International Journal of Scientific Research and Management (IJSRM)
||Volume||13||Issue||09||Pages||643-663||2025||
Website: https://ijsrm.net ISSN (e): 2321-3418
DOI: 10.18535/ijsrm/v13i09.ah01

Agricultural Sector – Economic Growth Nexus in Syria: Analysis for Review Agricultural and Economic Policies

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Abstract
Assessing agriculture's economic impact is crucial for policy reform and sustainable development. In Syria, it plays a key role, contributing 21% to GDP and 14% to employment. This study investigates the influence of the agricultural sector on economic growth in Syria, utilizing secondary time series data spanning the period from 2000 to 2022. The research employs descriptive analysis to outline the structural features of the sector, while multiple regression models and the Granger non-causality test are applied to examine causal dynamics. Empirical findings underscore the sector's significant role in the Syrian economy. Specifically, variables such as the value of agricultural production, the volume of plant and animal product exports, and population size exhibit a statistically significant positive effect on GDP. Conversely, the export of live animals does not show a significant statistical relationship with GDP. The Granger causality test confirms a unidirectional causal linkage from agricultural production value, agricultural exports, and demographic expansion to GDP. Based on these outcomes, the study recommends revising agricultural and trade policies to boost productivity, enhance competitiveness, and improve Syria's agricultural exports.

Keywords: Agricultural Sector, Agricultural Policies, Economic Growth, Syria.

1. Introduction

The critical assessment of agriculture's contribution to the broader economy plays a central role in the restructuring of economic and agricultural policy frameworks and is crucial for achieving long-term sustainable development. Within developing nations, agricultural strategies hold a strategic priority due to the sector's integral role. A widely used measure to gauge the economic status of a country is the proportion of agriculture in its Gross Domestic Product (GDP). This ratio tends to be higher in developing countries, where agriculture serves as a foundational sector, while in developed economies the sector's share is markedly diminished, sometimes approaching insignificance (Loizou et al., 2019).

As economies undergo transformation and progress toward industrialization, a notable structural shift typically occurs: the relative value of agricultural output declines, while outputs from non-agricultural sectors, particularly industry and services, experience significant growth. Consequently, in developed economies, agriculture no longer retains the dominant economic position it once held. Many such countries have adapted their economic structures accordingly, resulting in a transition toward sectors like manufacturing, trade, and services, and a corresponding decrease in dependency on agriculture.

Despite the observable decline in agriculture's share of national income as overall income levels rise, the sector remains essential as a primary livelihood source, particularly for economically disadvantaged populations (FAO, 2019). Even in high-income nations where agriculture contributes a minimal share to GDP, the sector continues to serve as a vital source of employment and income in several regions (FAO, 2015).

A recurrent and fundamental question arises within this context: In what ways can agriculture continue to drive economic growth, secure food supplies, and reinforce food security in light of intensifying sectoral competition and ongoing population expansion? Current global demographic trends indicate continued growth, albeit at a decelerating pace, with the global population reaching approximately 7.5 billion people, nearly half of whom reside in rural areas and derive their livelihoods from agriculture (FAO, 2015).

Agriculture, therefore, plays a vital role in economic development, particularly in regions where the majority of the population relies on agricultural activities for income generation and employment opportunities (Bruinsma, 2017).

Conversely, notwithstanding its historical significance and contribution to sustainable development, the agricultural sector has experienced a gradual erosion of its influence and capacity to fulfill its former role (Zhang and Dioa, 2020). The extent to which agriculture contributes to national development continues to be a point of contention within scholarly discourse (Luc Christiaensen et al., 2011). There remains no unified academic position regarding the exact role of agriculture in economic development, as this role is highly contingent upon the structural and economic particularities of each country.

In developed economies, the agricultural sector assumes a strategic dimension, while in developing nations it plays a central and highly active role within economic systems (Praburaj, 2018). The divergence in the function and prominence of agriculture across countries is largely shaped by factors such as natural resource endowments and historical trajectories, which critically influence the sector's contribution to economic growth (Johnston and Mellor, 1960).

In the context of developing countries, agriculture is marked by several defining characteristics, most notably its contribution of approximately 40–60% to Gross Domestic Product (GDP) and its employment of between 50–80% of the labor force engaged in agricultural production. Given this significant weight, any adverse developments affecting the agricultural sector in these nations tend to produce far-reaching repercussions across the broader economy. For instance, a downturn in the value of agricultural output, a diminished share of agriculture in total value added, or a contraction in agricultural employment can negatively impact overall national economic performance (Ableeva et al., 2019).

Importantly, the role of agriculture is not confined solely to its quantifiable contribution to economic development. In many countries, agriculture is regarded as a priority sector and an essential pillar of national security due to its function in supplying indispensable life-sustaining commodities (Beckman and Countryman, 2021). Beyond economic metrics, the agricultural sector is widely recognized as a strategic instrument in strengthening food security (Abdelhedi and Zoura, 2018; Pawlak and Kołodziejczak, 2020). Ensuring food security has become a pressing and high-priority objective across all countries, irrespective of their development stage. The fundamental necessity of food provision has elevated agriculture to a position of strategic significance within national economies (Nawrocha, 2016).

The foremost aim of agricultural production is to satisfy the population's demand for food products while also supplying raw materials to the industrial sector (Chebokchinova and Kapsargina, 2021). Traditionally, agriculture has played a multifaceted role encompassing food production, employment generation, industrial input provision, and in some cases, leadership in export performance. However, a more expansive perspective recognizes that the scope of agriculture extends well beyond these conventional parameters. The sector contributes substantially to environmental sustainability by safeguarding soil resources, preserving water supplies, alleviating poverty, and supporting food security initiatives (Meijerink and Roza, 2007). Commonly, the evaluation of agriculture’s role in economic development is framed through its GDP share. However, agricultural productivity and overall output also possess the capacity to catalyze broader economic advancement, foster industrialization, and influence relative national income levels (Gollin et al., 2002). Notably, recent trends reveal a paradox in which agriculture's GDP share has declined even as productivity has risen. For instance, in the East Asian economies often labeled as the “Asian Tigers,” the agricultural sector has receded in relative importance, giving way to accelerated growth in other economic sectors (Meijerink and Roza, 2007).

In the case of Syria, similar to numerous other developing countries, the economy continues to depend heavily on the agricultural sector, leveraging its substantial natural and agricultural resources. Agriculture occupies a pivotal position in Syria’s economic framework and has consistently outperformed other sectors in its contribution to GDP. In 2020, agriculture accounted for 24% of GDP (Central Bureau of Statistics, 2020), reflecting its ongoing relevance in contrast with nations that have undergone significant economic diversification and transformation. For instance, in Turkey, the agricultural sector’s share of GDP has undergone a marked decline (Aytop et al., 2014). In addition to its economic contribution, the Syrian agricultural sector also plays a vital role in employment generation and in mitigating unemployment. Approximately 15% of employment opportunities are derived from the sector, particularly among rural populations. Figure 1 presents the trajectory of agriculture’s share in Syria’s GDP from 2000 to 2022.

Despite a gradual reduction in its relative contribution, agriculture remains one of the most significant sectors within the Syrian economy.

The agricultural sector in Syria is marked by inefficiency and a general lack of professional management, despite its considerable inherent potential and available advantages. Although the country possesses extensive arable lands, abundant water resources, and a sizable human workforce, these assets have not been harnessed in a manner that ensures effective or efficient utilization. The outbreak of the Syrian uprising in 2011 generated profound adverse consequences across all sectors and economic activities, with the agricultural sector among the most severely affected. At present, agriculture in Syria confronts numerous structural and operational challenges that impede the country's ability to recover and rebuild. These circumstances underscore the pressing need to reexamine and reformulate Syria's developmental and economic strategies, with particular emphasis on establishing a coherent and forward-looking strategic vision for sectoral revitalization, especially within agriculture. The agricultural sector holds considerable potential to serve as a leading driver of economic development, particularly by enhancing agricultural exports, generating employment opportunities, and increasing its overall contribution to Gross Domestic Product (GDP).

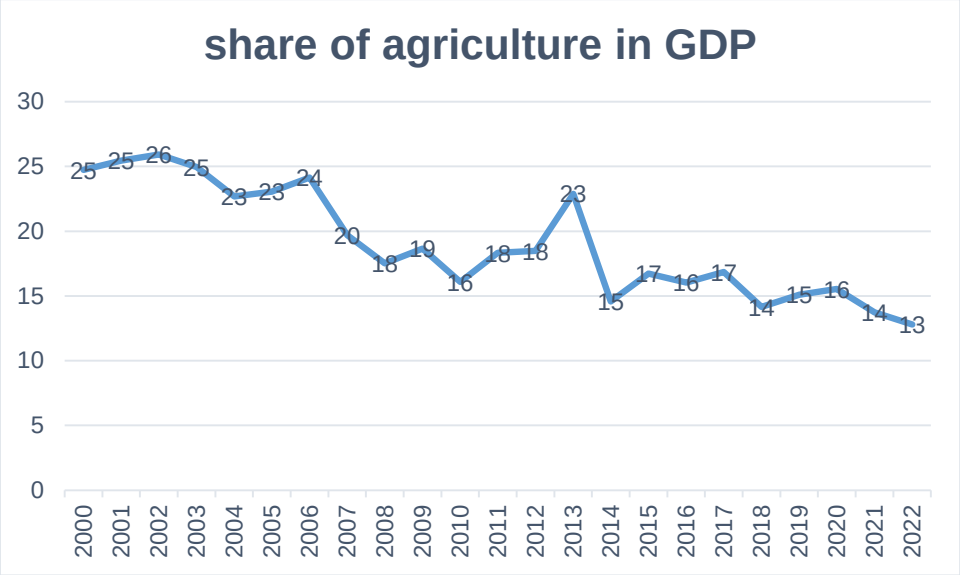

Figure 1. Share of Agriculture in GDP (%) in Syria

The originality of this research derives from its specific focus on the Syrian context. Globally, a substantial body of research has long explored the role of agriculture in economic growth and development (Johnston and Mellor, 1961; Johnson, 1993), with contributions such as that of Gollin et al. (2002) providing broader insights into agriculture's developmental role. However, in the case of Syria, a comprehensive review of the available literature reveals a conspicuous absence of empirical studies explicitly examining the impact of the agricultural sector on economic growth. While there have been efforts to identify and assess various contributors to economic development, such as the work by Mohsen et al. (2017), a focused investigation into agriculture's role remains notably lacking. Unlike previous studies, the current research is centered specifically on the economic impact of agriculture in Syria. Consequently, the study's distinctiveness lies in its empirical analysis of the sector's contribution to the Syrian economy, alongside its objective to generate policy-relevant recommendations that may support the restructuring of agricultural and economic strategies, thereby fostering improved agricultural performance.

2. Statement of the Problem

The research problem addressed in this study is framed against the backdrop of Syria's recent and exceptional historical developments. Over the past fifteen years, the country has experienced a series of extraordinary circumstances that have exerted profoundly negative effects on the agricultural sector and on national food security. According to Le et al. (2022), the total area of agricultural land underwent substantial fluctuations and disruptions following the outbreak of armed conflict, leading to direct repercussions on food insecurity, particularly within vulnerable and rural communities. Additionally, the agricultural sector incurred financial losses exceeding 16 billion U.S. dollars in just five years (FAO, 2017). Syria's broader

economic condition cannot be analyzed in isolation from the significant political upheavals that have taken place. In recent years, the country has undergone sweeping political and economic transformations, beginning with the revolutionary movement in 2011 and culminating in the political transition marked by the fall of the authoritarian regime on December 8, 2024. This new political and economic reality has created an opportunity for Syria's post-conflict leadership to adopt and implement reformed agricultural and macroeconomic policies that could serve as the foundation for a long-term development trajectory and the recovery of deteriorated sectors.

The agricultural sector is regarded as the most viable and strategically positioned domain to spearhead Syria's economic revival, for several compelling reasons: the abundance of natural and agricultural resources; the sector's capacity to supply inputs to industrial activities; its longstanding historical role in the economy; and the direct correlation between agricultural advancement and improved food security, especially critical in a context where over 7 million Syrians currently face food insecurity (FAO, 2017). Accordingly, the central issue this study seeks to address may be summarized by the following research question: What is the economic role played by the agricultural sector in Syria? And should agriculture be prioritized within the framework of the country's emerging economic policy?

3. Research Questions

The present study seeks to answer the following questions:

- What are the main characteristics and features of the agricultural sector in Syria?
- Does the agricultural sector positively affect economic growth in Syria?
- What are the factors that positively influence economic growth in Syria?
- What are the necessary measures and policies to enhance the contribution of agriculture to the Syrian economy?

4. Research Objectives

Within this context, the main objective of the current study is:

- To determine the relationship between the agricultural sector and Gross Domestic Product (GDP) in Syria.

More specifically, the study aims to:

- Review and present the current state of the agricultural sector in Syria;
- Identify the factors affecting GDP in Syria;
- Propose and formulate recommendations to develop agricultural production and enhance its role in economic growth.

The present study includes the following hypotheses:

- **H1**: The value of agricultural production has a statistically significant positive effect on GDP.
- **H2**: Plant and animal agricultural exports have a statistically significant positive effect on GDP.
- **H3**: Agricultural exports of live animals have a statistically significant positive effect on GDP.

This research is structured as follows: The introduction presents the background concerning the role and contribution of agriculture to the economy, along with an overview of the relationship between these two variables. The second section provides a review of the existing literature relevant to the topic. The third section outlines the data sources, analytical framework, and methodology adopted for the study, detailing the selected variables and the econometric models applied. The fourth section presents the empirical findings, offers a discussion of the results, and addresses the primary research question by determining the relationship between the agricultural sector and economic growth in Syria. The study concludes with a set of recommendations and policy directions intended to strengthen the role and improve the standing of the agricultural sector within the Syrian economy.

5. Literature Review

Numerous studies have proposed the existence of a positive correlation between the agricultural sector and economic growth. On the other hand, some research has indicated that agriculture's relative contribution tends to diminish as GDP rises, an observation predominantly applicable to developed economies. Raza et al. (2012) examined the agricultural sector's contribution to economic growth in Pakistan by applying a regression model to assess the relationship between GDP and the sub-sectors comprising agriculture. The model included five sub-components of agricultural output: major crops, minor crops, livestock, fisheries, and forestry. The results revealed a statistically significant association between economic growth and all

agricultural sub-sectors except forestry. The study recommended that in order to reinforce the agricultural sector's performance, it is necessary to improve productivity, ensure the efficient utilization of agricultural resources, and address the challenges facing the sector, given its pivotal role in the Pakistani economy.

In another study, Loizou et al. (2019) investigated the contribution of agriculture to regional economic development through an input-output analysis model, focusing on the role of agricultural policy within rural areas and assessing the impact of reforms under the Common Agricultural Policy (CAP). The results indicated that agriculture exerts a multi-sectoral influence. Policy reforms in the agricultural domain do not only affect the sector itself but also generate a range of direct and indirect effects across various economic sectors. The findings pointed to the potential for further improvements in agriculture, particularly in the domains of job creation and enhancement of farmers' income.

Similarly, Khorami and Pierof (2013) explored the role of agriculture in promoting economic development in Iran. Utilizing a descriptive-correlational method, the authors examined agriculture in comparison to other sectors such as industry, services, and trade. Their results suggested that while the agricultural sector contributes to economic development, the extent of its impact varies when compared to other sectors.

In the Afghan context, Muradi and Boz (2018) examined the contribution of agriculture to Afghanistan's economy during the period 2016–2017. Employing descriptive analysis, the authors presented the role of agriculture through a range of indicators. According to their findings, the agricultural sector accounted for approximately one-quarter of the country's total GDP, placing it as the second-largest contributor after the services sector. Beyond its economic role, agriculture was shown to provide critical employment opportunities and livelihoods for nearly 70% of the population living in rural regions.

Other reference studies suggest that the role of agriculture extends well beyond its proportional contribution to economic output and Gross Domestic Product (GDP), offering a range of broader socioeconomic benefits. For instance, Rahman (2017) investigated the significance of agriculture in the Bangladeshi economy and sought to identify the principal challenges facing the sector through an evaluation of its economic role. The findings indicated that while agriculture's direct contribution to GDP has declined in recent years, its indirect influence on non-agricultural sectors has grown. Moreover, agriculture plays additional crucial roles, such as generating foreign exchange earnings and providing employment opportunities for a substantial portion of the population, factors that contribute significantly to poverty alleviation.

Emerging economies frequently experience structural transformations, whereby economic significance shifts from one sector to another. In Brazil, Spolador and Roe (2013) examined the role of agriculture within the context of recent structural changes in the Brazilian economy. Their results highlighted a relative equilibrium among the major sectors contributing to GDP, with agriculture maintaining a substantial role. Despite broader shifts, the sector has continued to exhibit an active and stable contribution to national output. This finding contrasts with the experience of other emerging economies, where agriculture's share of GDP has steadily declined, primarily due to labor migration from agriculture, a typically low-productivity sector, towards more productive industries such as manufacturing and services.

In this regard, it is essential to recognize that the structural composition of any economy is inherently dynamic, with sectoral contributions rising and falling over time, leading to a form of inter-sectoral competition. As previously noted, the agricultural sector continues to exert influence in developing economies, unlike in developed countries, where its relative importance has decreased in favor of other economic domains. In this context, the study by Nawrocha (2016) evaluated the agricultural sector's impact on economic performance across European Union member states by analyzing time series data from 2000 to 2015. The researchers conducted a comparative assessment involving several EU countries. The study's findings revealed a clear shift in the sectoral composition of GDP, with agriculture's relative share diminishing as economic development progressed. Notably, while the level of employment within the agricultural sector declined, labor productivity in agriculture demonstrated a corresponding increase.

Within a related framework, various additional factors directly affect the value of agricultural production and are closely associated with economic growth. GDP and overall economic expansion are not determined solely by the absolute volume of agricultural output; rather, agricultural productivity serves as a critical determinant that influences both macroeconomic performance and growth trajectories. Enhancing agricultural productivity plays a pivotal role in amplifying the total volume of output generated by the sector. Therefore, fostering economic growth necessitates deliberate efforts to improve and expand productivity within agriculture (Omorogiuwa et al., 2014).

A number of studies have been undertaken to assess the impact of agricultural productivity on economic performance. Among these, İmrohoroğlu et al. (2014) analyzed the relationship between economic growth and agricultural productivity using a two-sector economic model. The study compared Turkey with other comparable nations, including Spain, Greece, and Portugal. The results underscored the decisive role that productivity levels play in shaping national income. Specifically, the study identified low agricultural productivity in Turkey as a principal factor contributing to the disparity in per capita income between Turkey and its peer countries. In response to these findings, the study recommended a comprehensive restructuring of overlapping policy frameworks that exert influence across multiple economic sectors.

In another study, Awan (2015) assessed the impact of agricultural productivity on economic growth in Pakistan by utilizing a time series spanning from 1972 to 2012. The analysis employed the autoregressive distributed lag (ARDL) approach to estimate the growth trajectory of the economy. The results revealed that several variables had a positive influence on economic growth, with the agricultural sector contributing a substantial share. Based on these findings, the researcher recommended enhancing the efficiency of the labor force through the advancement and expansion of agricultural and industrial education systems, as a means of boosting overall productivity.

Amire (2017) similarly underscored the contribution of agricultural productivity to comprehensive development by emphasizing its foundational role in providing the economic underpinnings necessary for sustainable growth. The study aimed to evaluate the impact of productivity on economic growth in Nigeria using time series data. The results aligned closely with earlier research, confirming the positive effect of agricultural productivity in promoting economic growth. The study highlighted the importance of implementing effective policy interventions aimed at improving agricultural productivity in order to increase overall agricultural output.

In synthesizing the findings from these reference studies, it becomes evident that the impact of agriculture on economic growth is not uniform but is instead shaped by the specific characteristics and context of each country. From a theoretical standpoint, an increase in agricultural output is generally associated with a positive influence on GDP and broader economic growth. However, from an alternative perspective, substantial growth in the output of other sectors may lead to a reduction in agriculture's relative share of GDP, an outcome commonly observed in advanced economies. In many global models of economic development, growth is accompanied by structural transformations in the economy, characterized by a decreasing contribution from agriculture and a rising prominence of sectors such as industry and services. This trend has been documented in several emerging economies, such as Turkey, where the share of agriculture in GDP declined from 36% in 1970 to 7.4% in 2013 (Aytop et al., 2014).

The present study seeks to address a critical gap in the literature by examining the contribution of the agricultural sector to Syria's GDP. The study's originality stems from the fact that existing research has largely overlooked this subject in the Syrian context, particularly in the period following the 2011 revolution. Furthermore, this research contributes to the academic discourse by providing a detailed account of the characteristics and features of the Syrian agricultural sector, its macroeconomic importance, and by empirically testing the sector's role in economic growth. This has been achieved through the application of a multiple regression model and the implementation of a causality test within the framework of the current study.

6. Materials and Methods

6.1. Study Area

Syria was selected as the geographical focus of this research. It is a country endowed with considerable natural and agricultural resources, where the agricultural sector plays a central role in contributing to GDP and generating employment opportunities. The total area of arable land in Syria is estimated at 6.097 million hectares, approximately 50% of which is currently under cultivation. Forested areas constitute about 3% of the country's total land area (Central Bureau of Statistics, Syria, 2022). Syria's crop production is diverse, with key agricultural outputs including wheat, barley, vegetables, fruits, and olives. Additionally, a variety of animal products are produced, such as milk, poultry, red meat, and fish.

From a geographical standpoint, Syria is situated north of the equator, between 35° to 42° east longitude and 32° to 37° north latitude. The country is bordered by the Mediterranean Sea and five neighboring states: Turkey to the north, Iraq to the east, Lebanon to the west, and both Palestine and Jordan to the south. Syria's

total border length measures approximately 2,413 kilometers, of which 183 kilometers consist of coastal boundaries along the Mediterranean Sea.
Climatically, Syria lies within the Mediterranean temperate and semi-arid zones. It experiences rainy winters, dry summers, and two short transitional seasons. Annual temperatures range from 0°C in winter to 48°C in summer, while rainfall levels vary significantly across regions, reaching up to 1,500 mm in mountainous areas. The country is divided into five agricultural stability zones, with average rainfall ranging from 350 mm in the first zone to 200 mm in the fourth zone. The fifth zone is classified as unsuitable for rainfed agriculture.
Syria's total land area covers 18.518 million hectares, and its population amounts to 29 million, including citizens residing both within and beyond national borders. Administratively, the country is divided into 14 governorates distributed across four distinct geographical regions: the coastal region, the mountainous region, the interior region, and the Badia (semi-desert) region. Each of these regions is characterized by specific climatic conditions, which contribute to the country's agricultural diversity. This climatic variability has positively influenced agriculture, most notably through the wide variety of crop types cultivated nationwide.

6.2. Data Collection

This study relied exclusively on secondary data sources. The secondary data used were obtained from the databases of the Food and Agriculture Organization (FAO) and the Central Bureau of Statistics in Syria. A time series dataset covering the period from 2000 to 2022 was used. The Central Bureau of Statistics in Syria provides annual secondary data related to the agricultural sector, which are officially published through national platforms. In contrast, the FAO database offers data that may consist of actual values or estimates derived from partner trade statistics. These datasets were used to address the central research questions: What is the impact of the agricultural sector on economic growth in Syria? And what are the factors that influence economic growth?

6.3. Data Sources

As previously noted, data availability represented one of the major challenges in this study. This constraint led the researcher to utilize multiple data sources, including:

- FAO (FAOSTAT), which provided data related to foreign trade (agricultural exports and imports)
- The Central Bureau of Statistics in Syria (CBS), which supplied data on agricultural production and gross domestic product (GDP)

6.4. Limitation

One of the principal difficulties encountered during the preparation of this research was the limited availability of comprehensive data. Even when general data were accessible, detailed and disaggregated data were often lacking. This limitation is largely attributed to the absence of a centralized digital system capable of producing accurate and consistent statistics while minimizing reporting errors. Consequently, multiple data sources were used to overcome this gap. In this study, the selected variables were those that directly affect GDP and are linked to agricultural output. Other variables that may influence GDP but do not have a direct connection to agriculture were excluded from the econometric model.

6.5. Definition of Variables

- *Dependent variable*

In this study, Syria's gross domestic product (GDP) serves as the dependent variable. GDP is measured as the monetary value of all final goods and services produced within the country over a defined period (Callen, 2008). In the Syrian context, GDP encompasses the total value of final output across all economic sectors, including agriculture, industry, construction, services, and others.

- *Independent variables*

A group of independent variables related to the agricultural sector and considered influential to GDP was employed in this study. These include: the value of agricultural production, two categories of agricultural exports (the first category includes crop and animal product exports, while the second encompasses live animal exports such as sheep, goats, and others), and population size. Each variable is defined as follows:

- The value of agricultural production, composed of two primary components:

- *Plant production*, covering major product groups such as cereals, fruits, vegetables, legumes, and other agricultural goods.
- *Animal and fish production*, including milk and dairy products, animal reproduction, eggs, fish, honey, and other animal-derived outputs.

- Agricultural exports, referring to the monetary value of agricultural goods exported from Syria during a given year.
- Population, representing the number of Syrian nationals residing within the country in a specific year.

6.6. Econometric Model

To assess the impact of the agricultural sector's contribution to economic growth, a multiple linear regression model was applied. Equation (1) represents the regression model used to evaluate the relationship between the agricultural sector (as represented by the independent variables) and GDP (the dependent variable). GDP is modeled as a function of four independent variables: population (POP), value of agricultural production (VAP), the first category of agricultural exports (AGREXP1), which includes plant and animal products, and the second category (AGREXP2), which includes live animal exports. The dependent variable is GDP.

The analysis and estimation were performed using EViews 12 statistical software. Accordingly, the regression model is specified as follows:

$$GDP = \beta 0 + \beta 1\,\mathrm{VAP} + \beta 2\,AGREXP1 + \beta 3\,AGREXP2 + \beta 4\,POPU + e \quad (1)$$

Where:

GDP represents the dependent variable: gross domestic product (in millions of SYP)
VAP represents the value of agricultural production (in millions of SYP)
AGREXP1 and AGREXP2 represent agricultural exports (in US dollars)
β0 denotes the intercept β1, β2, β3, β4 represent the estimated regression coefficients
E denotes the error term

A number of assumptions must be fulfilled in order to apply the multiple linear regression test. One critical assumption is the stationarity of the time series. A time series is considered stationary if its fundamental statistical properties, such as mean and variance, are constant over time (Witt et al., 1998). To test for stationarity, the Augmented Dickey-Fuller (ADF) unit root test was applied, as expressed in Equation (2). Initially, the test is performed at the level; if the series is non-stationary, it is re-tested at the first difference. If non-stationarity persists, the second difference is applied. The null hypothesis (H_0) posits that the series has a unit root (i.e., is non-stationary), while the alternative hypothesis (H_1) asserts that the series is stationary. The result is interpreted based on the significance level.

$$\Delta yt = \alpha + \beta t + \gamma yt - 1 + \sum_{i=1}^{p} \phi i\,\Delta yt - i + \epsilon t \qquad (2)$$

(*H*0): $\gamma = 0$ (unit root exists ⇒ non-stationary)

(*H*1): $\gamma < 0$ (no unit root ⇒ stationary)

The second assumption to be tested is the presence of heteroscedasticity, referring to the non-constant variance of the error term (residuals). The null hypothesis (H_0) in this context suggests the absence of heteroscedasticity (i.e., constant variance), while the alternative hypothesis (H_1) implies the existence of heteroscedasticity. The test outcomes are evaluated based on the statistical significance level.

The third assumption involves testing for multicollinearity among the independent variables. This issue arises when there is a correlation between independent variables, making it difficult to isolate the individual influence of each variable on the dependent variable. To ensure the validity of the model, there must be no strong correlation among the independent variables. To verify this, a multicollinearity test was conducted using the Variance Inflation Factor (VIF). A VIF value exceeding 10 indicates the presence of multicollinearity among the independent variables, while a value below 10 suggests the absence of such a problem (Hair et al., 1995).

The fourth assumption required for applying the multiple linear regression model is the normality of residuals. This assumption is essential as it assesses whether the residuals are normally distributed. Several statistical methods exist for testing normality. In the present study, the Jarque-Bera test was employed. Under the null hypothesis (H_0), the data are assumed to follow a normal distribution, while the alternative hypothesis (H_1) indicates that the data deviate from normality. The interpretation is based on the statistical significance level.

Various statistical tests are available to examine causal relationships between two variables in a model. In the current study, the Granger non-causality test was applied. This test determines whether a causal relationship exists between an independent and a dependent variable. More specifically, it evaluates whether the independent variables, namely, the value of agricultural production, agricultural exports, and population, Granger-cause the dependent variable, which is gross domestic product. The following mathematical formulation, presented in equation (3), represents the Granger causality model developed by Dumitrescu and Hurlin (2012):

$$y_{i.t} = a_i + \sum_{k=1}^{k} \gamma^{(k)}{}_i \, y_{i.t-k} + \sum_{k=1}^{k} \beta^{(k)}{}_i \, x_{i.t-k} + \epsilon_{i.t} \qquad (3)$$

$H_0: \beta_i = 0$ (No causality assumption)
$H_1: \beta_i = 0$ (Causality assumption)
$H_1: \beta_i \neq 0$ (Causality assumption)
The null hypothesis asserts that xxx does not Granger-cause yyy. Before applying the Granger test, it is necessary to verify the stationarity of the time series, as the test assumes stationary data. To confirm this condition, the Augmented Dickey-Fuller (ADF) unit root test was employed, as previously shown in equation (2). The null hypothesis assumes that the series is non-stationary, while the alternative hypothesis asserts stationarity, based on the level of statistical significance.

7. Findings and Discussions

7.1. Descriptive Analysis

Descriptive analysis was conducted as a fundamental step to summarize the dataset and define the main characteristics of the agricultural sector in Syria. In the current study, descriptive statistics were calculated for a series of variables prior to undertaking inferential analysis. All variables used are quantitative in nature. This analysis provides key statistical indicators for the agricultural sector in Syria, including the mean, frequency, percentage, maximum, and minimum values. The tables below present the descriptive results related to the study's variables.

It is essential to begin by outlining and describing the structure and characteristics of the Syrian agricultural sector before analyzing the relationships between the independent and dependent variables. The findings presented in Table 1 highlight the ten most widely produced crops in Syria between 2000 and 2022. The most productive crop categories were classified into the following groups: cereals, vegetables, industrial crops, and fruits. The table indicates that wheat and tomatoes were the leading crops in terms of volume, with average production levels of 3,020 and 972 thousand tons, respectively. It is important to note that wheat production has experienced a significant decline, with output having fallen by nearly half in recent years. This decrease is attributed to the impact of war and the abandonment of extensive areas of farmland.

Production of sugar beet and cotton also dropped dramatically, with production volumes decreasing by 96% and 99%, respectively. As a result, the industrial sector in Syria lost critical sources of input materials. The results show that olive production remained relatively stable, without significant decline. The average olive production was approximately 866.5 thousand tons. It should be noted that olives are among the most important crops for farmers across Syria. The area cultivated with olive trees is around 695,000 hectares (Central Bureau of Statistics, 2015). Regarding vegetables, tomatoes and potatoes were the highest-yielding crops, with 972.4 and 578.9 thousand tons, respectively. For fruits, apples were the most produced crop and demonstrated stable yields, averaging 302 thousand tons, unlike crops such as cotton, sugar beet, and wheat which experienced sharp declines.

Table 1: Most Produced Agricultural Crops in Syria.

Product (1000 ton)	2000	2005	2010	2015	2020	2022	Average	Change rate
Wheat	3105,5	4668,7	3083,1	2861,6	2848,5	1551,6	3019,8	-50,0
Barely	211.9	676.4	679.8	1614.9	2245.8	178.5	934,6	-15,8
Lentil	73	153.6	77.3	89.7	200.2	26.6	103,4	-63,6
Tomato	753.2	945.5	1156.3	722.6	1268.4	988.5	972,4	31,2
Potato	484.8	608.4	673.2	505.2	647.3	554.7	578,9	14,4

Cucumber	91.3	152.2	155	127.6	182.2	125.5	139,0	37,5
Cotton	802.2	1022	628.3	130.5	74	6.7	444,0	-99,2
Sugar beat	1522.7	1096.4	1493	29.3	0	60.5	700,3	-96,0
Olives	940.9	612.2	960.4	913.3	781.2	990.9	866,5	5,3
Apple	215.8	296	393.1	307.2	267.8	331.8	302,0	53,8

Syria produces a wide range of animal products, with milk being the most produced among them. Despite the war and its consequences, particularly the increase in feed prices that severely affected livestock breeders, milk production increased by 21.3%. In contrast, the results indicate a decline in the production of poultry, fish, and eggs, which decreased by 11%, 6%, and 33%, respectively. Among live animals, sheep remain the most numerous, with an average population of around 15.592 million heads, followed by cows, with an average of approximately 949.3 thousand heads. It is worth noting that the majority of animal products experienced a decline in production, especially around the year 2015, due to the war and its consequences. See table 2.

Table 2: Most Produced Animal Products in Syria

Product (1000 ton)	**2000**	**2005**	**2010**	**2015**	**2020**	**2022**	**Average**	**Change rate**
Milk (1000 ton)	1673	2357	2241	1978	2154	2030	2072,2	21,3
Table eggs (million)	2295	2767	2907	1758	2137	1535	2233,2	-33,1
Broiler (chicken) ton	89487	149112	175922	93957	111878	79723	116679,8	-10,9
Fish (ton)	13369	16980	12770	2925*	5726*	12559	10721,5	-6,1
Sheep number (1000)	13505	19651	15511	13701			15592,0	1,5
Cow number (1000)	984	1083	1010	720			949,3	-26,8

* Data not fully available

7.2. Agricultural Sector Contribution to GDP in Syria

The following table 3 shows the contribution of all sectors to GDP during the period 2000–2022. The results indicate that the average share of the agricultural sector, including all its sub-sectors (plant, animal, and fisheries), was approximately one-fourth, at 21%. The sector's contribution ranged from 14% in 2010 to a peak of 24% in 2020. Along with the industry and mining sector, agriculture is one of the two highest-contributing sectors to GDP, with both together accounting for nearly 50% of total GDP. It is important to note that the available agricultural resources in Syria, along with supportive agricultural policies, played a positive and effective role in enhancing the agricultural sector's contribution to GDP.

Table 3: Agricultural Sector Contribution to GDP Compared To Other Sectors

Sector	**2000**	**2005**	**2010**	**2015**	**2020**	**Average**	**Change rate**
Agriculture	22	20	14	24	24	20,8	9,1
Mining and manufacturing	40	36	34	21	22	30,6	-45,0
Building & construction	5	5	6	6	9	6,2	80,0
Wholesale & retail trade	10	12	16	6	10	10,8	0,0
Transport & communication	11	12	11	15	13	12,4	18,2
Finance & insurance	2	3	4	3	1	2,6	-50,0

Social & personal services	3	3	4	6	4	4	33,3
Government services	7	8	10	19	16	12	128,6
Private non-profit services	0	0	0	0	0	0	0,0
Customs duties	0	1	1	0	0	0,4	0,0

7.3. Agricultural Sector and Employment

The agricultural sector is one of the principal contributors to employment generation and plays a significant role in reducing unemployment in Syria, particularly in rural and agriculturally dependent regions. Over the past two decades, agriculture has remained one of the most important sources of employment. As presented in Table 4, the sector accounted for 15% of total employment in 2022, compared to 20% in 2005. This represents a 25% reduction in agricultural employment between 2005 and 2022. The primary factors contributing to this decline include migration from rural to urban areas and the growing reluctance of individuals to engage in agricultural work due to the sector's low financial returns.

In parallel, other economic sectors, especially services, have experienced substantial expansion and have emerged as major sources of employment. By 2022, the service sector accounted for 37% of total employment. Additionally, the finance sector contributed the least to employment generation, providing no more than 3% of total job opportunities.

Table 4: Contribution of the Agricultural Sector to Employment Compared to Other Sectors

Sector	**2005**	**2010**	**2015**	**2020**	**2022**	**Average**	**Change rate %**
Agriculture	20	14	9.5	12	15	14,1	-25
Mining and manufacturing	14	16	10.7	13	11	12,94	-21
Building & construction	14	16	8.5	10	11	11,9	-21
Wholesale & retail trade	16	18	16.1	18	19	17,42	19
Transport & communication	7	8	6.6	7	6	6,92	-14
Finance & insurance	2	3	2.4	1	1	1,88	-50
Social & personal services	27	25	46,2	39	37	34,84	37

7.4. Contribution of the Agricultural Sector to International Trade

Agricultural exports constitute a major source of foreign currency earnings for Syria. These exports comprise plant-based agricultural goods, animal products, and live animals. As shown in Table 5, the value of agricultural exports witnessed a steady increase from 2000, reaching a peak in 2010 at 2,764,634 thousand USD. However, this upward trend was sharply reversed following the outbreak of the war in 2011. By 2022, the value of exports had fallen dramatically to 556,744 thousand USD.

Simultaneously, the reduction in agricultural exports was accompanied by a sharp increase in agricultural imports. In recent years, imports have risen significantly, with agricultural imports increasing by approximately 182%, while agricultural exports decreased by around -26.3% over the period from 2000 to 2022. This imbalance resulted in an agricultural trade deficit amounting to 1,234,940 thousand USD. This shift can be attributed to several factors: the removal of large tracts of agricultural land from productive use, the displacement of farmers caused by conflict, and trade-related disruptions, most notably the interruption of export routes to neighboring markets, especially the Gulf States.

Table 5: Value of Agricultural Exports and Imports

Product (1000 usd)	**2000**	**2005**	**2010**	**2015**	**2020**	**2022**	Average	Change rate %
Agriculture export (Crops and livestock products -1000usd)	655853	846929	2545760	349762	667434	506254	928665	-22,8

Agriculture export (live animal -1000usd)	99057	216234	218874	40269	37749	50490	110446	-49,0
Total agricultural exports	754910	1063163	2764634	390031	705183	556744	1039111	-26,3
Agriculture import (Crops and livestock products -1000usd)	894759	1668484	3955053	2194222	2226515	2525413	2244074	182,2
Agriculture import (live animal -1000usd)	16841	22772	35715	38504	33313	32712	29976	94,2
Total agricultural imports	911600	1691256	3990768	2232726	2259828	2558125	2274050, 5	180,6
Balance	-156690	-628093	-1226134	-1842695	-1554645	-2001381	1234940-	1117,3

7.5. Top Agricultural Exports and Imports

Tables 6 and 7 below present the top agricultural exports and imports (in USD) for Syria during the period 2000–2022. In 2000, the most exported products included ginned cotton, live sheep, and tomatoes, while imports were dominated by corn, refined sugar, and maté leaves. By 2022, olive oil, live goats, and ginned cotton emerged as the leading export items, while wheat flour, cigarettes, and sunflower oil topped the list of imports. Fruits such as oranges and apples also maintained high export rankings. It is notable that animal products do not appear among either the top exports or imports. This is primarily due to the fact that domestic production of animal products is largely directed toward meeting local consumption needs, resulting in a considerable degree of self-sufficiency in these commodities.

Table 6: Top 10 Agricultural Exports and Imports in Syria, 2000

Agricultural export (1000 USD)	**2000**	**Agricultural import (1000 USD)**	**2000**
Cotton lint, ginned (1000 USD)	194920	Maize (corn)	107002
Sheep	97929	Refined sugar	82411
Tomatoes	76778	Maté leaves	63092
Anise, badian, coriander, cumin, caraway, fennel and juniper berries, raw	32500	Barley	61650
Crude organic material N.E.C.	18740	Margarine and shortening	60998
Grapes	14354	Rice, milled	56832
Other vegetables, fresh N.E.C.	14000	Rice, paddy (rice milled equivalent)	56832
Oranges	13150	Skim milk and whey powder	37492
Lentils, dry	10170	Tea leaves	36485
Potatoes	10033	Palm oil	25000

Table 7: Top 10 Agricultural Exports and Imports in Syria, 2022

Agricultural export (1000 USD)	**2022**	**Agricultural import (1000 USD)**	**2022**
Olive oil	119115	Cigarettes	375615
Goats	50000	Wheat and meslin flour	209806
Cotton lint, ginned	31948	Sunflower-seed oil, crude	161022
Pistachios, in shell	26639	Refined sugar	116167
Anise, badian, coriander, cumin, caraway, fennel and juniper berries, raw	24787	Food wastes	98224
Tomatoes	16108	Palm oil	91500
Other vegetables provisionally preserved	16100	Maté leaves	71611
Apples	15868	Rice, paddy (rice milled equivalent)	69690
Wheat	13404	Rice, milled	69542
Other stimulant, spice and	13241	Other fruits, N.E.C.	69479

aromatic crops, N.E.C.			

7.8. Empirical Results

A multiple linear regression model was employed to examine the impact of the agricultural sector on Syria's GDP during the period 2000–2022. Four independent variables representing different components of agricultural output were included. The model's robustness was verified using several diagnostic tests. The results are presented in the following tables. Table 8 shows the outcomes of the multicollinearity test among the independent variables, which examines whether significant correlation exists between them. The null hypothesis assumes no correlation. The variance inflation factor (VIF) was calculated for each variable. All VIF values were found to be less than 10, thereby confirming the absence of multicollinearity and supporting the null hypothesis.

Table 8: Results of Multicollinearity Test

Coefficients[a]			
Model		Collinearity Statistics	
		Tolerance	VIF
1	Value of Agricultural production	,394	2,536
	agriculture export (Crops and livestock products)	,379	2,642
	agriculture export (live animal)	,341	2,932
	Population	,648	1,544
a. Dependent Variable: Gross Domestic Product			

The Jarque–Bera test was conducted to assess the normality of residuals. The test statistic was 3.85 with a corresponding p-value of 0.1458, which exceeds the 0.05 threshold. Therefore, the null hypothesis is accepted, confirming that the data follow a normal distribution and validating the suitability of the regression model. A heteroscedasticity test was also performed. The test statistic (observed R-squared) was 5.387 with a p-value of 0.211, which is greater than 0.05. This result confirms the absence of heteroscedasticity in the model, thereby supporting the homoscedasticity assumption.

Table 9 presents the estimated coefficients from the regression model, evaluating the statistical significance and magnitude of the relationship between the independent variables and GDP. The coefficient of determination (R-squared) was 0.946, indicating that 95% of the variation in GDP is explained by changes in the independent variables: population, value of agricultural production, agricultural exports of crops and livestock, and live animal exports. The remaining 5% is attributable to other external factors not captured in the model.

Table 9: Results of the Regression Model of Agricultural Variables Influencing GDP

Variable	**Coefficient**	**Std. Error**	**t-Statistics**	**Prob (p-value)**
Constant	-654074.5	220837.3	-2.9618	0.0084***
Value of agricultural production	3.2638	0.3427	9.5242	0.0000***
Agricultural exports (crop and livestock products	0.1153	0.0372	3.0996	0.0062***
Agricultural exports (live animals)	-0.3592	0.2818	-1.2744	0.2187
Population	0.0467	0.0106	4.4149	0.0084***
R – squared	0.946			
Adjusted R – squared	0.934			
F- statistic	79.196			

Prob (p-value)	0.0000			
Dependent variable	GDP			

***, ** indicate statistical significance at the 1% and 5% levels, respectively.

Among the four independent variables included in the model, three, value of agricultural production, agricultural exports of crops and livestock, and population, exhibited a statistically significant and positive influence on Syria's GDP. The remaining variable, agricultural exports of live animals, did not show statistical significance at either the 1% or 5% significance levels.

The regression results demonstrate that the variable representing the value of agricultural production has a positive and statistically significant effect on GDP. The associated p-value is 0.000, which is less than 0.01, thereby confirming statistical significance at the 1% level. This result implies that a 1% increase in the value of agricultural production is associated with an estimated 3.264% increase in GDP. These findings are consistent with those reported in previous studies, such as Raza et al. (2012), who identified a positive relationship between total agricultural output (comprising crops and livestock) and GDP in Pakistan. Similar conclusions were drawn by Awokuse and Xie (2015), who affirmed the role of the agricultural sector in supporting GDP growth in countries such as Brazil, Colombia, and Mexico. Additionally, Olajide (2015) found that agricultural output positively influences GDP in the context of Nigeria.

Regarding agricultural exports of crops and livestock products, the regression analysis yielded a p-value of 0.000, indicating a statistically significant relationship with GDP at the 1% significance level. Practically, a 1% increase in these types of agricultural exports corresponds to an estimated 0.115% increase in GDP. These results are supported by several studies, including Verter and Bečvářová (2016), who concluded that agricultural exports significantly contribute to economic growth in Nigeria. Similarly, Uremadu and Onyele (2016) found that specific agricultural exports, such as cocoa, have a positive effect on economic development.

In contrast, the results for agricultural exports of live animals differ from those for other agricultural products. The p-value for live animal exports is 0.219, exceeding the 0.05 threshold, which indicates that the variable does not exhibit a statistically significant effect on GDP at the 5% level. This may be attributed to the relatively low export value of live animals compared to other agricultural commodities. It may also reflect the limited quantity and market value of such exports. Among the most notable of these are Syrian sheep, particularly the Awassi breed, known for its high-quality meat and strong demand in Gulf countries.

Lastly, the study reveals a positive and statistically significant relationship between population size and gross domestic product. The p-value is 0.000, indicating significance at the 1% level. According to the regression results, a 1% increase in population leads to an estimated 0.0467% increase in GDP. This relationship is explained by the fact that consumption, one of the core components of GDP, rises in parallel with population growth. These results are consistent with those of Dao (2012), who reported that population growth positively affects GDP, as well as with similar findings observed in Kenya by Obere et al. (2013).

The results of the unit root test are shown in Table 10. Confirming the stationarity of time series variables is a necessary prerequisite for applying the Granger non-causality test. One of the most widely used methods for testing stationarity is the Augmented Dickey-Fuller (ADF) test, which was applied to evaluate the statistical properties of the variables used in the study.

The ADF test was conducted at three levels: level, first difference, and second difference. At the level, the p-values for all variables exceeded 5%, except for agricultural exports of live animals, indicating non-stationarity. When tested at the first difference, the p-values remained above 5% for all variables except for agricultural exports of live animals and agricultural exports of crops and livestock, again suggesting non-stationarity.

Consequently, the test was repeated at the second difference. At this level, the p-values for all variables were found to be below 0.05, which leads to the rejection of the null hypothesis and the acceptance of the alternative hypothesis that the time series data are stationary. Accordingly, the conditions for applying the Granger non-causality test are met.

Table 10: ADF Unit Root Test Results for Stationarity on the Level, First Difference, and Second Difference

Variable	**Level**		**First difference**		**Second difference**	
	t-statistic	prob	t-statistic	prob	t-statistic	prob

GDP	-1.7391	0.3983	-2.2895	0.1840	-4.2823	0.00***
Value of agricultural production	-0.4891	0.8758	-5.4018	0.000***	-	-
Agricultural export1	-1.4649	0.5320	-3.9852	0.006***	-	-
Agricultural exports2	-3.9197	0.01***	-	-	-	
Population	-2.4147	0.1510	-2.1746	0.2211	-3.5324	0.01***

***, and ** denote rejection of the null hypothesis at the 1% and 5% significance levels

Once the stationarity of the time series was confirmed, the Granger non-causality test was applied to examine the direction of causality between each independent variable (value of agricultural production, agricultural exports of crops and livestock, agricultural exports of live animals, and population) and the dependent variable (GDP). The test was conducted in a unidirectional manner (from each independent variable to GDP). The results are presented in table 11.

Table 11: Granger Non-Causality Test – Results

Variables	Lags	Obs	F- statistics	Prob
Agricultural gdp does not Granger Cause GDP	6	17	34.3854	0.00***
Agricultural exports1 does not Granger Cause GDP	6	17	13.2181	0.01***
Agricultural exports1 does not Granger Cause GDP	6	17	26.7478	0.00****
Population does not Granger Cause GDP	6	17	8.01846	0.03**

***, and ** denote rejection of the null hypothesis at the 1% and 5% significance levels

The results presented in Table 11 illustrate the findings of the Granger non-causality test. The analysis indicates the existence of a causal relationship from the value of agricultural production to GDP in Syria, significant at the 1% level. Therefore, the null hypothesis is rejected in favor of the alternative hypothesis at this level of significance. These findings are in line with those reported by Elalaoui et al. (2021), who identified a causal linkage between agriculture and GDP in the case of Morocco.

Regarding agricultural exports of crops and livestock, the test results confirm the existence of a causal relationship to GDP in Syria at the 1% significance level. Accordingly, the null hypothesis is rejected, and the alternative hypothesis is accepted. These results are consistent with the conclusions of Alam and Myovella (2017), who found that agricultural exports have a measurable impact on GDP growth and recommended leveraging such exports to stimulate economic development in Tanzania. Similarly, the findings align with Verter and Bečvářová (2016), who also identified a causal link between agricultural exports and economic growth in Nigeria.

Lastly, the results demonstrate a causal relationship from population size to GDP. Thus, the null hypothesis is rejected and the alternative accepted at both the 5% and 1% levels of significance. These findings are supported by Obere et al. (2013), whose study indicated a positive association between population growth and GDP, concluding that rising population levels contribute to economic expansion in Kenya.

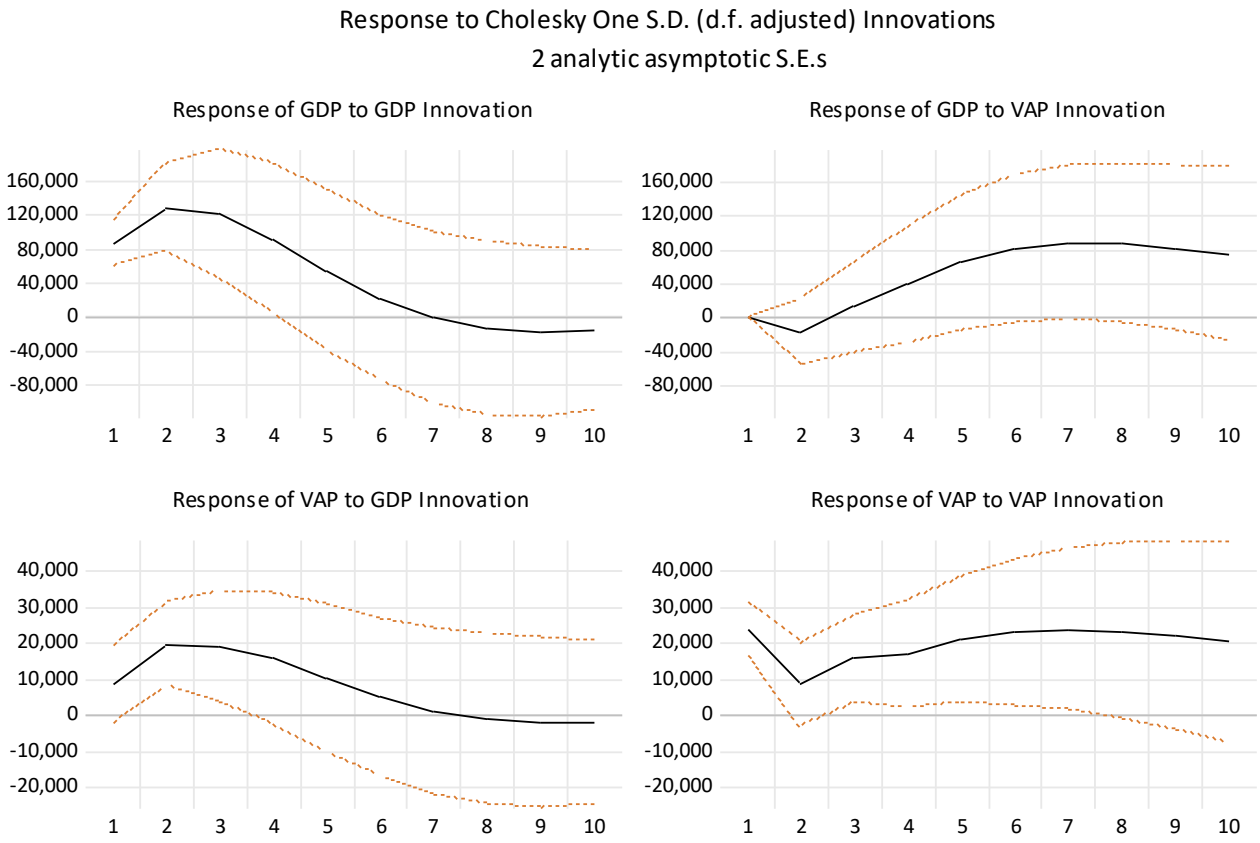

Figure 2. Impulse Response Results for Value of Agricultural Production

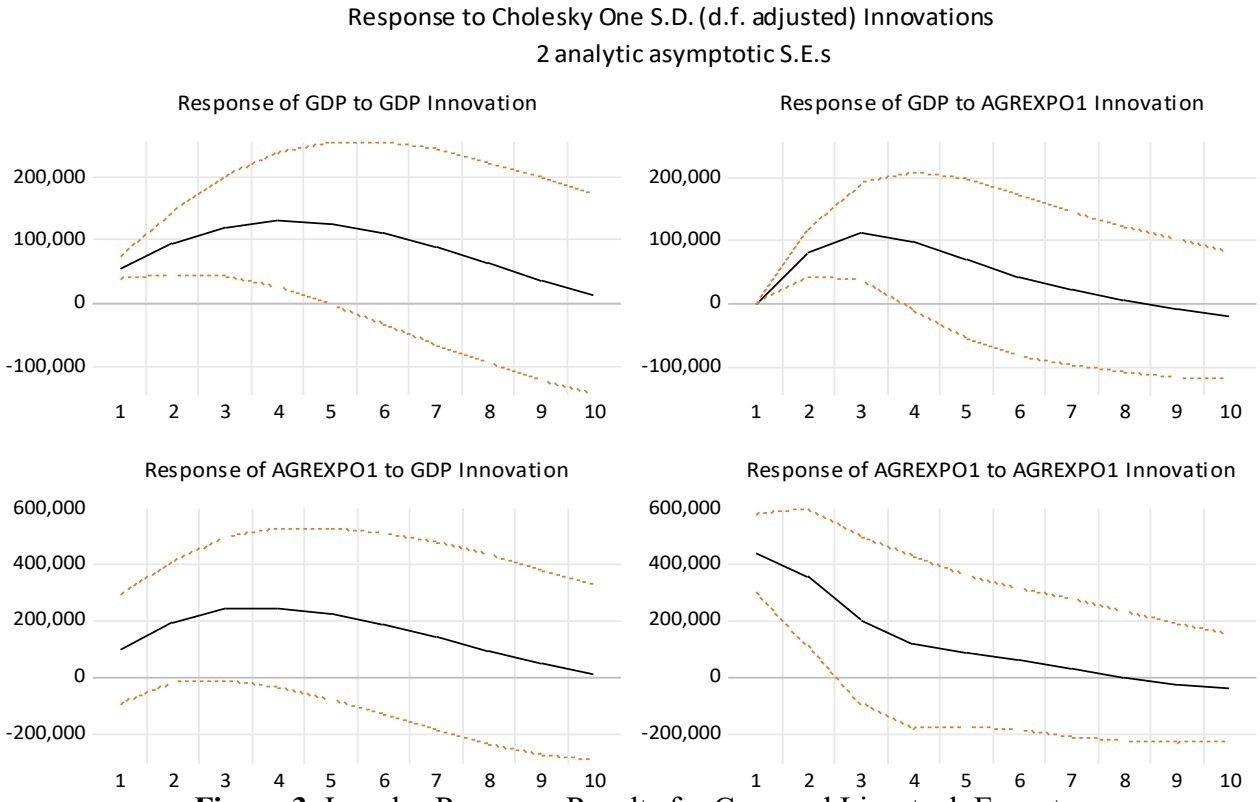

Figure 3. Impulse Response Results for Crop and Livestock Exports

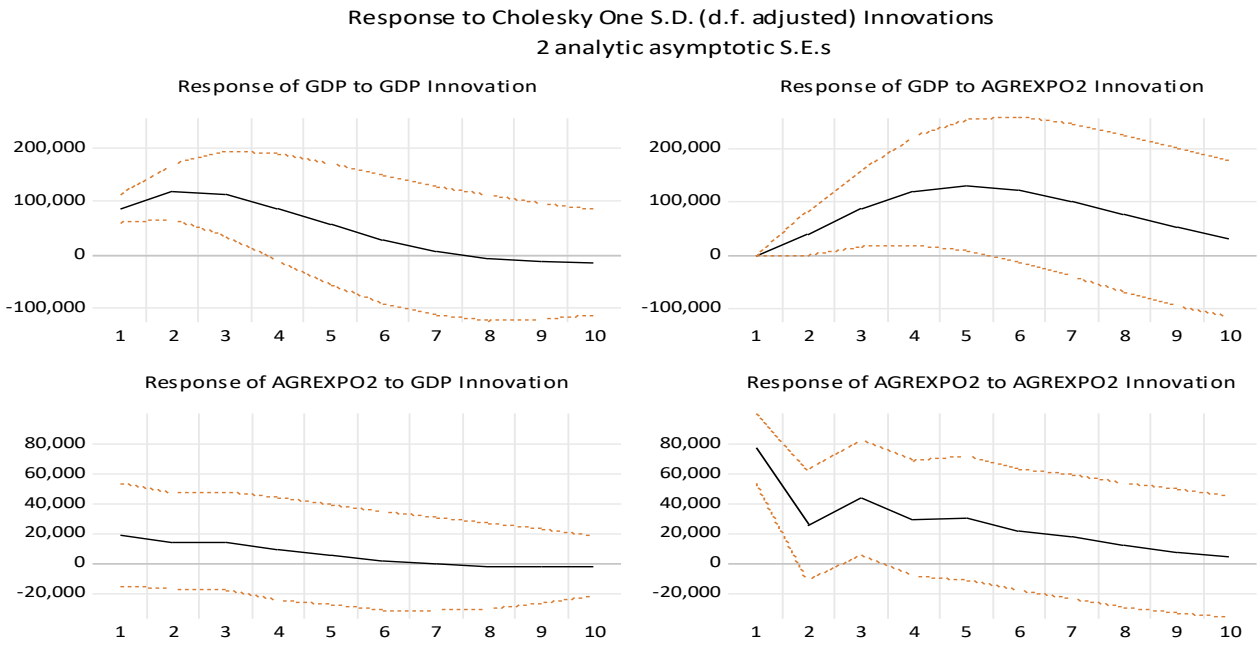

Figure 4. Impulse Response Results for Live Animals Exports

8. Conclusion and Policy Recommendations

In the aftermath of the revolution's success, Syria's newly formed government is pursuing a reformulation of its economic policy framework. Within this context, it is essential to define the role of the agricultural sector in the emerging economic structure. A reassessment of agriculture's place in the economy is critical to inform the restructuring of both economic and agricultural policy. Agriculture continues to represent one of Syria's most vital sectors, as demonstrated by key indicators such as its contribution to GDP, its export value, and its significance in employment generation, particularly in rural areas. Given Syria's substantial agricultural potential and the severe economic losses incurred by the sector during the years of conflict, economic and agricultural reforms should begin with a renewed focus on agriculture.

This study aimed to explore the role of agriculture within the Syrian economy by analyzing a time series dataset covering the years 2000 to 2022. The analysis examined the impact of several agriculture-related variables on GDP and identified structural developments within the agricultural sector by documenting its main characteristics. The methodological approach involved a combination of descriptive statistical analysis and econometric techniques, including a multiple linear regression model and Granger causality testing, to assess agriculture's contribution to economic performance.

The model incorporated four independent variables, value of agricultural production, agricultural exports of crops and livestock products, agricultural exports of live animals, and population, and one dependent variable, namely gross domestic product (GDP), as a measure of economic growth. According to the results, the descriptive analysis reveals that agriculture has retained its central role in Syria's economy. The sector's average contribution to GDP stands at approximately 21%, while it continues to provide employment for around 14% of the national labor force. These findings suggest that agriculture's role in GDP generation and employment has not diminished, but rather has remained relatively stable over time. Furthermore, Syria continues to be a significant producer of agricultural goods, including wheat, barley, tomatoes, olives, milk, and poultry meat.

In terms of agricultural trade composition, the three leading export products during the study period were cotton, live sheep, and olive oil. On the other hand, the top imported agricultural goods included wheat, sunflower oil, and sugar.

The results of the regression model indicate that three of the four independent variables, namely, the value of agricultural production, exports of crops and livestock, and population, exhibited a statistically significant and positive impact on GDP. The fourth variable, exports of live animals, was not found to be statistically significant. This may be explained by the relatively low export value of live animals in comparison to the other variables included in the model. These findings were further corroborated by the Granger causality test, which assessed the direction of causality between each independent variable and the dependent variable. The test results confirmed the existence of unidirectional causal relationships from the value of agricultural production, agricultural exports of crops and livestock, and population to GDP.

The findings of this study provide compelling evidence of the essential role played by agriculture in the Syrian economy. The agricultural sector should continue to be treated as a strategic priority, not only because of its direct contribution to economic growth, but also due to its broader developmental functions, including employment generation, the supply of raw materials to other sectors, enhancement of food security, promotion of social cohesion, and reduction of poverty rates. Furthermore, increasing agricultural production would help reduce government expenditures on agricultural imports, which reached approximately 2,274,050 thousand USD in 2022.

This study seeks to fill a significant gap in the existing literature regarding the role of agriculture in driving economic growth in developing countries such as Syria. It also offers robust empirical evidence supporting the sector's centrality in Syria's development. The research presents a practical framework for policymakers working in both agricultural and economic spheres, highlighting the necessity of positioning agriculture as a priority within Syria's broader development agenda. It is crucial that policymakers acknowledge that agriculture's role extends beyond economic development to encompass a wide array of socio-economic and environmental dimensions, as previously discussed.

Nevertheless, the agricultural sector in Syria faces a number of critical challenges. These include declining productivity, inefficiencies in governmental support programs, limited adoption of modern and climate-resilient agricultural systems, low levels of technological development, and unstable market conditions that contribute to income volatility among farmers. On the other hand, there is considerable potential to revitalize the sector, improve its efficiency, and achieve comprehensive development in coordination with other economic sectors. Based on the findings and discussion, this study proposes a set of policy recommendations, classified into two principal categories:

8.1. Development and Improvement of Agricultural Production in Syria

- Implement strategic planning principles in the agricultural sector by formulating long-term agricultural strategies that align with national development plans and applying an integrated, multi-sectoral planning approach.
- Improve agricultural production efficiency by promoting the adoption of modern technologies and agricultural innovations, organizing capacity-building and training programs for farmers, and encouraging sustainable and resource-efficient agricultural practices.
- Encourage investment in the agricultural sector by fostering an investment-friendly environment, strengthening public-private partnerships, supporting investment in research and development, promoting climate-resilient agricultural practices, and enhancing investment in agricultural value chains and infrastructure to minimize post-harvest losses and increase product value.
- Develop agricultural infrastructure, particularly transport and road networks, to facilitate market access for farmers; modernize water infrastructure, including irrigation systems, dams, and water management technologies; and upgrade agricultural facilities such as storage centers and processing plants.
- Review and assess the effectiveness of current agricultural support policies, including input subsidies and credit programs, and design more efficient and sustainable support mechanisms such as output-based subsidy schemes.
- Promote sustainable agricultural development by ensuring the conservation and responsible management of natural resources, encouraging the use of renewable energy in agriculture, promoting soil conservation measures, adopting modern irrigation systems, and implementing water desalination and treatment technologies, especially in light of increasing pressure on water resources.
- Apply agricultural risk management instruments, including agricultural insurance, to protect farmers from the effects of natural disasters and market volatility, ensuring the continuity of agricultural production.
- Digitize the agricultural sector by developing comprehensive and integrated agricultural databases to improve information access and enhance evidence-based decision-making grounded in accurate, real-time data.

8.2. Review and Evaluation of Trade Policies Concerning Agricultural Products (Export and Import Substitution Policies)

- Develop a comprehensive plan to expand agricultural exports by improving product quality and aligning with international quality standards, including compliance with global sanitary and phytosanitary regulations, in order to enhance the competitiveness of Syrian agricultural exports.
- Diversify agricultural export portfolios and promote the export of processed agricultural goods; provide the necessary export infrastructure and explore new international markets through in-depth analysis of their specific regulatory and consumer requirements.
- Offer governmental incentives and support for the establishment of agricultural industrial zones in proximity to production areas, with the aim of stimulating agro-industrial activities, generating added value, and attracting investment in agriculture and food processing.
- Introduce trade-related measures designed to protect local producers, stimulate domestic production, and improve the overall competitiveness of the national agricultural sector.
- Reassess current customs tariffs and consider implementing new tariffs on selected agricultural imports, with the objective of encouraging local production and supporting export-led growth. Such measures must be complemented by efforts to increase domestic supply in order to offset any reduction in imports.
- Reevaluate existing trade policies and adopt strategies that are contextually appropriate for Syria, with the dual goal of protecting both producers and consumers while ensuring the sustainable use of natural resources.
- Establish comprehensive and integrated commercial databases to facilitate access to trade data and improve decision-making through accurate, real-time, and transparent information on agricultural trade dynamics.

The findings of this study demonstrate that the agricultural sector is the most suitable candidate to spearhead economic development under Syria's current economic and political conditions. To expedite national economic recovery and growth, it is essential to prioritize key productive sectors, foremost among them, agriculture. This requires the adoption of well-crafted and effective policies and strategies that enhance agriculture's contribution to the economy and reinforce national food security. The modernization and revitalization of Syria's agricultural sector is no longer optional but a pressing necessity to realize the objectives of inclusive and sustainable development. Given the new government's intention to restructure the national economy, it is essential to reevaluate the strategic role of agriculture, address the constraints impeding economic development, and acknowledge the potential of agricultural development as a catalyst for broad-based economic improvement. This includes increasing farmers' incomes, enhancing food security, reducing unemployment, narrowing the trade deficit, and achieving sustainable development while preserving Syria's vital natural resources.

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