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The impact of agricultural and service sector output on economic growth in Vietnam

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Abstract

This study analyzes the role of agriculture and service sectors in Vietnam's economic growth using an autoregressive distributed lag model with data from 1990 to 2023. In the context of Vietnam's economic transition from an agriculture-based economy to industrialization and modernization, which are key national strategic objectives, this research aims to evaluate the critical economic factors influencing this transformation. Variables such as agriculture, services, exports, foreign direct investment, and population are examined to assess their short- and long-term impacts. The findings reveal that agriculture, despite being a traditional economic foundation, has a negative long-term impact due to its reliance on raw output and lack of modernization, which hinders growth. By contrast, the service sector exhibits a strong positive impact, reflecting urbanization trends and rising demand for knowledge-based services, making it a pillar of sustainable development. Exports show a negative long-term impact but a positive short-term effect, as Vietnam primarily exports low-value goods. Foreign direct investment contributes to growth through capital and technology transfers, whereas population dynamics do not have a significant impact because of the declining young workforce. This study underscores the necessity of transitioning from traditional to modernized agriculture, enhancing value-added production, and developing knowledge-based services. Policy recommendations focus on modernizing agriculture, optimizing foreign direct investment utilization, and fostering linkages between agriculture and services to ensure sustainable growth aligned with Vietnam's global integration strategy.

Keywords: Agriculture, ARDL model, economic growth, service sector, Vietnam.

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1. Introduction

Economic growth is a core topic in development studies, especially in developing countries, such as Vietnam, where the agricultural and service sectors play a crucial role in driving the economy. Agriculture provides essential resources and livelihoods for millions of people, whereas the service sector supports trade, innovation, and global integration. Assessing the impact of the outputs of these two sectors on economic growth is essential for designing effective policies for sustainable development.

Economic theory lays the foundation for understanding the relationship between sectoral output and economic growth. The neoclassical growth model of Solow [1] posits that economic growth is driven by capital accumulation, labor, and technological progress, with agricultural and service outputs contributing to resource enhancement and productivity. Romer [2] extends this with endogenous growth theory, emphasizing that improvements in sectoral productivity, such as technological advances in agriculture or efficiency in services, generate increasing returns and sustain long-term growth. Additionally, Jorgenson and Timmer [3] through structural transformation theory, highlight the shift from agriculture to services as economies develop, a trend clearly observed in Vietnam, where agriculture remains essential but services are becoming increasingly dominant. These theories align well with Vietnam's agricultural modernization and service sector expansion strategy.

The study by [4] although focused on foreign direct investment (FDI), also analyzed the role of agricultural productivity in economic growth in middle-income countries. These findings suggest that agricultural output enhances total factor productivity, thereby boosting gross domestic product (GDP). Zardoub and Sboui [5] emphasize that agricultural output, when combined with services and trade, has a positive but uneven impact on growth, depending on domestic policies.

Vietnam's economic growth has averaged 6–7% annually over the past three decades, with contributions from both agriculture and services. However, the specific impacts of these sectors on GDP need to be clarified, especially in the context of globalization and climate change. This study employs econometric methods to quantify the roles of these two sectors based on theory and prior empirical research with the aim of proposing sustainable development policies for Vietnam.

2. Empirical Review

Amidst the ongoing challenges of climate change, global economic repercussions of the COVID-19 pandemic, and structural shifts within national economies, studies examining the influence of agricultural and service sector output on economic growth have garnered significant attention from scholars worldwide. This review provides a synthesis of empirical research focused on the impact of these two sectors across different national and economic contexts while evaluating methodological approaches, core findings, and identifying areas for further investigation.

Anwar, et al. [6] analyzed the contribution of agriculture to Pakistan's GDP over the period 1975–2012 using the Ordinary Least Squares (OLS) method. The study investigated variables including agriculture, industry, trade, and GDP and revealed positive associations between trade, industrial output, and agriculture in relation to GDP growth. These findings suggest a need for robust policy measures to enhance agricultural development.

Singariya and Sinha [7] explored the relationships between per capita GDP, agricultural production, and manufacturing in India using time series data from 1970 to 2013. Applying vector error correction model, vector autoregression model, impulse response functions, and variance decomposition, this study confirmed long-run cointegration among the variables. Bidirectional causality between agriculture and per capita income was observed, with short-run effects from agriculture on GDP. The shock analysis further showed that agricultural disturbances had a prolonged impact on both GDP per capita and manufacturing output.

Similarly, Degu [8] examined intersectoral linkages within the Ethiopian economy from 1975 to 2017 using the vector error correction model, Granger causality tests, and impulse response techniques. The results indicate stable long-term relationships between agriculture, industry, and services. The study highlights the pivotal role of agriculture in stimulating growth across other sectors, supporting Ethiopia's (ADLI) strategy. Although agriculture's GDP share of GDP declined, its structural centrality remained intact.

In Nigeria, Fagbemi and Oladipo [9] utilized a structural vector autoregression model to assess the roles of agriculture and industry from 1980 to 2019. Both sectors have positive impacts on GDP, with industries exhibiting a stronger effect. The authors emphasized balanced investment between sectors for sustainable growth. Complementing these results, Akinwunmi and Akinola [10] using OLS regression from 1981 to 2018, reaffirmed agriculture's significant role in economic expansion and called for modernization and infrastructural development.

Through a sectoral convergence analysis, Bhowmik (2016) documented a declining trend in industrial GDP share of 1.69% annually in India, while agriculture and services increased by 0.93% and 0.74%, respectively, from 1950 to 51 to 2013–14.

Daniel and Okafor [11] used a cointegration and error correction model to evaluate the contributions of agriculture, industry, and services to Nigeria's GDP from 1985 to 2020. Services has emerged as the most influential sector, followed by industry and agriculture. This study advocates integrated policies to support inclusive sectoral growth.

Akram, et al. [12] conducted a cross-country analysis from 1990 to 2020 by applying regression techniques to examine the relationship between agricultural output and GDP. The results underscore the significance of agriculture in developing economies, where growth in agricultural output remains strongly correlated with GDP performance, while developed economies have experienced diminishing returns due to structural transitions toward industry and services.

Ajmair, et al. [13] and Chukwuma and Nnadi [14] further emphasized the growing importance of the service sector. These studies find that services, especially finance, telecommunications, and trade, are leading contributors to GDP and act as critical enablers of growth in other sectors. Using panel data analysis, Ibrahim, et al. [15] confirmed the service sector's leading role, calling for investment in human capital and infrastructure to sustain its expansion.

[16] differentiated between processed and unprocessed agricultural exports in South Africa and demonstrated that only processed exports had a positive effect on GDP, reinforcing the importance of value-added production for effective export-led growth strategies.

Velonjara and Gondje-Dacka [17] substantiated the role of foreign direct investment (FDI), finding statistically significant positive effects of FDI on economic growth in nine West African countries. However, they highlight the superior impact of the service sector on primary industries or FDI. Similarly, Wiredu, et al. [18] showed that trade openness, investment, and inflation have stronger correlations with GDP growth than FDI alone, although FDI remains a relevant growth driver.

Population dynamics, as both supply and demand forces, have dual effects on growth. While population growth may expand domestic markets and labor supply, it also strains natural resources and employment capacity. As observed by Singariya and Sinha [7] and Akram, et al. [12] demographic variables frequently act as intermediaries that influence labor productivity and per capita income.

In summary, the empirical studies reviewed provide comprehensive evidence of the multifaceted determinants of economic growth, particularly the pivotal roles of agriculture and services, export performance, FDI inflows, and demographic changes. These insights form a robust empirical and theoretical foundation for constructing an econometric model in which agricultural and service outputs, export value, population, and FDI are treated as explanatory variables for GDP. Such a model not only quantifies the contribution of each factor but also supports evidence-based policymaking aimed at fostering inclusive and sustainable economic development. To address these research gaps, this study employs a regression model to evaluate the influence of these economic factors on Vietnam's GDP, as follows:

$$GDP_t = \beta_0 + \beta_1 AGR_t + \beta_2 SER_t + \beta_3 EXP_t + \beta_4 POP_t + \beta_5 FDI_t + \varepsilon_t \quad (1)$$

The independent variables include Gross Domestic Product by sector of Agriculture, Forestry, and Fishing; Gross Domestic Product by sector of Services; Exports of Goods and Services; Foreign Direct Investment; and Population Growth, which will be compared against the dependent variable, Gross Domestic Product. This study focuses on Vietnam and uses data from 1990 to 2023. Table 1 provides a detailed description of the variables.

Table 1.
Description of variables.

Acronyms	Description	Sources
GDP	Gross domestic product (% of Growth)	*https://aric.adb.org/macroindicators*
AGR	Gross domestic product by sector of Agriculture, forestry and fishing (% of GDP)	*Statistical yearbook of Vietnam (1995-2023)*
SER	Gross domestic product by sector of Service (% of GDP)	
EXP	Exports of goods and services (% of GDP)	*https://databank.worldbank.org*
FDI	Foreign direct investment, net inflows (% of GDP)	
POP	Population growth (annual %)	

3. Methodology

The autoregressive distributed lag (ARDL) model was selected for its flexibility in capturing both long- and short-term relationships among variables in a time-series dataset. Unlike traditional regression techniques, ARDL does not require all variables to be stationary in the same order, as long as none are integrated in second-order I(2). This model, developed by Im, et al. [19] is particularly well-suited to Vietnam's macroeconomic data, which often exhibit volatility and structural trends over time. Furthermore, ARDL facilitates cointegration testing, allowing an assessment of whether a long-term equilibrium relationship exists between GDP and independent variables.

ARDL is an unrestricted dynamic model, in which the dependent variable is expressed as a function of its own lagged and lagged values of the other independent variables. Given its effectiveness in macroeconomic research, many scholars have adopted this approach when analyzing GDP and other key economic indicators.

The ARDL approach follows a general-to-specific framework and offers several advantages, including its ability to avoid integration-order constraints, making it applicable to both large and small samples. Unlike traditional models, it does not require all variables to share the same lag structure and provides unbiased estimates even in the presence of endogenous explanatory variables [20]. A key feature of ARDL is the Bounds test, which determines the long-term equilibrium relationships by estimating a dynamic error correction model (ECM). This process refines the parameter estimates for both the short- and long-run coefficients, while capturing the adjustment speed toward equilibrium. The quantitative analysis procedure within ARDL follows a structured approach, beginning with lag selection for model variables based on information criteria such as the Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan-Quinn Criterion (HQ). The second step involves stationarity testing using Correlogram Analysis, ensuring that the variables are not integrated at I(2) and that they have different stationarity properties. Finally, cointegration testing was conducted using the bounds test, which assesses the presence of a long-term relationship based on the F-Bounds Test. If the test statistic exceeds the critical values for I(0) and I(1), then a long-term equilibrium relationship is confirmed. Following these steps, the study will proceed with the estimation and evaluation of the Error Correction Model (ECM) within the ARDL framework, further refining the analysis of short-term and long-term economic dynamics.

$$\begin{aligned} DGDP_t = \beta_0 &+ \sum_{i=>1} \beta_1 DGDP_{t-i} + \sum_{i} \beta_2 DAGR_{t-i} + \sum_{i} \beta_3 DSER_{t-i} + \sum_{i} \beta_4 DEXP_{t-i} + \sum_{i} \beta_5 DPOP_{t-i} \\ &+ \sum_{i} \beta_6 DFDI_{t-i} + \psi ECM_{t-i} + \varepsilon_{2t} \end{aligned} \quad (2)$$

The Error Correction Model (ECM) was designed to adjust deviations from long-term equilibrium. Parameter ψ represents the speed of adjustment toward equilibrium when deviations occur. If the ψ coefficient in the ECM self-adjustment mechanism is negative and statistically significant, it confirms that GDP exhibits a self-correcting mechanism, gradually returning to its equilibrium level after deviating from the long-term relationship.

The fourth step in the ARDL estimation process involves estimating the ARDL model with the identified lags to examine both the long- and short-term relationships between the variables. The final step calculates the short-term impact of the variables using ECM based on the ARDL approach developed by Engle and Granger [21]. From Equation 1, the ARDL regression model employed in this study was as follows:

$$DGDP_t = \beta_0 + \sum_{i=>1} \beta_1 DGDP_{t-i} + \sum_i \beta_2 DAGR_{t-i} + \sum_i \beta_3 DSER_{t-i} + \sum_i \beta_4 DEXP_{t-i} + \sum_i \beta_5 DPOP_{t-i} + \sum_i \beta_6 DFDI_{t-i} + \lambda_1 GDP_{t-1} + \lambda_2 AGR_{t-1} + \lambda_3 IND_{t-1} + \lambda_4 EXP_{t-1} + \lambda_5 POP_{t-1} + \lambda_6 FDI_{t-1} + \varepsilon_{it} \quad (3)$$

The model for assessing long-term impact is defined:

$$GDP_t = \beta_0 + \lambda_1 GDP_{t-1} + \lambda_2 AGR_{t-1} + \lambda_3 SER_{t-1} + \lambda_4 EXP_{t-1} + \lambda_5 POP_{t-1} + \lambda_6 FDI_{t-1} + \varepsilon_{1t} \quad (4)$$

And the model for assessing short-term impact is specified:

$$DGDP_t = \beta_0 + \sum_{i=>1} \beta_1 DGDP_{t-i} + \sum_i \beta_2 DAGR_{t-i} + \sum_i \beta_3 DSER_{t-i} + \sum_i \beta_4 DEXP_{t-i} + \sum_i \beta_5 DPOP_{t-i} + \sum_i \beta_6 DFDI_{t-i} + \varepsilon_{2t} \quad (5)$$

Finally, to ensure the reliability of the regression results, diagnostic tests were conducted, including the Variance Inflation Factor (VIF) [22] normality test, Breusch-Godfrey Serial correlation LM test, heteroskedasticity test, Ramsey RESET test, and CUSUM test.

4. Empirical Analysis

This section presents the data, regression results, and the interpretation and analysis of the findings.

4.1. Descriptive Statistics

Table 2 presents descriptive statistics of the properties and characteristics of the variables used in this study. It reports the mean, minimum, and maximum values of each variable, along with the standard deviation and P-value of the Jarque-Bera statistic, to assess the normality of the variable distributions.

Table 2.
Descriptive Statistics of Variables.

	GDP	AGR	SER	EXP	POP	FDI
Mean	6.807265	21.56103	40.29724	60.82903	1.212088	5.420706
Median	6.917500	20.94050	41.24150	61.89450	1.035500	4.680500
Maximum	9.540000	40.48900	42.88000	93.85000	2.185000	11.93900
Minimum	2.552000	11.78500	35.71600	28.72300	0.682000	2.781000
Std. Dev.	1.634782	7.435966	1.980396	19.01935	0.410738	2.167297
Skewness	-0.669569	0.665605	-0.329868	0.015814	1.212205	1.394055
Kurtosis	3.375716	3.152043	1.810459	2.070328	3.240455	4.090423
Jarque-Bera	2.740475	2.543252	2.621201	1.225828	8.408741	12.69699
Probability	0.254047	0.280375	0.269658	0.541770	0.054930	0.051749
Sum	231.4470	733.0750	1370.106	2068.187	41.21100	184.3040
Sum Sq. Dev.	88.19290	1824.689	129.4250	11937.27	5.567275	155.0068
Observations	34	34	34	34	34	34

Based on the descriptive statistics table, the mean GDP growth rate was 6.81%, indicating relatively strong economic expansion during the study period. The average GDP contribution from the agricultural sector (AGR) was 21.56%, while that of the service sector (SER) was 40.29%, reflecting a stronger investment focus on services than agriculture. Exports (EXP) averaged 60.83%, highlighting their significant role in the economy. FDI has an average share of 5.42% of GDP, suggesting that FDI inflows constitute a relatively small proportion of total GDP. However, the standard deviation of 2.17% indicates a relatively high level of volatility over time. Similarly, exports exhibit considerable fluctuations, as reflected by their high standard deviation of 19.02%. Conversely, population growth (POP) remained stable, with a low standard deviation of 0.41, indicating minimal variation over time. The kurtosis values for GDP and other variables were close to 3, suggesting that the data distributions were approximately normal. Additionally, the high probability values (p-values > 0.05) suggest that most variables did not violate the assumption of normality.

4.2. Correlation Analysis

According to Table 3, the independent variables SER and EXP exhibit a negative correlation with the dependent variable GDP, with correlation values of -0.028759 and -0.382470, respectively. The remaining independent variables showed a positive correlation with GDP, indicating a balanced impact of the independent variables on economic growth. Additionally,

Table 4 shows that the independent variables had weak correlations with each other. Following Mukaka [23] and the empirical rule for assessing the strength of relationships between variable pairs, the independent variables in the model exhibit moderate correlation since all correlation coefficients are below 0.70. This ensured the absence of multicollinearity, and met the necessary conditions for the estimation model. Furthermore, after running the regression model, the study assessed Variance Inflation Factors (VIF) to verify multicollinearity issues.

Table 3.
Correlation Coefficients of Variables

	GDP	AGR	SER	EXP	POP	FDI
GDP	1.000000	0.242433	-0.028759	-0.382470	0.259243	0.404700
AGR	0.242433	1.000000	-0.491499	-0.622601	0.603962	0.188583
SER	-0.028759	-0.491499	1.000000	0.274308	-0.187241	0.246703
EXP	-0.382470	-0.622601	0.274308	1.000000	-0.676451	-0.318474
POP	0.259243	0.603962	-0.187241	-0.676451	1.000000	0.273708
FDI	0.404700	0.188583	0.246703	-0.318474	0.273708	1.000000

4.3. Optimal Lag Selection and Stationarity Testing of Variables

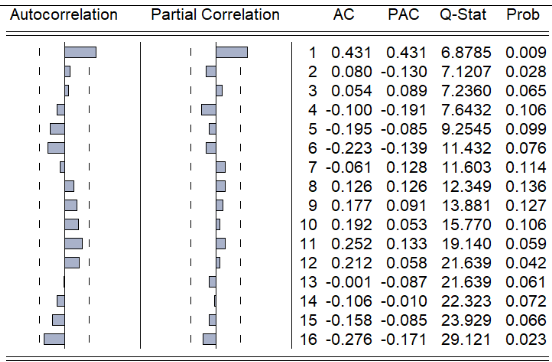
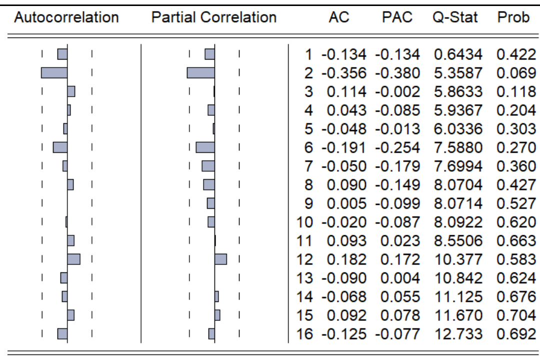
Table 4 presents the criteria for determining the optimal lag length based on key statistical indicators including the Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan-Quinn Criterion (HQ). The results indicate that Lag 0 is not suitable because it has a low log-likelihood value (LogL = -353.9251) and high AIC, SC, and HQ values. At Lag 1, the model improved significantly, with LogL increasing to -193.0445, LR reaching 251.3760, and FPE decreasing to 0.100876. The AIC, SC, and HQ values also declined compared with Lag 0, suggesting an improvement in the model fit. At Lag 2, further enhancements were observed, with LogL increasing to -127.9928, LR reaching 77.24887, and FPE decreasing to 0.021187. Additionally, the AIC, SC, and HQ reached their lowest values, confirming that lag 2 was the optimal selection. Based on these findings, Lag 2 was chosen as the most appropriate because it ensured the best model fit with the data by minimizing the key selection criteria.

Table 4.
Optimal Lag Selection.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-353.9251	NA	237.0283	22.49532	22.77015	22.58642
1	-193.0445	251.3760	0.100876	14.69028	16.61406	15.32796
2	-127.9928	77.24887*	0.021187*	12.87455*	16.44728*	14.05881*

When applying the ARDL Bounds Testing approach, conducting stationarity tests is a mandatory prerequisite for assessing the degree of integration among observed time-series data. The stationarity of the variables was determined using Correlogram Analysis. Table 5 indicates that GDP is stationary at level I(0), whereas the remaining three variables are stationary at level I(1). These characteristics confirm that the ARDL regression model is appropriate, as it can accommodate variables integrated at different orders, provided that none are integrated at I(2).

Table 5.
Stationarity Test Results of Variables

Variables	I(0)	I(1)
GDP		

GDP, I(0):

	AC	PAC	Q-Stat	Prob
1	0.431	0.431	6.8785	0.009
2	0.080	-0.130	7.1207	0.028
3	0.054	0.089	7.2360	0.065
4	-0.100	-0.191	7.6432	0.106
5	-0.195	-0.085	9.2545	0.099
6	-0.223	-0.139	11.432	0.076
7	-0.061	0.128	11.603	0.114
8	0.126	0.126	12.349	0.136
9	0.177	0.091	13.881	0.127
10	0.192	0.053	15.770	0.106
11	0.252	0.133	19.140	0.059
12	0.212	0.058	21.639	0.042
13	-0.001	-0.087	21.639	0.061
14	-0.106	-0.010	22.323	0.072
15	-0.158	-0.085	23.929	0.066
16	-0.276	-0.171	29.121	0.023

GDP, I(1):

	AC	PAC	Q-Stat	Prob
1	-0.134	-0.134	0.6434	0.422
2	-0.356	-0.380	5.3587	0.069
3	0.114	-0.002	5.8633	0.118
4	0.043	-0.085	5.9367	0.204
5	-0.048	-0.013	6.0336	0.303
6	-0.191	-0.254	7.5880	0.270
7	-0.050	-0.179	7.6994	0.360
8	0.090	-0.149	8.0704	0.427
9	0.005	-0.099	8.0714	0.527
10	-0.020	-0.087	8.0922	0.620
11	0.093	0.023	8.5506	0.663
12	0.182	0.172	10.377	0.583
13	-0.090	0.004	10.842	0.624
14	-0.068	0.055	11.125	0.676
15	0.092	0.078	11.670	0.704
16	-0.125	-0.077	12.733	0.692

Variables	Lag	I(0) AC	I(0) PAC	I(0) Q-Stat	I(0) Prob	I(1) AC	I(1) PAC	I(1) Q-Stat	I(1) Prob
AGR	1	0.867	0.867	27.863	0.000	0.054	0.054	0.1045	0.746
	2	0.702	-0.199	46.692	0.000	-0.144	-0.148	0.8806	0.644
	3	0.597	0.171	60.787	0.000	0.053	0.071	0.9868	0.804
	4	0.521	-0.018	71.859	0.000	0.052	0.023	1.0957	0.895
	5	0.440	-0.042	80.016	0.000	-0.019	-0.006	1.1108	0.953
	6	0.356	-0.034	85.559	0.000	-0.088	-0.081	1.4421	0.963
	7	0.282	-0.021	89.165	0.000	-0.116	-0.117	2.0351	0.958
	8	0.223	-0.003	91.509	0.000	0.013	0.004	2.0426	0.980
	9	0.159	-0.076	92.751	0.000	0.090	0.070	2.4289	0.983
	10	0.105	0.018	93.313	0.000	-0.077	-0.068	2.7276	0.987
	11	0.057	-0.047	93.488	0.000	-0.057	-0.023	2.9001	0.992
	12	0.028	0.041	93.531	0.000	0.075	0.041	3.2091	0.994
	13	-0.006	-0.073	93.533	0.000	0.052	0.021	3.3650	0.996
	14	-0.051	-0.046	93.692	0.000	-0.049	-0.038	3.5088	0.998
	15	-0.081	0.017	94.117	0.000	-0.150	-0.138	4.9495	0.993
	16	-0.095	-0.010	94.734	0.000	-0.127	-0.135	6.0424	0.988
SER	1	0.704	0.704	18.358	0.000	0.080	0.080	0.2300	0.632
	2	0.343	-0.301	22.850	0.000	-0.244	-0.252	2.4405	0.295
	3	0.150	0.105	23.737	0.000	-0.240	-0.210	4.6642	0.198
	4	0.105	0.056	24.187	0.000	-0.016	-0.050	4.6749	0.322
	5	0.062	-0.083	24.350	0.000	0.133	0.032	5.4052	0.368
	6	-0.047	-0.127	24.445	0.000	-0.070	-0.160	5.6119	0.468
	7	-0.122	0.012	25.116	0.001	-0.121	-0.103	6.2639	0.509
	8	-0.138	-0.040	26.007	0.001	0.055	0.053	6.4045	0.602
	9	-0.178	-0.153	27.561	0.001	0.058	-0.044	6.5686	0.682
	10	-0.217	-0.022	29.959	0.001	-0.174	-0.255	8.0906	0.620
	11	-0.177	0.075	31.630	0.001	-0.156	-0.135	9.3675	0.588
	12	-0.112	-0.053	32.327	0.001	-0.021	-0.114	9.3910	0.669
	13	-0.048	0.038	32.460	0.002	0.136	-0.084	10.455	0.656
	14	-0.083	-0.143	32.880	0.003	0.101	-0.061	11.071	0.680
	15	-0.103	0.040	33.569	0.004	-0.060	-0.083	11.302	0.731
	16	-0.078	-0.040	33.985	0.005	-0.058	-0.095	11.535	0.775
EXP	1	0.907	0.907	30.544	0.000	-0.041	-0.041	0.0598	0.807
	2	0.791	-0.183	54.487	0.000	0.053	0.051	0.1635	0.921
	3	0.671	-0.069	72.288	0.000	-0.205	-0.202	1.7834	0.619
	4	0.565	0.007	85.297	0.000	0.053	0.039	1.8956	0.755
	5	0.456	-0.096	94.081	0.000	-0.195	-0.181	3.4563	0.630
	6	0.348	-0.072	99.370	0.000	-0.022	-0.079	3.4761	0.747
	7	0.257	0.029	102.36	0.000	-0.023	0.003	3.4995	0.835
	8	0.185	0.014	103.98	0.000	-0.079	-0.169	3.7859	0.876
	9	0.118	-0.067	104.66	0.000	-0.070	-0.091	4.0236	0.910
	10	0.069	0.046	104.90	0.000	0.051	0.013	4.1556	0.940
	11	0.028	-0.021	104.94	0.000	-0.115	-0.211	4.8544	0.938
	12	-0.000	0.000	104.94	0.000	-0.125	-0.201	5.7183	0.930
	13	-0.021	-0.001	104.97	0.000	-0.052	-0.129	5.8717	0.951
	14	-0.020	0.091	104.99	0.000	-0.013	-0.205	5.8826	0.969
	15	-0.037	-0.163	105.08	0.000	0.077	-0.048	6.2654	0.975
	16	-0.075	-0.120	105.46	0.000	0.034	-0.138	6.3429	0.984
POP	1	0.875	0.875	28.408	0.000	0.122	0.122	0.5243	0.469
	2	0.738	-0.118	49.251	0.000	-0.439	-0.461	7.5147	0.023
	3	0.603	-0.067	63.629	0.000	-0.050	0.109	7.6078	0.055
	4	0.474	-0.060	72.815	0.000	0.021	-0.250	7.6247	0.106
	5	0.351	-0.066	78.011	0.000	0.061	0.181	7.7771	0.169
	6	0.237	-0.049	80.472	0.000	0.195	0.074	9.3735	0.154
	7	0.137	-0.039	81.318	0.000	0.126	0.216	10.059	0.185
	8	0.053	-0.019	81.451	0.000	-0.171	-0.150	11.378	0.181
	9	-0.018	-0.036	81.467	0.000	-0.325	-0.186	16.381	0.059
	10	-0.068	0.010	81.703	0.000	-0.031	-0.089	16.428	0.088
	11	-0.088	0.057	82.114	0.000	0.235	0.028	19.280	0.056
	12	-0.092	0.011	82.582	0.000	-0.057	-0.260	19.460	0.078
	13	-0.095	-0.034	83.103	0.000	-0.189	-0.056	21.496	0.064
	14	-0.095	-0.019	83.652	0.000	-0.105	-0.268	22.165	0.075
	15	-0.095	-0.028	84.238	0.000	-0.031	0.123	22.228	0.102
	16	-0.098	-0.029	84.887	0.000	0.040	-0.141	22.335	0.133
FDI	1	0.682	0.682	17.228	0.000	0.096	0.096	0.3311	0.565
	2	0.326	-0.259	21.288	0.000	-0.008	-0.017	0.3336	0.846
	3	-0.010	-0.227	21.292	0.000	-0.059	-0.057	0.4671	0.926
	4	-0.272	-0.185	24.301	0.000	-0.223	-0.215	2.4554	0.653
	5	-0.315	0.092	28.477	0.000	-0.098	-0.063	2.8505	0.723
	6	-0.355	-0.244	33.991	0.000	-0.128	-0.131	3.5552	0.737
	7	-0.300	-0.025	38.074	0.000	-0.105	-0.121	4.0484	0.774
	8	-0.208	-0.062	40.106	0.000	-0.031	-0.089	4.0926	0.849
	9	-0.133	-0.058	40.973	0.000	-0.127	-0.200	4.8740	0.845
	10	-0.011	0.001	40.979	0.000	-0.044	-0.137	4.9703	0.893
	11	0.125	0.124	41.811	0.000	0.123	0.023	5.7706	0.888
	12	0.186	-0.077	43.740	0.000	-0.086	-0.231	6.1770	0.907
	13	0.298	0.235	48.910	0.000	0.241	0.140	9.5202	0.733
	14	0.270	-0.099	53.366	0.000	0.250	0.156	13.330	0.501
	15	0.103	-0.159	54.055	0.000	-0.008	-0.072	13.334	0.576
	16	-0.047	-0.022	54.204	0.000	-0.047	-0.107	13.484	0.637

4.4. Cointegration Testing Among Variables (Bound Test)

After determining the optimal lag length and testing for stationarity, the bound test was conducted to examine the long-term relationship between economic growth (GDP) and the independent variables (AGR, SER, EXP, POP, and FDI). Table 6 presents the results of the bound test.

Table 6.
Bound Test Results.

F-Bounds Test		**Null Hypothesis: No levels relationship**		
Test Statistic	**Value**	**Significant**	**I(0)**	**I(1)**
F-statistic	5.304995	10%	2.26	3.35
k	5	5%	2.62	3.79
		2.5%	2.96	4.18
		1%	3.41	4.68

The results in Table 7 indicate that the calculated F-statistic (5.304995) exceeded the upper-bound critical values at 90%, 95%, and 99%, which were 3.35, 3.79, and 4.68, respectively. Therefore, it can be confirmed that cointegration or a long-term relationship exists between the dependent variable (GDP) and the independent variables (AGR, SER, EXP, POP, and FDI). The estimation of both long- and short-term relationships among these variables is presented in the following section.

4.5. ARDL Model Estimation

The long-term relationship between the dependent variable (GDP) and independent variables was estimated using the ARDL model. The long-run and short-run elasticities are represented by the coefficients of the independent variables in Table 7.

Table 7.
Estimation Results.

Variables	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
The dependent variable: GDP. Long-Term Estimation Results				
AGR	-0.269120	0.167719	-1.604593	0.0235
SER	0.373190	0.194209	-1.921596	0.0383
EXP	-0.113326	0.046005	-2.463334	0.0225
FDI	0.292728	0.112805	2.594987	0.0169
POP	-0.213281	1.603276	-0.133028	0.8954
The dependent variable: D(GDP). Short-Term Estimation Results				
C	37.73610	6.103669	6.182527	0.0000
D(GDP(-1))	0.414113	0.163657	2.530366	0.0195
D(SER)	0.103199	0.195039	0.529120	0.1023
D(EXP)	0.062721	0.056667	1.106851	0.0809
D(EXP(-1))	0.139955	0.050944	2.747258	0.0121
CointEq(-1)*	-1.159430	0.184693	-6.277622	0.0000

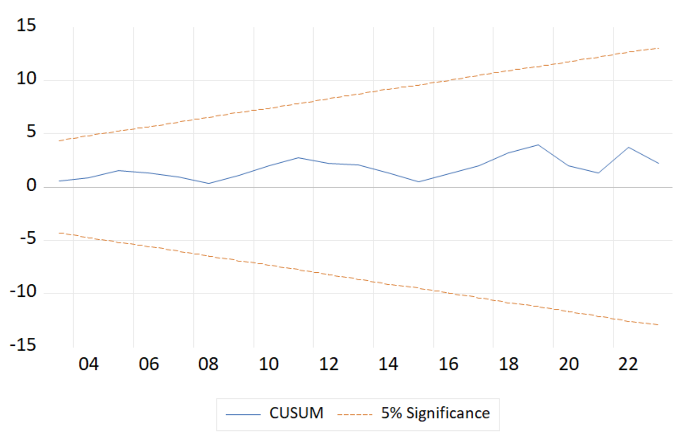
To ensure reliability of the estimation results, we conducted six diagnostic tests. The results are presented in Table 8 and 9, respectively.

Table 8.
Diagnostic Test Results.

No	**Test**	**P-Value**	**Results**
1	Normality test	0.734418	The residuals follow a normal distribution.
2	Breusch-Godfrey Serial Correlation LM Test	0.1596	No autocorrelation
3	Heteroskedasticity Test: Breusch-Pagan-Godfrey	0.8722	No heteroskedasticity
4	Ramsey Reset Test	0.3103	No need for additional variables

Table 9.
Variance Inflation Factor (VIF) and CUSUM Test Results

Variables	Coefficient Variances	Centered VIF
GDP(-1)	0.029931	1.673715
GDP(-2)	0.036669	2.089914
AGR	0.038823	30.01551
SER	0.089709	6.396888
SER(-1)	0.049473	4.109636
EXP	0.005019	3.046912
EXP(-1)	0.006404	5.045745
EXP(-2)	0.003419	2.086739
FDI	0.025393	2.521097
POP	3.484276	8.697881
C	203.6424	2.921097



The entered VIF values are all below 10, indicating that, according to Hair, et al. [22] the long-term impact assessment model does not exhibit multicollinearity. Regarding the CUSUM test, there was no clear indication of instability or significant structural changes in the model over the examined period as the CUSUM line remained within the critical boundaries. Overall, the CUSUM plot suggests that the regression model in this study was stable over time.

4.6. Discussion of Research Findings

4.6.1. Long-Term Estimation Results

The coefficient of AGR is -0.269120 ($p = 0.0235 < 0.05$), indicating a statistically significant negative impact; that is, a 1% increase in agriculture's share of GDP leads to a 0.269% decline in GDP growth. This finding suggests that overreliance on agriculture can hinder the long-term economic growth of Vietnam. By contrast, SER has a positive and statistically significant coefficient of 0.373190 ($p = 0.0383 < 0.05$), implying that a 1% increase in the service sector's share of GDP results in a 0.373% increase in GDP growth, highlighting the critical role of services in driving long-term economic expansion.

The coefficient of EXP is -0.113326 ($p = 0.0225 < 0.05$), indicating a significant negative effect; that is, a 1% increase in exports as a share of GDP leads to a 0.113% decline in GDP growth. This result reflects Vietnam's heavy reliance on low value-added exports, which may limit its long-term economic sustainability. Conversely, FDI has a positive and significant coefficient of 0.292728 ($p = 0.0169 < 0.05$), suggesting that a 1% increase in FDI inflows as a share of GDP leads to a 0.293% increase in GDP growth, reinforcing the role of FDI as a key driver of long-term economic expansion. Finally, POP has a negative coefficient of -0.213281 ($p = 0.8954 > 0.05$), but its effect is statistically insignificant, implying that population growth does not have a clear long-term impact on GDP growth in Vietnam.

Short-Term Estimation Results

The coefficient of D(GDP(-1)) is 0.414113 ($p = 0.0195 < 0.05$), indicating that past GDP growth positively affects current GDP growth, thus reflecting the persistence of economic momentum. The coefficient of D(SER) is 0.103199 ($p = 0.1023 > 0.05$), suggesting a positive but statistically insignificant short-term effect, possibly due to the lagged nature of service sector spillovers.

The coefficients of D(EXP) and D(EXP(-1)) are 0.062721 ($p = 0.0809$) and 0.139955 ($p = 0.0121 < 0.05$), respectively, indicating that exports positively influence GDP growth in the short run with a stronger lagged effect. This suggests that exports can provide short-term economic benefits in contrast to their negative long-term impacts.

The coefficient of CointEq(-1) is negative and highly significant, confirming a strong self-adjustment mechanism, meaning that when GDP deviates from its long-run equilibrium, it corrects at a rate of 115.9% per year, reinforcing the presence of cointegration among the variables.

First, it finds that the output of the agricultural sector has a statistically significant negative impact on long-term GDP growth in Vietnam. This contrasts with numerous previous studies, such as Anwar, et al. [6]; Singariya and Sinha [7]; Degu [8] and Akinwunmi and Akinola [10] which argue that agriculture positively contributes to economic growth, especially in developing countries. This difference can be explained by the structural characteristics of Vietnam's agricultural sector, which remains heavily reliant on raw production, with limited value addition and technological innovation.

By contrast, the findings support the views of Ibrahim, et al. [15] and Chukwuma and Nnadi [14] who highlight the positive impact of the service sector on GDP growth. This reflects the economic restructuring trend and the increasing role of modern service industries in promoting sustainable growth.

Regarding exports, the study reveals a negative impact in the long run, but a positive effect in the short term. This is consistent with the findings of Mlambo, et al. [16] who suggested that the export of unprocessed goods may hinder long-term growth while still providing short-term benefits.

FDI continues to be confirmed as a driver of long-term economic growth, aligning with the results of Velonjara and Gondje-Dacka [17]. However, the population variable shows no statistically significant effect in either the short or long term, differing from some earlier studies, such as Singariya and Sinha [7] possibly due to Vietnam's demographic transition toward an aging population.

Thus, this study contributes further empirical evidence supporting the need to reorient development policies toward agricultural modernization, service sector expansion, and improving the quality of FDI in Vietnam.

5. Policy Implications

To mitigate over-reliance on agriculture and enhance value addition within the sector, the government should accelerate the industrialization and modernization of agriculture, with a focus on developing agricultural value chains (deep processing and quality enhancement) rather than merely increasing output. Investments in agricultural technology (e.g., irrigation systems and improved crop varieties) and support for agro-processing enterprises are essential to counteract adverse effects while facilitating the transition of rural labor toward the industrial and service sectors.

Development of the service sector, particularly knowledge-based services, should be prioritized. Greater investment in high-value-added service industries, such as information technology, finance, and logistics, is recommended, moving beyond reliance on traditional services, such as tourism and retail. The government should support labor skill development and advance digital infrastructure (as recommended by the Organisation for Economic Co-operation and Development [24]) to boost productivity and competitiveness in the services sector, thereby strengthening its role as a key driver of economic growth.

Diversifying the export structure and reducing dependence on raw commodities are critical. The government should shift its focus from exporting unprocessed goods (e.g., agricultural products and natural resources) to processed and industrial products with higher value added. Policies should incentivize firms to invest in production technologies, improve supply chains, and diversify export markets to mitigate the risks of global price volatility, while optimizing short-term gains from exports.

The allocation of foreign direct investment should be optimized for strategic sectors. The government should channel FDI into manufacturing, high-tech industries, and modern services rather than traditional agriculture. Establishing specialized industrial zones, offering tax incentives for projects that generate high value addition and quality employment, and improving the legal environment are necessary to attract sustainable capital inflows.

Enhancing infrastructure and fostering linkages between agriculture and services are imperative. Investments in logistics infrastructure (e.g., warehousing and transportation) should be prioritized to support agricultural and service supply chains, minimize postharvest losses, and improve distribution efficiency. The promotion of integrated economic models (agriculture-processing services) through financial and technological support for small and medium enterprises can create positive spillover effects on economic growth.

These policy implications address the core issues highlighted by the research findings. They aim to minimize the negative impacts of agriculture and raw exports, maximize the potential of services and FDI, and enhance intersectoral linkages and labor quality. The proposed measures are not only aligned with Vietnam's economic context but are also consistent with recommendations from international studies, contributing to the overarching goal of sustainable economic growth and modernization in the long term.

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