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# Reassessing the Role of Agriculture: Limited Impact of Agricultural Production on Growth Stability in Developing Economies.

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**Abstract**

Objective: This study investigates whether agricultural production enhances macroeconomic growth stability in developing economies, examining both direct effects and the moderating role of climate-related factorsMethodology: We employ a panel data approach using Pooled OLS, Country Fixed Effects, Two-Way Fixed Effects (country and year), and Two-Stage Least Squares (2SLS) instrumental variable estimators. Endogeneity is addressed through internal instruments (deeper lags of the dependent variable), with instrument strength validated by a first-stage F-statistic of 35.12. Diagnostic tests include VIF for multicollinearity, Jarque-Bera for normality, Breusch-Pagan for heteroskedasticity, Cook's Distance for influential observations, and Leave-One-Country-Out for coefficient stability.Sample: The study uses 144 country-year observations from 16 developing economies across Latin America, East and Southeast Asia, South Asia, Sub-Saharan Africa, and the MENA region over the period 2015–2024. The dependent variable is a novel non-parametric growth stability index constructed as the reciprocal of the absolute deviation of GDP growth from its long-term trend.Key Findings: Agricultural production volume has no statistically significant direct effect on growth stability across all specifications, challenging linear Agriculture-Led Growth narratives. However, the Climate Change Performance Index enters positively and significantly under country fixed effects ($\beta = 0.065$, $p < 0.01$), indicating that environmental performance—not raw output volume—is the operative channel through which agriculture influences macroeconomic resilience. Growth stability exhibits strong persistence (coefficient 0.724–0.809, $p < 0.01$), suggesting path dependence and slow adjustment to policy interventions. Inflation significantly destabilizes growth paths ($\beta = -0.017$, $p < 0.05$), while trade openness contributes conditionally to stability ($\beta = 0.058$, $p < 0.01$ under country FE). The two-way fixed effects model explains 96.35% of the variation in growth stability ($R^2 = 0.9635$).Conclusion: Expanding agricultural output alone cannot buffer developing economies against boom-and-bust cycles. Effective stabilization requires climate-smart agriculture, rural infrastructure investment, and shock-responsive food security systems. The strong persistence of growth stability implies that once instability becomes entrenched, reversing it requires sustained structural interventions rather than short-term sectoral policies.

**Keywords:** Agricultural Production; Economic Growth Volatility; Macroeconomic Resilience; Climate Change; Fixed Effects Panel; Developing Countries.

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# 1. Introduction

## 1.1 Background

- **Importance of agriculture in developing economies**

The changes in the structure of the economies around the world have always been one of the fundamental concepts in developmental economics with an evident divide between developed and developing countries. The development processes experienced by wealthy nations have ensured that the role of agriculture in their economies has continuously shrunk to a point of insignificance in terms of their GDP and workforce contribution (Awokuse & Xie, 2014). Contrasting this experience are developing and emerging economies, which depend on their primary sector as an essential pillar for development. Agriculture is still a major part of life in many underdeveloped nations since it constitutes most of the workforce available (Gina et al., 2023). Although industrialization has continued in these countries for years now, there still remains a significant gap between the primary and other economic sectors, particularly in areas such as Sub-Saharan Africa and Latin America.

Theoreticians of development have long been engaged in debates over the nature of agriculture in terms of its role in development. The theory of Agricultural Led Growth (ALG), on the other hand, suggests that having a strong primary sector will be key to macroeconomic growth due to the numerous linkages involved (Awokuse & Xie, 2014). In particular, a strong agricultural base will enable industrialization by ensuring that there is adequate provision of raw materials, savings for investments in the secondary sector, demand for industrial products, provision of labor for industries and foreign currency from agriculture (Gina et al., 2023). It is noteworthy that neglecting the potentiality of a country's agricultural sector before embarking on a process of industrialization will most likely lead to imbalanced wealth distribution and development stagnation.

In addition to being part of the structure of the macroeconomic system, agriculture holds an unparallel social and economic necessity due to its direct influence on extreme poverty alleviation and food security. According to statistics compiled by global bodies, most of the poor people in the world live in the rural areas, depending solely on local agrifood systems (Nugroho, 2021). Empirical evidence indicates that growth in productivity in the agricultural sector is responsible for alleviating poverty much faster than other sectors of the economy, as it results in direct job creation, increasing profit margins for farms, and rising real wages (Pawlak & Kołodziejczak, 2020). In addition, agriculture is responsible for defining food security dynamics. The global

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population will be crossing several milestones in the next few decades; thus, there will be a tremendous increase in demand for food (Pawlak & Kołodziejczak, 2020). An increase in production in this sector will act as a safeguard to prevent chronic hunger and protect households from fluctuations in global food prices.

Despite all these considerations, the agricultural scenario within the developing world continues to face significant limitations emanating from inefficiencies in the system, as well as challenges associated with the changing dynamics of globalization. The smallholder-based approach still faces a number of inefficiencies that include limited adoption of digital technologies in agricultural activities, increased expenses on inputs, and fragmented value chains dominated by the exploitative oligopsonies (Nugroho, 2021). Moreover, the weaknesses in the system continue to be amplified by the changing environment conditions that pose direct threats to soil quality and sources of water, increasing the financial risks facing the smallholder farmers (Bastidas-Orrego et al., 2023). Consequently, there is a need for transformation towards more sustainable financing of agriculture, improved public policy measures, and development of strong international relationships to cope with these challenges. Thus, an evaluation of the multi-faceted impact of agriculture in the developing world becomes crucial for the achievement of the UN SDGs.

- **Economic growth volatility in developing countries**

Output volatility, which may be described as the pattern of irregular and unpredictable swings in the rate of growth of real GDP, is one of the key challenges that developing countries face on a macroeconomic level. Although more developed countries are usually characterized by relatively stable business cycles and occasional departures from their normal long-run growth paths, less developed countries regularly have to deal with serious macroeconomic shocks (Aguiar & Gopinath, 2007). This phenomenon is not merely a temporary deviation, but a situation where the continuous instability has a detrimental effect on the long-run capacity of the country to grow. There is substantial evidence in the macroeconomic literature that suggests a significant negative correlation between volatility and long-term economic growth (Ramey & Ramey, 1995). It should be noted, thus, that identifying the factors behind volatility and its impact is critical.

The greater sensitivity of the growth of developing economies to fluctuations is primarily due to structural imbalances, especially their dependence on the export of commodities, as well as low export diversification. Low- and middle-income countries have not yet been able to break away from their specialization-based production structure in which they only produce few goods such

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as food, minerals, or energy, while consuming sophisticated manufactured goods (Prebisch, 1950). This makes these countries highly vulnerable to shocks in the terms of trade, since commodity prices tend to be volatile and fluctuate cyclically (Loayza et al., 2007). With the decline in the price of commodities internationally, a fall occurs in the level of earnings from exports, causing balance of payment problems, a depreciation of their domestic currency, and falling output in the nation. Since the domestic financial market in these economies tends to be relatively undeveloped, this creates shocks in the economy as a whole.

Apart from the vulnerability of developing economies to external shocks due to trade structure, other domestic factors also tend to enhance, not reduce, volatility within such economies. One of the main elements of internal instability in developing countries is the presence of procyclical fiscal policies. In a well-structured economy, a government should engage in countercyclical activities by saving when the economy does well and increasing spending when there is a recession (Kaminsky et al., 2004). As a result of domestic political and economic factors and limited access to foreign finance in periods of recession, developing countries tend to use periods of revenue growth to expand government spending dramatically and cut down on it sharply during periods of economic slowdown. Procyclicality intensifies the inherently volatile nature of private enterprises. Moreover, shallow domestic financial markets and poor regulation of these markets prevent households and corporations from accessing credit needed for consumption and investments.

The socio-economic implications of growth volatility are extremely significant, particularly when considering its detrimental effect on the development of human capital as well as poverty reduction initiatives. Whereas rich individuals have diversification opportunities within their asset portfolio, poor households in the developing world do not have insurance mechanisms to shield them against economic slowdowns. Thus, economic crises compel the poor to adopt survival strategies that limit their potential productivity in the long-run; for example, withdrawing children from schools to join the workforce or cutting down on nutrition (Frankenberg et al., 2003). In the aggregate, extreme volatility generates high levels of uncertainty, which are very off-putting for foreign direct investments, and discourages capital accumulation due to the risks involved with long-term manufacturing investments. Considering the current global environment, which poses new risks to macroeconomic stability such as tighter financial markets and climatic supply shocks, there exists an urgent need to undertake a thorough study of growth volatility.

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- **Role of agriculture in macroeconomic resilience and food security**

The modern world is characterized by developing and emerging nations being faced with multiple challenges such as geopolitical risks, climatic disturbances, and extreme financial market volatilities. Under these conditions, agriculture has regained its prominence in macroeconomic discussions not only because it is one of the most essential sectors of production but also due to the fact that it has become an important pillar for ensuring macroeconomic resilience and food security in these nations (Constas et al., 2021). Although the industrial and services sectors face extreme downturns accompanied by labor layoffs in times of macroeconomic crises, the agrifood chain acts as a countercyclical shock absorber.

The sustainability of macroeconomics in developing regions is highly associated with the internal resilience of the agrifood supply chains and their ability to address balance of payments risks. In many cases, the presence of a productive agricultural sector within the economy of developing countries acts as a natural buffer for any international trade disruptions and reliance on foreign imports (Bastidas-Orrego et al., 2023). In the case of disruptions of global supply chains and sharp spikes in commodity prices in international markets, developing countries that have productive agriculture can simply skip importing expensive products and retain foreign exchange reserves in order not to provoke currency depreciation (Loayza et al., 2007). Moreover, due to the fact that food is a significant element in the CPI of developing countries, domestic agricultural productivity is crucial in addressing food inflation risks.

On the other hand, agriculture provides the boundaries within which the country's food security is defined, and food security is a structural requirement for economic development and stability. Food security requires four major pillars of: availability, access, utilization, and stability (FAO, 2023). In most underdeveloped areas, small-scale agriculture becomes the direct source of such pillars in ensuring availability of food at the local level and providing broad employment in rural areas that guarantees the economic access to food (Pawlak & Kołodziejczak, 2020). At the same time, poor performance of agricultural infrastructure in terms of poor storage facilities, weak distribution systems, and minimal use of technology results in increased food loss after harvest and local food insecurity (Nugroho, 2021). If agriculture is unable to meet domestic demand, it leads to food insecurity and, consequently, incurs severe macroeconomic costs of underdeveloped human capital, higher health spending, and social instability.

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Nevertheless, both roles played by agriculture – the provision of macroeconomic resilience and food security – are increasingly jeopardized amid ongoing crises at the international level. In particular, climate change, which involves unpredictable rainfalls and severe weather conditions, is a direct challenge to agriculture's productivity and destabilizes food production systems globally (Bastidas-Orrego et al., 2023). Moreover, the increasing number of geopolitical conflicts contributes to the fragility of the sector through disrupting fertilizer supplies and energy markets, thereby causing significant increases in input prices for agriculture among poor countries (Zhou et al., 2020). The response to these challenges calls for a fundamental shift toward more resilient models of farming based on climate-smart practices, increased public investments in infrastructure development, and effective management of value chains. This issue thus becomes crucial in terms of academia and policies, as it will allow fulfilling the goals of the United Nations' SDGs, especially SDG 1 and SDG 2.

### 1.2 Research Problem

In spite of numerous efforts made throughout the years via development programs and structural adjustment initiatives, economic growth in developing countries still proves volatile and unstable due to the high prevalence of boom-and-bust cycles. This type of macroeconomic instability occurs primarily because of the structural deficiencies of such countries combined with their vulnerability to external shocks in the economy. It is common practice for developing economies to export a small selection of commodities, thus making them extremely vulnerable to unpredictable changes in the global market (Aguiar & Gopinath, 2007). As soon as external shocks occur and lead to capital flight, adverse terms of trade changes or even political upheavals, developing countries experience sharp declines in production. This situation becomes even more critical due to poor domestic institutions and procurement policies that are conducted in a procyclical manner and, therefore, add to the decline instead of counteracting it (Kaminsky et al., 2004). In contrast to advanced nations, developing economies do not have deep and well-developed financial systems, nor do they have reliable welfare programs. All these factors account for the fact that economic instability affects investments and the development of human capital.

Indeed, discovering effective sectorial engines that will be able to withstand those shock waves and secure macroeconomic stability has emerged as one of the key concerns of modern policy planners; at the same time, there remains a crucial deficiency within the current body of empirical literature when it comes to discussing the potential stabilizing power of the agricultural sector.

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While conventional theoretical paradigms tend to underestimate the first sector's potential as low-productive and destined to diminish in significance in terms of contribution to national economies, modern observations have shown that the primary sector may prove to play the key role of a necessary counter-cyclical cushion against the backdrop of macroeconomic crises (Gina et al., 2023). Still, very little empirical proof has been provided in relation to what extent sustainable agricultural production contributes to improving the stability of economic growth within developing nations. Macroeconomic studies usually consider agriculture to be just an engine for increasing GDP volumes, rather than helping mitigate the output variability of the economy overall.

### 1.3 Research Questions

To address the identified gaps in the literature and provide empirical clarity on the macroeconomic dynamics of developing economies, this study formulates and investigates the following research questions:

- **Research Question 1 (RQ1):** To what extent, and through what specific structural mechanisms, does agricultural production enhance macroeconomic growth stability and minimize output volatility in developing countries?
- **Research Question 2 (RQ2):** How do climate-related factors and environmental anomalies (such as temperature variations, precipitation shocks, and extreme weather events) affect the relationship between agricultural productivity and macroeconomic stability?

### 1.4 Research Objectives

In direct alignment with the research questions, the specific objectives of this study are:

- **Research Objective 1 (RO1):** To empirically quantify the impact of agricultural production variations on aggregate economic growth volatility across a panel of developing nations.
- **Research Objective 2 (RO2):** To evaluate the moderating role of climate change indices on the agrifood sector's capacity to function as a macroeconomic stabilizer.

### 1.5 Significance and Contribution of the Study

The present study makes unique contributions to existing empirical research in the area of development economics, structural transformation, and macroeconomic stabilization. Whereas past research has extensively studied the factors influencing the size of economic growth, the

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current paper changes the analytical focus by considering the sectoral factors that affect the stability of economic growth. The contributions made by this research can be stated in three points as follows:

To begin with, the proposed research provides an innovative and nonparametric approach to measuring the economic stability of growth which goes a step ahead of conventional static indices of macroeconomic variance. Instead of using complicated parametric approaches to measure volatility in economy, this study proposes a new dynamic and time varying index of stability based on the reciprocal of the absolute deviation of the GDP growth rate from its long term trend. The suggested index proves to be effective in detecting structural breaks and asymmetries in the output by making no assumption about the distribution of macroeconomic variables. It is this advanced and direct index of economic growth stability that acts as the dependent variable in this study.

On the other hand, from a methodological perspective, this paper relies on a multi-step econometric method to analyze the factors leading to growth stability. Uncovering the sources of growth volatility in macroeconomic panels is inevitably tied to the occurrence of endogeneity problems, reverse causality (where the stability of growth in turn influences agricultural investments), and the lack of some variables. The analysis that relies purely on OLS or fixed effects methods can mean bias and inconsistency given what I just said econometric problems. As a result, this paper takes advantage of a hierarchical modeling plan to tackle the problems mentioned above. Firstly, baseline Pooled OLS, Country Fixed Effects and Country-Year Fixed Effects models are fitted to establish baseline results and see how accounting for unobserved heterogeneity might change the results. Secondly, to explicitly deal with endogeneity issues resulting from the lagged dependent variable and also possible reverse causality, a Two-Stage Least Squares (2SLS) instrumental variable technique is utilized. Longer lags of the dependent variable (GS_t-2 and GS_t-3) act as instruments for the lagged growth stability term. Also, diagnostic tests such as the first-stage F-statistic for checking instrument strength.

Third, this research presents complete empirical analysis conducted with the help of a panel of developing countries spanning Sub-Saharan Africa, South Asia, and Latin America. Instead of focusing on individual country-level analyses, which tend to be limited by structural transformation, institutional strength, and climate sensitivity, this cross-regional perspective helps identify how the agrifood sector performs as a countercyclical shock absorber within each of the distinct macroeconomic environments. From a policy perspective, this empirical analysis presents

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key information that could help governments in the Global South make sound policy decisions related to investing in the development of climate-smart agriculture systems in order to stabilize their macroeconomies.

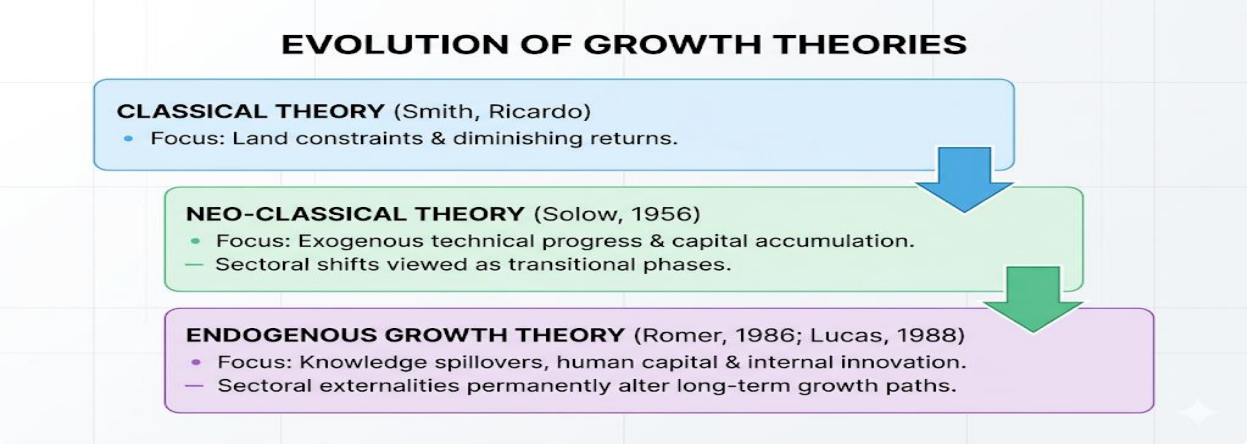
## 2. Literature Review

### 2.1 Theoretical Framework

#### Economic Growth Theories

The history of development of the economic growth theories creates the theoretical basis to understand the role of sectoral dynamics within the aggregate national income. The Classical theory of growth developed by Adam Smith and David Ricardo put stress on finite resources of the land and on diminishing returns on labor inputs in agriculture while treating industry as the major driver of growth. This sectoral structure was mathematically expressed in the Exogenous Neo-Classical Theory of growth created by Solow (1956). In particular, according to this approach, aggregate national income grows over time due to population growth, capital accumulation, and exogenous technological change.

Exogenous approach in the economic growth theory received criticism from Romer (1986) and Lucas (1988) who developed the concept of the Endogenous Growth Theory. In contrast to the Exogenous Growth Theory, the endogenous approach treats economic growth as an internally motivated process stimulated by human capital investment, knowledge spillovers, and innovation. Thus, under Endogenous Approach, sectoral structures are treated as not only as the elements contributing to aggregate income but as the factors causing permanent shifts in economic growth rate of the country. If certain sectors experience rapid learning-by-doing or stimulate technological change within other sectors, their development results in increasing aggregate growth rate.




**Source: Own elaboration**

## Agriculture-Led Growth Hypothesis

Agriculture-led growth (ALG) hypothesis is the theory which claims that investments in structure and increases in productivity in agriculture act as a fundamental trigger for macroeconomic growth, especially during the initial phases of the process of industrialization. The Agricultural-Led Growth hypothesis is a refutation of theories regarding growth in underdeveloped countries, like that of Lewis' dual economy, which regards agriculture as a mere surplus of labor, which only needs to be transferred to productive industry. The ALG hypothesis put forth by Johnston & Mellor (1961) claims that agriculture not only supplies surplus labor but is also multidimensional in nature and contributes towards development through five different channels of the macroeconomic economy: food production, material production, foreign currency earnings, marketing for industries, and domestic savings.

In countries which rely heavily on agrifood systems for their gross domestic product and job employment opportunities, increases in agricultural productivity create a strong positive impact. It was proven by Johnston and Mellor (1961) that increased agricultural productivity reduces real price level of food in country, which consequently does not lead to an increase in the nominal wages of the labor employed in industry. Moreover, a thriving rural economy provides for a large internal demand for industrially produced goods as well as agricultural products.

The current versions of the ALG Hypothesis, as stated by Awokuse and Xie (2014), suggest that overall agricultural growth is much better at alleviating poverty and promoting rural non-farm economic activity than an equivalent amount of growth would be in the other sectors of the

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economy. Agricultural growth will help provide a foundation of poor people's purchasing power for maintaining a stable level of internal demand, thereby allowing population migration from rural to urban areas to occur and providing the stable macroeconomic foundation for long-term structural change.

**Macroeconomic Stability Theories**

Theories regarding macroeconomic stability identify how to lessen fluctuations in total economic activity and help to insulate countries from harmful business cycles. To this end, early Keynesian economics demonstrated how market economies are inherently subject to continuous periods of instability created by variations in total demand for goods and services, as well as varying levels of investment ("animal spirits"). As part of these principles, Keynesian economists promote the use of contractions in total demand during periods of economic expansion through the use of countercyclical fiscal and monetary policies during periods of economic contraction (i.e. injecting liquidity and increasing the level of government spending) to smooth the fluctuations in total output and achieve the maximum level of employment. Conversely, according to Real Business Cycle theory, fluctuations in macroeconomic performance are ultimately the result of unexpected exogenous supply shocks that affect the production process (for example, unexpected changes in technology, unexpected changes in productivity, or unexpected changes in terms of trade). According to RBC theorists, fluctuations in macroeconomic performance are conducive to optimal market responses to exogenous supply shocks (Aguiar & Gopinath, 2007).

In developing nations, fundamental structural differences, and barriers to development (institutional frictions) imply that traditional business cycle theory must be altered substantially to apply; thus, Aghion et al. (2010), incorporated imperfections in the capital market into their macroeconomic stability theory and showed that firms can experience "deep disruptive events" from exogenous shocks when they do not have access to hours from the capital market during an economic downturn. The lack of access to credit forces firms to reduce their long-term investments and R&D, thus turning a transitory shock into a permanent reduction in potential output.

Moreover, in many developing countries, the political economy constraints that governments use also create a pro-cyclical fiscal behavior in which governments spend too much during economic booms and cut back on investment during recessions, thus compounding output volatility (Kaminsky et al., 2004). In this regard, modern macroeconomic stability theory emphasizes that the development of structural stabilizers (i.e.: diversified economic bases and strong domestic

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production sectors) will enable economies to withstand supply and demand shocks without the continued reliance on limited resources provided by the state's stabilization fund.

### 2.2 Agricultural Production and Economic Growth

**Empirical Evidence on Agriculture and GDP Growth**

The academic research has demonstrated that agricultural activity has an essential role in terms of economic contributions. The studies conducted internationally have shown to a statistically significant, and positive relationship between agricultural growth and total economic growth (i.e. GDP growth) across a wide range of countries. Awokuse and Xie (2014) provided evidence supporting the idea of agriculture as a means of increasing economic activity by providing a significant increase in aggregate total economic activity, supporting the agriculture-led growth hypothesis using a rigorous two pronged panel data study to estimate forecast their models solutions; using vector autoregressive (VAR), and cointegration techniques to test for causality between economic activity (GDP) and agriculture productive improvement. They further support the agriculture-led growth hypothesis by identifying that the stronger increases in total economic activity from agriculture stem from lower per capita incomes, when the agricultural sector represents a larger portion of the working population.

Empirically, the literature also suggests that lack of attention to agriculture can impede broader economic growth. Specifically, in many regions (including Sub-Saharan Africa and some of South Asia) where there has historically been little investment in rural infrastructure or agricultural R&D, we see low levels of overall growth and continued poverty traps (Gina et al., 2023). Applied evidence from SVAR shows that shocks to agricultural output lead to immediately positive changes in both the manufacturing and service sectors because of strong forward and backward linkages between them and agriculture. These findings illustrate that agricultural development is not a backward economic stage but rather a fundamental component required for long-term, sustainable GDP increases within developing economies.

**Productivity Effects of Agriculture**

Agriculture's productivity effects are transmitted through a number of intra-sectoral and inter-sectoral channels, which radically transform the efficiency of an economy's structures and landscapes. Intra-sectorally, agricultural productivity advancements are largely attributable to the widespread adoption of modern agricultural inputs, including new plant genetics, synchronised irrigation systems, chemical fertilizers and digitalised market information networks (Nugroho,

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2021). As a result, as smallholder farmers transition from subsistence farming to input-optimised agriculture, their yields per hectare increase dramatically. Consequently, two things happen - their farm income rises, which helps increase rural savings and reduces the price of food produced in the domestic market.

As a structural catalyst for agricultural production, inter-sectoral agricultural productivity growth also facilitates the release of surplus agriculture labour to the economy's more modern sectors without compromising food security levels. With the improvement in agriculture's efficiency, fewer people are needed to produce the food required by the domestic market, which in turn provides an opportunity for those previously engaged in agriculture to migrate easily to work in manufacturing or high-value service sectors - as demonstrated in Lewis's (1954) classic dual sector model.

Agricultural productivity also provides foreign exchange through high-value agrifood exports, which allows developing countries to import capital goods and advanced industrial technologies to improve both domestic economic growth and agricultural productivity. There is a large body of empirical evidence generated through Total Factor Productivity (TFP) accounting that indicates that agricultural TFP growth has large inter-sectoral effects, enabling lower costs of production for non-agricultural sectors and increasing the overall level of competitiveness of a country's economy.

**Structural Transformation Literature**

The structural transformation literature looks at how economies over the very long-run have shifted from an economically active population that was primarily engaged in low productivity agricultural production to an economically active population primarily engaged in higher productivity industrial and services production. In this view, the relationship between agriculture (as measured by shares of total value added and total employment) and total value added in all three sectors was thought to be linear and systematically decreasing through time (Chenery & Syrquin 1975). Recent literature on structural transformation, however, has shifted its focus to acknowledging that this process is not smooth, but rather highly heterogeneous and characterized by structural bottlenecks, particularly for developing countries. As such, many developing countries are undergoing the phenomenon of "premature de-industrialization," where the transition from agricultural production to higher productivity industrial sectors has not occurred, but rather

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the labor force has transitioned out of agricultural production and into the informal urban services sector without first passing through an industrial services sector.

The poor trajectory of structural transformation reinforces the importance of agriculture as a source of stability in an economy. McArthur and Sachs (2019) stress that for an economy to successfully transform its structure, there must be an initial "green revolution" that improves agricultural productivity. If an economy industrializes while its agriculture is not productive, the economy's dependence on imported food will create balance-of-payments difficulties and result in macroeconomic instability. Due to these factors, researchers in the modern literature on structural transformation advocate that transformation must occur through an integrated approach; that is, agriculture should not be viewed only as an antiquated sector, but as a dynamic sector with respect to modernization and should occur with respect to industrial development so that a balanced, resilient process of macroeconomic transformation can take place.

### 2.3 Economic Growth Stability and Volatility

#### Growth Volatility in Developing Countries

One of the most notable features of the macroeconomic environment for developing countries in the Global South is the volatility along their economic growth paths. In contrast to advanced, industrialized economies that tend to have stable long-run economic growth paths and relatively small and predictable fluctuations around those paths, developing economies tend to experience profound contractions in their economic output and wild fluctuations in their economic growth paths (Aguiar & Gopinath, 2007). Studies suggest that the standard deviation of real GDP growth rates for low-income countries is often between two and three times greater than that for high-income (OECD) countries. The consequences of this structural instability can be very negative—the presence of chronic volatility will shorten private companies' planning horizons; stifle the long-term formation of domestic capital; and significantly reduce the effectiveness of public infrastructure investments.

In addition to demonstrating this pattern, literature has indicated that growth volatility has been shown to be regressive socio-economically. Due to the lack of a global social safety net, as well as the presence of underdeveloped insurance markets, developed countries are not able to effectively address sudden drops in economic activity, thus causing long-term harm to the most vulnerable segments of society. During periods of economic downturn, families with low incomes usually have no other option than to sell off productive assets, decrease their healthcare

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expenditure, and exclude their children from the educational system in order to generate funds for their immediate survival (Frankenberg et al., 2003). These types of negative coping strategies permanently decrease future productivity of labour and create intergenerational cycles of poverty. Therefore, modern development economists consider that reducing growth volatility and increasing macroeconomic predictability are equally important for human welfare and sustainable development as increasing the absolute level of GDP growth.

**Sources of Macroeconomic Instability**

There are many reasons why developing countries experience macroeconomic instability. These causes may include, but are not limited to: the relationship between domestic political and economic factors, and their relationship to structural and institutional weaknesses. One principal reason that domestic economies are often volatile is due to the use of pro-cyclical fiscal policy by the government. In a perfect macroeconomic world, governments would utilize counter-cyclical fiscal policy to smooth out the business cycle. Unfortunately, because developing countries often have significant political pressures and institutional weaknesses, they will typically increase their public expenditures aggressively at the time of significant revenue inflows, and then cut their public investments effectively to zero at the time of revenue declines, thus worsening volatility in the private sector. In addition, developing countries tend to have very shallow domestic financial markets, thus providing little opportunity for domestic firms to access financing for their investments and smooth their investments through down cycles.

Developing countries are at risk due to their high dependency on exporting a limited number of materials. This is made worse by the large amounts of movements that the prices of commodities go through, as well as the sudden downturns (cyclical crashes) that can occur when commodity-dependent countries experience a sudden shift in the amount of money they can earn through exports and the volume of money they can borrow. As a result, rapid changes in international capital flows, sudden stops in foreign direct investment, and global interest rate shocks can all affect domestic price inflation and exchange rate crises, pointing to the fact that the structural openness of developing markets has a greater rate than their domestic regulatory/stabilization capabilities.

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**External Shocks and Resilience**

Research on Economic Resilience looks primarily at an economy's ability to sustain itself through severe shocks. It can do so by being able to absorb, adapt to, and recover from such shocks without 'structural damage' being impacted. Resilience should be seen as more than just a passive 'resistance' to shocks; but rather an indication of an economy's structural flexibility, the quality of its institutions and the diversity of their sectors." In many developing countries one of the factors affecting the ability to build Resilience is through Structural Rigidity. Some examples of these Structural Rigidity are; low labour mobility (ability to move labour easily); Disjointed Domestic Markets of the countries and high levels of informal employment. These examples illustrate that when the rigid economies are subjected to an external shock like a Global Financial Crisis or a Disruption in International Supply Chains, the economic shock would quickly propagate through their economic system resulting in prolonged economic recessions and/or systemic instability.

In this regard the agricultural sector has increasingly been seen as an essential factor for macroeconomic stability. The agrifood sector is often a natural countercyclical stabilizer to the macroeconomic downturns because it typically provides baseline employment, absorbs displaced urban labour, and sustains fundamental domestic demand, through severe macroeconomic downturns and global pandemics when modern manufacturing and services have suffered an enormous drop-off in production and employment (Gina et al., 2023). In addition, a strong domestic agricultural sector creates a buffer from balance of payments shocks, by decreasing the degree to which an economy relies on expensive foreign food imports, which helps to maintain foreign reserves and stabilise the domestic currency in the event of foreign economic crises (Loayza et al., 2007).

### 2.4 Climate Change and Agricultural Performance

**Drought and Agricultural Productivity**

Growing evidence indicates that climate change is an existential threat to agricultural production in developing countries through increasingly frequent and severe episodes of drought. Furthermore, most agricultural systems in the Global South are primarily rainfed and lack sufficient modern irrigation infrastructure; hence, water availability is the primary determinant of annual crop yield. A number of studies using downscaled climate models and empirical data have demonstrated that long-term drought shocks lead to rapid declines in total factor productivity in

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agriculture, with associated widespread crop failure, livestock death and rapid degradation of productive topsoil.

**Temperature effects on economic activity**

New macroeconomic research is uncovering that rising temperatures have a direct and negative effect on wide economic activities, going beyond just the environmental aspect. Pioneering research work, for example, Dell et al. (2012), has shown that an increment in temperature leads to a decrease in economic growth of about 1.3 percentage points in poor countries. The downside temperature-growth association works through different main channels: it lowers labor productivity in sectors exposed to the outdoors, causes faster wearing out of capital, and raises health risks for humans. The agricultural sector feels the sting of the temperature effect quite strongly because of the biological groundwork.

Temperature fluctuations, and shifting weather patterns, affect the timing of crop development, increase the loss of water through evaporation, create conditions favorable for crop pests, and at the same time cause plants to reach and exceed their tolerance limits to heat, resulting in massive yield losses. In addition, since farming depends largely on human labor in many developing areas, extreme heat waves not only put agricultural laborers at risk of heat stress but also result in a decrease in their work efficiency and the total amount of work done each day due to the direct physiological impact of exposure to high temperatures. At the macro level, these microeconomic disruptions pile up producing a shrinkage of the growth rates at the sector level and greater fluctuations in the overall GDP.

**Climate Vulnerability in Developing Economies**

Developing countries are paradoxically placed in the climate change picture. They are the ones suffering the worst economic consequences of climate change, even though they have contributed the least to greenhouse gas emissions historically. Their situation is worsened by a combination of their poor geographic location and very limited capacity to adjust and respond to changes. For example, many developing countries find themselves in tropical and subtropical regions where the yearly temperatures are already reaching or exceeding the levels that are best for human work and plant growth, so that any temperature increase is going to be very damaging.

Besides, the resource and governance structures of the poorer countries fundamentally limit their adaptability to the rising risks of climate change. For example, small farmers generally do not have the means to obtain formal agricultural insurance, resilient crop seeds, and up-to-date water

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management systems, which expose them greatly to weather fluctuations (Bastidas-Orrego et al. 2023).

Then again, at the national level, excessive public debts and a lack of fiscal resources lead to a situation where governments are unable to build large-scale climate-protective infrastructures, such as regional irrigation networks, advanced warning systems, and durable networks of transportation. Because of climate-induced disruptions to supply, which are becoming more frequent and more severe, the overall vulnerability of this system could cause the permanent destabilization of agricultural production, the weakening of domestic food security, and the continuous macroeconomic instability within the developing world.

### 2.5 Research Gap

**Limited Studies Combining These Variables**

Years of research have resulted in a wide variety of literature diving deep into different aspects of economic development. But a primary research gap still exists where agricultural production, economic growth stability, climate variables, and dynamic panel econometrics meet. The knowledge base remains highly broken up and separate streams of research working mainly in isolation. One set of literature focuses only on the factors determining absolute economic growth volume, largely sidelining how sectoral configurations might influence growth stability or output variance over time. Another set, mainly within agricultural economics, accounts for microeconomic vulnerabilities of smallholders to weather shocks but fails to link such local disruptions with aggregate macroeconomic business cycles and national resilience systems.

Besides that, although more and more people are seeing the disastrous effects of climate change, empirical research seldom accounts for the moderating influence of climate anomalies on the link between sectoral performance and macroeconomic stability. Most models of volatility treat climate factors as mere control variables instead of seeing them as systemic shocks that often means a fundamental change in how the primary sector acts as an economic stabilizer. The current literature, by not incorporating these aspects into a single empirical system, leaves a huge puzzle piece missing for policymakers in the Global South. The present research targets this gap head-on and offers a thorough, econometrically solid study of the way agricultural productivity coupled with climate change impacts the stability of economic growth in the long run.

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## 3. Methodology

### 3.1 Econometric Framework

This paper uses a panel data method to explore the effect of agricultural output on the stability of economic growth. Three different econometric methods are applied to the data. The first one focuses purely on how agricultural production affects the stability of economic growth. The second one analyzes how agricultural production and stability of growth can still be compatible after taking into account the impact of macroeconomic variables like inflation and openness to trade on stability of growth. The third method picks up a dynamic feature by adding the first lag of dependent variable and a climate-related variable, thereby enabling one to measure the extent of stability in economic growth as well as the impact of a changing climate on economic performance. Country-specific effects (i\mu) and time-specific effects (t) are taken into account to adjust for unmeasured differences among countries and over time.

$$GS_{it} = \alpha + \beta_1 AGR_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

$$GS_{it} = \alpha + \beta_1 AGR_{it} + \beta_2 INF_{it} + \beta_3 TRADE_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (2)$$

$$GS_{it} = \alpha GS_{i,t-1} + \beta_1 AGR_{it} + \beta_2 Climate_{it} + \beta_3 INF_{it} + \beta_4 TRADE_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (3)$$

This research explores how agricultural output and economic growth stability are linked by using a panel data method in steps with fixed effects for countries and years. The first equation of this study brings the main effect of agricultural production on growth stability. The second equation changes the basic model by adding inflation and trade openness as main macroeconomic variables controlling for the overall economic environment. Then, Equation (3) adds a dynamic feature by including the lagged dependent variable and introduces climate-related variables, Because of this enabling a check of growth stability's persistence account for agricultural production, climate conditions, inflation, and trade openness. Making use of country fixed effects (i) helps to take into consideration the differences between countries not changing over time and year fixed effects (t) reflect common shocks impacting all countries over time.

The empirical analysis uses Fixed Effects (FE) and Two-Stage Least Squares (2SLS) instrumental variable estimators. The Fixed Effects estimator accounts for the time-invariant country-specific characteristics that may influence economic growth stability. But due to the dynamic model involving the lagged dependent variable and potential endogeneity between agricultural

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production and economic growth stability, a 2SLS instrumental variable approach is chosen. This method is very suitable for panel data with a relatively large number of cross-sectional units and a short time dimension. The 2SLS approach handles endogeneity by using internal instruments (deeper lags of the dependent variable), reflects the persistence of growth stability, lessens the bias due to omitted variables, and also considers the unobserved differences between countries.

### 3.2 Definition of Variables

The dependent variable for this study is Economic Growth Stability (GS). It shows how stable and resilient economic growth is throughout the years. Our leading predictor variable is Agricultural Production (AGR), which is the main sector focused on producing food and raw materials. Besides that, climate variables/environmental shocks have been very important factors affecting economic growth and its stability. Macro stability is represented by Inflation (INF). Besides that, Trade Open (TRADE) measures the degree to which countries have become integrated in the world market. These variables are chosen using the theoretical and empirical research that identifies their significance for economic growth and stability.

The panel consists of 16 developing and emerging countries: Brazil Mexico China India Indonesia, South Africa Turkey Thailand, Vietnam Philippines Nigeria, Pakistan Morocco Egypt, Colombia, and Malaysia. The selection of these countries is based on several aspects. The first being that they are from different geographical areasLatin America, East and Southeast Asia, South Asia, Sub-Saharan Africa, the Middle East and North Africa (MENA)which would make sure that there is a wide variety of economic structures and climatic conditions in these regions. Besides, these countries are the World Bank's low-middle to upper-middle income economies with differences in the degree of agricultural dependence, trade openness, and inflationary volatility. And, they have undergone various growth volatilities like commodity price shocks, currency crises, and climate-induced disruptions, which give them good characteristics for studying the stability of economic growth. Also, the need for data availability of key variables like agricultural production inflation trade openness, and environmental shocks, has guided the selection rather than the consistent multi-year panel period, which allows for either balanced or unbalanced panel econometric estimation. Altogether, this sample will help the study to understand the diverse impact of agricultural production on the stability of growth in various developmental and institutional settings.

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### 3.3 Diagnostic Tests

Different In order to validate and ascertain the reliability of empirical results, various diagnostic and robustness tests are performed. At first, the Variance Inflation Factor (VIF) is used to identify the multicollinearity issue among the independent variables, and typically, a threshold of 5 is used to indicate problematic correlation. Then, to verify if residuals are normally distributed, the Jarque-Bera normality test is conducted which is a standard assumption for valid statistical inference. After that, the Breusch-Pagan test is done for heteroskedasticity which is a situation of non-constant variance of the error terms, and if it is found, one would need to use robust standard errors. Also, to single out the influential observations that will strongly alter the regression results, Cook's Distance is employed, and those observations that are higher than the cutoff value of 4/n4/n are considered to be potentially problematic.

The Leave-One-Country-Out (LOO) stability test is used which involve omitting one country at a time from the sample and re-run the model; the standard deviation of lagged growth stability coefficient that resulted from these repetitions acts as a measure of coefficient stability and sensitivity to individual countries. And, the Fixed Effects F-test serves to check if the country and year fixed effects are jointly significant and Because of this, provide justification to using fixed effects rather than pooled OLS. Besides, the 2SLS first-stage F-statistic is employed for the strength of the instrument being tested and a cut-off of 10 is used to decide whether the instrument(s) are weak or not. Lastly, the 2SLS estimation with instrumented lagged growth stability coefficient is looked at to assess the growth stability persistence after resolving the endogeneity issues. Taken together, these tests give a very detailed evaluation of the model assumptions, robustness, and method of identification.

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## 4. Empirical Results

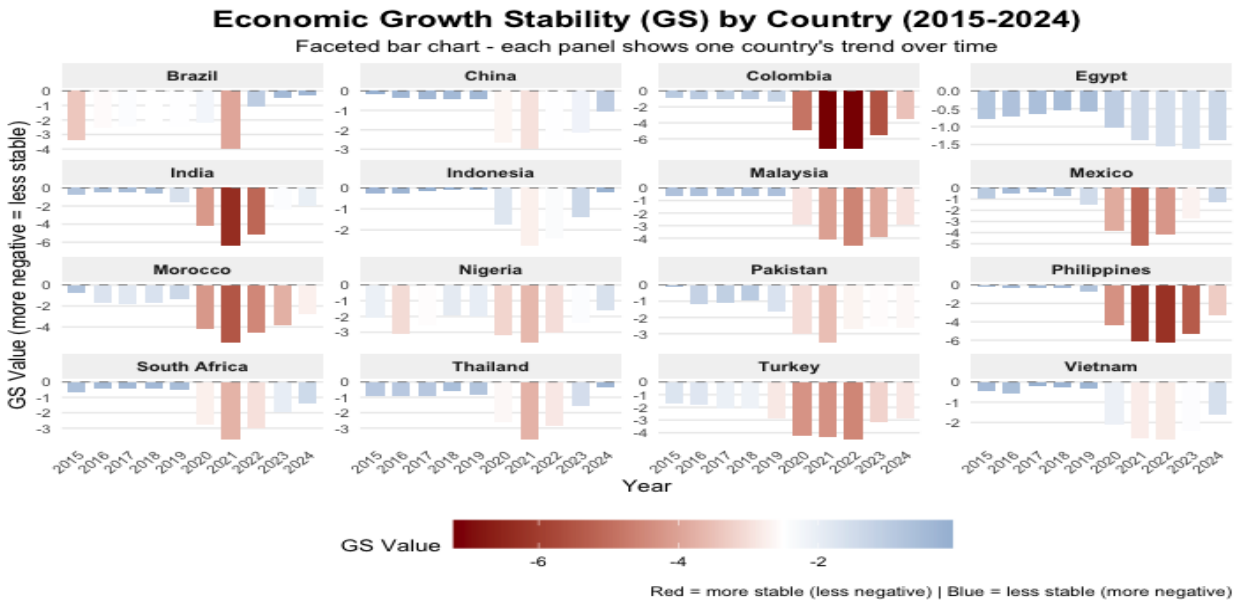
### 4.1 Descriptive Statistics

**Table 1: Descriptive Statistics Table (2015-2024, All 16 Countries)**

| Variable | Min | Q1.25 | Median | Mean | Q3.75 | Max | SD | CV (%) |
|---|---|---|---|---|---|---|---|---|
| Growth Stability | -7.21 | -2.92 | -1.7 | -2.06 | -0.66 | -0.09 | 1.62 | 78.6 |
| Trade Openness | 13.4 | 32.67 | 44 | 62.33 | 72.82 | 200.5 | 45.46 | 72.93 |
| Ag Production | 85.5 | 99.35 | 102.1 | 103.23 | 107.9 | 125 | 7.12 | 6.9 |
| CCPI | 27.76 | 48.7 | 56.11 | 54.52 | 59.5 | 71.6 | 8.26 | 15.15 |
| Inflation | -1.61 | 2.46 | 3.96 | 7.15 | 7.81 | 72.31 | 9.96 | 139.39 |

**Source: Own elaboration**

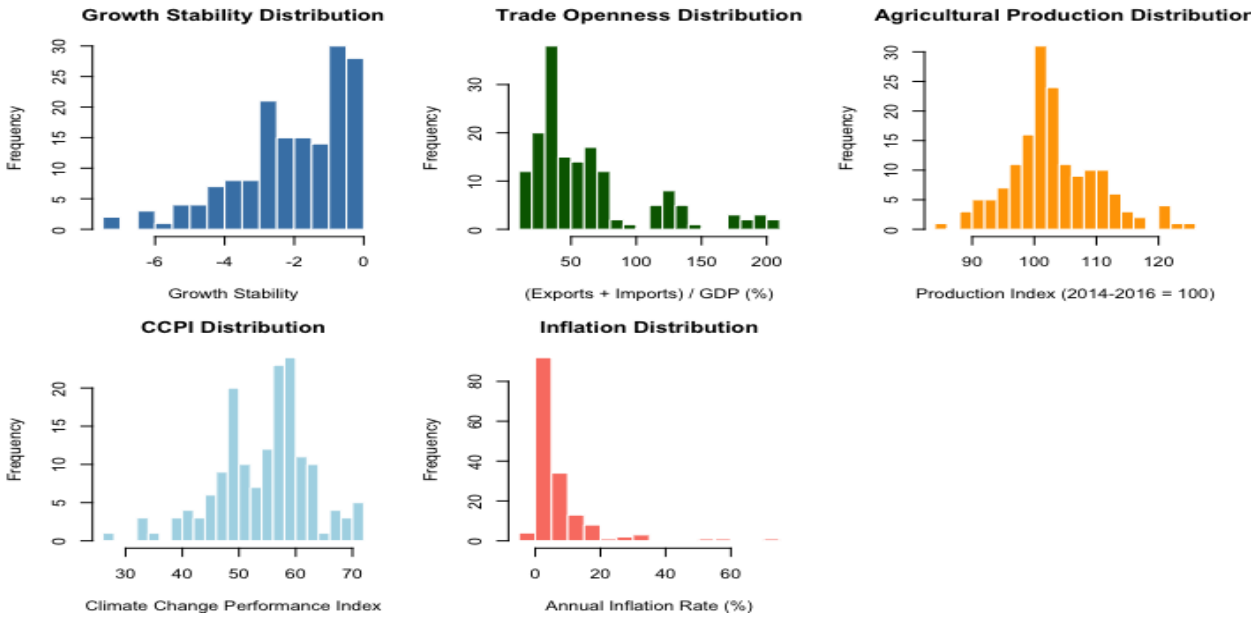
Table 1 shows the descriptive statistics of variables in the analysis period 2015-2024 for the 16 sample countries. The average of Growth Stability is -2.06. Its standard deviation is 1.62. So, there are economic stability differences among countries. Trade Openness has the biggest variability (CV = 72.93%), with the minimum and maximum values of 13.4 and 200.5 respectively, showing that countries are at very different levels about international trade integration.




**Source: Own elaboration**

Agricultural Production has a fairly constant pattern, with the mean of 103.23 and the coefficient of variation of 6.9%, implying that there are not big fluctuations among the sample countries. The Climate Change Performance Index (CCPI) has the average of 54.52, which means that

environmental performance varies a lot among the countries. Inflation is the most volatile variable (CV = 139.39%), as its values go from -1.61 to 72.31, which points to wide differences in macroeconomic conditions and price stability among the countries studied.




**Source: Own elaboration**

### 4.2 Correlation Matrix

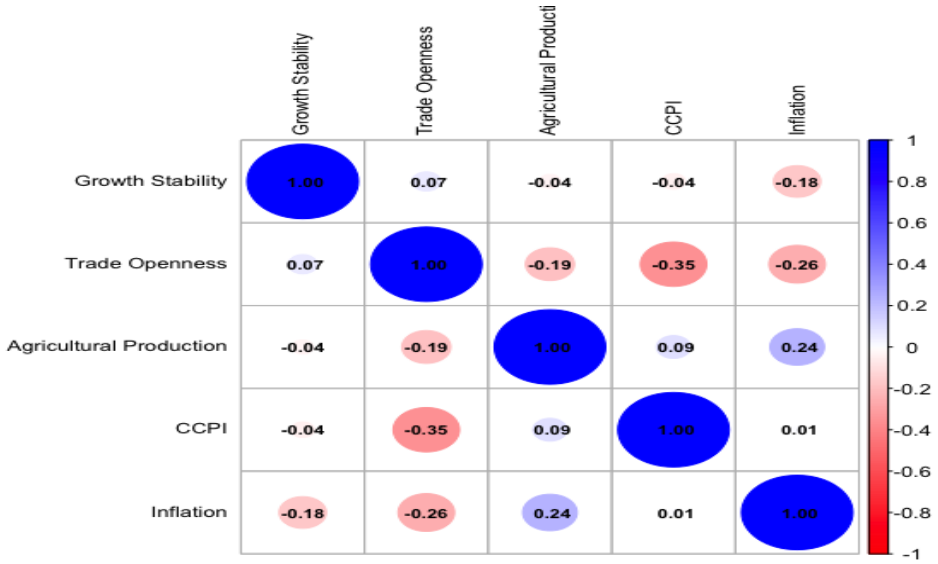
**Table 2. Correlation Matrix**

| Variables | Growth Stability | Trade Openness | Agricultural Production | CCPI | Inflation |
|---|---|---|---|---|---|
| **Growth Stability** | 1 | 0.066 | -0.035 | -0.043 | -0.18 |
| **Trade Openness** | 0.066 | 1 | -0.193 | -0.354 | -0.256 |
| **Agricultural Production** | -0.035 | -0.193 | 1 | 0.093 | 0.239 |
| **CCPI** | -0.043 | -0.354 | 0.093 | 1 | 0.006 |
| **Inflation** | -0.18 | -0.256 | 0.239 | 0.006 | 1 |

**Source: Own elaboration**

Table 2 displays the correlation matrix for the variables used in this study. The findings reveal that overall the explanatory variables are weakly correlated, which implies that multicollinearity probably will not be an issue. Growth Stability only has a very small positive correlation with Trade Openness (0.066) and negative correlations with Agricultural Production (-0.035), CCPI (-

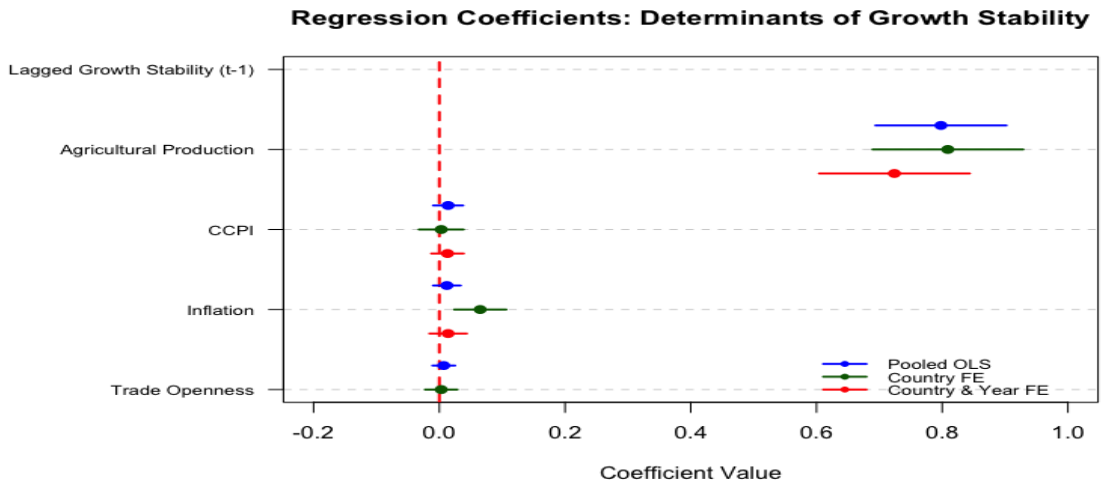
0.043), and Inflation (-0.180). Trade Openness However shows moderate negative correlations with CCPI (-0.354), Inflation (-0.256), and Agricultural Production (-0.193). Agricultural Production correlates positively with CCPI (0.093) and Inflation (0.239), but these are very weak relationships. Besides, the near-zero correlation between CCPI and Inflation (0.006) means that there is no significant linear relationship between the two. In short, none of the correlation coefficients exceeded the threshold of 0.70 that is typically used to determine multicollinearity, suggesting that the explanatory variables can be combined in the econometric models without any issues of serious multicollinearity.




**Source: Own elaboration**

### 4.3 Baseline Regression Results

Using pooled OLS, country fixed effects, and country-year fixed effects specifications, Table 3 presents the regression outcomes for different factors influencing Growth Stability. In all the models, the lagged dependent variable is positive and statistically significant at a high level, revealing that growth stability is strongly persistent over time. There is no indication of a statistically significant effect of Agricultural Production per any of the specifications. Only in the country fixed-effects model, CCPI displays a positive and significant effect which implies that changes in climate performance might lead to higher growth stability when the unique features of countries are taken into account. In the country and year fixed-effects model, the effect of Inflation turns negative and significant statistically, meaning that a rise in inflation leads to a decrease in growth stability.




**Source: Own elaboration**

Trade Openness correlates positively with growth stability only in the country fixed-effects case. The models' ability to explain the variations in the dependent variable Quite a bit enhances with the addition of fixed effects, as evidenced by the increase in R from 0.636 in the pooled model to 0.964 in the model with country and year fixed-effects, thereby demonstrating the importance of accounting for unobserved heterogeneity across countries and over time.

**Table 3. Regression Results: Determinants of Growth Stability**

| Variables | Pooled OLS | Country FE | Country & Year FE |
|---|---|---|---|
| Lagged Growth Stability (t−1) | 0.798*** (0.053) | 0.809*** (0.061) | 0.724*** (0.061) |
| Agricultural Production | 0.014 (0.012) | 0.003 (0.018) | 0.013 (0.013) |
| CCPI | 0.012 (0.011) | 0.065*** (0.021) | 0.014 (0.015) |
| Inflation | 0.007 (0.009) | 0.003 (0.013) | -0.017** (0.008) |
| Trade Openness | 0.002 (0.002) | 0.058*** (0.020) | 0.020 (0.016) |
| Constant | -2.783** (1.365) | No | No |

**Notes:** Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10.

**Source: Own elaboration**

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Table 4 presents the goodness-of-fit measures of three fitted models. The findings reveal a big jump in the amount of variation explained by the model after incorporating fixed effects. The R value rises from 0.636 for the pooled OLS model to 0.8926 for the country fixed-effects model and even to 0.9635 when both country and year fixed effects are included. On a similar note, the residual standard error, which reflects the unexplained variation, is reduced from 1.005 to 0.582, which points towards a form model fitting. In fact, the F-statistics are highly significant (at 1% level) for all the models and, That's why, the models can be regarded as moderate explanatory. Overall, these results imply that taking into account country-specific and time-specific disparities can greatly enhance the results of growth stability.

**Table 4. Model Summary Statistics**

| Statistics | Pooled OLS | Country FE | Country & Year FE |
|---|---|---|---|
| Observations | 144 | 144 | 144 |
| $R^2$ | 0.636 | 0.8926 | 0.9635 |
| Adjusted $R^2$ | 0.6228 | 0.8742 | 0.9543 |
| Residual Std. Error | 1.005 | 0.966 | 0.582 |
| F-statistic | 48.21*** | 48.67*** | 104.70*** |

**Notes:** Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

**Source: Own elaboration**

### 4.5 Robustness Checks

Several diagnostic and robustness tests were conducted to check the reliability and robustness of the estimated models. These tests check for possible econometric problems like multicollinearity, normality of residuals, heteroskedasticity, influential observations, coefficient stability and the importance of fixed effects. Also, to test the robustness of the dynamic specification, an instrumental variable estimation was conducted. The outcomes of these diagnostic tests are presented in Table 5.

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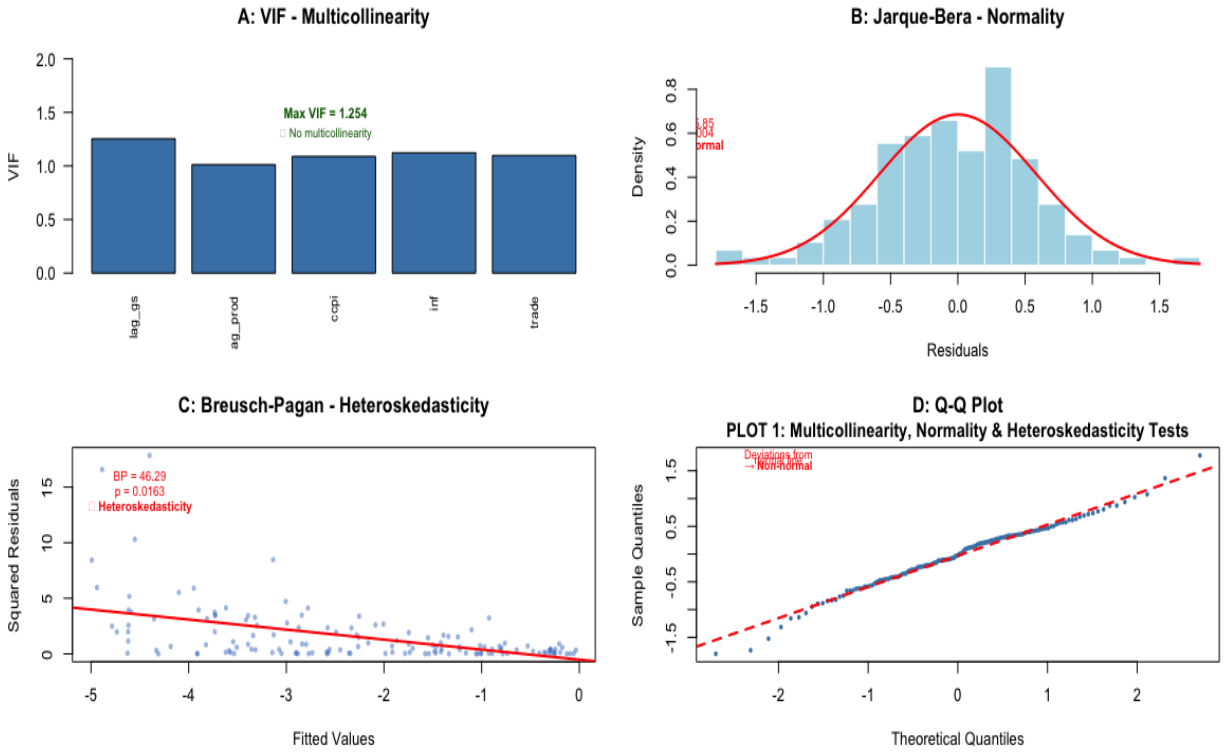
**Table 5. Robustness and Diagnostic Tests**

| Test | Statistic | p-value | Interpretation |
|---|---|---|---|
| Variance Inflation Factor (Max VIF) | 1.254 | - | No multicollinearity concerns |
| Jarque-Bera Normality Test | 15.849 | 0.0004 | Residuals are not normally distributed |
| Breusch-Pagan Test | 46.293 | 0.0163 | Presence of heteroskedasticity |
| Influential Observations (Cook's Distance) | 12 | - | Limited number of influential observations |
| Leave-One-Country-Out Stability (SD of lagged GS coefficient) | 0.0121 | - | High coefficient stability |
| Fixed Effects F-Test | 12.866 | 0 | Fixed effects jointly significant |
| Instrument Strength (First-Stage F) | 35.12 | - | Strong instrument |
| Instrumented Lagged GS Coefficient (2SLS) | 0.5567 | 0 | Positive and significant persistence effect |

**Source: Own elaboration**

The maximum VIF is well below the conventional threshold of 5, indicating the absence of multicollinearity. The Jarque-Bera and Breusch-Pagan tests suggest non-normal residuals and heteroskedasticity, respectively, supporting the use of robust standard errors. The Leave-One-Country-Out validation confirms the stability of the lagged growth stability coefficient. The fixed-effects F-test strongly supports the inclusion of country and year effects. The instrumental variable estimation using GSt−2GS_{t-2}GSt−2 as an instrument for GSt−1GS_{t-1}GSt−1 produces a positive and significant coefficient, consistent with the baseline dynamic specification.




**Source: Own elaboration**

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## 5. Discussion

### 5.1 Interpretation of Results

#### Stabilizing Role of Agricultural Production

Baseline empirical estimations tell a complex story about the macroeconomic role of the primary sector. Most importantly, Agricultural Production coefficients are actually insignificant statistically in all three different static forms in Table 4. Such statistical neutrality indicates that simply raising the absolute volume of agricultural output does not necessarily be a direct structural stabilizer for the aggregate business cycle when assessed by linear, unmoderated models. This result is very important for development economics: it questions the idea that traditional supply-side increases in raw agricultural volume could be the way to offset aggregate macroeconomic fluctuations if the agricultural sector is still vulnerable to external shocks. The primary sector's ability to absorb upheavals cannot be sufficiently depicted by focusing only on production volumes. Rather, its stabilizing role is linked to environmental factors and climate changes, which determine the stability and dependability of agriculture over time.

#### Climate-Related Economic Vulnerability

One of the clearest indications of the great dependence of the developing countries on the environment when it comes to severe shocks can be seen in the Climate Change Performance Index (CCPI) results. In the model with country fixed effects (Model 2), the CCPI has a positive and statistically very significant effect on growth stability ( $\beta = 0.065$, $p < 0.01$). Even so, its statistical significance is lost in the two-way fixed effects model ( $\beta = 0.014$, NS), which also accounts for common time trends. It is because, when tackling a country's specific geographical and environmental risk factors, macroeconomic stability is directly enhanced. The problem is that climate changes are systemic, border-crossing, and time-varying like region-wide droughts or global supply chain shocks that affect input pricesthe local stabilization advantages of climate performance are a lot diminished by global time-trends of climate. So climate change does not act as a microeconomic friction in a localized manner. It is a macro-level shock that not only disrupts production consistency but also increases economic uncertainty and causes aggregate growth volatility among developing countries.

### 5.2 Comparison with Previous Studies

The empirical evidence from this research has revealed aspects that both agree with and contradict certain parts of the established macroeconomic development literature. The result that unmoderated agricultural production volume is statistically insignificant is a point that goes against the traditional, linear claims of the Agriculture-Led Growth (ALG) hypothesis, which

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was introduced by the pioneering study of Johnston and Mellor (1961) and later empirically updated by Awokuse and Xie (2014) among others. These conventional models imply that growth in agriculture always results in macroeconomic development at a broader level.

What we found But is a more nuanced picture. On one hand, agriculture can be the engine of GDP volume raising However it cannot be expected to reduce GDP variance by itself, only when it is climate-shock protected does it achieve this. This finding largely supports the arguments of Loayza et al. (2007) who pointed out that in developing countries, due to the primary sector's vulnerability to supply disruptions, specialization of the economy in this sector could also mean the increase of the structural volatility.

In addition, the very statistically significant and positive impact of the CCPI even after controlling for country-fixed effects fits reasonably well with the pioneering research of Dell et al. (2012) about how temperature shocks can affect growth. In reality it is shown that environmental performance affects business cycle fluctuations directly in this article indicates that climate change is Actually something important in determining the stability of macroeconomic paths and this is in line with the recent research by Bastidas-Orrego et al. (2023).

Lastly, our findings about the harmful effect of inflation ($\beta = -0.017$, $p < 0.05$\$) and the conditional advantages of trade openness ($\beta = 0.058$, $p < 0.01$\$) align with the seminal macroeconomic models of Kaminsky et al. (2004) and Aghion et al. (2010). This illustrates that the inherent inflexibilities and underdeveloped financial systems of the Global South expose these countries to significant risks from nominal and external economic shocks.

### 5.3 Policy Implications

#### Agricultural Investment Policies

Because aggregate agricultural volume alone fails to stabilize economic growth, governments must urgently pivot away from policies that focus solely on expanding raw production yields. Instead, public and private capital must be directed toward structural modernization and value-chain integration. Priority should be given to constructing extensive rural transport networks, expanding localized post-harvest storage facilities, and deploying regional irrigation networks to eliminate the extreme reliance on rainfed farming.

Additionally, providing smallholders with access to formal agricultural credit markets and micro-insurance instruments is essential. Deepening financial inclusion allows agricultural producers to maintain steady investments and smooth consumption during downturns,

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transforming the agrifood sector from a volatile primary activity into a highly resilient economic anchor.

## 6. Conclusion

This study offers a new look at the structural role of the primary sector in developing economies. Rather than looking at aggregate GDP volume, it shifts the analytical focus to macroeconomic growth stability. Considering a panel data structure over 144 country-year observations with entity and temporal fixed effects, the empirical evidence is that raw agricultural production volume does not directly affect business cycle smoothing in a statistically significant way. Instead, macroeconomic stability depends heavily on environmental factors as the Climate Change Performance Index ($\beta = 0.065$, $p < 0.01$) positively and A lot under country fixed effects reflect this. Besides, the results show that, although trade openness helps partly resilience, domestic inflation destabilizes growth paths actively.

Thorough diagnostic testing and instrumental variable 2SLS estimations provide evidence for the very high continuity of the growth stability path while at the same time pointing to non-normal, heteroskedastic error structures. The major policy implication of these findings is that the conventional development methods aimed simply at production increase are not enough to protect developing economies from the disruption of the boom-and-bust cycles. To turn the primary sector into a real macroeconomic buffer, the policymakers in the Global South Because of this have to make an immediate shift to climate-smart agricultural systems, rural infrastructure development, and shock-responsive food security systems. The agrifood sector's disengagement from environmental volatility is a must for not only to stabilize domestic inflation, but also to safeguard foreign exchange reserves and to establish a resilient path to long-term sustainable development.

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