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Underscoring the Agents of Sustainable Growth in Developing Countries: The Case of Senegal

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ABSTRACT

This paper uncovers the macroeconomic factors of economic growth in Senegal utilizing data from 1974 to 2019. It employs the ARDL model, Bound test, and the Toda-Yamamoto causality approach to analyze the relationships among variables. The findings reveal that external debt positively influences GDP growth in the long run, while foreign direct investment (FDI) positively affects it in the short time frame. Toda-Yamamoto causality results indicate bidirectional causality between GDP growth and inflation, external debt, and foreign aid, whereas a unidirectional causality runs from FDI to GDP growth. The findings of the research gauge that policymakers should consider FDI and external debt as crucial tools to promote economic growth in developing countries such as Senegal.

Keywords: Economic Growth, FDI, External Debt, Inflation, Bound Test, Causality Analysis.

JEL Classification: F35, F41

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1. INTRODUCTION

The question of how best to promote economic growth remains a central debate across nations. A country's long-term sustainable growth rate is a critical determinant of its capacity to enhance the well-being of its population. Consequently, economic development remains a primary objective for many governments—particularly developing countries—where growth is a significant concern within national and international policy agendas (Mostafa, 2010). Therefore, identifying the key determinants of growth is essential for policymakers, both from a strategic political standpoint and for effective macroeconomic management. These determinants typically include internal and external macroeconomic variables such as investment, supply chains, employment, interest rates, budget deficits, foreign capital, and compliance with international standards (Biswas & Kumar, 2014).

While no singular, unified theory about economic growth exists, several schools of thought offer insight into the various contributing factors. Among the most influential is the neoclassical growth model, introduced by Solow, which emphasizes total factor productivity and capital accumulation; Romer (1986) and Lucas (1988) exposed the endogenous growth theory, which highlights innovation capacity and human capital as core drivers, of long-term growth (Arvantidis et al., 2009).

Today, numerous models of economic growth are applied globally. Understanding the origins and stages of economic development remains one of the most complex and widely studied areas in contemporary social science. Notably, growth performance varies significantly across countries. This variance continues to fuel debate among economists, policymakers, and political leaders seeking to identify the factors that enable some countries to achieve sustained progress. In contrast, others remain entrenched in poverty (Gebru, 2015).

Despite over six decades of independence, Senegal's economic trajectory has experienced limited transformation. In the first decade after independence, real economic growth averaged 2% but declined to 0.6% in the 1970s and turned negative (–0.4%) in the 1980s. Structural adjustment programs introduced during that period failed to generate sustained economic development. The production model—largely dependent on agricultural and mining income—has not yielded an efficient allocation of factors conducive to long-term growth, even with mobilized resources. Between 1960 and 1980, Senegal's GDP growth rate averaged just 2.3% annually, while population growth averaged 3%, resulting in a persistent gap (Noula, 1994).

Assessing macroeconomic trends is fundamental to evaluating a country's economic progress. Fig.1 illustrates the evolution of key indicators in Senegal—GDP growth, domestic savings, investment, and inflation rates. The data show that policymakers consistently sought to keep inflation below 4% to preserve consumer purchasing power and sustain economic stability. While overall growth remained modest, it peaked at 7.39% in 2017, driven by structural reforms under the Emerging Senegal Plan. In contrast, economic growth fell to its lowest point-1.32%-in 2020, due primarily to the impacts of the COVID-19 pandemic and restrictions on public health issues. Meanwhile, the savings rate rose from 6.66% in 2009 to 12.24% in 2021-a 50% increase-although it remains low due to generally limited income levels. Investment, a critical growth driver fueled by foreign aid and direct investment, increased from 19.7% in 2009 to 30.75% in 2021, with a peak of 34.95% recorded in 2020.

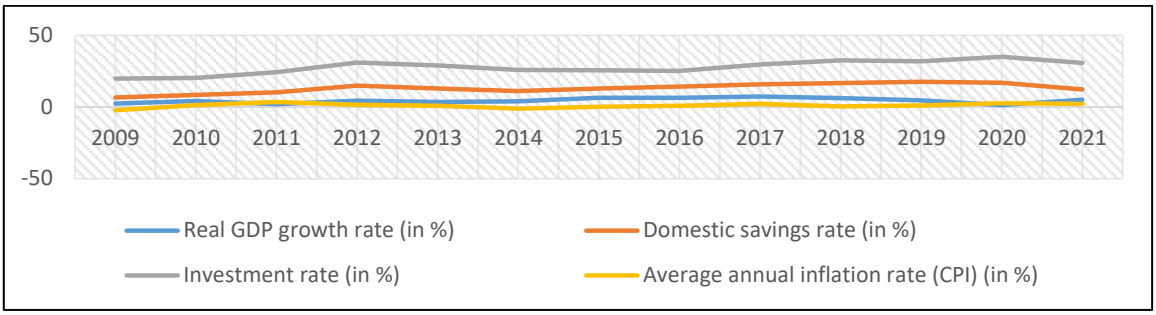

Fig.1: Evolution of Macroeconomic Indicators for Senegal (2009-2021)

Source: *BCEAO, 2022.*

The global economy was deeply affected during COVID-19, and Senegal was no exception. While GDP growth was projected at 6.8% in September 2019, the economy contracted by 0.7% in 2020. In response, the government adopted an expansionary fiscal policy to stimulate activity and reverse the decline. Economic growth recovered to 5.0% in 2021, led by robust performance in the secondary (+8.8%), the tertiary (+4.4%), and the primary sector (+4.1%) (MEPC, 2020).

Knowing the macroeconomic determinants of growth in developing countries—especially those like Senegal, grappling with poverty and underdevelopment—is essential for formulating sound economic, fiscal, financial, and monetary policies. This study contributes to the literature by probing Senegal's macroeconomic growth drivers, focusing on inflation, external debt, foreign aid, and foreign direct investment (FDI), based on time-series data from 1974 to 2019. A multidisciplinary approach is necessary to capture the broader policy implications of these findings.

This research provides charming findings for economic stakeholders, including policymakers, researchers, international institutions, and non-governmental organizations. It also serves as a valuable reference for students and academics interested in Senegal's economic dynamics and development pathways.

The following section gives the appropriate empirical literature. The second section represents the methodology and empirical findings. The following section outlines the methodology and data, the fourth part of the study discusses the findings, and the final part gives the conclusions with policy implications.

2. LITERATURE REVIEW

Economic growth remains a highly debated and complex topic in economics. Numerous studies have produced differing findings, and the theory of economic growth continues to generate significant scholarly discussion. Perspectives on growth drivers vary depending on the school of economic thought. Nonetheless, economic growth is fundamental to any economy, as it determines the wealth generated within a nation—typically measured annually through national accounts. Understanding the dynamics of economic growth is vital for improving living standards, and it remains a central concern for policymakers worldwide. As such, countries frequently implement fiscal reforms in pursuit of sustained growth.

Economic growth indicates the worth of goods and services generated in a nation and directly influences the population's standard of living. However, unlike engineering projects with predefined blueprints, no universally applicable model for achieving growth exists. Growth can be enhanced by improving the amount and quality of goods and services per capita. Long-term economic expansion typically depends on increased factors of production, sound government policies, capital accumulation, and an expanding labor supply. These conditions, technological advancement, and resource availability are essential for economic development. Moreover, countries with skilled labor tend to experience higher productivity and growth. The standard of living is determined by per

capita production, and improvements in per capita output reflect progress in living standards (Begg et al., 2014).

However, various economic growth theories exist, and several frameworks attempt to identify its core drivers. This review highlights two of the most influential growth models: neoclassical and endogenous. The neoclassical model, developed by Solow (1956), emphasizes capital accumulation, investment, labor, and technological develop as the fundamental sources of growth. On the contrary, the endogenous growth theory focuses on innovation and human capital, underscoring the importance of education, technological advancement, and institutional policies.

This section also summarizes empirical findings from key studies examining the factors of economic growth across different regions and periods:

Abessolo (1998) analyzed economic growth determinants in sub-Saharan Africa (1975–1992) using an augmented Solow model. The study found that reducing the budget deficit, maintaining low inflation, and increasing investment significantly contribute to higher growth rates.

Barro (2003) emphasized that per capita wealth growth is influenced by education, healthcare, life expectancy, low population growth, limited public consumption, low inflation, and adherence to the rule of law.

Kida (2009) studied the WAEMU countries (1980–2005), concluding that exports, investment, and financial sector development positively impact growth, while political instability and external debt have adverse effects.

Gebru (2015) examined growth in Ethiopia (1974–2013) using the ARDL and ECM models. Physical and human capital enhances growth, whereas external debt curbs the GDP increase.

Antoine (2015) conducted a comparative study of resilient WAEMU countries (1980–2013), applying OLS analysis. The results highlighted the long-run importance of human capital, investment, and FDI in fostering growth.

Chizonde (2016) explored Zambia's growth drivers (1961–2015) using ARDL and Bound Test procedures. Exchange rates, oil prices, physical capital, agricultural productivity, inflation, and government expenditure influenced long-term growth.

Mekonnen (2017) used ARDL to analyze Ethiopia's economic growth (1974–2015). The findings indicated that human capital and gross capital formation positively influenced growth, while external debt and foreign aid had adverse effects.

Altaseb and Singh (2018) qualitatively reviewed 17 empirical studies on Ethiopia, concluding that physical capital, human capital, external debt, FDI, aid, political institutions, demographics, monetary policy, and trade dynamics significantly influence growth.

Ahmadou and Diatta (2018) used linear models to compare WAEMU and BRICS countries (1990–2015). They found that human and physical capital, public spending, and labor force size were key growth drivers in BRICS nations. They recommended similar improvements for WAEMU countries.

Okombi (2019) examined Congo's economic growth (1999:Q1–2016:Q4) using ECM. Public spending, fixed capital formation, and economic freedom were growth-enhancing, whereas oil prices, trade openness, and political instability were detrimental.

Ayhan et al. (2023) demonstrated, using quantile-on-quantile regression, that economic growth in G-7 countries increases CO_2 emissions and upturns to environmental pollution.

Kartal et al. (2024) identified coal and oil consumption as primary drivers of economic growth in India and China, based on ARDL analysis.

Using quantile-on-quantile regression, Ulussever et al. (2025) elucidated that income growth, energy prices, and energy consumption exacerbate environmental degradation in five Gulf Cooperation Council members.

In summary, the literature underscores that the determinants of economic growth vary widely by context and methodology. While many studies highlight positive influences such as human capital, investment, technology, and infrastructure, others reveal negative impacts from political instability, high inflation, environmental stress, and excessive population growth. Thus, growth strategies must be tailored to each nation's unique economic and institutional conditions.

To increase the living standards of citizens of underdeveloped countries and to have higher levels of welfare, they need to improve their economic growth rates and exhibit sustainable growth performance. Among the critical conditions for developing countries to achieve sustainable growth are a qualified labor force, high entrepreneurial potential, cheap input, technology for industrialization, affordable energy, foreign capital inflow, and grants for capital constraints. Therefore, empirically testing the factors affecting developing countries' growth is essential. Determining the determinants of growth with empirical research will significantly contribute to the literature and provide ideas to policymakers. In this sense, the necessary opportunity windows for developing countries to combat poverty and make development moves can be discovered. In this sense, there exists a research gap in the literature concerning the study of ODA and FDI determining the growth performance of developing countries. This study will also significantly contribute to the literature by investigating the effects of two crucial factors, ODA and FDI, on growth in the sample of Senegal, a low-income country.

3. METHODS

This section outlines a growth model designed to identify and analyze supreme macroeconomic indicators affecting economic growth in Senegal. The variables considered include inflation, unemployment, foreign direct investment (FDI), foreign aid, technology, human capital, investment, natural resources, trade openness, innovation, and various political and social factors. An analytical framework is required to investigate these determinants empirically over the long term. This study focuses on a subset of these variables to assess their significance in Senegal's economic growth, aiming to meet the research objectives through empirical analysis.

A descriptive research design is employed, which is appropriate for identifying the causal nexus between real economic growth and its potential drivers. As derived from the literature, the foundational model is an extended version of the neoclassical growth model:

$$\mathbf{Y= f (K, L)} \qquad \mathbf{(1)}$$

where K and L represent physical and human capital, respectively.

In Senegal case, the economic growth function is formulated based on the extended neoclassical model, where GDP growth is modeled as a function of foreign aid, external debt, inflation, and FDI. This modeling approach is consistent with similar studies, such as those by Sanyang (2019) and Mekonnen (2017), which examine the macroeconomic determinants of growth in Gambia and Ethiopia, respectively.

3.1 Data

The dataset is selected based on the availability and relevance of reliable data. Data for this analysis were retrieved from the World Bank database and span the period from 1974 to 2019. The explanations about the data is summarized in Table 1.

Table 1: The Data Definitions

	Variable	Symbol	Definition	Unit	Source
Dependent Variable	Economic Growth	GDPG	GDP Growth	Annual %	World Development Indicators
Independent Variable	Inflation	INF	Inflation, GDP deflator	Annual %	
	External Debt Stocks	EDS	External debt stocks	% of GNI	
	Foreign Direct Investment	FDI	Foreign direct investment, net inflows	% of GDP	
	Official Development Assistance	ODA	Net ODA received	% of GNI	

The functional form representing the nexus between GDP growth and the explanatory variables is as follows:

$$\mathbf{Y=f(GDPG, INF, EDS, FDI, ODA)} \quad \mathbf{(2)}$$

All variables (except ODA) are log-transformed to address heteroscedasticity and enhance elasticity interpretation, following Gujarati (2004). The modified growth equation becomes:

$$\boldsymbol{lnY_t = \beta_0 + \beta_1 lnGDPG + \beta_2 lnINF + \beta_3 lnEDS + \beta_4 lnFDI + \beta_5 ODA + \varepsilon} \quad \mathbf{(3)}$$

Here, Yt denotes GDP growth at time t, and εt is the error term, accepted to be independently distributed with zero mean and constant variance, capturing all other relevant variables not used in the research.

To estimate the long-run link between GDP growth and the chosen macroeconomic indicators (FDI, ODA, inflation, and external debt), the paper employs the Autoregressive Distributed Lag (ARDL) model. This empirical approach is especially convenient for small samples and mixed levels of stationarity, as introduced by Pesaran and Shin (1999) and developed by Pesaran et al. (2001).

It is a theory-based framework of any process that has been tested over a long period of time. It is wider in scope and size. It generally reflects the relationships between the elements involved in the process. It is the basis for the parameters of the study. Defines the boundaries of the research. Specifically, Author(s) should identify the dependent and explanatory variables to be used in the study.

3.2. Methodology

The economic theory often supposes the existence of a long-term equilibrium nexus between non-stationary time series. The stationary has a significant role in using time series; the range of variables varies between stationary and non-stationary series. The stationarity characteristics of time series are crucial to prevent the spurious regression risk, which reveals that linear regression with non-stationary variables is ineffective. When regression containing non-stationary variables often results in a false regression problem. This occurs when no relationship exists, but the regression findings present a significant and high link between the variables. It should be noted that the unit root test is necessary to verify if any of the variables utilised in the regression are not in order 2 to apply the ARDL model. However, examining the variables with time series data is essential before applying any regression to the variables. This study has used the Augmented Dickey-Fuller (ADF), Phillips Perron (PP), Kwiatkowski Phillips Schmidt Shin (KPSS), and Ng Perron tests to find the stationarity level of variables, and 5% is used as the critical value.

Following the Bound Test procedure for unit root, all indicators included in the analysis have to be stationary in level I (0) or I (1) to apply the method of the ARDL model by Persaran and Shin (1999) and then ameliorated by Persaran et al. (2001).

Before beginning any estimated regression model, it is essential to perform relevant residual diagnostic and stability diagnostic checks to attest to the trustability of the regression model and its stability. Therefore, before confirming the results, the specifications of any econometric model should be carefully considered. These tests include serial correlation, normality, linearity, heteroscedasticity, and stability checks. These analytical tests are necessary to verify the authenticity of the forecasted coefficients. Depending on the results of the analysis, it may be required to reset the model.

Pesaran & Shin (1999) urged that the estimated ARDL model makes it possible to verify the cointegration or the presence of a long or short-term relationship between the model's variables. For assessing the long and short-run nexus between the dependent variable (GDP growth) and explanatory variables (foreign aid, inflation rate, external debt, and FDI), the study applies the ARDL model to the cointegration and error correction model (ECM) according to the degree of stationarity of the variable levels.

The ARDL model can be applied in the case where all the variables are integrated at level I (0) and at order I (1) or reciprocally cointegrated (Pesaran & Shin, 1999). Using the Bound Test approach for cointegration works better than the cointegration tests of Engle & Granger (1987), Johansen (1991), and Philips & Hansen (1990) cointegration tests in small data samples, as in this research. Also, different variables obtain an optimal number of offsets, which is not allowed in Johansen-type models. Long-term and short-term parameters are estimated therewithal in ARDL estimation. Finally, using the ARDL technique is better; we will have an unbiased and efficient model estimator.

Null hypothesis H0: There is no long-term relationship

When the occured F-statistic is bigger than the upper bound critical value given by Persaran et al. (2001), the null hypothesis is not accepted. When the F-statistic is less than the lower bound values, the null value is received, and if the F-statistic value is between lower and upper bound critical values, there is no conclusion for the test. The bound procedure is valid even if the time series variables contain an equivocal order of integration. Therefore, even if variables are all I(0), all I(1), or a combination of both, the approach remains valid, while specific approaches require all variables to have identical integration order.

Essentially, the ARDL model process to cointegration (Pesaran et al., 2001) implicates outlooking the ECM type of the ARDL model for the drivers of economic growth:

Estimated Unrestricted (ECM) is as follows in eq.4:

$$\Delta GDPG_t = \beta_0 + \sum_{i=1}^{m} \beta_{1i} \Delta GDPG_{t-i} + \sum_{i=0}^{m} \beta_{2i} \Delta INF_{t-i} + \sum_{i=0}^{m} \beta_{3i} \Delta EDS_{t-i} + \sum_{i=0}^{m} \beta_{4i} \Delta FDI_{t-i} + \sum_{i=0}^{m} \beta_{5i} \Delta ODA_{t-i} + \beta_6 GDPG_{t-1} + \beta_7 INF_{t-1} + \beta_8 EDS_{t-1} + \beta_9 FDI_{t-1} + \beta_{10} ODA_{t-1} + \varepsilon_t \quad (4)$$

Where $\boldsymbol{m}$ represents the highest lag of a regressor in the model. $\boldsymbol{\beta_0}$ represents the intercept, while $\boldsymbol{\varepsilon t}$ represents the error term. The model is forecasted by utilizing EViews, and the highest lag of each regressor (m) is held by understating the Akaike Information Criteria (AIC).

The Toda Yamamoto causality test peruses the presence of a long-term causal nexus between two variables. ECM is applied when there is a cointegrating relationship or long-term equilibrium relationship. Without a cointegrating relationship, the short-term relationship is examined by different variables. However, the Granger causality test is a method to analyze if one variable assists in predicting another. The Granger causality method must secure the stability of time series data, and the integration procedure must be straightforward. However, the efficiency of the Granger causality test is low when the procedure of integrating the time series is different or unclear. This analysis will use Toda and Yamamoto's (1995) approach as an alternative.

4. EMPIRICAL RESULTS

This chapter presents unit root test results and the bound test procedure, then the long run and short run nexus and the Toda Yamamoto causality test between variables and the correlation coefficient and the stability conditions of the models.

4.1. Unit Root Tests Results

It is mandatory to control the time series characteristics of each variable series before using the data to estimate the model ARDL. So, to avoid a spurious regression problem, correcting the non-stationarity of the macroeconomic variables is imperative. In addition, when a series includes a unit root, it is normal to make the series stationary by transforming the variables by differentiation. To find out the degree of integration, unit root tests are applied by using the standard Augmented Dickey-Fuller (ADF), Phillips Perron (PP), Kwiatkowski-Phillips-Schmidt-Shin (KPSS), and Ng-Perron tests with a value of 5% critical. Annex.1 and Annex.2 show the results of unit root tests.

The results show that economic growth (GDPG) and inflation (INF) are integrated at level I(0). In the KPSS test, the external debt stocks (EDS) and the FDI are integrated at a level, while ADF, PP, and NG-Perron are integrated in order (1). In KPSS and PP, the net official development (ODA) is integrated at the level, while ADF and NG-Perron are integrated in order (1).

The findings specify that some variables are stationary at the level, others are in the first difference, and none are integrated in order 2. Then, as indicated by Pesaran et al. (2001), the ARDL model cointegration is the most suitable method to estimate or verify the long and short-term relationship between variables.

4.2. Post Estimation Tests Results

Relevant post-estimation or standard properties of the model are called to verify the validity of the regression models. This study used some diagnostic and stability tests, which include the normality test (Jaque- Bera test), serial correlation test t (Brush & Godfrey LM test), heteroscedasticity test, linearity test (Ramsey RESET Test), and the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) test. These diagnostics are required to verify the trustworthiness of the estimated coefficients, and there may be a need for model restructuring depending on the diagnostics results. Pesaran et al. (2001) advise these test procedures. A judgment is made after comparing the probability value associated with the test statistic and the critical value (5%). The null hypothesis is accepted when the p-value is bigger than the critical value (5%), and the null hypothesis is not accepted if the p-value is less than the critical value (5%). According to test results presented in Table 2, there is no heteroskedasticity and serial correlation problem. The results confirm the normality and linearity conditions.

Table 2: Diagnosis and Stability Tests

	TEST	H_0	Obs*R-squared	Prob. Chi^2
Serial correlation	LM Test	No autocorrelation	3.885560	0.14
Normality	Jarque-bera Test	Residuals normality distributed	4.395804	0.11
Heteroscedasticity	ARCH Test	Homoscedastic	0.175469	0.68
Linearity	Ramsey Reset Test	Linear relationship	0.541707	0.59
Stability	CUSUM	Stable		
	CUSUMQ	Stable		

In addition, the CUSUM and the CUSUMQ tests are applied to verify the stability of the models. The empirical check found the factor's stability because the accumulative mark did not go outwards the frame between the two critical lines, as given in Annex.3.

4.3. Bound Test Results

For getting the optimal lag length for cointegration analysis, it has been estimated one by one from lag (1) to lag (4) because the study uses annual data. The optimal lag length is lag (2) using minimum AIC values, and its Chi-Square probability value has no autocorrelation problem, as given in Table 3.

Table 3: Optimal Lag Selection for Bound Test

M	AIC	SIC	X^2 BREUSCH- GODFREY (2)
1	5.133481	5.741728	4.073176 (0.13)
2*	5.040022	5.859185	1.839611 (0.39)
3	4.586175	5.620503	9.115003 (0.01)
4	3.944566	5.198399	9.891067 (0.01)

Source: *Computation Using EViews. * Indicates the selected lag length, X^2 Breusch- Godfrey is autocorrelation test statistics. Prob. values are given in parentheses.*

The Unrestricted ECM is estimated to have a 2-log Wald Test for one lagged dependent and explanatory variable. The calculated F-Statistic from the Wald Test is 4.629047, as given in Table 4, and it is confronted with the Pesaran et al. (2001:300-301) statistics.

Table 4: Result from ARDL Bound Test

K	F statistic	Critical values	
		%5 significance level	
		Lower Bound	Upper Bound
4	4.629047	2.86	4.01

Source: *Computation Using EViews. K indicates the independent variables amount. Critical values retrieved from Table C1(III) in Pesaran et al. (2001:300).*

Since the F-Statistic is higher than the upper bound, the null hypothesis of no cointegration relationship between variables is refused, as given in Table 4. Hence, there is a cointegration relationship between GDP growth and its drivers.

4.4. ARDL Model Results

The ARDL model begins estimating the long-term model after verifying the cointegration relationship between variables. The results show a long-term relationship between economic growth and the following variables: inflation, external debt, FDI, and net ODA. The estimated long-run coefficient utilizing the ARDL model and selected AIC result is given in Table 5.

Table 5: Estimated Long Run Coefficients from ARDL (4, 1, 4, 1, 4) Model

Dependent Variable: GDPG				
Variables	**Coefficient**	**Std.Error**	**t statistic**	**Probability**
EDS	0.053096*	0.011088	4.788635	0.00
FDI	-0.007069	0.288438	-0.024506	0.98
INF	-0.049968	0.033055	-1.511668	0.14
ODA	-0.757270*	0.153032	-4.948456	0.00
c	6.784837	1.261518	5.378311	0.00

Source: Computation using E-views. * means 1% significance level.

The result in Table 5 indicates that external debt stocks (EDS) positively impact GDP growth at a 5% significance level. EDS's coefficient is 0.053096, which shows the percentage change in EDS, bringing a 0.053096 percent change in GDP growth in Senegal. Foreign aid (ODA) hurts GDP growth at a 5% significance level, and the official development aid coefficient is -0.757270; an increase in ODA will decrease economic growth, keeping all things fixed during the study period in Senegal. However, inflation (INF) and FDI have a negative impact but are insignificant on GDP growth in Senegal.

4.5. Error Correction Model (ECM)

The short-run ECM model is calculated after approving the long-term coefficients of the growth model. As discussed above, error adjustment (ECM) refers to the degree of adjustment made to bring a dynamic model back into balance. It is a residual of a lagged period that comes from the estimated long-term dynamic model. The error correction term coefficient shows how fast the variables reach equilibrium. Also, it has to have negative signs and be significant at the standard considerable level. (i.e., the p-value has to be smaller than 5%).

Table 6. Results of Error Correction for selected ARDL (4, 1, 4, 1, 4) Model

Dependent Variable= GDPG				
Variables	**Coefficient**	**Std. Error**	**t statistic**	**Probability**
D(GDPG(-1))	1.236558*	0.245424	5.038456	**0.00**
D(GDPG(-2))	0.729743*	0.167604	4.353975	**0.00**
D(GDPG(-3))	0.427841*	0.107609	3.975870	**0.00**
D(EDS)	-0.068798	0.049435	-1.391674	**0.17**
D(FDI)	0.510414	0.428805	1.190318	**0.24**
D(FDI(-1))	1.694260*	0.505740	3.350064	**0.00**
D(FDI(-2))	2.134582*	0.604647	3.530296	**0.00**
D(FDI(-3))	0.832179	0.510533	1.630020	**0.12**
D(INF)	0.011122	0.052247	0.212880	**0.83**
D(ODA)	-0.636987*	0.196727	-3.237918	**0.00**
D(ODA(-1))	1.452119*	0.233446	6.220360	**0.00**
D(ODA(-2))	0.672017**	0.247886	2.710995	**0.01**
D(ODA(-3))	0.651996*	0.207774	3.138006	**0.00**
CointEq(-1)*	-2.639798*	0.335868	-7.859619	**0.00**

R-squared	0.869692	Mean dependent var	0.168698
Adjusted R-squared	0.809192	S.D. dependent var	4.089526
S.E. of regression	1.786367	Akaike info criterion	4.259447
Sum squared resid	89.35102	Schwarz criterion	4.838670
Log likelihood	-75.44838	Hannan-Quinn criter.	4.471755
Durbin-Watson stat	1.870336		

Source: Computation Using Eviews. *, ** means 1%, 5% significance level respectively.

The CointEq(-1) has a negative sign and significance with a coefficient estimate of -2.639798, so it supports the cointegration in the Bound Test, as given in Table 6. Thus, the existence of a long-run causality running from the independent variables to GDP growth. The CointEq(-1)= -2.639798 stands for that the deviation from the long-term in the prior period on economic growth is revised by 263.97% in the next year. Therefore, this means the fast correction towards long-run equilibrium is 263.97% within one period.

The result shows that external debt stocks (EDS) have a negative impact but are insignificant at a 5% significance level on GDP growth in the short run. The FDI positively impacts at a 5% significant level on economic growth in the short run. Inflation has a positive impact but is insignificant at a 5% significance level on GDP growth in the short run. The net ODA has positive and negative coefficients, so we cannot decide, but its probability is significant at a 5% significance level.

4.6. Toda Yamamoto Causality Analysis Test Results

This test presents the causal relationship between the variables by indicating whether the relationship is unidirectional or bidirectional using a 5% significance level of test statistics. There is a relationship when the probability of the test statistic is less than 5% significant level.

The results found the interpretations of the causal relationship between variables are given in Annex.4. According to the findings, there is a bidirectional causality between (GDPG and INF), (EDS and GDPG), (GDPG and ODA), (FDI and INF), and (EDS and ODA). While the other variables (INF and ODA), (FDI and ODA), (FDI and GDPG), (INF and EDS), and (FDI and EDS) have unidirectional causality. Thus, the results above show that all independent variables, such as inflation, ODA, external debt, and FDI, lead to GDP growth.

5. CONCLUSION

This study investigates the drivers of economic growth in Senegal from 1974 to 2019, using the ARDL model to explore both long- and short-term relationships among key macroeconomic variables. The bounds-testing procedure's findings ratify the cointegration between GDP growth and its selected determinants: inflation, FDI, external debt stocks (EDS), and ODA.

In the long run, external debt stocks (EDS) are estimated to positively and statistically significantly impact GDP growth. Conversely, ODA exerts a significant but adverse effect on economic growth. While exhibiting negative coefficients, FDI and inflation do not have significant long-term impacts on GDP growth.

In the short run, the findings remark that FDI positively impacts GDP growth, while inflation also shows a positive effect, although statistically insignificant. These findings are consistent with Hammam (2010), who reported similar short-run effects. However, unlike Havi et al. (2013), who found that foreign aid and FDI positively affect growth in Ghana, this study concludes that in Senegal, only external debt positively and significantly influences long-term growth, whereas ODA has an adverse effect. Mekonnen (2017), using a similar ARDL framework in Ethiopia, found that both external debt and foreign aid adversely affected growth, while inflation, physical capital, and human capital had positive effects. Gebru (2015) similarly reported an adverse effect of external debt on growth and found foreign aid and inflation statistically insignificant.

Although inflation does not significantly influence economic growth in Senegal, policymakers must maintain low inflation—preferably in the single digits—through prudent fiscal and monetary policies to foster macroeconomic stability.

The Toda-Yamamoto causality analysis divulges bidirectional causality between GDP growth and inflation, external debt, and ODA, suggesting mutual influence. However, the nexus between FDI and GDP growth is unidirectional, with FDI causing GDP growth in the long term. This implies that, while all selected variables contribute to economic growth, only FDI does not respond to GDP growth within the studied timeframe. This contrasts with the findings by Havi et al. (2013), who observed no causality from any independent variable to GDP growth in Ghana.

The evidence underscores that external debt is a critical driver of economic growth in Senegal. Thus, the government should enforce policies to maximize the developmental impact of debt, especially by channeling funds into productive sectors such as agriculture and industry. These investments could enhance food security, promote industrialization, and reduce unemployment. However, caution is warranted, as excessive debt accumulation could jeopardize fiscal sustainability. Debt should be used efficiently, targeting high-return growth sectors to ensure timely repayment and boost economic potential. Preference should be given to domestic borrowings, such as treasury bills, over external loans that may carry restrictive conditions misaligned with Senegal's development priorities.

Given the adverse long-term effect of ODA, there is a need to reallocate foreign aid toward sectors with higher growth potential and to strengthen governance and management of aid flows. Inflation, while statistically insignificant in the short and long term, has remained below 4% in recent years—a trend that should be sustained through careful macroeconomic management.

Finally, as FDI significantly influences short-term growth, the government must prioritize political stability, legal security, and institutional transparency to attract and retain foreign investors. Encouraging investment from the Senegalese diaspora should also be a strategic priority to stimulate domestic investment and support sustainable growth to improve living standards.

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ANNEXES

ANNEX.1 The Unit Root Test Results

Variables	ADF	PP	KPSS	Decision
GDPG	**-4.885074(1)c*** -3.588509(1%) -2.929734(5%) -2.603064(10%)	**-6.501018(2)c*** -3.584743(1%) -2.928142(5%) -2.602225(10%)	**0.255304(2)c*** 0.739000(1%) 0.463000(5%) 0.347000(10%)	I(0)
INF	**-5.826658(0)b*** -4.175640(1%) -3.513075(5%) -3.186854	**-5.789328(4)b*** -4.175640(1%) -3.513075(5%) -3.186854	**0.051759(3)b*** 0.216000(1%) 0.146000(5%) 0.119000	I(0)
EDS	**-1.767832(0)c** -3.584743(1%) -2.928142(5%) -2.602225(10%)	**-2.025927(4)c** -3.584743(1%) -2.928142(5%) -2.602225(10%)	**0.143116(5)c*** 0.739000(1%) 0.463000(5%) 0.347000(10%)	I(0)
ΔEDS	**-5.171620(0)a*** -2.618579(1%) -1.948495(5%) -1.612135(10%)	**-5.283055(3)a*** -2.618579(1%) -1.948495(5%) -1.612135(10%)		I(1)
FDI	**0.712372(1)a** -2.618579(1%) -1.948495(5%) -1.612135(10%)	**0.216641(2)a** -2.617364(1%) -1.948313(5%) -1.612229(10%)	**0.142915(3)b**** 0.216000(1%) 0.146000(5%) 0.119000(10%)	I(0)
ΔFDI	**-11.10780(0)a*** -2.618579(1%) -1.948495(5%) -1.612135(10%)	**-11.28635(1)a*** -2.618579(1%) -1.948495(5%) -1.612135(10%)		I(1)
ODA	**-0.488771(1)a** -2.618579(1%) -1.948495(5%) -1.612135(10%)	**-3.195443(3)c**** -3.584743(1%) -2.928142(5%) -2.602225(10%)	**0.176234(5)b*** 0.216000(1%) 0.146000(5%) 0.119000(10%)	I(0)
ΔODA	**-5.697189(3)b*** -4.198503(1%) -3.523623(5%) -3.192902(10%)			I(1)

Notes: The numbers in parentheses "(.)" are the lag lengths the Schwarz Criterion determines in the ADF test. Bartlett Kernell estimation method is used in PP and KPSS. a: indicates that regression does not involve constant term or trend; b: indicates regression involves both constant term and trend; c: indicates regression involves constant term. *, ** indicates 1%, 5% significance level.

ANNEX.2 Ng-Perron Unit Root Test Results

Variables	NG-Perron				Decision
	MZa	MZt	MSB	MPT	
GDPG	**-25.8824(1)b*** -23.8000(1%) -17.3000(5%) -14.2000(10%)	**-3.59720(1)b*** -3.42000(1%) -2.91000(5%) -2.62000(10%)	**0.13898(1)b*** 0.14300(1%) 0.16800(5%) 0.18500(10%)	**3.52182(1)b*** 4.03000(1%) 5.48000(5%) 6.67000(10%)	I(0)
INF	**-21.1744(0)b**** -23.8000(1%) -17.3000(5%) -14.2000(10%)	**-3.24442(0)b**** -3.42000(1%) -2.91000(5%) -2.62000(10%)	**0.15322(0)b**** 0.14300(1%) 0.16800(5%) 0.18500(10%)	**4.36042(0)b**** 4.03000(1%) 5.48000(5%) 6.67000(10%)	I(0)
EDS	**-1.23439(0)c** -13.8000(1%) -8.10000(5%) -5.70000(10%)	**-0.54287(0)c** -2.58000(1%) -1.98000(5%) -1.62000(10%)	0.43979(0)c 0.17400(1%) 0.23300(5%) 0.27500(10%)	**13.0553(0)c** 1.78000(1%) 3.17000(5%) 4.45000(10%)	I(0)
ΔEDS	**-21.2222(0)c*** -13.8000(1%) -8.10000(5%) -5.70000	**-3.18800(0)c*** -2.58000(1%) -1.98000(5%) -1.62000	**0.15022(0)c*** 0.17400(1%) 0.23300(5%) 0.27500	**1.39454(0)c*** 1.78000(1%) 3.17000(5%) 4.45000	I(1)
FDI	**0.22848(1)c** -13.8000(1%) -8.10000(5%) -5.70000(10%)	**0.06960(1)c** -2.58000(1%) -1.98000(5%) -1.62000(10%)	**0.30462(1)c** 0.17400(1%) 0.23300(5%) 0.27500(10%)	**11.6851(1)c** 1.78000(1%) 3.17000(5%) 4.45000(10%)	I(0)
ΔFDI	**-17.3826(0)c*** -13.8000(1%) -8.10000(5%) -5.70000(10%)	**-2.92218(0)c*** -2.58000(1%) -1.98000(5%) -1.62000(10%)	**0.16811(0)c*** 0.17400(1%) 0.23300(5%) 0.27500(10%)	**1.50462(0)c*** 1.78000(1%) 3.17000(5%) 4.45000(10%)	I(1)
ODA	**-6.69696(1)c** -13.8000(1%) -8.10000(5%) -5.70000(10%)	**-1.82342(1)c** -2.58000(1%) -1.98000(5%) -1.62000(10%)	**0.27228(1)c** 0.17400(1%) 0.23300(5%) 0.27500(10%)	**3.68087(1)c** 1.78000(1%) 3.17000(5%) 4.45000(10%)	I(0)
ΔODA	**-18.3314(0)b**** -23.8000(1%) -17.3000(5%) -14.2000(10%)	**-3.00861(0)b**** -3.42000(1%) -2.91000(5%) -2.62000(10%)	**0.16412(0)b**** 0.14300(1%) 0.16800(5%) 0.18500(10%)	**5.08548(0)b**** 4.03000(1%) 5.48000(5%) 6.67000(10%)	I(1)

Notes: The numbers in parentheses "(.)" are the lag lengths the Schwarz Criterion determines in the ADF test. Bartlett Kernell estimation method is used in Ng-Perron tests. a: indicates that regression does not involve constant term or trend; b: indicates regression involves both constant term and trend; c: indicates regression involves constant term. *, ** indicates 1%, 5% significance level.

ANNEX.3

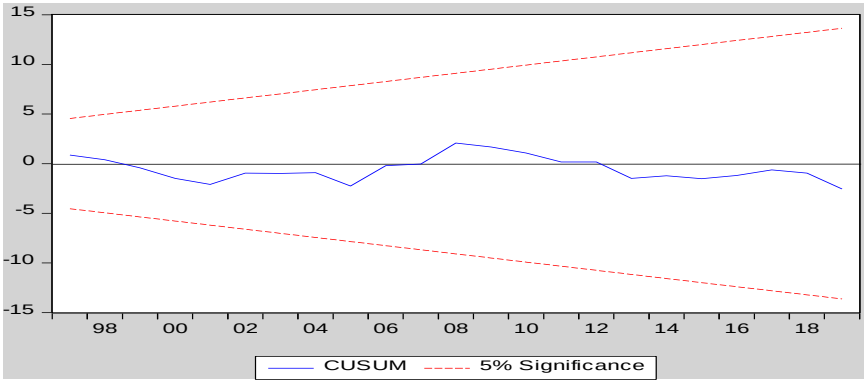

Fig.2: Plot of Cumulative Sum of Recursive Residual

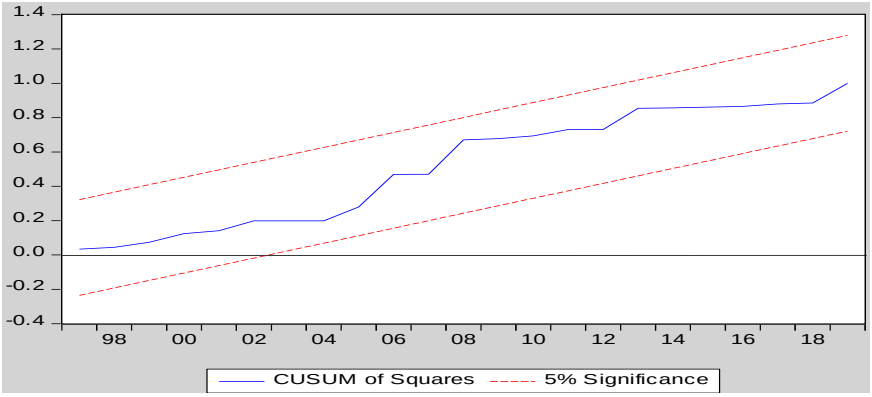

Fig.3: Plot of Cumulative Sum of Squares of Recursive Residual

ANNEX.4 Results of Toda Yamamoto Causality Tests

Nul hypothesis	Chi-square	Probability	Direction
GDPG is not a cause of INF	11.65894	0.02	From GDPG to INF
INF is not a cause of GDPG	11.07489	0.03	From INF to GDPG
GDPG is not a cause of EDS	22.38076	0.00	From GDPG to EDS
EDS is not a cause of GDPG	34.31644	0.00	From EDS to GDPG
GDPG is not a cause of FDI	5.207601	0.27	From GDPG to FDI
FDI is not a cause of GDPG	34.11312	0.00	From FDI to GDPG
GDPG is not a cause of ODA	37.03083	0.00	From GDPG to ODA
ODA is not a cause ofGDPG	52.14696	0.00	From ODA to GDPG
INF is not a cause of EDS	7.232006	0.12	From INF to EDS
EDS is not a cause of INF	9.879936	0.04	From EDS to INF
INF is not a cause of FDI	10.33295	0.03	From INF to FDI
FDI is not a cause of INF	17.02679	0.00	From FDI to INF
INF is not a cause of ODA	15.71040	0.00	From INF to ODA
ODA is not a cause of INF	3.781488	0.44	From ODA to INF
EDS is not a cause of FDI	4.190961	0.38	From EDS to FDI
FDI is not a cause of EDS	11.77006	0.02	From FDI to EDS
EDS is not a cause of ODA	21.14542	0.00	From EDS to ODA
ODA is not a cause of EDS	47.05327	0.00	From ODA to EDS
FDI is not a cause of ODA	90.10855	0.00	From FDI to ODA
ODA is not a cause of FDI	8.211328	0.08	From ODA to FDI

Source: *Computation Using Eviews.*