D(INF)	0.100382	0.063656	1.576950	0.1166
D(TOPN)	-0.023212	0.018739	-1.238713	0.2171
D(EXDT)	0.039949	0.020644	1.935136	0.0545
C	1.708466	0.852492	2.004085	0.0466

Mean dependent var	-0.163152	S.D. dependent var	2.782228
S.E. of regression	2.109766	Akaike info criterion	3.901998
Sum squared resid	801.2002	Schwarz criterion	5.566552
Log likelihood	-486.2217	Hannan-Quinn criter.	4.566541

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: D(AGPF1)
Method: ARDL
Date: 08/24/24 Time: 15:56
Sample: 2001 2022
Included observations: 310
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): GINT INST GINT*INST GDPG BM TOPN EXDT
Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
GINT	0.312748	0.091490	3.418368	0.0008
INST	-17.50994	5.141576	-3.405559	0.0008
GINT*INST	0.035389	0.174832	0.202420	0.8398
GDPG	-0.276895	0.112369	-2.464158	0.0146
BM	-0.188190	0.044898	-4.191490	0.0000
TOPN	-0.001450	0.044740	-0.032415	0.9742
EXDT	0.099213	0.018202	5.450666	0.0000
	Short Run Equation			
COINTEQ01	-0.268214	0.068667	-3.905989	0.0001
D(GINT)	0.278310	0.596581	0.466509	0.6414
D(INST)	-15.53992	15.79034	-0.984141	0.3263
D(GINT*INST)	0.424817	0.610076	0.696335	0.4871
D(GDPG)	0.145764	0.068239	2.136080	0.0340
D(BM)	-0.041160	0.081150	-0.507207	0.6126
D(TOPN)	-0.015512	0.029559	-0.524790	0.6004
D(EXDT)	-0.000448	0.019985	-0.022407	0.9821
C	3.260772	0.994014	3.280407	0.0012

Mean dependent var	-0.134232	S.D. dependent var	2.780955
S.E. of regression	2.142140	Akaike info criterion	3.921898
Sum squared resid	848.9214	Schwarz criterion	5.567691
Log likelihood	-499.2303	Hannan-Quinn criter.	4.578594

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: D(AGPF1)
Method: ARDL
Date: 08/24/24 Time: 16:02
Sample: 2001 2022
Included observations: 301
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): BFR INST BFR*INST GDPG BM INF EXDT
Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
BFR	0.255214	0.084898	3.006113	0.0030
INST	-33.57156	10.81621	-3.103818	0.0022
BFR*INST	0.463546	0.185420	2.499982	0.0133
GDPG	0.012517	0.076255	0.164152	0.8698
BM	-0.257429	0.009686	-26.57795	0.0000
INF	0.245754	0.042130	5.833255	0.0000
EXDT	0.033533	0.004500	7.451256	0.0000
Short Run Equation				
COINTEQ01	-0.283083	0.101481	-2.789520	0.0059
D(BFR)	0.604767	1.163797	0.519650	0.6040
D(INST)	-34.06931	65.06419	-0.523626	0.6012
D(BFR*INST)	0.621632	1.249914	0.497340	0.6196
D(GDPG)	0.111087	0.054589	2.034977	0.0434
D(BM)	0.000901	0.122166	0.007374	0.9941
D(INF)	0.104490	0.051006	2.048576	0.0420
D(EXDT)	0.007653	0.020459	0.374051	0.7088
C	3.446342	1.161034	2.968338	0.0034

Mean dependent var	-0.162676	S.D. dependent var	2.809422
S.E. of regression	2.103747	Akaike info criterion	3.868391
Sum squared resid	774.5065	Schwarz criterion	5.552189
Log likelihood	-471.1400	Hannan-Quinn criter.	4.540984

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: D(AGPF1)
Method: ARDL
Date: 08/24/24 Time: 16:22
Sample: 2001 2022
Included observations: 309
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): MFR INST MFR*INST GDPG INF EXDT
Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
MFR	-0.203482	0.077315	-2.631857	0.0092
INST	26.08447	13.85981	1.882023	0.0613
MFR*INST	-0.425725	0.175174	-2.430302	0.0160
GDPG	0.101618	0.096730	1.050531	0.2948
INF	-0.011012	0.071418	-0.154196	0.8776
EXDT	0.056288	0.011641	4.835497	0.0000
Short Run Equation				
COINTEQ01	-0.265154	0.071207	-3.723689	0.0003
D(MFR)	0.616159	0.762918	0.807634	0.4203
D(INST)	-43.23382	55.21421	-0.783020	0.4346
D(INST*MFR)	0.587498	0.781346	0.751904	0.4530
D(GDPG)	0.039417	0.037032	1.064400	0.2884
D(INF)	0.117253	0.047444	2.471396	0.0143
D(EXDT)	0.001569	0.023874	0.065735	0.9477
C	9.293749	2.380792	3.903638	0.0001

Mean dependent var	-0.177829	S.D. dependent var	2.782369
S.E. of regression	2.276277	Akaike info criterion	3.929775
Sum squared resid	1025.924	Schwarz criterion	5.400065
Log likelihood	-510.6236	Hannan-Quinn criter.	4.516634

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: D(AGPF1)
Method: ARDL
Date: 08/24/24   Time: 16:28
Sample: 2001 2022
Included observations: 310
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): TFR INST TFR*INST GDPG BM TOPN EXDT
Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
TFR	0.127620	0.068939	1.851203	0.0657
INST	-28.62384	7.198452	-3.976389	0.0001
TFR*INST	0.306641	0.105944	2.894378	0.0043
GDPG	-0.112115	0.111280	-1.007505	0.3150
BM	-0.227386	0.024360	-9.334339	0.0000
TOPN	-0.028785	0.027174	-1.059277	0.2909
EXDT	0.028556	0.007851	3.637422	0.0004
Short Run Equation				
COINTEQ01	-0.352375	0.113143	-3.114427	0.0021
D(TFR)	-0.150590	0.270305	-0.557110	0.5781
D(INST)	0.735694	25.64360	0.028689	0.9771
D(INST*TFR)	-0.028277	0.400552	-0.070596	0.9438
D(GDPG)	0.060322	0.033073	1.823900	0.0698
D(BM)	0.019894	0.038793	0.512841	0.6087
D(TOPN)	-0.013613	0.021772	-0.625261	0.5326
D(EXDT)	0.031124	0.013419	2.319360	0.0215
C	7.378351	2.060671	3.580557	0.0004

Mean dependent var	-0.134232	S.D. dependent var	2.780955
S.E. of regression	2.231137	Akaike info criterion	3.962921
Sum squared resid	920.9250	Schwarz criterion	5.608714
Log likelihood	-505.9376	Hannan-Quinn criter.	4.619617

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: D(AGPF1)
Method: ARDL
Date: 08/24/24 Time: 16:32
Sample: 2001 2022
Included observations: 310
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): IFR INST IFR*INST GDPG BM TOPN
Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
IFR	-0.177292	0.064024	-2.769151	0.0061
INST	-10.42928	5.018870	-2.078015	0.0390
IFR*INST	0.120687	0.043275	2.788837	0.0058
GDPG	-0.247354	0.137673	-1.796675	0.0739
BM	0.040082	0.052010	0.770661	0.4418
TOPN	-0.095257	0.044777	-2.127371	0.0346
Short Run Equation				
COINTEQ01	-0.259703	0.099178	-2.618546	0.0095
D(IFR)	-0.483210	0.396362	-1.219114	0.2242
D(INST)	16.62591	17.89838	0.928906	0.3541
D(IFR*INST)	-0.470367	0.414774	-1.134032	0.2581
D(GDPG)	0.107334	0.046286	2.318918	0.0214
D(BM)	-0.016956	0.076925	-0.220429	0.8258
D(TOPN)	0.005088	0.027459	0.185296	0.8532
C	10.84641	4.426017	2.450604	0.0151

Mean dependent var	-0.134232	S.D. dependent var	2.780955
S.E. of regression	2.244094	Akaike info criterion	4.046185
Sum squared resid	1012.228	Schwarz criterion	5.506537
Log likelihood	-535.5513	Hannan-Quinn criter.	4.628887

*Note: p-values and any subsequent tests do not account for model selection.

AGPF2

Dependent Variable: D(AGPF2)
Method: ARDL
Date: 08/24/24 Time: 16:55
Sample: 2001 2022
Included observations: 301
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): PRT INST PRT*INST BM INF EXDT

Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
PRT	0.132910	0.071862	1.849508	0.0659
INST	-17.76028	2.811803	-6.316332	0.0000
PRT*INST	0.202230	0.071097	2.844416	0.0049
BM	-0.040099	0.043665	-0.918348	0.3596
INF	0.252526	0.057591	4.384846	0.0000
EXDT	-0.004478	0.014935	-0.299842	0.7646
Short Run Equation				
COINTEQ01	-0.083866	0.039232	-2.137678	0.0338
D(PRT)	-0.019491	0.253940	-0.076753	0.9389
D(INST)	-80.73984	82.93137	-0.973574	0.3315
D(INST*PRT)	1.459900	1.664518	0.877071	0.3815
D(BM)	0.019000	0.050938	0.372993	0.7096
D(INF)	-0.009932	0.024691	-0.402270	0.6879
D(EXDT)	-0.019038	0.017914	-1.062783	0.2892
C	2.777694	1.769068	1.570145	0.1180

Mean dependent var	-0.668844	S.D. dependent var	1.261645
S.E. of regression	1.156182	Akaike info criterion	2.318118
Sum squared resid	255.3205	Schwarz criterion	3.812193
Log likelihood	-241.4217	Hannan-Quinn criter.	2.914926

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: D(AGPF2)
Method: ARDL
Date: 08/24/24 Time: 16:54
Sample: 2001 2022
Included observations: 309
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): GINT INST GINT*INST INF EXDT
Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
GINT	0.861511	0.232397	3.707064	0.0003
INST	-26.30644	5.687042	-4.625680	0.0000
GINT*INST	1.023317	0.241101	4.244347	0.0000
INF	0.050340	0.093496	0.538421	0.5908
EXDT	0.103899	0.018266	5.688100	0.0000
Short Run Equation				
COINTEQ01	-0.097609	0.037237	-2.621317	0.0094
D(GINT)	-0.044788	0.089652	-0.499582	0.6179
D(INST)	-4.159820	5.808056	-0.716216	0.4746
D(GINT*INST)	0.014085	0.168292	0.083696	0.9334
D(INF)	0.014284	0.019389	0.736708	0.4621
D(EXDT)	-0.001140	0.015952	-0.071441	0.9431
C	1.686126	1.250563	1.348293	0.1790

Mean dependent var	-0.656873	S.D. dependent var	1.248708
S.E. of regression	1.059237	Akaike info criterion	2.209016
Sum squared resid	240.1043	Schwarz criterion	3.492601
Log likelihood	-247.8605	Hannan-Quinn criter.	2.721352

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: D(AGPF2)
Method: ARDL
Date: 08/24/24 Time: 16:58
Sample: 2001 2022
Included observations: 301
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): BFR INST BFR*INST BM INF EXDT
Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
BFR	0.810970	0.248857	3.258773	0.0013
INST	-28.90988	12.52134	-2.308849	0.0220
BFR*INST	0.758305	0.263546	2.877320	0.0045
BM	-0.891503	0.075786	-11.76345	0.0000
INF	-0.169315	0.134573	-1.258163	0.2099
EXDT	0.060424	0.021625	2.794160	0.0057
Short Run Equation				
COINTEQ01	-0.096943	0.035436	-2.735735	0.0068
D(BFR)	0.176337	0.290275	0.607484	0.5443
D(INST)	-19.56926	19.49825	-1.003642	0.3168
D(BFR*INST)	0.298250	0.346745	0.860142	0.3908
D(BM)	0.073816	0.035752	2.064688	0.0403
D(INF)	0.023381	0.025602	0.913271	0.3623
D(EXDT)	-0.005732	0.017045	-0.336308	0.7370
C	2.178499	1.134588	1.920080	0.0563

Mean dependent var	-0.668844	S.D. dependent var	1.261645
S.E. of regression	1.166929	Akaike info criterion	2.253256
Sum squared resid	260.0893	Schwarz criterion	3.747330
Log likelihood	-231.1411	Hannan-Quinn criter.	2.850064

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: D(AGPF2)
Method: ARDL
Date: 08/24/24 Time: 16:58
Sample: 2001 2022
Included observations: 301
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): MFR INST MFR*INST BM INF EXDT

Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
MFR	0.583156	0.148644	3.923162	0.0001
INST	-19.35029	11.59906	-1.668263	0.0969
MFR*INST	0.298686	0.156352	1.910346	0.0576
BM	-0.744127	0.054541	-13.64355	0.0000
INF	-0.102242	0.048885	-2.091467	0.0378
EXDT	0.087238	0.014174	6.154829	0.0000
Short Run Equation				
COINTEQ01	-0.087173	0.040146	-2.171403	0.0311
D(MFR)	0.374187	0.418836	0.893399	0.3728
D(INST)	-38.97857	30.59984	-1.273816	0.2043
D(INST*MFR)	0.544002	0.421248	1.291406	0.1981
D(BM)	0.053209	0.033393	1.593413	0.1127
D(INF)	0.008747	0.024709	0.353993	0.7237
D(EXDT)	-0.010745	0.017911	-0.599903	0.5493
C	1.211212	0.878829	1.378212	0.1698

Mean dependent var	-0.668844	S.D. dependent var	1.261645
S.E. of regression	1.165843	Akaike info criterion	2.261938
Sum squared resid	259.6051	Schwarz criterion	3.756012
Log likelihood	-232.5171	Hannan-Quinn criter.	2.858746

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: D(AGPF2)
Method: ARDL
Date: 08/24/24 Time: 17:00
Sample: 2001 2022
Included observations: 310
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): TFR INST TFR*INST BM TOPN EXDT
Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
TFR	0.600056	0.253499	2.367094	0.0189
INST	-40.05203	15.96957	-2.508023	0.0129
TFR*INST	0.515411	0.240940	2.139165	0.0336
BM	0.046379	0.049537	0.936250	0.3503
TOPN	-0.049141	0.034930	-1.406846	0.1610
EXDT	0.107091	0.014588	7.340859	0.0000
Short Run Equation				
COINTEQ01	-0.118812	0.048234	-2.463233	0.0146
D(TFR)	0.002928	0.064960	0.045077	0.9641
D(INST)	-2.632570	6.691968	-0.393392	0.6944
D(INST*TFR)	0.025302	0.106165	0.238326	0.8119
D(BM)	-0.003028	0.034416	-0.087969	0.9300
D(TOPN)	-0.008813	0.016319	-0.540079	0.5897
D(EXDT)	-0.014258	0.013434	-1.061360	0.2898
C	-0.201938	0.539587	-0.374246	0.7086

Mean dependent var	-0.656091	S.D. dependent var	1.253957
S.E. of regression	1.122446	Akaike info criterion	2.367088
Sum squared resid	253.2369	Schwarz criterion	3.827439
Log likelihood	-261.0188	Hannan-Quinn criter.	2.949790

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: D(AGPF2)
Method: ARDL
Date: 08/24/24 Time: 17:02
Sample: 2001 2022
Included observations: 307
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): IFR INST IFR*INST INF TOPN EXDT

Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
IFR	-0.394851	0.092338	-4.276135	0.0000
INST	21.75384	11.37416	1.912566	0.0573
IFR*INST	-0.382085	0.133791	-2.855834	0.0048
INF	0.858939	0.286308	3.000054	0.0030
TOPN	-0.710485	0.172779	-4.112096	0.0001
EXDT	0.107880	0.040643	2.654311	0.0086
Short Run Equation				
COINTEQ01	-0.049918	0.015194	-3.285274	0.0012
D(IFR)	-0.094815	0.122287	-0.775347	0.4391
D(INST)	-0.615127	7.757743	-0.079292	0.9369
D(IFR*INST)	-0.043888	0.145154	-0.302350	0.7627
D(INF)	-0.005243	0.031583	-0.166015	0.8683
D(TOPN)	-0.006954	0.020287	-0.342778	0.7321
D(EXDT)	0.004775	0.015780	0.302563	0.7625
C	4.860415	1.887568	2.574961	0.0108

Mean dependent var	-0.659253	S.D. dependent var	1.252210
S.E. of regression	1.168867	Akaike info criterion	2.217324
Sum squared resid	267.7849	Schwarz criterion	3.694322
Log likelihood	-230.9891	Hannan-Quinn criter.	2.806989

*Note: p-values and any subsequent tests do not account for model selection.

AGPF3

Dependent Variable: D(AGPF3)
Method: ARDL
Date: 08/24/24 Time: 20:20
Sample: 2001 2022
Included observations: 305
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): PRT INST PRT*INST GDPG BM
Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
PRT	0.066608	0.020554	3.240627	0.0014
INST	4.205803	1.849186	2.274408	0.0239
PRT*INST	-0.285734	0.021843	-13.08126	0.0000
GDPG	-0.104428	0.027799	-3.756491	0.0002
BM	0.003019	0.028244	0.106901	0.9150
Short Run Equation				
COINTEQ01	-0.389973	0.116508	-3.347182	0.0010
D(PRT)	0.477504	0.202736	2.355294	0.0194
D(INST)	-34.56332	13.88131	-2.489918	0.0135
D(INST*PRT)	0.790560	0.304149	2.599250	0.0100
D(GDPG)	-0.006619	0.042425	-0.156009	0.8762
D(BM)	-0.081502	0.099981	-0.815174	0.4159
C	1.047374	0.709885	1.475415	0.1416

Log likelihood-536.5098

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: D(AGPF3)
Method: ARDL
Date: 08/24/24 Time: 20:24
Sample: 2001 2022
Included observations: 296
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): GINT INST GINT*INST BM INF TOPN EXDT
Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
GINT	0.217506	0.147665	1.472970	0.1426
INST	-5.853097	4.773057	-1.226279	0.2218
GINT*INST	0.305041	0.195335	1.561630	0.1202
BM	0.294520	0.066355	4.438527	0.0000
INF	-1.232361	0.245034	-5.029355	0.0000
TOPN	0.142707	0.058159	2.453751	0.0151
EXDT	0.106398	0.016600	6.409599	0.0000
Short Run Equation				
COINTEQ01	-0.286987	0.114333	-2.510105	0.0130
D(GINT)	0.997661	0.523007	1.907547	0.0581
D(INST)	-55.28791	22.81799	-2.422997	0.0164
D(GINT*INST)	1.734201	0.755820	2.294464	0.0230
D(BM)	-0.002610	0.124286	-0.021001	0.9833
D(INF)	0.264556	0.141416	1.870770	0.0631
D(TOPN)	-0.007132	0.052786	-0.135116	0.8927
D(EXDT)	-0.094604	0.042663	-2.217471	0.0279
C	-2.864798	1.908418	-1.501137	0.1352

Log likelihood -498.9148

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: D(AGPF3)
Method: ARDL
Date: 08/24/24 Time: 20:27
Sample: 2001 2022
Included observations: 296
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): BFR INST BFR*INST GDPG BM INF
Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
BFR	0.013546	0.041010	0.330317	0.7415
INST	7.869069	3.497627	2.249831	0.0256
BFR*INST	-0.179020	0.073088	-2.449367	0.0152
GDPG	0.044555	0.075705	0.588532	0.5569
BM	-0.050652	0.019075	-2.655470	0.0086
INF	-0.625951	0.147258	-4.250715	0.0000
	Short Run Equation			
COINTEQ01	-0.299648	0.107333	-2.791756	0.0058
D(BFR)	0.996895	1.202306	0.829152	0.4081
D(INST)	-117.9422	136.0681	-0.866788	0.3872
D(BFR*INST)	1.971987	2.370184	0.831997	0.4065
D(GDPG)	0.026092	0.055279	0.472017	0.6375
D(BM)	0.007392	0.131230	0.056330	0.9551
D(INF)	0.171080	0.101556	1.684592	0.0937
C	3.138009	1.126969	2.784469	0.0059

Log likelihood -506.9726

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: D(AGPF3)
Method: ARDL
Date: 08/24/24 Time: 20:33
Sample: 2001 2022
Included observations: 305
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): MFR INST MFR*INST GDPG BM TOPN EXDT
Fixed regressors: C
Number of models evalulated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
MFR	-0.035094	0.009026	-3.887987	0.0001
INST	2.577307	0.559978	4.602517	0.0000
MFR*INST	-0.032873	0.007465	-4.403609	0.0000
GDPG	0.012691	0.000939	13.51003	0.0000
BM	-0.004863	0.000674	-7.210861	0.0000
TOPN	-0.000393	0.000520	-0.755483	0.4509
EXDT	-0.001030	0.000105	-9.794584	0.0000
Short Run Equation				
COINTEQ01	-0.623668	0.162051	-3.848597	0.0002
D(MFR)	-1.067287	0.375898	-2.839299	0.0077
D(INST)	129.3757	107.1293	1.207660	0.2288
D(INST*MFR)	-1.850913	1.474074	-1.255645	0.2109
D(GDPG)	0.007328	0.054026	0.135637	0.8923
D(BM)	0.151185	0.126570	1.194483	0.2339
D(TOPN)	0.023714	0.067908	0.349208	0.7273
D(EXDT)	0.023636	0.034912	0.677016	0.4993
C	4.243126	0.950729	4.463024	0.0000

Log likelihood -453.7782

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: D(AGPF3)
Method: ARDL
Date: 08/24/24   Time: 21:04
Sample: 2001 2022
Included observations: 302
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): TFR INST TFR*INST INF TOPN EXDT
Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
TFR	-0.002978	0.001484	-2.007123	0.0461
INST	0.153165	0.067813	2.258631	0.0250
TFR*INST	-0.001994	0.001076	-1.853574	0.0653
INF	0.000682	0.000165	4.145680	0.0001
TOPN	0.000175	4.23E-05	4.130186	0.0001
EXDT	-8.50E-05	8.56E-06	-9.928571	0.0000
Short Run Equation				
COINTEQ01	-0.411183	0.087957	-4.674801	0.0000
D(TFR)	-0.113586	0.034983	-3.246921	0.0018
D(INST)	10.93975	39.03482	0.280256	0.7796
D(INST*TFR)	-0.169148	0.609640	-0.277456	0.7817
D(INF)	-0.008795	0.052621	-0.167130	0.8674
D(TOPN)	-0.039833	0.048297	-0.824743	0.4105
D(EXDT)	-0.025473	0.002739	-9.301091	0.0000
C	2.807271	0.954955	2.939688	0.0037

Log likelihood -441.8339

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: D(AGPF3)
Method: ARDL
Date: 08/24/24 Time: 22:08
Sample: 2001 2022
Included observations: 296
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): IFR INST IFR*INST BM INF TOPN
Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
IFR	-0.125784	0.015950	-7.886134	0.0000
INST	10.38141	1.361934	7.622546	0.0000
IFR*INST	-0.134768	0.018307	-7.361566	0.0000
BM	0.068643	0.012894	5.323437	0.0000
INF	-0.035962	0.019769	-1.819091	0.0705
TOPN	0.041773	0.010539	3.963515	0.0001
Short Run Equation				
COINTEQ01	-0.414020	0.120894	-3.424653	0.0008
D(IFR)	0.129382	0.224839	0.575442	0.5657
D(INST)	-48.17741	11.95780	-4.028953	0.0000
D(IFR*INST)	0.652531	0.284110	2.296755	0.0293
D(BM)	-0.103949	0.113746	-0.913868	0.3620
D(INF)	0.148641	0.085561	1.737250	0.0840
D(TOPN)	-0.023706	0.059912	-0.395683	0.6928
C	5.168951	1.759727	2.937360	0.0037

Log likelihood -491.6558

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: D(AGPF4)
Method: ARDL
Date: 12/01/24 Time: 21:49
Sample: 2001 2022
Included observations: 296
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): PRT INST PRT*INST BM TOPN
EXDT
Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
PRT	0.086094	0.012045	7.147611	0.0000
INST	-1.408298	0.249110	-5.653318	0.0000
PRT*INST	0.060650	0.009200	6.592103	0.0000
BM	0.000886	0.001098	0.806875	0.4208
TOPN	-0.004342	0.001129	-3.844979	0.0002
EXDT	3.39E-05	0.000219	0.154937	0.8770
	Short Run Equation			
COINTEQ01	-0.101319	0.052161	-1.942424	0.0536
D(PRT)	-0.027614	0.022072	-1.251077	0.2125
D(INST)	4.500126	3.768755	1.194062	0.2340
D(INST*PRT)	-0.101270	0.078225	-1.294594	0.1971
D(BM)	-0.002635	0.001441	-1.828361	0.0691
D(TOPN)	-0.001631	0.000940	-1.734392	0.0845
D(EXDT)	0.000374	0.001261	0.296272	0.7674
C	0.527758	0.273283	1.931179	0.0550
Log likelihood	489.3740			

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: D(AGPF4)
Method: ARDL
Date: 12/01/24   Time: 21:55
Sample: 2001 2022
Included observations: 296
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): GINT INST GINT*INST GDPG
BM TOPN EXDT
Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
GINT	0.136664	0.037026	3.691035	0.0003
INST	-3.475634	1.103109	-3.150761	0.0019
GINT*INST	0.129325	0.038037	3.399976	0.0008
GDPG	0.066647	0.019965	3.338229	0.0010
BM	-0.000699	0.005327	-0.131245	0.8957
TOPN	-0.013820	0.005453	-2.534366	0.0122
EXDT	-0.001774	0.001261	-1.406732	0.1613
	Short Run Equation			
COINTEQ01	-0.050227	0.021744	-2.309920	0.0221
D(GINT)	-0.003461	0.008957	-0.386422	0.6997
D(INST)	0.193139	0.623060	0.309985	0.7569
D(GINT*INST)	-0.009342	0.019771	-0.472519	0.6372
D(GDPG)	0.003061	0.001873	1.634479	0.1040
D(BM)	-0.001729	0.002532	-0.683065	0.4955
D(TOPN)	-0.001393	0.000986	-1.412122	0.1597
D(EXDT)	0.000323	0.001036	0.311722	0.7556
C	0.220825	0.085257	2.590100	0.0104
Log likelihood	541.9696			

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: D(AGPF4)
Method: ARDL
Date: 12/02/24 Time: 03:42
Sample: 2001 2022
Included observations: 296
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): BFR INST BFR*INST GDPG BM
TOPN
Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
BFR	0.042986	0.007634	5.630711	0.0000
INST	-2.596444	0.419841	-6.184353	0.0000
BFR*INST	0.043574	0.007229	6.027481	0.0000
GDPG	0.023492	0.007147	3.287118	0.0012
BM	-0.000309	0.001509	-0.204527	0.8382
TOPN	-0.011673	0.002211	-5.280288	0.0000
	Short Run Equation			
COINTEQ01	-0.135536	0.061532	-2.202674	0.0288
D(BFR)	-0.013341	0.008638	-1.544477	0.1242
D(INST)	1.699364	0.865424	1.963621	0.0511
D(BFR*INST)	-0.027279	0.014849	-1.837072	0.0678
D(GDPG)	0.005281	0.002443	2.161948	0.0319
D(BM)	-1.08E-05	0.002116	-0.005089	0.9959
D(TOPN)	-0.001446	0.001182	-1.223575	0.2227
C	0.771247	0.340348	2.266053	0.0246
Log likelihood	519.9008			

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: D(AGPF4)
Method: ARDL
Date: 12/02/24 Time: 03:48
Sample: 2001 2022
Included observations: 296
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): MFR INST MFR*INST GDPG BM
EXDT
Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
MFR	0.073783	0.019455	3.792507	0.0002
INST	-4.717096	1.596609	-2.954446	0.0035
MFR*INST	0.067505	0.020127	3.353890	0.0010
GDPG	-0.000870	0.003671	-0.237091	0.8128
BM	0.008376	0.003466	2.416622	0.0166
EXDT	-0.004306	0.001146	-3.756836	0.0002
	Short Run Equation			
COINTEQ01	-0.120974	0.047741	-2.533947	0.0121
D(MFR)	-0.011684	0.006339	-1.843100	0.0669
D(INST)	1.063973	1.199266	0.887187	0.3761
D(INST*MFR)	-0.016778	0.016834	-0.996679	0.3202
D(GDPG)	0.005961	0.001978	3.013127	0.0029
D(BM)	-6.40E-05	0.001720	-0.037207	0.9704
D(EXDT)	0.000652	0.000781	0.834878	0.4049
C	0.264401	0.083438	3.168836	0.0018
Log likelihood	509.1353			

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: D(AGPF4)
Method: ARDL
Date: 12/02/24 Time: 03:52
Sample: 2001 2022
Included observations: 296
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): TFR INST TFR*INST BM TOPN
EXDT
Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
TFR	0.019549	0.003908	5.002794	0.0000
INST	-0.700695	0.288298	-2.430450	0.0160
TFR*INST	0.016832	0.004518	3.725207	0.0003
BM	0.010912	0.002229	4.896346	0.0000
TOPN	-0.000919	0.002017	-0.455446	0.6493
EXDT	-0.003823	0.000802	-4.766498	0.0000
	Short Run Equation			
COINTEQ01	-0.181019	0.052934	-3.419685	0.0008
D(TFR)	-0.009386	0.005551	-1.690685	0.0926
D(INST)	-0.672180	1.106030	-0.607741	0.5441
D(INST*TFR)	0.007523	0.017217	0.436981	0.6626
D(BM)	-0.002381	0.001812	-1.314408	0.1903
D(TOPN)	-0.001082	0.001078	-1.003778	0.3168
D(EXDT)	0.000882	0.001137	0.775561	0.4390
C	1.131957	0.320425	3.532676	0.0005
Log likelihood	502.2676			

*Note: p-values and any subsequent tests do not account for model
selection.

Dependent Variable: D(AGPF4)
Method: ARDL
Date: 12/02/24 Time: 03:57
Sample: 2001 2022
Included observations: 296
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): IFR INST IFR*INST BM
Fixed regressors: C
Number of models evaluated: 1
Selected Model: ARDL(1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
IFR	0.011182	0.005531	2.021652	0.0444
INST	-0.896437	0.329077	-2.724092	0.0070
IFR*INST	0.016731	0.005706	2.932288	0.0037
BM	0.029306	0.002562	11.43783	0.0000
	Short Run Equation			
COINTEQ01	-0.153865	0.062480	-2.462625	0.0146
D(IFR)	-0.002862	0.006100	-0.469242	0.6394
D(INST)	0.238359	0.337354	0.706555	0.4806
D(IFR*INST)	-0.003958	0.007506	-0.527238	0.5986
D(BM)	-0.006481	0.002527	-2.564586	0.0110
C	0.949920	0.371345	2.558050	0.0112
Log likelihood	441.6801			

*Note: p-values and any subsequent tests do not account for model selection.

Biodata

A. Personal Data

1. Full Names: Rufus Adetule ADENIPEKUN
2. Address: 9 Omodayo Owotuga Street, BERA Estate, off Chevron Drive, Lekki, Lagos
3. Email and Phone Number : rufustule@outlook.com , 08078191660
4. Date and Place of Birth: 27th January 1967 Ondo
5. Nationality: Nigerian
6. Name and Address of Next of Kin: Adenipekun, Olanike Victoria, 9 Omodayo Owotuga Street, BERA Estate, off Chevron Drive, Lekki, Lagos, Nigeria

B. Educational Background

Educational Institutions Attended with Dates and Qualifications

Lead City University Ibadan, Oyo State (Ph.D. Economics) In-view

Lead City University Ibadan, Oyo State (M.Sc. Economics) 2019- 2021

Ladoke Akintola University of Tech, Ogbomosho, Osun State (MBA International Finance) 1998-2000

Federal Polytechnic Ado Ekiti, Ekiti State (HND Distinction) 1988 - 1993

Oshodi Comprehensive High School, Oshodi Lagos State 1985 - 1987

West African Examination School O 'level 1985 - 1987

St. Joseph Primary School, Aponmu, Ondo State 1973 – 1979

(First School Leaving Certificate)

C. Working Experience with Dates

Flour Mills of Nigeria Plc, Lagos Director, Group Accounting 2022 till Date

Flour Mills of Nigeria Plc, Lagos Finance Director	2018 till 2021
Flour Mills of Nigeria Plc, Lagos (Regional Head of Finance)	2014 – 2017
Flour Mills of Nigeria Plc, Lagos (Finance Divisional Head)	2010 – 2014
Acklands Grainger, Ontario Canada (Senior Manager, FP&A)	2006 – 2010
Air Liquide Limited, Tema Ghana (Financial Controller)	2002 – 2005
Air Liquide Nigeria Limited, Lagos (Area Accountant)	1996 - 2001

D. Award and Fellowships

European American University, Republic of Panama, Central America

(Honorary Doctor of Science in Business Mgt. and Corporate Finance) 2019

E. Membership of Academic Professional Bodies:

Accelerated Mgt Program (Yale School of Mgt, New York, USA) – Feb 2022

Fellow, Institute of Strategic Human Capital Managers (FSHCM) – March 2021

Fellow, Institute of Chartered Accountant of Nigeria (FCA) – April 2011

Member, Project Management Institute (PMP) – June 2009

Certified Associate member - Investment Funds Institute of Canada – Jan 2008

Certified Functional Consultant – SAP (FICO) – June 2008

Certified Public Accountant, (CPA – New York USA) 2007

SAP FI/CO Consulting – Toronto College of Tech, Canada– 2007

Associate member - Institute of Chartered Accountant of Nigeria (ACA) - 1997

Associate member - Institute of Management (MNIM) – 1997

Associate member - Chartered Institute of Taxation of Nigeria (ACIT) – 1999

F. Publication (if Any): ADENIPEKUN Rufus Adetule & OGUNJIMI Olusola Olakunle, Government Expenditure and Agricultural Performance in Nigeria: A Test for Causality. Asian Basic and Applied Research Journal. Volume 6 (Issue 1), 2022

G. Major Conferences Attended with Dates:

52nd Annual Accountant Conference 2022: Adopting Sustainability for Economic Prosperity.

53rd Annual Accountant Conference 2023: Imperative for Inclusive Development

African Institute of Public Administration Conference 2022: Enterprise Risk Management

U.S. Soyabean Export Council (USSEC): Commodity Clasic 2021

H. Referees

1) Nassib Rafful
   Managing Director, Manufacturing
   Flour Mills of Nigeria Plc
   Apapa, Lagos, Nigeria

2) Williams Erimona
   Partner, EY
   Victoria Island, Lagos, Nigeria

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Signature Date

The University Compliance Certification

This is to certify that this Thesis written by Rufus Adetule ADENIPEKUN with Matric No: LCU/PG/001216 in the Department of Economics, Faculty of Management and Social Sciences, Lead City University, Ibadan is in full compliance with the approved University format and style.

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Signature Date