Theoretical and Applied Economics
Volume XXXIII (2026), No. 3(648), Autumn, pp. 117-134

Analyzing the impact of agricultural growth on inclusive growth in Côte d'Ivoire: key challenges and opportunities

Konan Jules KOUADIO
Shihezi University, China
rulio5884@gmail.com
Koffi Célestin N'GORAN
University Peleforo Gon Coulibaly in Korhogo, Côte d'Ivoire.
nkoffiagos2012@gmail.com
Wei CHANG
Shihezi University, China
shzu_iec@163.com

Abstract. *This study examines how agricultural growth affects inclusive growth in Côte d'Ivoire, focusing on structural transformation and sectoral linkages. Using an Autoregressive Distributed Lag (ARDL) model and Granger causality tests from 1991 to 2021, the findings show that agricultural growth initially negatively impacts non-farm employment but positively influences industrial growth and investment in the long term. The results indicate a unidirectional causality where agricultural growth drives industrial expansion without reverse effects, highlighting weak sectoral linkages. To foster inclusive growth, the study recommends policies enhancing sectoral connectivity through tax incentives, industrial cluster development, and foreign investment promotion.*

Keywords: non-farm employment, agricultural growth, industrial growth, ARDL model.

JEL Classification: O1, O11, O14.

Introduction

Although African's economic growth is mainly driven by the production and export of primary products, the benefits accrue to small groups within the broader economy. The extractive sector, while an important driver of growth, creates few jobs, mainly in urban areas, and is often associated with inequality and social conflict (Ferguson, 2005; Nunnenkamp and Spatz, 2003). In contrast, industry has generally contributed more to GDP growth than agriculture and services, but this unbalanced growth explains the limited progress in poverty reduction despite overall economic growth (Franks, S, 2005). Agriculture is vital to Africa's economy, providing income for 90% of the rural population and accounting for about 20% of total export value (Benedict. S. Kanu et al., 2014). It employs a significant portion of the labor force, with women making up 47% of agricultural workers. As Africa's population is projected to double by 2050, agricultural production must increase substantially to meet growing demands, exacerbated by urbanization and changes in consumption patterns (Thomas and Zuberi, 2012).

The concept of inclusive growth emphasizes expanded access to sustainable socio-economic opportunities for the majority of the population, while protecting vulnerable groups (UNECA and AU, 2012)[(1)]. In Côte d'Ivoire, addressing the challenges of inclusive growth is crucial. Inclusive development requires a coordinated approach that values agriculture while strengthening its linkages with other economic sectors. By improving agricultural productivity and promoting sectoral integration, it is possible to reduce poverty and increase economic opportunities for the majority of the population. In line with the African Development Bank's objectives (African Development Bank, 2023), the government of Cote d'Ivoire has implemented several strategic plans, mainly the National Agricultural Investment Plan (PNIA) and the Ivorian Strategic Development Plan (CSP, 2023-2028) to overcome the challenges facing Côte d'Ivoire's agricultural sector. These plans focus on enhancing the processing of agricultural products, with a target of processing at least 50% of such products. Moreover, this approach seeks to improve the sector's competitiveness, ensure food security, and create jobs, thereby contributing to inclusive growth and structural transformation. This article examines the impact of agricultural growth on inclusive growth in Côte d'Ivoire, focusing on key challenges and opportunities in fostering broader economic inclusivity.

Many studies have demonstrated positive effect of inclusive growth on economic development when sectoral development are taken into account (Lewis, 1954; Fei & Ranis, 1964; Matsuyama, 1992). Mainly, agricultural-led growth theory involves enhancing productivity to catalyze broader economic expansion, improving overall welfare by generating surpluses that invigorate the economy and facilitate job creation across sectors (Gollin 2010; Johnston and Mellor 1961; Kuznets 1961; Kuznets and Murphy, 1966; Ngai and Pissarides, 2007) as well as international organization (Bank, 2007; FAO, 2020). Indeed, agriculture's development is considered as a source of surplus labor and resources for industrialization. Subsequent models emphasized agriculture's provision of food, raw materials, and savings for investment in other sectors (Diao et al., 2018; Gollin, 2010; Johnston and Mellor, 1961; Kuznets, 1961). Recent studies highlight the dynamic

interactions between agriculture and other sectors, demonstrating that agricultural growth stimulates industrialization and structural transformation (Christiaensen, et al., 2006; Christiaensen, et al., 2011; Herrendorf et al., 2014; Pingali 2012; Vollrath, 2011). Agricultural growth fosters inclusive growth by enhancing productivity and incomes within the sector, benefiting the broader economy and creating employment opportunities beyond agriculture (Anderson, 2010; Autor et al., 2003; De Vries et al., 2015; Dollar et al., 2016; Eichengreen & Gupta, 2013; Swinnen, 2018).

Although some countries have struggled to achieve inclusive growth despite notable progress in agricultural development (Dollar, 2004; Dollar & Kraay, 2004), sectoral integration remains crucial for addressing socio-economic challenges. It shapes an economy's capacity to reduce inequality, poverty, and unemployment alongside economic growth (Rodrik et al., 2016). Empirical evidence from countries such as China and several European nations demonstrates that agriculture has played a significant role in poverty alleviation and job creation (Dollar et al., 2016; Loizou et al., 2019; Pingali, 2012; Ravallion & Chen, 2009).

In the case of India, Aggarwal (2018) observed that employment opportunities in high-productivity sectors have not expanded sufficiently due to trade-induced economic specialization and weakened cross-sectoral linkages. This finding underscores the importance of fostering inclusive growth through robust linkages between economic growth and employment generation, as well as between growth and poverty reduction (Aaronson et al., 2014; Sawtelle, 2007; Sodipe & Ogunrinola, 2011) Furthermore, various studies emphasize that integrating agriculture with industry enhances economic profitability, viability, and sustainability (Acemoglu & Guerrieri, 2008; Bustos et al., 2016; Ngai & Pissarides, 2007). For instance, evidence suggests that bidirectional causality between agriculture and industry yields substantial benefits for both sectors (Chaudhuri & Rao, 2004; Henneberry, Khan, & Piewthongngam, 2000). Similar outcomes have been observed in the Brazilian economy (Bustos et al., 2016b). Moreover, industrial development is significantly shaped by the transition from extensive to intensive production systems, which are often driven by innovation and capital deepening (Berthélemy & Söderling, 2001; Chen et al., 2011; Ngai et al., 2019). In this context, technological advancements in agriculture serve as a catalyst for structural transformation and broader economic modernization (Anderson, 2010; Autor et al., 2003; Swinnen, 2018).

In Côte d'Ivoire, agriculture plays a multifaceted role in economic and inclusive growth (World Bank, 2021; FAO, 2020). Studies have highlighted the positive impact of agricultural exports on economic growth (Keho, 2020; Paul-Alfred, 2020) and the importance of agricultural manufacturing, human capital, and foreign direct investment for job creation (Kouakou, 2023). Concerning inclusive growth, several institutional and socio-economic factors influence its dynamism. For instance, research using principal component analysis to calculate an inclusiveness index revealed that household consumption expenditures, bureaucracy, and population growth improve the inclusiveness of Ivorian growth, while GDP per capita and democracy hinder it (Botchuin, 2021; Adeosun et al., 2022).

However, the Ivorian agricultural sector faces significant challenges, including the impacts of climate change, soil degradation, and deforestation (Kouassi et al. 2021). To address these challenges, the government has launched the National Agricultural Investment Plan II (PNIA II), aiming to modernize rural infrastructure and promote resilient agricultural practices (World Bank,2022; Farmonaut ,2024). Additionally, initiatives to strengthen agricultural market regulation and encourage crop diversification are underway to reduce dependence on cocoa and improve sector resilience against climate-related risks.

This research aims to fill the research gap by examining the impact of agricultural growth on non-farm employment and structural transformation using an ARDL model and Granger causality tests. The main hypothesis is that agricultural growth leads to job creation in non-farm sectors, contributing to inclusive growth. The study will explore the characteristics of economic growth in Côte d'Ivoire and assess whether agricultural productivity can contribute to inclusive growth. Two primary questions will be addressed: What are the characteristics of economic growth in Côte d'Ivoire? Can agricultural productivity contribute to inclusive growth in Côte d'Ivoire?

The study is organized into sections that present the introduction and literature review (1), followed by conceptual framework in section (2), The data description and descriptive statistics in section (3), the results and discussion in the section (4), and conclude with recommendations in the section (5). By exploring these questions, the research aims to provide insights into how agricultural growth can be leveraged to enhance inclusive growth and structural transformation in Côte d'Ivoire.

Conceptual framework

This section presents theoretical and empirical framework, the description of the variables and the estimation methodology.

Agricultural Growth and Inclusive Development in Côte d'Ivoire

Given that the core theme of this paper is agricultural growth and inclusive development, this study proposes an operational definition of inclusive growth within the context of Côte d'Ivoire. For growth to be truly inclusive in the Ivorian context, agricultural expansion must generate economy-wide benefits specifically through employment creation and income gains while emphasizing the importance of intersectoral linkages. This resonates with literature emphasizing that inclusive growth should not merely focus on increasing GDP growth rates but rather on improving productivity and the living conditions of the poor through a more equitable distribution of the gains from economic growth (Fofana et al., 2022).

As agriculture in Côte d'Ivoire is often constrained by the availability of arable land and employs roughly 45% of the total labor force (FAO, 2023), the degree of bidirectional integration between the agricultural sector and other economic sectors is critical in

determining the success or failure of the country's structural transformation policies. Yet, this dimension is frequently overlooked in macroeconomic assessments of national performance toward emergence.

The underlying assumption of this framework is that growth is inclusive when it allows the majority of society to participate in, benefit from, and contribute to the growth process. Agriculture can serve as a critical lever for stimulating employment, raising incomes, and improving living standards—especially when previously marginalized populations are granted access to decent and productive employment. The long-term effects of inclusive growth include reduced unemployment, lower dependency on food aid and public subsidies, and increased government revenues. Higher employment and income levels are often associated with lower crime rates and greater political stability key conditions for attracting foreign direct investment (Andriano, 2024).

This paper thus argues that adopting an inclusive approach to agricultural development within a broader policy reform agenda is necessary to ensure the equitable distribution of economic benefits and employment opportunities across both rural and urban populations. Such an approach ensures that the progress made in agriculture translates into tangible social and economic outcomes for the wider population.

Despite Côte d'Ivoire's rich natural resource base, the agricultural sector faces major challenges in meeting the country's development expectations. Agricultural growth has been primarily driven by the expansion of cultivated land, rather than by improvements in productivity a path that is unsustainable in the long term (Fofana et al., 2022). Moreover, per capita agricultural GDP growth has remained limited, partly due to the parallel expansion of the agricultural labor force. Compounding this, the FAO has warned that climate change will continue to put substantial pressure on renewable water resources needed for irrigation a stress that is expected to intensify in the coming decades (FAO, 2023; Watt & Chamberlain, 2011). This scenario poses significant risks to agricultural output in Côte d'Ivoire between 2080 and 2100, with potentially large production losses.

These dynamics underscore the urgency of shifting toward productivity-led agricultural strategies that are environmentally sustainable and intersectorally integrated. Only through such approaches can agricultural growth serve as a driver of inclusive development and lead to more resilient and equitable economic outcomes.

Theoretical and empirical modeling

Theoretical modeling

The relationship between agricultural growth and non-agricultural employment is essential for inclusive growth and structural transformation in developing economies. To achieve this objective, we construct a model based on the model of economic growth developed by *(Barro 1990; Lucas Jr 1988; Mankiw, Romer, and Weil 1992; Romer 1990)* which is a endogenous growth model.

The theoretical functional form of the endogenous growth model is given by:

$$Y = f(K, L, X) \quad (1)$$

Where Y represents gross domestic product, K is capital, L is labor, and X represents other exogenous variables.

From this, we specify the theoretical ARDL model

$$\Delta y_t = \alpha + \sum_{=1}^{p} \beta_i \Delta y_{t-i} + \sum_{i=0}^{q} \gamma_i \Delta X_{t-i} + \delta_1 \Delta y_{t-1} + \delta_2 \Delta x_{t-1} + \varepsilon_t \quad (2)$$

Where Y is the dependent variable, X are the exogenous variables, Δ is the first difference operator, and ε is the error term.

The Error Correction Model (ECM) is obtained by:

$$\Delta y_t = \alpha + \sum_{=1}^{p} \beta_i \Delta y_{t-i} + \sum_{i=0}^{q} \gamma_i \Delta X_{t-i} + \emptyset ECT_{t-1} + \varepsilon_t \quad (3)$$

Where ECT is the error correction term representing the long-run relationship and $\emptyset$ is the speed of adjustment coefficient.

To analyze the dynamic causality between variables, we apply the Granger causality test:

$$y_t = \sum_{=1}^{p} \alpha_i \Delta y_{t-i} + \sum_{i=0}^{q} \beta_i X_{t-i} + \varepsilon_t \quad (4)$$

Where p and q are the maximum lags considered for Y and X respectively. It is a statistical tool to test whether one-time series can predict another time series. The concept, developed by Clive Granger in 1969, is based on the idea that if the prediction of a time series can be improved by incorporating the past values of another time series, then is said to Granger-cause.

Empirical modeling

The autoregressive distributed lag (ARDL) estimation method is a robust statistical technique for analyzing long-term relationships between variables in time series data, accommodating variables that are stationary at level I (0), at the first difference I (1), or a mix of both. The process begins with the collection of relevant data, followed by a descriptive analysis to assess the stationarity, central tendencies, and variability of the variables. Subsequently, the ARDL model is estimated using standard linear regression, incorporating appropriate lags for both dependent and explanatory variables to capture the dynamic relationships. The model's robustness is evaluated through several residual diagnostic tests: the CUSUM test for parameter stability, the Breusch-Godfrey LM test for autocorrelation, the White test for heteroscedasticity, the Shapiro-Wilk test for normality, and the variance inflation factor (VIF) test for multicollinearity. These tests ensure the

reliability and validity of the model, confirming that it provides consistent and unbiased estimates. The following empirical ARDL model is used in this study:

$$\Delta NFEMP_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta NFEMP_{t-i} + \sum_{i=0}^{q_1} \beta_1 \Delta AGRV_{t-i} + \sum_{i=0}^{q_1} \beta_2 \Delta INDV_{t-i} + \sum_{i=0}^{q_1} \beta_3 \Delta SAV_{t-i} + \sum_{i=0}^{q_1} \beta_4 \Delta GFCF_{t-i} + \sum_{i=0}^{q_1} \beta_5 \Delta EXR_{t-i} + \gamma_1 \Delta NFEMP_{t-i} + \gamma_2 \Delta AGRV_{t-i} + \gamma_3 \Delta INDV_{t-i} + \gamma_4 \Delta SAV_{t-i} + \gamma_5 \Delta GFCF_{t-i} + \gamma_6 \Delta EXR_{t-i} + \varepsilon_t \quad (5)$$

The Error Correction Model (ECM) is obtained by the following equation:

$$\Delta NFEMP_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta NFEMP_{t-i} + \sum_{i=0}^{q_1} \beta_1 \Delta AGRV_{t-i} + \sum_{i=0}^{q_1} \beta_2 \Delta INDV_{t-i} + \sum_{i=0}^{q_1} \beta_3 \Delta SAV_{t-i} + \sum_{i=0}^{q_1} \beta_4 \Delta GFCF_{t-i} + \sum_{i=0}^{q_1} \beta_5 \Delta EXR_{t-i} + \emptyset ECM_{t-1} + \varepsilon_t \quad (6)$$

Where:

$NFEMP$ is the Non-Farm employment, $AGRV$ is Agricultural Value Added, $INDV$ is Industrial Value Added, SAV is Service Value Added, $GFCF$ is Gross Fixed Capital Formation, EXR is Exchange rate, Δ denotes the first difference operator, α_0 is the constant term, $\alpha_i, \beta_i, \gamma_i$ are the coefficients, ε_t is the error term, ECM_{t-1} is the error correction term representing the long-term relationship;$\emptyset$ is the speed of adjustment coefficient.

Data description and descriptive statistics

Data description

The empirical model utilizes data from 1991-2021, primarily from the World Bank except Agricultural Added Value (*AGRV*) drawn from FAO database. Key variables include: Non-Farm Employment Rate (*NFEMP*) obtained by the sum of industry and service employment as % of total employment, Agricultural Added Value (*AGRV*), Industrial Added Value (*INDV*), Service Added Value (*SAV*) representing respectively the value added by agriculture, value added by industry, and value added by services as % of GDP. Gross Fixed Capital Formation (*GFCF*) indicating the net increase in fixed assets and investment as % of GDP and the Exchange Rate (*EXR*) which reflects changes in import/export costs for the country. The GDP is desegregated into Agricultural Added Value (*AGRV*) representing the value added by crop production, livestock, forestry, and fishing, Industrial Added Value (*INDV*) including activities such as mining, manufacturing, construction, and utilities, while Service Added Value (*SAV*) covers a wide range of activities including retail, transport, finance, real estate, and public administration.

To analyse the relationship between agricultural productivity growth and inclusive growth in Côte d'Ivoire, it is essential to consider a sufficiently long period to capture the effects of economic reforms and assess long-term impacts. The economic reforms initiated in the late 1970s, following the agricultural commodities crisis, led to the widespread adoption of structural adjustment programs across developing economies in the early 1990s. In Côte d'Ivoire, these reforms profoundly transformed the economic system, with significant implications for the agricultural sector and inclusive growth. To accurately evaluate these impacts, it is necessary to encompass a sufficiently extended timeframe to reflect economic adjustments and variations in agricultural productivity. Thus, the study covers a thirty-year period, allowing for the observation of long-term trends beyond the immediate effects of the reforms. This period also ensures that the available data are robust enough to adhere to the normal distribution law, which is crucial for reliable statistical analysis. This approach ensures a comprehensive and well-founded assessment of the reforms and their effects on agricultural productivity and inclusive growth, accounting for both immediate impacts and long-term changes.

Descriptive statistics

Table 1 presents a summary of the descriptive statistics. Descriptive statistics show the means are higher than standard errors, indicating the sample means are likely good representations of the population means. Additionally, the fact that the standard errors are less than the means suggests that the data points are clustered relatively closely around the mean, indicating a lower degree of variability in the data, which is beneficial for our model.

Table 1: *Descriptive statistics*

Variables	Mean	Std.error
Non-farm employment(% Total employment)	50.73	0.69
Agriculture added value(%GDP)	18.88	0.9
Industry added value(%GDP)	18.11	0.57
Service added value (%GDP)	42.65	1.45
Gross Capital Formation	16.78	0.83
Exchange Rate (%)	96.54	1.48

Source: Authors

Table 1: *Unit root test ADF*

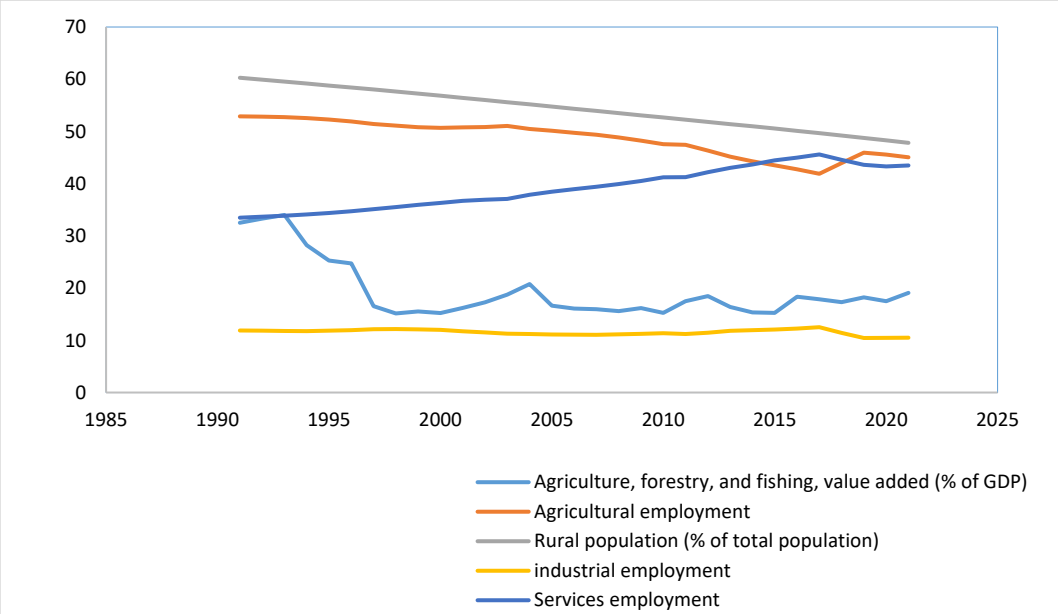
Variables	Test Type	Level/First Difference	Test Statistic
Non-farm employment	ADF	I(0)	-2.69
Non-farm employment	ADF	I(1)	-3.23***
Agricultural added value	ADF	I(0)	-4.13***
Agricultural added value	ADF	I(1)	-3.69***
Industry added value	ADF	I(0)	-3.09
Industry added value	ADF	I(1)	-3.83***
Services added value	ADF	I(0)	-1.91
Services added value	ADF	I(1)	-4.28***
Gross fixed capital formation	ADF	I(0)	-2.45
Gross fixed capital formation	ADF	I(1)	-4.89***
Exchange rate	ADF	I(0)	-1.63
Exchange rate	ADF	I(1)	-5.40***
H_0: Null hypothesis: The series has a unit root/ H_1:No H_0:			

Sources: Authors

The Augmented Dickey-Fuller (ADF) reported in the **table 2** test reveals that most variables are non-stationary at levels but stationary after first differencing, suggesting regressions at level form may be spurious, with the exception of agricultural added value, which is stationary at level.

Figure 1 shows a significant decline in agriculture's GDP and employment share alongside reduced rural population, while industry and services employment grew substantially. This reflects a shift towards more productive sectors, increased resilience, and potential for sustainable growth. This economic characteristic reflects a shift towards more productive sectors. This transition underscores urbanization trends and highlights the economy's move towards diversification, improved productivity, and higher income levels. These changes suggest increased economic resilience and potential for sustainable growth, although they necessitate supportive policies to ensure that the benefits of this transformation are inclusively shared across the population.

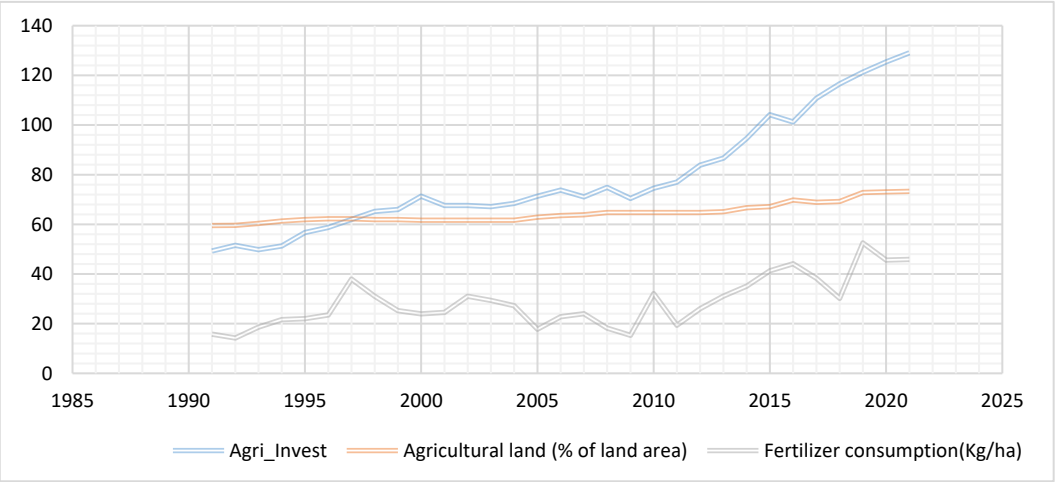
Figure 1: *Evolution of employment and agricultural value added by sector*



Source: Authors

Figure 2 shows rising trends of agricultural investment, land utilization, and fertilizer use, indicating structural change in the sector. Increased investment stimulates productivity, efficiency and economic growth through advanced technologies which leads to higher output and job creation, particularly in rural areas impacting poverty alleviation. Efficient land utilization and fertilizer use maximize crop yields and improve food security by increasing food availability and stabilizing prices. Furthermore, these improvements facilitate structural transformation by reallocating labor to higher-productivity sectors, promoting economic diversification, and adding value through agro-processing.

Figure 2: *Trends in the use of agricultural inputs*



Source: Authors

Results and discussions

This section presents the robustness tests which validate the ARDL model's reliability

Robustness tests associated with the ARDL model results

Table 3 presents the Variance Inflation Factor (VIF) test results. To ensure the variables reliability, we tested for multicollinearity using VIF, as high multicollinearity can distort estimated coefficients and reduce model precision. We specified the ARDL model and selected optimal lags for each variable based on the Akaike Information Criterion (AIC). The VIF test, is conducted on the explanatory variables and their lagged terms and is interpreted as follows: VIF< 5 indicates no serious multicollinearity, 5 ≤ VIF < 10 indicates moderate multicollinearity, and VIF ≥ 10 indicates high multicollinearity (corrective actions needed). The Variance Inflation Factor (VIF) test indicates no serious multicollinearity.

Table 2: *Variance Inflation Factor (VIF) test*

Variable	Lags	VIF	1/VIF
Ln(Services added value)	0	8.42	0.118
Ln(Agriculture added value)	1	8.23	0.121
Ln(Gross fixe capital formation)	0	7.09	0.141
Ln(Industry added value)	1	6.88	0.145
Ln(Industry added value)	0	6.68	0.149
Ln(Gross fixe capital)	2	6.12	0.163
Ln(Exchange rate)	1	5.78	0.173
Ln(Exchange rate)	0	5.6	0.178
Ln(Services added value)	1	5.12	0.195
Ln(Agricultural added value)	0	4.65	0.214
Ln(Gross fixe capital formation)	1	4.65	0.214
Mean		VIF	6.29

Sources: Authors

Table 4 presents the cointegration test results. It shows that the Fisher statistic (5.5) exceeds the upper bounds, indicating a long-run relationship between the variables. Consequently, both short-run and long-run equations will be estimated.

Table 3: *Bound test of cointegration*

Level of significance (α %)	Lower value	Upper value	Hypothesis
5%	2.62	3.79	H0:No level relationship
10%	2.26	3.35	
Accpt if F<critical calculate for I (0) regressors, reject if F>to critical value Computed F-statistic: 5.5			

Source: Authors; * denotes significance at 5% and 10%level

Table 5 reports the results of the robustness tests. it emerges from the results the absence of autocorrelation, of heteroscedasticity and the errors are normally distributed. The validation of an ARDL model requires the homoscedasticity of residuals, a normal distributed error term and no serial correlation on the residuals. The results in table 4 demonstrate the model's robustness.

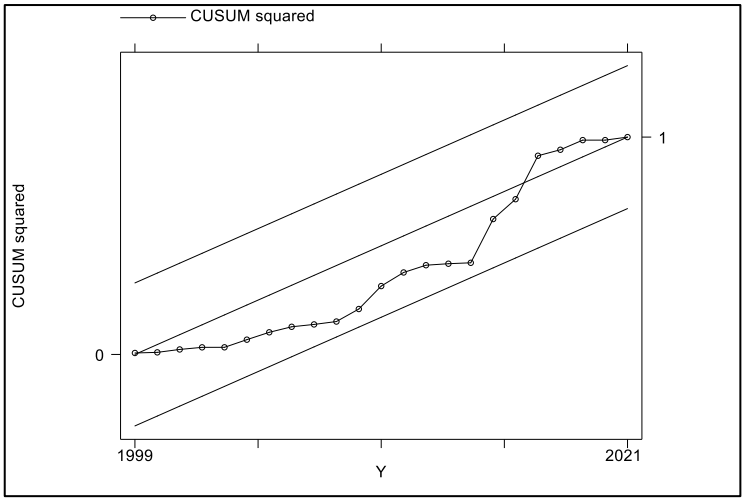
Table 4: *Results of robustness test*

Tests	Hypothesis	P>chi2	Decision
Breusch–Godfrey LM test	H0: No serial correlation/H1: non H0	0.412	Do not reject H0
White's test	H0: Homoscedasticity/H1: non H0	0.412	Do not reject H0
Ramsey RESET test (normality)	H0: Model has no omitted variables/H1: non H0	0.014	Do not reject H0

Source: Authors

Figure 3 record residuals stability test. After estimation, we verify the stability of the model's coefficients over time, at the end of the forecast. We use *Brown-Durbin-Ewans (1975)* tests. This test allows us to detect structural instabilities. Globally there is instability if the curve crosses the corridor. It appears that the model does not have a structural break. Therefore, the model is stable and its forecasts and inferences are robust.

Figure 3: *CUSUM stability test*



Source: Authors

Granger causality test results

Table 6 reports the Granger causality test results. According to *Granger (1988),* in the presence of cointegration, there must be at least one direction of causality: unidirectional or bidirectional. There are various methods for lag length selection in recent literature, including the Akaike Information Criterion (AIC), the Schwartz Information Criterion (SIC), and *Hsiao (1979)*'s sequential procedure. Our results reveal significant causal relationships that underscore the pivotal role of agricultural performance in influencing broader economic variables. The analysis indicates that agricultural added value is the Granger cause of non-farm employment, suggesting that fluctuations in agricultural productivity substantially affect employment levels outside the agricultural sector. This result highlights the importance of agricultural sector in driving labor market dynamics, influencing non-farm job creation and supported the theory according to which agriculture-led growth can stimulate the broader economy by increasing rural incomes, which in turn raises demand for goods and services produced in other sectors *(Johnston and Mellor, 1961*).

Table 5: *Matrix of Granger causality test*

Null hypothesis : Independent variable does not cause the dependent variable				
Dependent variable (1)	**Independent variables(2)**	**F-Statistic**	**Lags**	**Conclusion**
D_lnNon-farm employment	D.lnAgricultural added value	6.37***(0,095)	3	Reject
D_lnNon-farm employment	D.lnIndustry added value	15.28***(0,002)	3	Reject
D_lnNon-farm employment	D_lnServices added value	20.19***(0.00)	3	Reject
D_lnNon-farm employment	D_lnGross fixe capital formation	15.42***(0.001)	3	Reject
D_lnNon-farm employment	Exchange rate	16.51***(0.001)	3	Reject
D_lnAgricultural added value	D.lnIndustry added value	10,2(0.2)	3	Accept
D_lnAgricultural added value	D_lnServices added value	12,02***(0.007)	3	Reject
D_lnIndustry added value	D.lnAgricultural added value	23,02***(0.00)	3	Reject
D_lnIndustry added value	D_lnServices added value	46,30***(0.00)	3	Reject
D_lnServices added value	D.lnIndustry added value	11,51***(0.009)	3	Reject
D_lnGross fixe capital formation	D.lnAgricultural added value	8,02***(0.04)	3	Reject

Notes: P-value in parenthese; Standard errors in parentheses * p<0.01, ** p<0.05, *** p<0.1 significance level.
Sources: Authors

Moreover, the findings stipulate that agricultural growth is the granger causes of industrial and services expansion, and improve gross fixed capital formation. It means that agricultural growth stimulates demand for industry, services and improves investment through saving. In other word, agricultural growth assumes its role of forward and backward linkages by spurring growth in other sectors. This finding is consistent with *Timmer's (2005)* study, who argued that agricultural productivity leads to higher rates of investment in physical capital, thereby promoting overall economic development. However, the industrial growth does not affect agricultural sector highlighting a key challenge identified in many developing countries studies in the economic literature. This lack of integration limits the potential for mutually reinforcing growth between these sectors, as found by *Gollin et al.(2002)*. These results show that agricultural growth plays a crucial role in economic development by influencing non-farm employment, stimulating industrial and service sector growth, and improving investment in capital formation in Cote d'Ivoire.

ARDL estimation report

The ARDL model results are recorded in **table 7**, providing an insight of the short-run and long-run relationships between non-farm employment and the explanatories variables. The adjustment term with a negative and significant (at 1% level) coefficient of about 0.288, which intuitively means that a possible shock on non-farm employment is corrected at the convergence speed of 28.8% in the area of study. Moreover, the coefficient of the lagged non-farm employment is positive and significant, indicating about 59.3% stability of non-farm employment over the study period. Moreover, agricultural and industrial growths have a negative and significant effect on non-farm employment, with respective coefficients of 0.058 and 0.0567. This suggests that a 1% increase in these sectors will decrease the non-farm employment of about 5.8% and 5.67%, respectively and it is due to the fact that agricultural sector in Cote d'Ivoire employs more than 46% of total worker force and is still the leading sector in terms of employment according to FAO. Furthermore, the development of agricultural sector causes a labor surplus oriented toward nonagricultural sector. As shown in Table 5, industry growth does not cause agricultural sector growth, thereby limiting agriculture's role in job creation within the value chain. These results align with structural transformation literature *Timmer* (1988), highlighting labor shifts from non-farm sectors and short-term labor market inefficiencies in responding to sector-specific growth. Gross capital formation (proxy to investment) and exchange rates negatively impact non-farm employment, indicating that capital-intensive growth can initially reduce labor demand, similar to trends in automation. The exchange rate effect aligns with open economy macroeconomics, where currency appreciation reduces export competitiveness and employment in export-driven sectors (*Freund and Pierola*, *2012)*.

Table 6:*ARDL estimation result*

Variables	Coefficients
Short-run equation	
LD. ln (non-farm employment)	0.593***(-0.127)
D. ln (agricultural added value)	-0.0580**(-0.019)
D. ln (industry added value)	-0.0567***(-0.022)
D. ln (service added value)	0.0695***(-0.016)
D. ln (gross capital formation)	-0.0708***(-0.017)
LD. ln (gross capital formation)	-0.0490***(-0.013)
D. ln (exchange rate)	-0.201***(-0.045)
Long-run equation	
ADJ	-0.288***(-0.075)
Ln (agricultural added value)	-0.065(-0.075)
Ln (industry added value)	0.357**(-0.090)
Ln (service added value)	-0.203***(-0.086)
Ln (gross capital formation)	0.211**(-0.044)
Ln (exchange rate)	0.360**(-0.103)
Constant	0.362*(-0.175)
Observations	29
R-squared	0.858
Adj R-squared	0.735
Log likelihood	112.638

Standard errors in parentheses * p<0.01, ** p<0.05, *** p<0.1
Sources: Authors

Conversely, service sector growth positively impacts non-farm employment, indicating that it boosts job creation in the early stages of economic development *(Eichengreen and Gupta ,2013b)*. This is supported by *De Vries et al. (2015)*, who found that the service sector is increasingly driving economic growth and job creation in developing countries.

Agricultural growth does not directly impact non-farm employment in the long run; however, industrial growth and gross capital formation positively influence it. Granger causality and ARDL results reveal that agricultural growth indirectly boosts non-farm employment by supporting industrial growth and generating investment income, as noted by *(Kuznets, 1961; Lucas, 1953)*. A 1% increase in the industrial sector and gross capital formation leads to a 35.7% and 21.1% rise in non-farm employment, respectively. These findings align with *McMillan, et al.(2017)*, emphasizing industrialization as crucial for higher productivity and job creation in developing countries. Conversely, a negative and significant effect of services growth on non-farm employment is found in the long-run. It shows that the services sector is more labour-extensive. The exchange rate has a positive and significant effect on non-farm employment, suggesting that a depreciation of the local currency enhances non-farm employment by boosting export competitiveness as also founded by *(Rodrik, 2008)* . In the long run, the exchange rate positively affects non-farm employment, suggesting that currency depreciation boosts export competitiveness and thus increases non-farm employment, consistent with *Rodrik (2008)*. Conversely, service sector growth negatively impacts non-farm employment, indicating its labor-extensive nature.

Conclusion and recommendations

This study analysed the effect of agricultural growth on inclusive growth through the dynamic relationship between agricultural growth and non-farm employment in Côte d'Ivoire. It applied a combined approach of an ARDL model and Granger causality test on data covering the period 1991 to 2021 and provided by World Bank and FAO. Preliminary results show that non-farm employment adjusts to shocks at a 28.8% speed, with 59.3% stability shown by the lagged term in the short run. Key findings stipulate that agricultural growth negatively impacts non-farm employment in the short-run due to labor shifts and inefficient labor markets. It emerges of the both approaches alignment that agricultural growth positively affects industrial expansion, investment, and exchange rate conditions. Consequently, agricultural growth indirectly supports non-farm employment through industrial growth and capital formation. However, the lack of bidirectional causality between agricultural and industrial growth, limits agriculture's role in supporting non-farm job creation.

To achieve significant structural transformation for inclusive growth, the study recommends policies that strengthen the agriculture-industry connection. This includes targeted tax incentives, industrial clusters, and training programs to build skills and support innovation. Encouraging businesses to pursue international opportunities and cross-sector

partnerships will further enhance these efforts. Moreover, future research should further explore the specific contributions of different agricultural branches to inclusive growth and the effectiveness of policy interventions aimed at enhancing these linkages.

Note

(1) UNECA et AU : www.uneca.org

References

Aaronson, D., Hu, L., Seifoddini, A., and Sullivan, D.G. (2014). Declining Labor Force Participation and Its Implications for Unemployment and Employment Growth. *Economic Perspectives* 38(4).

Acemoglu, D., and Guerrieri, V. 2008. Capital Deepening and Nonbalanced Economic Growth. *Journal of Political Economy* 116(3):467–98.

Adeosun, O.A., and Tabash, M.I. (2022). Pro-poor and inclusive growth in West Africa. *African Journal of Economic and Management Studies*, 13(1), 105-135.

Aggarwal, A. (2018). Economic Growth, Structural Change and Productive Employment Linkages in India: Did Market Transition Matter? *South Asia Economic Journal* 19(1):64–85.

Anderson, K. (2010). *The Political Economy of Agricultural Price Distortions*. Cambridge University Press.

Andriano, L. (2024). Agricultural droughts and under-five mortality in Côte d'Ivoire: Differential impacts across social and demographic groups*. Population and Environment. <https://doi.org/10.1007/s11111-024-00469-0>

Autor, D.H., Levy, F., and Murnane, R.J. (2003). The Skill Content of Recent Technological Change: An Empirical Exploration. *The Quarterly Journal of Economics* 118(4):1279–1333.

Bank (2007). *World Development Report 2008: Agriculture for Development*. World Bank Publications.

Barro, R.J. (1990). Government Spending in a Simple Model of Endogeneous Growth. *Journal of Political Economy* 98(5, Part 2):S103–25. doi: 10.1086/261726.

Berthélemy, J.-C., and Söderling, L. (2001). The Role of Capital Accumulation, Adjustment and Structural Change for Economic Take-off: Empirical Evidence from African Growth Episodes. *World Development* 29(2):323–43.

Botchuin, W.C. (2021). Institutional Factors of Inclusive Growth: Evidence from Cte Divoire. *Journal of Economics and International Finance* 13(1):13–23.

Bustos, P., Caprettini, B., and Ponticelli, J. (2016a). Agricultural Productivity and Structural Transformation: Evidence from Brazil. *American Economic Review* 106(6):1320–65.

Chaudhuri, K., and Rao, R.K. (2004). Output Fluctuations in Indian Agriculture and Industry: A Reexamination. *Journal of Policy Modeling* 26(2):223–37.

Chen, S., Jefferson, G.H., and Zhang, J. (2011). Structural Change, Productivity Growth and Industrial Transformation in China. *China Economic Review* 22(1):133–50.

Christiaensen, L., Demery, L., and Kuhl, J. (2011). The (Evolving) Role of Agriculture in Poverty Reduction—An Empirical Perspective. *Journal of Development Economics* 96(2):239–54.

Christiaensen, L.J., Demery, L., and Khl, J. (2006). *The Role of Agriculture in Poverty Reduction: An Empirical Perspective*. Vol. 4013. World Bank Publications.

De Vries, G, Timmer, M., and De Vries, K. (2015). Structural Transformation in Africa: Static Gains, Dynamic Losses. *The Journal of Development Studies* 51(6):674–88. <doi: 10.1080/00220388.2014.997222>

Diao, X., McMillan, M., and Wangwe, S. (2018). Agricultural Labour Productivity and Industrialisation: Lessons for Africa. *Journal of African Economies* 27(1):28–65.

Dollar, D., and Kraay, A. (2004). Trade, Growth, and Poverty. *The Economic Journal* 114(493):F22–49.

Eichengreen, B., and Gupta, P. (2013a). The Real Exchange Rate and Export Growth: Are Services Different? Bank of Korea WP 17.

FAO (2020). The State of Food Security and Nutrition in the World. Disponible en ligne: <www.fao.org>

Farmonaut (2024). Sustainable Agricultural Transformation in Côte d'Ivoire: Innovations and Opportunities for Green Economic Growth. Available at <https://farmonaut.com/africa/transformation-agricole-durable-en-cote-divoire-innovations-et-opportunites-pour-une-croissance-economique-verte/>

Fei, J.C.H., and Ranis, G. (1964). Capital-Labor Ratios in Theory and in History: Reply. *The American Economic Review* 1063–69.

Ferguson, J. (2005). Seeing like an oil company: space, security, and global capital in neoliberal Africa. *American anthropologist*, 107(3), 377-382.

Fofana, I. et al. (2022). *Agricultural development promises more growth and less poverty in Africa. *Development Policy Review*, 40(6), e12669. <https://doi.org/10.1111/dpr.12669>

Franks, S. (2005). Our common interest: Report of the commission for Africa. Political Quarterly-London then Oxford-Macmillan then Blackwell-, 76(3), 446.

Freund, C., and Pierola, M.D. (2012). Export Surges. *Journal of Development Economics* 97(2):387–95.

Gollin, D. (2010). Agricultural Productivity and Economic Growth. *Handbook of Agricultural Economics* 4:3825–66.

Gollin, D., Parente, S., and Rogerson, R. (2002). The Role of Agriculture in Development. *American Economic Review* 92(2):160–64.

Granger, C.W.J. (1988). Causality, Cointegration, and Control. *Journal of Economic Dynamics and Control* 12(2–3):551–59.

Henneberry, S.R., Khan, M.E., and Piewthongngam, K. (2000). An Analysis of Industrial–Agricultural Interactions: A Case Study in Pakistan. *Agricultural Economics* 22(1):17–27. doi: 10.1111/j.1574-0862.2000.tb00002.x.

Herrendorf, B., Rogerson, R., and Valentinyi, A. (2014). Growth and Structural Transformation. *Handbook of Economic Growth* 2:855–941.

Hsiao, C. (1979). Autoregressive Modeling of Canadian Money and Income Data. *Journal of the American Statistical Association* 74(367):553–60.

Johnston, B.F., and Mellor, J.W. (1961). The Role of Agriculture in Economic Development. *The American Economic Review* 51(4):566–93.

Kouakou Kouakou, P.A. (2020). Agricultural Productions and Its Implications on Economic Growth in Ivory Coast: The Use of the Econometric Approach. *Applied Economics and Finance* 7(4):126.

Kouakou Kouakou, P.-A. (2023). Impact of Local Processing of Agricultural Raw Materials on Job Creation in the West African Monetary and Economic Union. Agricultural and Resource Economics: *International Scientific E-Journal* 9(3):250–65.

Kuznets, S. (1961). Economic Growth and the Contribution of Agriculture: Notes on Measurement.

Lewis, W.A. (1954). Economic Development with Unlimited Supplies of Labour.

Loizou, E., Karelakis, C., Galanopoulos, K., and Mattas, K. (2019). The Role of Agriculture as a Development Tool for a Regional Economy. *Agricultural Systems* 173:482–90.

Lucas Jr, R.E. (1988). On the Mechanics of Economic Development. *Journal of Monetary Economics* 22(1):3–42.

Mankiw, N.G., Romer, D., and Weil, D.N. (1992). A Contribution to the Empirics of Economic Growth. *The Quarterly Journal of Economics* 107(2):407–37.

Matsuyama, K. (1992). Agricultural Productivity, Comparative Advantage, and Economic Growth. *Journal of Economic Theory* 58(2):317–34.

McMillan, M., Rodrik, D., and Sepúlveda, C. (2017). Structural Change, Fundamentals and Growth: A Framework and Case Studies. National Bureau of Economic Research.

Ngai, L.R., and Pissarides, C.A. (2007). Structural Change in a Multisector Model of Growth. *American Economic Review* 97(1):429–43.

Nunnenkamp, P., and Spatz, J. (2003). Foreign direct investment and economic growth in developing countries: how relevant are host-country and industry characteristics? (No. 1176). Kiel working paper.

Pingali, P.L. (2012). Green Revolution: Impacts, Limits, and the Path Ahead. Proceedings of the National Academy of Sciences 109(31):12302–8. doi: 10.1073/pnas.0912953109.

Ravallion, M., and Chen, S. (2009). "China's (Uneven) Progress against Poverty". Pp. 65–111 in *Governing rapid growth in China*. Routledge.

Rodrik, D. (2008). The Real Exchange Rate and Economic Growth. *Brookings Papers on Economic Activity* 2008(2):365–412.

Rodrik, D., McMillan, M., and Sepúlveda, C. (2016). Structural Change, Fundamentals, and Growth. Structural Change, Fundamentals, and Growth. Washington DC: IFPRI.

Romer, P.M. (1990). Endogenous Technological Change. *Journal of Political Economy* 98(5, Part 2):S71–102. doi: 10.1086/261725.

Sawtelle, B. (2007). Analyzing the Link Between Real GDP and Employment: An Industry Sector Approach: Employment Responsiveness to Long-Term Real GDP Expansion Differs Markedly Across US Industry Sectors. *Business Economics* 42:46–54.

Sodipe, O.A., and Ogunrinola, O.I. (2011). Employment and Economic Growth Nexus in Nigeria. *International Journal of Business and Social Science* 2(11):232–39.

Swinnen, J. (2018. "The Political Economy of Agricultural and Food Policies". Pp. 381–98 in *The Routledge Handbook of Agricultural Economics*. Routledge.

Timmer, C.P. (1988). The Agricultural Transformation. *Handbook of Development Economics* 1:275–331.

Timmer, P. (2005). *Agriculture and Pro-Poor Growth: An Asian Perspective*. Available at SSRN 1114155.

Vollrath, D. (2011). The Agricultural Basis of Comparative Development. *Journal of Economic Growth* 16:343–70.

Watt, S., and Chamberlain, J. (2011). Water, climate change, and maternal and newborn health. Current Opinion in *Environmental Sustainability*, 3(6), 491–496. <https://doi.org/10.1016/j.cosust.2011.10.001>

World Bank (2022). Increased Productivity Can Transform Growth Prospects in Côte d'Ivoire. Available at <https://blogs.worldbank.org/fr/africacan/une-productivite-accrue-peut-transformer-les-perspectives-de-croissance-en-cote-divoire>

Zuberi, T., and Thomas, K.J. (2012). Demographic projections, the environment and food security in sub-Saharan Africa. Regional bureau for Africa, United Nations working group, 22.