Impact of commercial bank credit on agricultural output in Nigeria

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Abstract

This study looks at the impact of commercial bank credit on Nigerian agricultural output between 1981 and 2022. Data was obtained from Central Bank of Nigeria's statistical bulletin (2023), and analyzed using the bound test of cointegration and the Nonlinear Autoregressive Distributed Lag (NARDL) model. The results from the bound test confirm a long-run equilibrium relationship between the examined variables. The findings from the NARDL models reveal that Commercial Bank Credit to Agriculture (CBCA) significantly enhances agricultural output (AOP), while the Agricultural Credit Guarantee Scheme Fund (ACGSF) has a negative impact. Additionally, interest rates (INT) exhibit an insignificant effect on agricultural productivity. These results support the financial intermediation theory, affirming that commercial bank credit fosters agricultural production in both the short-run and long-run. Consequently, this study recommends that policymakers implement measures to incentivize banks to extend credit to the agricultural sector, such as reducing reserve requirements for agricultural loans and rewarding banks that meet specific lending thresholds. Furthermore, banks should expand their presence in rural areas to facilitate financial access for farmers, and the Agricultural Credit Guarantee Scheme Fund should be restructured to improve awareness and accessibility.

Keywords: Commercial bank credit, agricultural output, NARDL, Nigeria.

1. Introduction

In developed nations, the agricultural sector plays a crucial role in the economy, significantly contributing to food production, employment, foreign exchange, and living standards. It generates investment capital faster than any other sector, linking various industries through its complex value chain (Emeaghalu, 2018). Agriculture has the capacity to propel economic expansion and advancement in numerous nations, especially in Africa, where it is the largest employer and major contributor to GDP (IFAD, 2001). In Nigeria, two-thirds of the inhabitants resides in rural areas, where agro-activity is the main industry, employing over seventy percent of the workforce and accounting for between thirty to forty percent of the country's GDP (Falaye, 2023).

One key factor influencing agricultural productivity and growth is access to bank credit, which allows farmers to buy inputs such as seeds, machinery, fertilizers, and invest in irrigation systems and modern farming methods (Ikubor et al., 2024). However, the agricultural sector in Nigeria has faced underfunding, with farmers struggling to obtain loans from formal financial institutions (Ikubor et al., 2024). Agricultural output refers to the total production of goods and services, measured in either quantity (e.g., tons of crops or liters of milk) or monetary value (total revenue from agricultural activities), covering sectors like crop production, livestock, forestry, and fisheries (FAO, 2020).

Scholars like Abubakar & Muhammad (2023), Aduralere (2019), Lawal et al. (2019), and Adewale et al. (2015) have explored the link between commercial bank loan and agricultural productivity in Nigeria. Bank credit is believed to positively impact the economy by boosting agricultural output (Udih, 2014). Recognized as a tool for transforming the agricultural sector, commercial bank credit can help ensure food security, create jobs, and diversify the economy (Golley and Samuel, 2021). Despite its significance, obtaining and repaying credit in agriculture remains challenging due to institutional issues, such as restrictive lending conditions, the risk of loan defaults, and high interest rates charged by financial institutions (Aduralere, 2019).

Even with initiatives like the Agricultural Credit Guarantee Scheme Fund (ACGSF) and substantial government investments in the sector, Nigeria's agricultural performance remains subpar, unable to produce enough food for household use and raw resources for agro-allied companies, or sufficient foreign exchange from exports (Olomola & Nwafor, 2018). The underperformance has led to food shortages, high food prices, increased agricultural imports, and a reduction in foreign exchange. This study investigates how the productivity of agricultural activities in Nigeria is affected by commercial bank lending and aimed at providing useful insights and recommendations for policymakers, advancing knowledge, and setting the stage for further research. The study is divided into four other sections: the second section is the literature review; methodology is discussed in section three, analysis and discussion of results in section four, and a summary and conclusion in section five.

2.0 Literature Review

2.1 Review of Empirical Literature

Ikubor et al. (2024) delved into the impact of deposit money banks' credit on the farming productivity from 1990 to 2022. Using Johansen cointegration and multiple regression analysis, their findings revealed a link between commercial bank credit and agricultural output in Nigeria. The results indicated that, ACGS program and commercial bank loans to agriculture were positively significant, while lending rates had little effect on agricultural output. Additionally, inflation and farm size negatively impacted the sector.

Abubakar and Muhammad (2023) conducted a thorough investigation into the effect of agrofinancing provided by commercial banks on cultivation output in Nigeria, spanning the years 1981 to 2020, employing the Autoregressive Distributed Lag (ARDL) model for their analysis, the research indicated that funding from commercial banks exerted a valuable and extensive influence on agro-production, whereas real interest rates and price hike demonstrated adverse effects and negligible long-term association with output.

Obi-Nwosu et al. (2022) analyzed how commercial bank credit affects the farming industry's input to Nigeria's GDP from 1986 to 2020, employing the ARDL method. The results indicated that commercial bank credit to agriculture did not significantly influence the sector's contribution to real GDP.

Ejemezu and Agu (2021) studied the effects of commercial banks' credit on agro-productivity in Nigeria between 1986 and 2020. Their investigation used data from the CBN statistical bulletin and also the Debt Management Office, applying trend analysis, cointegration using the ARDL bounds test, and ECM regression models. The findings showed a long-term relationship and that bank prime lending rates and commercial agricultural credit schemes had a significant positive impact on agricultural GDP.

Adaeze (2020) studied the impact of commercial bank credit on agricultural expansion in Nigeria, using the Ordinary Least Squares (OLS) technique. Findings of the study showed that agricultural credit, government expenditure on agriculture, and the agricultural credit guarantee program was impactful and noteworthy on agricultural output, whereas interest rates had adverse and negligible effect.

Aduralere (2019) used the completely modified OLS technique to explore the effects of commercial bank loans on farming industry's output in Nigeria between 1980 and 2015. The study discovered that during the study period, bank assets, interest rates on farm loans, and commercial bank monetary credit financing all had a significant statistical effect on farming output.

Oyewale and Alliu (2018) explored the impact of bank credit financing on farming productivity in Nigeria using the ARDL schematic from 1981 to 2016. They found that in the short run, except for lending rates, which had adverse effect on the agricultural industry, bank credit and government investment positively impacted agricultural performance.

Olorunsola et al (2017), using the Non-linear Autoregressive Lag model (NARDL), studied the link between agricultural output and credit in Nigeria between 1992Q1 and 2015Q4. The results showed no short-term dissymmetry in the relationship, but long-term adjustments indicated that positive changes in lending to agriculture had a significant role in increasing agricultural output. Abbas et al. (2016) examined how formal credit affected Pakistan's agricultural productivity

between 1996 and 2015 using the Johansen cointegration tests and OLS. Their findings showed a beneficial and substantial linkage between agricultural productivity and formal credit.

2.2 Gap in the Literature

Despite extensive research on commercial bank credit and agricultural productivity, only a few studies have employed nonlinear ARDL techniques. The current study aims to address this gap by utilizing the improved nonlinear ARDL model, which captures both positive and negative fluctuations in credit and their effects on agricultural output in Nigeria.

2.3 Theoretical Framework for Model Specification

This study is grounded in financial intermediation theory, structural change theory, financial liberalization theory, and credit channel theory. The financial intermediation theory, which explains how banks facilitate fund transfers between savers and borrowers, forms the core of this research. Commercial banks play a pivotal role in ensuring that farmers access necessary funding for investments in agricultural inputs, technology, and infrastructure, which can enhance agricultural productivity.

3.1 Model Specification

The study adapts the model developed by Olorunsola et al. (2017), which utilizes the nonlinear autoregressive distributed lag (NARDL) approach introduced by Shin and Greenwood-Nimmo (2014). Their model is a fundamental statistical structure that examines the correlation between the tangible progress of productivity in agriculture (y) and agricultural sector credit financing (x). The model is expressed as:

 $\mathcal{Y}_{t} = \beta^{+} X_{t}^{+} + \beta^{-} X_{t}^{-} + \mu_{t} (1)$

Where y_t = Real growth of agricultural output at time t

 x_t = Natural logarithm of credits from private sector to agriculture

 $\mu_t = \text{Error term}$

 β^+ and β^- = the related asymmetric long-run characteristics, showing that the development of agricultural output reacts asymmetrically to fluctuations in private sector loans and The partial sum processes of positive (+) and negative (-) changes in x_t are represented by x_t^+ and x_t^- .

The model is an econometric time series method that enables the estimation of nonlinear connections between variables. The nonlinear ARDL method offers a more precise understanding of the positive (increase) and negative (decrease) impacts of commercial bank credit on agricultural output, as well as the transient and permanent engagement. As a result, the general form of the NARDL model is:

$$y_t = \beta_i \sum_{j=1}^p x_{t-j}^+ + \beta_k \sum_{j=i}^p x_{t-j}^- (2)$$

$$(I, k, =1, 2, \dots, p)$$

Where y_t and x_t are the outcome and input variables respectively, and x_t is divided into partial sum processes of changes that are either positive (increasing) or negative (decreasing). The investigation modified the model of Olorunsola et al, (2017), their two variables (The actual increase in agricultural production and financing for the agricultural sector.) are modified as agricultural productivity i.e output and commercial bank credit financing to agricultural industry respectively, also two variables are added; Agricultural Credit Guarantee Scheme Fund and interest rate to provide a broader perspective and consider multiple factors that can influence agricultural sector's performance. Thus, functional model for this study is:

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AOP=F(CBCA, ACGSF, INT)
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(3)

Where AOP= agricultural productivity (output)

CBCA= Commercial Bank Credit to Agriculture

ACGSF= Agricultural Credit Guarantee Scheme Fund

INT= Real interest rate

And the econometric model is:

Impressive Journal of Management and Social Sciences ISSN: 3043-6311 Volume 1, Issue 1 March 2025 $lnAOP_t = \alpha_0 + \alpha_1 lnAOP_{t-1} + \alpha_2 lnOP_{t-1}$

$$AOP_{t} = \alpha_{0} + \alpha_{1}lnAOP_{t-1} + \alpha_{2}lnCBCA_{t\ t-1}^{+} + \alpha_{3}lnCBCA_{t\ t-1}^{-} + \alpha_{4}lnACGSF_{t\ t-1}^{+} + \alpha_{5}lnACGSF_{t\ t-1}^{-} + \alpha_{6}lnINT_{t\ t-1}^{+} + \alpha_{7}lnINT_{t\ t-1}^{-} + \sum_{i=1}^{p}\beta_{1}lnAOP_{t-i} + \sum_{j=0}^{p}\beta_{2}lnCBCA_{t\ t-i}^{+} + \sum_{j=0}^{p}\beta_{3}lnCBCA_{t\ t-i}^{-} + \sum_{j=0}^{p}\beta_{2}lnACGSF_{t\ t-i}^{+} + \sum_{j=0}^{p}\beta_{3}lnACGSF_{t\ t-i}^{-} + \sum_{j=0}^{p}\beta_{6}lnINT_{t\ t-i}^{+} + \sum_{j=0}^{p}\beta_{7}lnINT_{t\ t-i}^{-} + \varepsilon_{t}$$
(4)

Error correction (ECM) form of the model (3) is expressed as follows:

$$\Delta lnAOP_{t} = \alpha_{0} + \sum_{i=1}^{p} \beta_{1} \Delta lnAOP_{t-i} + \sum_{j=0}^{p} \beta_{2} \Delta lnCBCA^{+}_{t-i} + \sum_{j=0}^{p} \beta_{3} \Delta lnCBCA^{-}_{t-i}$$
$$+ \sum_{j=0}^{p} \beta_{4} \Delta lnACGSF^{+}_{t-i} + \sum_{j=0}^{p} \beta_{5} \Delta lnACGSF^{-}_{t-i} + \sum_{j=0}^{p} \beta_{6} \Delta lnINT^{+}_{t-i}$$
$$+ \sum_{j=0}^{p} \beta_{7} \Delta lnINT^{-}_{t-i} + \theta_{1}ECT_{t-1} + \varepsilon_{t} \quad (5)$$

Equation (4) represents the long-run model, whereas equation (5) corresponds to the short-run model, with agricultural output (AOP) serving as the outcome (dependent) variable. The variations in the Agricultural Credit Guarantee Scheme Fund (ACGSF), commercial bank financing to agriculture (CBCA), and lending (interest) rate (INT) are depicted through their respective positive (increase) and negative (decrease) partial sums. In this context, α and β denote the corresponding long- and short-run coefficients, while α_0 represents the constant term in the schematic. The error term is denoted by ε_t , and θ_1 in equation (5) which are the coefficients of the error correction term (ECT), it accounts for the adjustment process toward long-term equilibrium.

3.2 Estimation technique and procedure

This study utilizes time series econometric techniques to investigate the impact of commercial bank credit on Nigerian Agricultural output. Specifically, the nonlinear ARDL model is applied to provide a more precise understanding of the positive (increase) and negative (decrease) effects of commercial bank credit on agricultural output in the short-run and the long run. The Augmented Dickey-Fuller (ADF) unit root test is employed as a pre-estimation test to avoid spurious regression. Additionally, the ARDL bounds test of co-integration is employed to check the long-run equilibrium relationship between the dependent and independent variables.

Impressive Journal of Management and Social SciencesISSN: 3043-6311Volume 1, Issue 1March 2025**3.3** Data type and sources

The analysis uses yearly sequential data from the 2023 World Bank Progress Indicators (WDI) and CBN 2023 Statistical Bulletin. The real interest rate (INT), commercial bank loan to the agriculture (CBCA), the Agricultural Credit Guarantee Scheme Fund (ACGSF), and agricultural industry's GDP (used as a stand-in for agricultural output) are the variables for which statistics are gathered. The World Bank Development Indicators (2023) provides data on the agricultural gross domestic product (AOP) and the real interest rate (INT), while the CBN's Statistical Bulletin (2023) provides data on the Agricultural Credit Guarantee Scheme Fund (ACGSF) and commercial bank credit to agriculture (CBCA).

4. results and Analyses

This section presents and discusses the findings of the study, which are outlined below.

	AOP	CBCA	ACGSF	INT
Mean	1.351268	1.007788	4.316350	0.464665
Median	1.357706	0.996879	4.425391	3.666917
Maximum	1.567849	1.366267	4.859270	18.18000
Minimum	1.087781	0.623957	3.031812	-65.85715
Std. Dev.	0.088985	0.165893	0.480976	14.08439
Skewness	-0.609804	-0.202499	-1.456161	-2.752699
Kurtosis	4.739293	2.728123	4.339941	13.23403
Jarque-Bera	7.897017	0.416396	17.98486	236.3282
Probability	0.019283	0.812046	0.000124	0.000000
Sum	56.75325	42.32711	181.2867	19.51593
Sum Sq. Dev.	0.324650	1.128335	9.484843	8133.171
Observations	42	42	42	42

Table 1. Result of descript	ive statistics
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Source: Eviews 9 output

The descriptive statistics are shown for each of the study variables in Table 1. The result indicates that the mean values for all variables during the period from 1981 to 2022 are positive and relatively small. Additionally, the standard deviations for all variables are low, except for the interest rate, suggesting that the estimated values for all variables, apart from the interest rate, closely align with their true values. Furthermore, the data varies between minimum and maximum values of 1.088 and 1.568 for AOP. The mean value for the Agricultural Credit Guarantee Scheme Fund (ACGSF) is 4.3163, with a minimum of 3.0318 and a maximum of 4.859. The result also reveals that all variables exhibit negative skewness. The estimated kurtosis values for AOP, ACGSF, and CBCA, except for the interest rate, fall within the permissible limits of +3 to -3, indicating that the data does not suffer from leptokurtosis.

Moreover, the probability values of the Jarque-Bera (JB) normality assessment for all variables, except CBCA, are significant at the 5% level, suggesting that all variables, except CBCA, deviate from normal distribution.

Impressive Journal of Management and Social Sciences ISSN: 3043-6311 Volume 1, Issue 1 March 2025 Table 2. Result of ADF unit root test

Variables	ADF at level	ADF at 1 st difference	Order of integration
AOP	-2.8848	-6.8598	I (1)
CBCA	-3.2087	-6.4182	I (1)
ACGSF	-3.6117		I (0)
INT	-7.6233		I (0)
ADF Critical Value (%) = -3.52			

Source: Eviews 9 output

Table 2 shows the result of unit root tests, with the use of the Augmented Dickey Fuller (ADF) stationary test, variables were examined for stationarity with intercept and trend. This is because intercept and trend were found to be significant when both were included. As shown in the table, the results reveal that ACGSF, and INT have no unit root at level which means they are stationary at level, because the absolute values of the ADF test for the variables are greater than their critical values at 5% level of significance, ie (-3.6117) and (-7.6233) > (-3.52) which implies that the data is stationary without transformation [I(0)]. However, the variables AOP and CBCA became stationary at 1st difference with calculated ADF of (-6.8598) and (-6.4182) greater than the ADF critical value (-3.52), hence AOP and CBCA are integrated of order one [I (1)]. The different or mixed order of integration of the variables provides a vital justification for the adoption of the NARDL model in this study.

	8		
Test Statistics	Values	К	
F-statistic	8.7308	6	
Significance 10%	10 Bound 2.12	11 Bound 3.23	
5% 2.5%	2.45 2.75	3.61 3.99	
1%	3.15	4.43	

Table 4. ARDI	bounds	test of	cointe	gration	result
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Eviews 9 output

Table 4 demonstrates the result of the ARDL Bounds Test of co-integration, indicating that the F-statistic value of 8.7308 exceeds the upper bound (I1) at the 5% significance level. This confirms the presence of a stable long-term link between the study variables, suggesting that the response variables maintain a long-term relationship with the outcome (dependent) variable.

Table 5. Result of long run NARDL model

8				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
CBCA POS	0.629471	0.158612	3.968630	0.0012
CBCA_NEG	0.631532	0.074252	8.505232	0.0000
ACGSF_POS	-0.196807	0.048958	-4.019881	0.0011
ACGSF_NEG	-0.359047	0.108488	-3.309544	0.0048
INT_POS	-0.001186	0.001453	-0.816447	0.4270
INT_NEG	-0.003704	0.001614	-2.294706	0.0366

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С	1.083487	0.104210	10.397121	0.0000
R-squared	0.956896	Mean dependent var		1.370964
Adjusted R-squared	0.893677	S.D. dependent var		0.064313
S.E. of regression	0.020971	Akaike info criterion		-4.610404
Sum squared resid	0.006596	Schwarz criterion		-3.619234
Log likelihood	110.5977	Hannan-Quinn criter.		-4.257754
F-statistic	15.13617	Durbin-Watson stat		2.576483
Prob(F-statistic)	0.000001			

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Source: Eviews 9 output

Table 6. Result of short run NARDL model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CBCA POS)	0.587127	0.124545	4.714172	0.0003
D(CBCA POS(-1))	0.366726	0.129545	2.830878	0.0126
D(CBCA POS(-2))	-0.145125	0.100309	-1.446791	0.1685
D(CBCA NEG)	0.091012	0.065106	1.397911	0.1825
D(CBCA_NEG(-1))	-0.225152	0.077847	-2.892242	0.0112
D(CBCA_NEG(-2))	-0.131763	0.102420	-1.286492	0.2178
D(ACGSF_POS)	-0.099512	0.089512	-1.111719	0.2838
D(ACGSF POS(-1))	-0.025177	0.099380	-0.253338	0.8034
D(ACGSF POS(-2))	0.361651	0.082194	4.399977	0.0005
D(ACGSF NEG)	0.133979	0.123588	1.084076	0.2954
D(ACGSF NEG(-1))	0.223518	0.137637	1.623969	0.1252
D(INT POS)	0.001736	0.000990	1.753593	0.0999
aD(INT POS(-1))	0.002249	0.000903	2.489408	0.0250
D(INT POS(-2))	0.002401	0.000917	2.619207	0.0193
D(INT NEG)	-0.001787	0.001353	-1.320963	0.2063
ECM(-1)	-0.848464	0.110381	-7.686670	0.0000
R-squared	0.956896	Mean dependent var		1.370964
Adjusted R-squared	0.893677	S.D. dependent var		0.064313
S.E. of regression	0.020971	Akaike info criterion		-4.610404
Sum squared resid	0.006596	Schwarz criterion		-3.619234
Log likelihood	110.5977	Hannan-Quinn criter.		-4.257754
F-statistic	15.13617	Durbin-Watson stat		2.576483
Prob(F-statistic)	0.000001			

Source: Eviews 9 output

Table 6 is the result of short run NARDL model; the result signifies that all the variables apart from CBCA positive have no significant impact on the dependent variable. CBCA positive have a p-value of 0.003 which is significant and a proportionality factor (coefficient) of 0.587 which implies that one percent increase in CBCA will increase AOP by about 58.7 percent this conforms with financial intermediation theory which states that commercial banks contribute a crucial role in increasing agro-industry output. The error correction coefficient ECM (-1) lies between 0 and 1, has a negative sign and also has a coefficient of 0.848 but correctly signed and statistically significant. This implies that about 84.8% of disequilibrium from previous years' shocks was corrected in the long-run within a preceding year.

Table 7. Result of Breusch-Godfrey Serial Correlation LM Test

F-statistic	3.639092	Prob. F(1,19)	0.0717
Obs*R-squared	6.269006	Prob. Chi-Square(1)	0.0123

Source: Eviews 9 output

Table 8. Result of Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.805760	Prob. F(18,20)	0.6753
Obs*R-squared	16.39372	Prob. Chi-Square(18)	0.5651
Scaled explained SS	3.702044	Prob. Chi-Square(18)	0.9999
Scaled explained SS	3.702044	Prob. Chi-Square(18)	0.9999

Source: Eviews 9 output

In an attempt to confirm the validity and certainty of outcomes reported above. First, the study used Breusch-Godfrey Serial Correlation LM Test to check the residuals for serial correlation. The tests suggest that the disturbance terms lacks serial correlation since the p-value (0.0717) is greater than 5% level as shown in table 7. In addition, Breusch-Pagan-Godfrey test was employed to ascertain whether the error terms are homoscedastic. As shown in table 8, the p-value of (0.6713) is higher than 5% level. Therefore, the errors terms are homoscedastic.



Figure 2. Normality Test Source: Eviews 9 output

The figure 2 result shows that the model is normally distributed because the Jacque-Bera probability value (0.69) is more than the 5% critical value.



Figure 3. Stability Test, Source: Eviews 9 output

4.2 **Results of the stability tests**

An attempt was made to check if the parameters and estimated model are stable over time. The Cumulative Sum (CUSUM) and Cumulative Sum Square (CUSUMSQ) were used. The model and long-term parameters are stable, as evidenced by the Cumulative Sum of Recursive Residuals test plot, which stays under the 5% level of significance.

5. Conclusions and Recommendations

The NARDL approach is used in this study to scutinize how Nigerian agricultural output is influenced by commercial bank borrowing. The findings of the cointegration bounds test suggest the existence of a long-term correlation between the independent and dependent variables. Commercial bank credit (CBCA) has a favourable and considerable effect on agricultural production (AOP) throughout the long-run and short term, that is the findings from the approximated NARDL model. Whereas the interest rate (INT) has no discernible effect, the Agricultural Credit Guarantee Scheme Fund (ACGSF) has a detrimental effect on agricultural output. Nigerian agricultural output is positively impacted by commercial bank credit, according to the study's findings.

The study prescribes that authorities should implement strategies that expand the accessibility of commercial bank credit for farmers for instance; policy makers should implement regulations that encourage banks to lend to the agricultural sector, such as lower reserve requirements for agricultural loans or incentives for banks that meet certain lending targets. Commercial banks should establish or expand local branches in rural areas to improve access to banking services and facilitate better communication with farmers and also evaluate the farmers before giving them loans to avoid diversion and mismanagement of the loans. The agricultural credit guarantee scheme fund should be reevaluated and strengthened to make it more effective by increasing awareness and outreach; enhance education and outreach programs to inform farmers about the scheme, its benefits and application processes. This education would help them understand how to access credit, manage loans effectively, and make informed financial decisions that can contribute to increased agricultural output.

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