AGRICULTURAL GROWTH STABILITY FOR EMPLOYMENT GENERATION AND FOOD SECURITY IN NIGERIA: ASSESSING THE ROLE OF INVESTMENT

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ABSTRACT

Stable agricultural growth is crucial for employment generation and food security in developing countries. Motivated by the lag in agriculture's contribution to food security and employment generation in Nigeria, the study examined the role of investment factors in the stability of Nigeria's agricultural growth using the Generalized Auto-regressive Conditional Heteroscedastic (GARCH) regression model. Findings revealed that the equilibrium path of growth in Nigeria's agriculture is influenced positively and significantly by its own value in the immediate past period $(\beta = 0.89; p \leq 0.01)$ *and aggregate volume of credit obtained from commercial banks* $(\beta = 0.3; p \leq 0.01)$*. Conversely, foreign direct investment in agriculture* $(\beta = -0.04; p \leq 0.01$ *and federal recurrent spending* $(\beta = -0.2; p \leq 0.01)$ *had significant negative influence on the path of growth. More importantly, in spite of the significant damping influence of commercial banks' credit to agriculture* $(\beta = -0.10; p \leq 0.01)$*, persistent oscillation characterized the variance of agricultural growth. Also, asymmetric volatility characterized the variance of agricultural growth, with good news exerting greater influence on agricultural output volatility than bad news. The study recommends a drastic investment policy that will not only promote agricultural FDI inflow and private investment but also ensure more effective public funding of agriculture. A more effective monetary policy that will make the banking sector more efficient is also needed.*

Keywords: Agricultural growth stability, investment, GARCH, Persistent volatility, Commercial Bank Credit, Foreign Direct Investment (FDI)

INTRODUCTION

Unemployment and food insecurity are major crises confronting most developing countries. According to Singh (2025), a significant proportion (10.52 percent) of the youth population in Sub-Saharan Africa is unemployed. Lewis (2013) explains that the unemployment crisis in developing countries is traceable to overpopulation, overvalued exchange rates, low levels of productivity, an excessive propensity to import, and an unbalanced investment pattern skewed against labour-intensive sectors such as agriculture. Food insecurity in these countries, on the other hand, manifests in the form of food inflation, hunger and high food imports. Inconsistent, low and unpredictable agricultural growth leads to food insufficiency when domestic food production is unable to meet domestic demand (Akande, 2025). Food self-insufficiency leads to high food imports, low domestic employment, high demand for foreign exchange, and trade deficits. Low income resulting from sub-optimal and unpredictable production often constrains most farmers to live in poverty. Declining agricultural productivity often leads to rising food prices.

High expenditure on food commodities resulting from inconsistent agricultural growth wipes away people's income, aggravates food insecurity and malnutrition, creating widespread poverty and inducing volatility in other sectors of the economy. Adequate investment in agriculture can reverse this trend. This is because investment enables farm-firm to optimally use inputs, increase farm-level employment by aiding value addition and adopt technologies necessary for increased production. Improved investment also leads to increase farm size and farm diversification. According to Borensztein et al., (1998), Danescu (2012), Amighini (2017), Gammeltoft (2021), investment by multi-nationals in agriculture can generate farm-level employment, enhance value addition and compliment domestic investments. This is because multinational investments bring package of capital, technology, managerial expertise/skills, promotes access to foreign markets, enhances local and national tax revenues and, supports social infrastructures that drive economic and community development.

Improved public spending on agriculture on the other hand is important for the provision of needed infrastructures, social services in rural areas as well as subsidy on critical agricultural inputs that farmers may find difficult to invest on. Beginning with the colonial era objective of increasing production of export crops for the British market and its industries, policy to improve Nigerian agriculture has had its focus on agricultural knowledge generation and dissemination, programmes that generate growth, food & nutritional security as well as employment through value chain improvement. Also, the need to generate and disseminate agricultural knowledge has led to the establishment of the first-generation research and extension institutes which include: the Agricultural Extension and Research Liaison Service (AERLS) at the Ahmadu Bello University, Zaria, in 1963; the International Institute of Tropical Agriculture (IITA) in 1967, and the International Livestock Centre for Africa [ILCA] (Oyeleke 2021).

Other public interventionist experiments that were implemented include: Farm Settlement Schemes and the National Accelerated Food Production Programme (NAFPP), launched in 1972; the Operation Feed the Nation, launched in 1976; River Basin and Rural Development Authorities established in 1976; Green Revolution Programme, inaugurated in 1980; the World Bank-funded Agricultural Development Projects (ADP); Nigerian Agricultural Land Development Authority (NALDA), established in 1992, the first National Fadama Development Project (NFDP-1), the National, Special Programme on Food Security (NSPFS), the Root and Tuber Expansion Programme (RTEP). The implementation of the Agricultural Transformation Agenda (ATA) of 2011; the Agriculture Promotion Policy (2016-2020) followed in succession to achieve the objective of increasing food production, increasing income, and alleviating rural poverty. Also, the need to attract more private investment into agriculture led to the implementation of the National Agricultural Technology and Innovation Policy (NATIP), 2022-2027.

This policy provides key measures that include tax holiday, zero duty on equipment, improved credit access through the Nigeria Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL), public- private partnership for infrastructure, and a 2.5 billion + push into agro-processing (FMRD, 2022).

In spite of these efforts, however, evidence suggests that the growth of Nigerian agriculture has been unstable. According to the Nigeria Economic Summit Group (NESG, 2025), food inflation in Nigeria has been on an upward trend, moving from 33.9% in December 2023 to 35.41% in January, 2024. Also, food insecurity has been prevalent with the number of food-insecure Nigerians moving from 66.2 million in Q1 2023 to 100 million in Q1 2024. Akpoghelie *et al*. (2024) further reported that 18.6 million Nigerians are facing acute hunger and that 43 million more are showing crises level and above crisis-level hunger coping strategies. Soaring food importation bill again provides evidence of inability of domestic food production to meet domestic demand. Pressure on food imports has made Nigeria's food import bill which was N3.47 billion in 1990 to rise to a staggering 13.64 billion and N959.5billion by 2001 and 2019 respectively. High food prices and rural-urban migration have also been the natural corollary of low farm productivity and low income in the rural sector (Adesina, 2013, Ashagidigbi, 2019). Low income from farming constrains most farmers to live in poverty. Decreasing level of food supply is leading to rising domestic prices of foods. High expenditure on food commodity wipes away people's income, aggravates food insecurity and malnutrition, creating widespread poverty and induces volatility in other sectors of the economy. Also, rising rural –urban migration has resulted from youths lacking employment in agriculture. This raises the question of what factors drive agricultural growth instability in Nigeria?

Empirical analysis of Ugbaka*, et al* (2021) had addressed the relationship between agricultural sector productivity and agricultural growth using cointegration analysis and error correction model. Kelikume and Uwani (2020) on the other hand provided information on the causal linkage between output and real GDP growth using vector error correction model and impulse response. Gani *et al* (2025) also addressed relationship between agricultural productivity and economic growth using ARDL model. Similarly, employing the ARDL model, Hassan *et al* (2023) evaluated the impact of agriculture on economic growth in Nigeria. However, study on the effect of investment on agricultural growth volatility in Nigeria and its implication for food security, employment generation is yet to be conducted. The paper therefore analyzed the role of investment factors on the stability of Nigerian agricultural growth in relation to employment generation and food security.

The rest of the paper is structured as follows. Section 2 presents the review of statistical literature for addressing boundary instability while Section 3 presents data and method of data analysis. Section 4 presents results and its discussions while Section 5 is on summary, conclusion and limitation of the study.

2.0 REVIEW OF LITERATURE

2.1 Models for Estimating Trajectory in Complex System

Time series processes often follow complex paths characterized by several twist and turns of different radii. Nonlinear maps and chaos characterize trajectories where orderly processes can unexpectedly transition into chaotic behavior or sensitivity to initial conditions, often exemplified by the "butterfly effect," where small changes can lead to significant consequences. The work of Edward Lorenz in the 1960s demonstrated that complex trajectories or orbits results when slight variations in data lead to drastically different outcomes, underscoring the inherent unpredictability of complex systems. Models for characterizing complexity, trajectory instability and object boundaries in analytical literature have included the fractal theory, the empirical mode decomposition (EMD), the Active Contour Model (ACM), autoregressive conditional heteroskedasticity(ARCH), the generalized autoregressive conditional heteroskedasticity (GARCH), and dynamic system theory among others.

Engle (1982) proposed the Auto-Regressive Conditional Heteroscedascity (ARCH) model. The advantage of the model for free energy dynamical system analysis over other analytical models lies in the fact that it separates the free energy trajectory from the common tangent path. More specifically, it separates the variance equation from the mean equation. Secondly, in contrast to some deterministic recursive and integrated functional system models, the role of exogenous variables in a dynamic system can be explicitly evaluated. In this model, complex system trajectories are estimated via simultaneous estimation of mean and conditional variance equations. The GARCH is a variant of the more general autoregressive conditional heteroskedasticity (ARCH) of Engle (1982) and generalized as GARCH (Generalized ARCH) of Bollerslev (1986). In particular, the GARCH model was developed to capture the heteroskedasticity (empirical evidence of non-constant variance of shocks or non-stationary shocks) observed in many financial and macroeconomic time-series. The form of heteroskedasticity embedded in the GARCH model also allows the variance of the forecast error to depend on the previous period variance and the size of the previous period's shock. In its general form, an GARCH model is of the form:

$$Y_t = A_o + \emptyset_1 Y_{t-1} + \cdots \emptyset_P Y_{t-p} + \beta_0 X_t + \beta_1 X_{t-1} \ldots \beta_n x_{t-n} + \varepsilon_t \quad (1)$$

$$\sigma_t^2 = \omega + \alpha\sigma_{t-1}^2 + \delta\varepsilon_{t-1}^2 + \gamma X_{it} \quad (2)$$

Where Y_t is the dependent variable; X_i is a vector of exogenous regressors; $\emptyset, \beta, \omega, \delta, \gamma$ are the parameters, X_i are predetermined regressors; σ_t^2 (the GARCH term) is the conditional variance of the dependent variable in the mean equation (var(ε_t)); ω is the intercept of conditional variance equation; ε_{t-1}^2 (the ARCH term) is the news about volatility from the previous period measured as the lag of squared residual from the mean equation; α and β are the coefficients associated with the ARCH and GARCH term respectively.

The introduction of conditional variance into (1) leads to a GARCH-in-Mean (GARCH-M) model (Engle, Lilien and Russel, 1987) which is often used in financial applications where the expected return on an asset is related to the expected asset risk. In this model, the coefficient on the expected risk is a measure of the risk-return tradeoff. Persistence is examined by examining the coefficients on the ARCH and GARCH terms. An index greater than 0.5 on the GARCH term indicates that increases (decrease) in volatility in the past is subsequently followed by increases (decreases), implying that the path is unstable, persistent, volatile and non-mean reverting.

3 DATA AND EMPIRICAL MODEL

3.1 The Data

Data for the study were obtained from secondary sources. The data spanned from 1970 to 2021 and were sourced from the Food and Agriculture Organization (FAOSTAT) statistical database and the Central Bank of Nigeria (CBN) statistical bulletin. Specifically, data on agricultural GDP were sourced from FAOSTAT, while data on commercial bank credit to agriculture, foreign direct investment in agriculture and federal government recurrent expenditures on agriculture were sourced from the statistical bulletin of the Central Bank of Nigeria (CBN).

3.2 Empirical Model

The parameters of the generalized autoregressive conditional heteroscedastic (GARCH) model were estimated. The exponential GARCH (EGARCH) form of the estimated models is:

$$y_t = \lambda_1 y_{t-1} + \lambda_2 logbcr_{t-1} + \lambda_3 logfdiag_{t-1} + \lambda_4 logfdiag_{t-2} + \lambda_5 logfedexp_{t-1} + \varepsilon_t \quad (3)$$

$$\sigma_t^2 = \omega + \alpha\left(abs\left(\varepsilon_{t-1}\frac{1}{\sqrt{\sigma_{t-1}^2}} \right) - E\|Z\| \right) + \gamma\left(\varepsilon_{t-1}\frac{1}{\sqrt{\sigma_{t-1}^2}} \right) + \beta\log(\sigma_{t-1}^2) + \delta * logbcr_{t-1} + \emptyset_1 * logfdiag_{t-1} + \emptyset_2 * logfdiag_{t-2} + \varphi * fedexp_{t-1} \quad ..(4)$$

Where, ω =the constant (baseline log-variance); $\beta\log(\sigma_{t-1}^2)$ = the GARCH term which captures the persistence of log variance; $\alpha\left(abs\left(\varepsilon_{t-1}\frac{1}{\sqrt{\sigma_{t-1}^2}} \right) - E\|Z\| \right)$ = the ARCH (magnitude) term with ε_{t-1} being the residual from the mean equation and, $\left(\varepsilon_{t-1}\frac{1}{\sqrt{\sigma_{t-1}^2}} \right)$ = standardized residual; $E\|Z\|$ = the expected value of the absolute standardized error. Subtracting this expected value guarantees that the shock term α has a mean of zero, keeping the model stable;

$\gamma\left(\varepsilon_{t-1}\frac{1}{\sqrt{\sigma^2_{t-1}}}\right)$ = the leverage (symmetry) term. This measures the sign effect. If γ is negative, it indicates that negative shocks (bad news) cause higher future volatility than positive shocks of the same magnitude

y_t =log of the estimated value of agricultural production measured in constant 2014-2016 standard thousand local currency (SLC)

$logbcr$ = log of credit from commercial banks (billion naira); $logfdiag$= log of proportion of agricultural FDI in total FDI (%); $logfedex$= value of federal spending on agriculture (billion naira); t indexes time; $\lambda, \alpha, \beta, \gamma, \emptyset \; and \; \varphi$ are coefficients.

4 RESULT AND DISCUSSIONS

Table 1 presents the estimates from the GARCH and EGARCH regression models of the effect of investment factors on agricultural growth in Nigeria. The post-estimation statistics indicate a good fit of both GARCH and EGARCH models to the data (Table 1; Figures 1&2). However, the likelihood ratio test ($\beta = 19.76; p = 0.05$) confirmed that the EGARCH model fit more to the data than the GARCH model and was selected as the lead model.

The result from the mean equation of the lead model showed the equilibrium trajectory of the Nigerian agricultural output is influenced positively and significantly by its own value in the immediate past ($\beta = 0.89; p \leq 0.01$) as well as that of aggregate volume of credit obtained from commercial banks ($\beta = 0.3; p \leq 0.01$). The positive influence of bank credit on agricultural output is consistent with the expectation that access to credit influences farmers' output. Oladotun (2019) and Obagbemi *et al*. (2022) had earlier found that access and utilization of credit had positive effect on the output of farmers. Nguyen *et al.* (2023) also explained that credit could play significant role in mitigating the negative impact of weather shocks and increase output. Credit influence agricultural production process by providing farmers the means of purchasing capital inputs and hiring labour especially in situation when they are financially constrained.

In contrast to the positive and significant effect of bank credit, the proportion of foreign direct investment going into agriculture ($\beta = -0.04; p \leq 0.01$ as well as federal recurrent spending on agriculture ($\beta = -0.2; p \leq 0.01$) had significant negative influence on agricultural output. This implies that increases in the proportion of FDI going into agriculture and federal spending on agriculture are associated with lower agricultural output. The result is inconsistent with the expectation that FDI positively influence output in the host country and that public investment on infrastructure positively influence agricultural output growth. However, public investment can only promote economic growth when it is high and stable enough (Bayraktar, 2019).

More generally, effectiveness of public investment significantly declines when its level is below the expected threshold. Higher volatility of public investment also lower growth rates significantly, especially in low-income countries where volatility of public investment can be high (Bayraktar, 2019). Furthermore, negative effect FDI share in agriculture suggests that the agricultural share of FDI in total FDI inflow may be falling.

The variance equation revealed that the parameter for the symmetry term is positive and statistically significant, implying that good news has a greater influence on the volatility of agricultural growth than bad news of the same magnitude. This also implies that positive shocks to agricultural production have more influence on the variance of agricultural production than negative shocks. Furthermore, in spite of the significant damping influence of commercial bank credit to agriculture, persistent and non-mean-reverting $(\beta = 0.65; p \leq 0.01)$ oscillations characterized the variance of agricultural growth. Persistent, non-mean-reverting oscillations imply that the equilibrium path of agricultural output is characterized by long-range bubbles and busts. However, unpredictable agricultural growth retards investment and may contribute negatively to food security, value addition and job creation in the long run.

5 CONCLUSION, RECOMMENDATIONS AND LIMITATION OF THE STUDY

The study broadly assessed the role of investment factors on stability of agricultural growth in Nigeria. Evidence leads to the conclusion that the equilibrium path of Nigeria's agricultural growth is influenced positively and significantly by its own value in the immediate past as well as that of aggregate volume of credit obtained from commercial banks. Conversely, foreign direct investment in agriculture, as well as federal recurrent spending on agriculture, had a significant negative influence on agricultural growth in Nigeria. More importantly, despite the significant damping effect of commercial banks' credit to agriculture, persistent oscillations characterized the variance in agricultural growth. However, good news has a greater influence on the volatility of agricultural output than bad news of the same magnitude.

A drastic investment policy that will not only promote agricultural FDI inflow and private investment but also ensure more effective public funding of agriculture is recommended. Also, a more effective monetary policy is needed to make the banking sector more effective. The new public investment policy must be redirected towards investments and incentives that encourage greater productivity and sustainable production practices to achieve greater effectiveness.

A major limitation is the lack of data beyond 2021 for many variables, which limits the dataset size and may affect the consistency of the estimates. Furthermore, the use of a proxy for the proportion of agricultural FDI inflow in total FDI implies that actual FDI investment in agriculture was not used in the study.

Table 1: Generalized Auto-Regressive Conditional Heteroscedasticity (GARCH) Regression of Effect of Investment Factors on Agricultural Growth in Nigeria

Double Logarithm					Exponential GARCH[1]				
Mean Equation									
Variable	Coeff.	Std. Error	z-Stat.	Prob.	Variable	Coeff	Std. Error	z-Stat.	Prob.
Constant	0.98	0.38	2.6	0.01***	Constant	0.97	0.30	3.19	0.00***
Logaggdp(-1)	0.89	0.04	19.47	0.00***	Logaggdp(-1)	0.89	0.04	24.28	0.00***
Logbankcred(-1)	0.03	0.01	3.50	0.00****	Logbankcred(-1)	0.03	0.01	4.12	0.00***
Logfdi(-1)	0.01	0.02	0.59	0.55	Logfdi(-1)	0.01	0.01	0.62	0.53
Logfdi(-2)	-0.02	0.02	-0.90	0.37	Logfdi(-2)	-0.04	0.01	-2.76	0.01***
Logfedexp(-1)	-0.02	0.01	-2.49	0.01***	Logfedexp(-1)	-0.02	0.01	-4.42	0.00***
Variance Equation									
Constant	0.00	0.00	1.46	0.14	Constant	-1.19	$1.79x10^{-4}$	-6251.14	0.00***
$Resid(-1)^2$	-0.07	0.20	-0.36	0.72	ABS RESID(-1)/SQR(GARCH(-1))	-0.93	0.02	-39.48	0.00****
GARCH(-1)	0.94	0.42	2.25	0.02**	RESID (-1)/ SQR(GARCH(-1))	0.44	0.23	1.88	0.07*
Logbankcred(-1)	$1.42xe^{-5}$	0.00	0.04	0.97	Log(GARCH-1(-1))	0.65	0.10	6.40	0.00***
Logfdi(-2)	-0.00	0.00	-1.47	0.14	Log(bankcr(-1))	-0.10	0.04	-2.71	0.01***
Logfedexp(-1)	0.00	0.00	-0.21	0.83	Logfdi(-1))	0.69	0.63	-1.10	0.27
					Logfdi(-2))	0.10	0.60	0.17	0.87
					Logfedexp(-1))	0.20	0.14	1.42	0.15
Adj R^2 =0.99; SSR=0.13; Log-likelihhod=86.67: Dubin Wat.=2.24; AIC=-2.99; SC=2.52					Adj R^2 =0.99; SSR=0.13; Log-likelihhod=90.55: Dubin Wat.=2.22; AIC=-3.06; SC=-2.53				

Source: Author's Computation from Data, 2025; ***-**, * Significant at 1%, 5%, 10% respectively.

[1] = Lead Equation

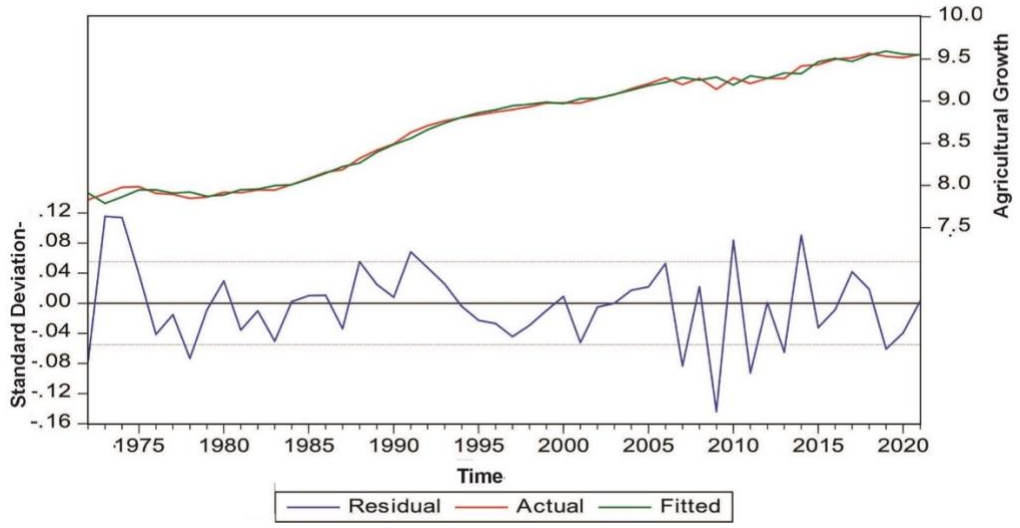

Figure 1. Fit of Data to E-GARCH Model
Source: Author's Computation from Data, 2025

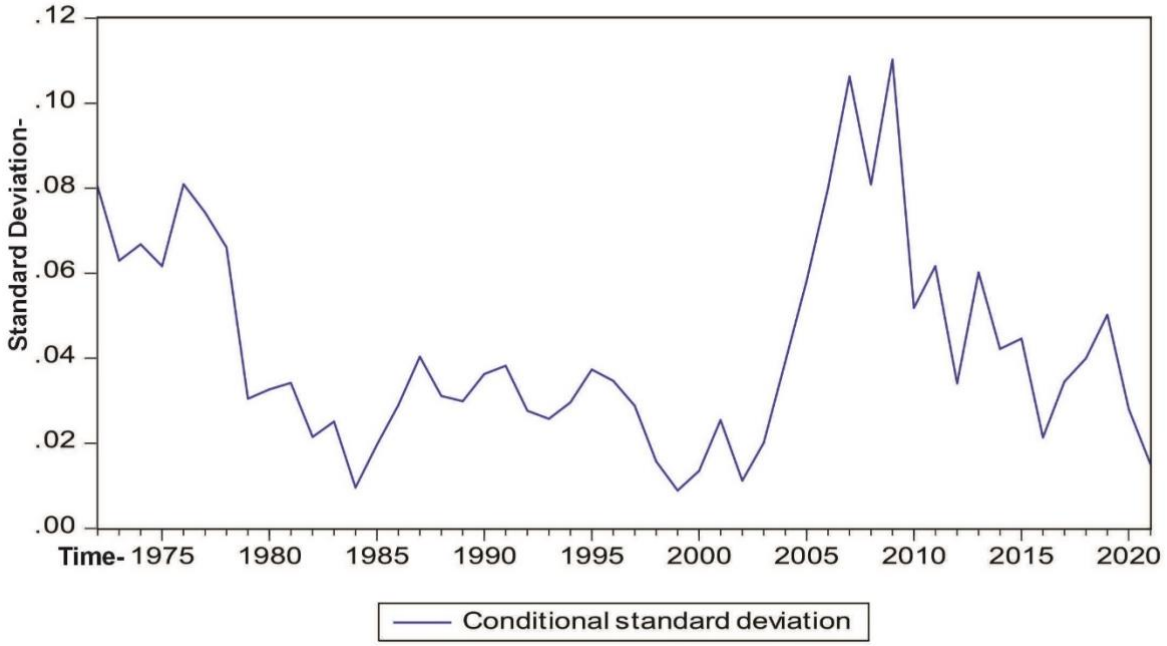

Figure 2: Conditional Volatility from E-GARCH Model.
Source: Author's Computation from Data, 2025

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