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The Impact of Petroleum Pricing on Manufacturing Sector Performance in Nigeria

Celina Chinyere Udude and Nnachi D. N.

Department of Economics, Ebonyi State University Abakaliki, Nigeria.

ABSTRACT

This study was designed to empirically verify and discussed the impact of petroleum pricing on manufacturing sector performance in Nigeria. The study made use of data on manufacturing sector contribution to GDP tagged manufacturing sector output (MSO) as the dependent variable while oil price (OILP) and exchange rate (EXC) were the independent variables. The study first and foremost conducted a test of stationarity using Augmented Dickey-Fuller (ADF) technique and the result showed that all the variables are stationary after first difference. Johansen co-integration test was used to test for long run relationship between the specified model and the result showed two co-integrating vectors. Vector error correction mechanism was use was used to determine the speed of adjustment from short run to long run equilibrium, and the estimation shows a significant speed of adjustment approximately 50 percent annually. Findings from the long run estimate of the VECM result show that oil price (OILP) was found to be significant in impacting on manufacturing sector output and it equally possessed the correct sign. Hence, the relationship conforms to a priori expectations of a positive relationship between oil price and manufacturing sector output. This study showed that any activity or activities in the oil sector which directly or indirectly increases the prices of crude oil in the international community will ultimately push manufacturing sector's growth of Nigeria up.

Keywords: Petroleum, Pricing, Manufacturing sector and Nigeria

INTRODUCTION

Generally, oil is referred to as the engine of a modern economy. This is because of its immense usefulness in every modern economy today. Oil is the basic material for a wide range of products such as lubricants, asphalt, tars, tires, solvents, plastic, foams, bubble gums, deodorants, crayons, etc. Bacon and Kojima (2008)[1], asserts that the amount of oil derived products an economy consumes depends on numerous factors, such as the level of gross domestic product (GDP), the structure of the economy's industrial sector, the availability of choices among fuels that permit substitution, and the level of technological progress. These also jointly depict the stage of economic development on which a country operates. It is important to note that the use of crude oil after it is extracted from the ground is limited; the situation is absolutely turned around, once it is refined and made

available. This is because oil products, especially fuels are very important for use in different sectors of an economy, such as the transportation, construction, industrial and power-producing sectors Ojapinwa and Ejumedi (2014)[2]. The household use of oil is also overwhelmingly significant for low-income countries, where the power-producing sector is still in an immature phase.

Until the early 70's, the mainstay of Nigeria economy was agriculture. Then the country was famed for her proficiency inthe production of groundnuts, hence the Kano groundnut pyramids, oil palm and the faster part of cocoa in the westernpart of the country. The discovery of oil in the country in commercial quantities brought about radical changes in theeconomy of the nation [3]. All other sectors seemed to have gone into oblivion and indeed were abandoned thereby makingthe country to be totally dependent on oil for her foreign exchange earnings; not agriculture any more. All effort madesince then to diversify the economy of the country have come to naught. Expectedly the narrowing of the economy to amonolithic export commodity has its attendant drawback as oil by virtue of its importance to the economics of nations hasinevitably become a subject of political manipulation.

The growth of petroleum industry in Nigeria appears to have brought dramatic changes in the structure of the economy since 1970. In less than a decade, agricultures share of gross domestic product (GDP) declined from roughly one-half to less than 30% and its erstwhile preeminence as generators of state revenue and foreign all but vanished. Crude oil become one of the world's most strategic natural resources required as a crucial input in contemporary economic activities. A versatile, non-renewable natural resource, crude oil is a highly demanded commodity in both rich and poor countries, providing about 50% of the global energy requirements Adagunodo (2014)[4]. Crude oil consists of a mixture of many substances, mainly hydrocarbons with other elements, including sulphur, nitrogen and oxygen. Oil deposits are distributed around the world, existing in large quantities in various continents.Huge production takes place in Alaska, Texas, the Gulf of Mexico, Venezuela and Brazil in SouthAmerica. The North Sea produces crude oil, as well as the Arabian Peninsula; there are proven oil reserves that make the region the world's most predominant producer of the commodity. In Africa, huge oil reserves also exist in the Niger Delta, as well as in the Gulf of Guinea, where Nigeria, Cameroon and Angola are major producers of the commodity [4 and 2]. In view of the strategic nature of the Petroleum Industry as the predominant source of global energy, it has become a prime source of revenue generation to many countries, particularly in the developing world. In this respect, the organization of Petroleum Exporting Countries (OPEC), which comprises eleven

countries from the developing world, has played a leading role in the global oil industry, promoting market stability and ensuring a steady flow of revenue accruing to member countries of the cartel Inyiama and Okpe (2015)[5]. The petroleum industry has assumed a primate positionin the Nigerian economy accounting for 80% of thenation's GDP in the recent times Lukeman(2003)[6]. Theindustry has also pushed Nigeria to the forefront of theglobal industry, making the country the 6th largest exportingand 7th largest producer of oil in the world. Revenue from petroleum sector comprising export earning, petroleumprofits tax and royalties has grown steadily over theyears. Between 1970 and 1998, earning from oil rosefrom 75.3% to a peak of 84.1% of the total federally generated revenue Onwiodukit and Adenuga(1998)[7]. Also, IMF estimates showed, Nigeria's earnings fromcrude oil increases from US $8,500 billion in 1989, and to$10.600 billion in 1990. By 1995, these earnings haddeclined to $7,001 billion and declining further to $5.276billion in 1998. However, crude oil prices have increasedsteadily in the new millenium following the implementation of strict production quotas imposed by OPEC onmember-countries to stem the flow of excess crude oil in the global market place [8].

Rising oil prices make large revenue sources for the government of Nigeria. When oil prices go up, experience suggests that a high price for oil is not usually sustainable and will subsequently fall in the long run Arinze(2011)[9]. When oil prices do fall, governments usually find that the level of expenditure they have attained is not sustainable. At such times, the will be a cutback in expenditure, as the government tries to reduce its spending so that it does not go beyond its revenue. At such times there will be an upward resistance to wage reductions, primarily because the population feels the entitlement to the oil revenue; this will mean a reduction in manpower and production as well.Consequently, the fall in oil prices will lead to increasing unemployment in society and the once rising economic growth will eventually decline; sometimes beyond its' original value.As such, though the oil price increase brought with it high export earnings and revenue for the FGN, the depressive effects of the high oil prices to the economy of the importing countries ultimately outweighs its economic benefits to oil exporting countries like Nigeria [9].

As a result of the dominant role played by the oil sectorin the nation's economy, economic performance hasbeen linked to oil prices in the past three decades. Thisrather unenviable development has inspired the currentadministration to diversify the nation's economy awayfrom its dependence on crude oil by harnessing naturalgas, bitumen and other solid minerals. In year 2000, thanks to the oil windfall, the growth rate of oil GDP improvedby 4.8 % compared with the previous year. Theunexpected boom in the international market helped topropel the growth performance of the entire economy [10].

RESEARCH QUESTIONS

The following lead questions are provided for which this study is tailored towards finding their answers:

- To what extent does petroleum pricing affectoutput of manufacturing sector in Nigeria?
- Is there a long-run relationship betweenpetroleum pricing and manufacturing sector output in Nigeria?
- Is there any significant causal relationship between output of the manufacturing sector and petroleum pricing in Nigeria.

OBJECTIVES OF THE STUDY

This study has the central objective of investigating the pattern of industrial (manufacturing) output responses to petroleum price shocks in Nigeria. Specifically, the following objectives would be achieved:

- To investigate the impact of petroleum pricing on manufacturing output in Nigeria.
- To determine if there is long-run relationship between petroleum pricingand manufacturing output in Nigeria.
- To empirically determine whether there is significant causal relationship between output of the manufacturing sector and petroleum pricing in Nigeria.

STATEMENT OF HYPOTHESES

The following hypotheses shall be tested in the course of the study:

HYPOTHESIS 1

H_o: petroleum pricing has no significant impact on manufacturing output in Nigerian.

H_1: petroleum pricinghas significant impact on manufacturing output in Nigerian.

HYPOTHESIS 2

H_o: There is no long run relationship between petroleum pricingand manufacturing output in Nigeria.

H_1: There is long run relationship between petroleum pricingand manufacturing output in Nigeria.

HYPOTHESIS 3

H_o: There is no significant causal relationship between output of the Nigerian manufacturing sector and petroleum pricing in Nigeria.

H_1: There is significant causal relationship between output of the Nigerian manufacturing sector and petroleum pricing in Nigeria.

RESEARCH METHODOLOGY

RESEARCH DESIGN

The study used multiple regression analysis in the form of Ordinary Least Square (OLS) method to test the effect of changes in crude oil selling prices, export, and production and foreign exchange rates in Nigeria. The multiple regression analysis shows the dependent variable as a function of a multiple independent variables in line with the aim of the study. The methodology of the study is majorly the ex - post facto research design. Ex-post facto research is systematic empirical inquiry in which the scientist does not have direct control of independent variables because their manifestations have already occurred or because they are inherently not manipulated. This research work embraces the use of secondary time series data in examining the macroeconomic effect of petroleum pricing on manufacturing output performance in Nigeria.This type of research is based on a scientific and analytical examination of dependent and independent variables. With respect to the master plan for executing the research work, how petroleum pricing affect manufacturing output performance. The measurement approach was taken care of with the aid of advanced econometric estimates and some statistical test like co-integration, error correction mechanism, etc. are utilized.The estimation covered the period between 1981 and 2014 while data collected are analysed with the aid of E-views 9.0 edition.

ESTIMATION PROCEDURE

Unit Root Test: When we deal with a time series data the first and foremoststep is to check whether the underlying time series is stationary or not. If we want to apply the appropriate technique on the underlying time series, then we must be aware of the order of integration of underlying time series. Stationarity is important in the context that if we apply OLS to a non-stationary time series it may result in spurious regression. To check for unit root in

the data, Augmented Dickey-Fuller (ADF) test is used. ADFtest has the following regression equation

$$\Delta Y_t = \beta_1 + \beta_{2t} + \delta Y_{t-1} + i\ \Delta Y_{t-1} + \varepsilon t$$

Where εt is white noise error, $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$ where Δ represents first difference, q represents number of lagged difference, These lags are included to make error term in equation (5.3) white noise.β_1 is intercept and t represents time trend. In considering the levels the data could be said to be integrated, Augmented Dickey fuller (ADF) test statistics shall be compared with the critical values at 5% level of significance. A situation whereby the ADF test statistics is greater than the critical values with consideration of the absolute values, the data at the tested order will be said to be stationary. Augmented Dickey-Fuller test relies on rejecting a null hypothesis of unit root (the series are non-stationary) in favor of the alternative hypotheses of stationarity.

Co integration Test: If we regress two non-stationary time series on each other it may result in a spurious regression. If underlying time aeries is non-stationary then OLS is not a good option for estimations. OLS is an appropriate method if all the variables are I (0) i.e. stationary at level otherwise one should check for the possible co-integration relationship between the underlying non-stationary series. Co integration is based on the fact that data contains unit root but are integrated of order 1, meaning that they became stationary after first difference. This will necessitate that the residuals be tested for unit root and if the residuals turn out to be I (0) then we can say that their linear combination is stationary and both the variables are co integrated. A test for co-integration can be regarded as a pretest to avoid spurious regression. There are several methods to check co-integration relationship between the variables like Engel-Granger (EG) or Augmented Engel-Granger (AEG). However, for this study Johansen co integration method is selected. Johansen maximum likelihood test allows testing for more than one co integration relations. Johansen test allows estimation of the entire possible long run relations. It uses two likelihood tests for determining the co integration relations: The Trace test and The Maximum Eigenvalue test. Under the trace statistics, we compare the given t-statistics with its critical value at 5 % level of significance. If the T-statistics is greater than the critical value, we reject the null hypothesis but if otherwise, we accept the null hypothesis.

Vector Error Correction Mechanism (VECM): The next step is to estimate the equation above using ordinary least square (OLS) technique. Having ascertained whether or not co-integration exist, then the next step requires the construction of error correction model to model dynamics relationship. The purpose of the error correction model is to indicate the

speed of adjustment from the short-run equilibrium to the long-run equilibrium state. If co-integration is accepted, it suggests that the model is best specified in the first difference of its variables with one period lag of the residual {ECM (-1)} as an additional regressor. However, the ECM strategy provides an answer to the problem of spurious correlations. If MSO and OILP variables are co- integrated the corresponding error correction representation must be included in the system so that by so doing, one can avoid mis-specification and omission of the important constraints, but on the other hand, if the variables are not integrated of the same order or are not cointergrated, the VECM cannot be applied either Wakeford (2006)[11], The greater the co-efficient of the parameter, the higher the speed of adjustment of the model from short-run to long-run equilibrium.

The granger Causality test: Pairwise Granger causality test is a method of investigating whether x causes y and also to see the extent which current y can be explained by past values of y and then to see whether by including lagged values of Y we can improve the explanation of X. X is said to be Granger-caused by variable X if A helps in the prediction of Y, or if the coefficients on the lagged A's are statistically significant Valadkhani and Mitchell William, (2001)[12]. The main idea of causality is quite simple, if X causes Y, then changes in X should precede changes in Y. This characteristic makes causality test an important one in the test of endogeniety. If X causes Y; it implies that X shall help to predict Y. This means that in a regression of Y against past values of Y, the addition of past values of X as explanatory variables should contribute significantly to the explanatory power of the regression. To test the null hypothesis of "X does not cause Y", we regress Y against its lagged values and the lagged values of X (unrestricted regression) and then regress Y only against lagged value of Y (the restricted regression).

DATA DISCUSSION

The variables employed in this study are discussed below:

Manufacturing Sector Output (MSO): This is the monetary value of all the manufactured finishedgoods and services produced within a country's borders in a specific time period. It is a measure of the productivity of the manufacturing sector of the economy. The manufacturing sector output constitutes a significant portion of the industrial sector which includes; manufacturing, mining, and utilities. Although these sectors contribute only a small portion of gross domestic product (GDP), it is a leading indicator of economic health as manufacturing output reacts quickly to ups and downs in the business cycle.

Crude Oil Price (OILP): Crude oil prices measure the spot price of various barrels of oil, most commonly either the West Texas Intermediate or the Brent Blend. The OPEC basket price is used in the course of this work.

Exchange Rate (EXR): Exchange rate is the price of one country's currency expressed in another country's currency. There are several types of exchange rates depending on: the regulation: fixed, "floating" (depending on demand and supply) and flexible exchange rate (hovering inside a certain corridor). This study makes use of naira /dollar exchange rate for the period under consideration.

DATA SOURCE

The empirical analysis will make use of time series data spanning across 1981-2014. Data used for the analysis is sourced mainly from Central Bank of Nigeria (CBN) statistical bulletins and OPEC bulletin.

PRESENTATION AND ANALYSIS OF RESULTS

PRESENTATION OF RESULT

The attempt to study the impact of petroleum pricing on manufacturing sector output inthe Nigerian economy led the researcher to gather data and to subject same to series of econometric tests including unit root test using Augmented Dickey-Fuller (ADF) and Johansencointegrationwhile vector error correction mechanism was used to estimate the coefficients of the parameters specified in chapter three. The test results and their discussions are presented below.

UNIT ROOT TEST

The Augmented Dickey-Fuller (ADF) test was employed to test for the existence of unit roots in the data. The test results are presented below:

Table 1: Augmented Dickey Fuller Unit RootTest

Trend and Intercept (Series at Level)

Series	ADF Test Statistic	5% critical values	Order	Lag	Remarks
LMSO	-1.732605	-3.552973	I(0)	1	**Not Stationary**
LOILP	-2.163726	-3.552973	I(0)	1	**Not Stationary**
EXR	**-2.145052**	**-3.552973**	**I(0)**	**1**	**Not Stationary**

Sources: *Researchers' compilation from E-view (version 7.0)*

Table 2: Augmented Dickey Fuller Unit RootTest

Trend and Intercept (Series at 1st Diff.)

Series	ADF Test Statistic	5% critical values	Order	Lag	Remarks
LMSO	-6.133145	-3.557759	I(1)	1	**Stationary**
LOILP	-6.546826	-3.557759	I(1)	1	**Stationary**
EXR	**-5.316862**	**-3.557759**	**I(1)**	**1**	**Stationary**

Sources: *Researchers' compilation from E-view (version 7.0)*

From the Augmented Dickey-Fuller unit root results presented above both at level and first difference, the result shows that none of the variables employed for the statistical analysis was stationary at level. Hence they all contain unit roots. This is because their ADF test statistics were all less than their critical values at five percent level of significance. This necessitated first differencing of which its result is summarized in the second table. The result presented in the second table above shows that all the variables became stationary after first differencing since their ADF test statistics were all greater than their critical values. This means that the variables are integrated of order, one. Thus, the series are stationary.

CO INTEGRATION TEST

This was used to test for the presence of long run relationship between the variables considered. For this purpose of this study, the Johansen co integration technique was adopted. Two or more variables are therefore said to be co-integrated if they have a long-term, or long run equilibrium, relationship between them. The summary result is presented in table 3 below:

Table 3: Johansen co integration test for the series; LMSO, LOILP and EXR

Hypothesized		Trace	0.05	
No. of CE(s)	Eigen value	Statistic	Critical Value	Prob.**
None *	0.511942	40.11842	29.79707	0.0023
At most 1 *	0.436589	17.88145	15.49471	0.0214
At most 2	0.003070	0.095308	3.841466	0.7575

Sources: *Researchers' compilation from E-view (version 7.0)*

From the result above, the Johansen co integration indicated two co integrating equations. This is because trace statistics is greater than the critical values in two of the hypothesized equations as can be seen from the table while the critical value is greater than the trace statistics in only one of the hypothesized equation. Similarly, from the result, the Eigenvalues are significantly greater than zero in two of the hypothesized equations as indicated by their p-values. In other words, the null hypothesis of no co integration among the variables is rejected in at least two equations. The test result shows the existence of a long-run equilibrium relationship with two co integrating equations at 5% significance level. Hence there is a long-run equilibrium relationship between petroleum pricing and manufacturing sector output in Nigeria.

VECTOR ERROR CORRECTION MECHANISM (ECM)

Having differenced the variables used for this analysis before stationary was induced; it implies that long run relationship has been lost. In order to capture the short run fluctuation and to estimate the parameters of economic relationship existing among the chosen variables, **VECM** is therefore meant to tie the short-run dynamics of the co integrating equations to their long-run static dispositions. Below is the VECM result for the given data.

Table 4: VECM Estimate

CointegratingEq:	CointEq1	
MSO(-1)	1.000000	
OILP(-1)	1482.281	
	(237.755)	
EXR(-1)	-85.63684	
	(104.782)	
C	-52178.23	
Error Correction:	D(MSO)	P-Value
CointEq1	-0.502551	0.0000
D(MSO(-1))	0.171929	0.1158
D(OILP(-1))	-37.71537	0.0000
D(EXR(-1))	11.39761	0.0048
C	260.4723	0.0001

R-squared	0.832199	
Adj. R-squared	0.807340	
F-statistic	33.47621	

Sources: *Researchers' compilation from E-view (version 7.0)*

From the VECM result presented above, the estimated coefficient of ECM (-1) equals -0.502551. The coefficient reveals that the speed of adjustment between the short-run and long-run realities of the co integrating equations is 50 percent. This entails that the model corrects its previous period disequilibrium at the speed of 51 percent annually. Complementarily, its p-value of 0.0000 shows that the ECM (-1) coefficient is statistically significant since it is less than 0.05. The sign and significant status conforms to thegranger representative theorem which holds that a negative and statistically significant error correction coefficient is a necessary condition for the variables to be co integrated.

The coefficient of determination (R^2) has a value of 0.832199. This shows that about 83.2 percent of the change in manufacturing sector output is attributable to changes in petroleum pricing while about 16.8 percent of the changes is attributable to the influence of other variables not included in the regression model.

The value for F-statistics value of 33.47621 indicates that there is significant joint influence of the explanatory variables on the dependent variable.

DIAGNOSTIC TESTS

The validity of the estimated vector error correction result was tested against serial correlation using Breusch-Godfrey test and the result is presented below.

VEC Residual Serial Correlation LM Tests		
Lags	LM-Stat	Prob
1	7.252901	0.6108

Sources: *Researchers' compilation from E-view (version 7.0)*

From the LM test above, the LM statistics is approximately 7.252901and its P-value is 0.6108while the level of significance 5%. Since The P-value is greater than 0.05 and in accordance with Breuch-Goddfrey test, we accept the null hypothesis of no autocorrelation and conclude that the error terms are not serially correlated.

TEST OF HYPOTHESES

HYPOTHESIS ONE

H_o: H_o: petroleum pricing has no significant impact on manufacturing output in Nigerian.

Following from the estimated VECM result, it is observed that petroleum pricing has the expected positive sign. Hence, increase in petroleum pricing has a positive impact on manufacturing sectors productivity in Nigeria. With a statistically significant coefficient estimate, we therefore reject the null hypothesis of no significance and accept the alternate hypothesis and conclude that petroleum pricing has statistically significant impact on manufacturing sector in Nigeria.

HYPOTHESIS TWO

H_o: There is no long run relationship between petroleum pricingand manufacturing sector output in Nigeria.

To test the hypothesis stated above, we consider the result of the Johansen co integration test estimated earlier on. From the result of the co integration test analyzed earlier, both trace statistics and Max Eigen value indicate that there is presence of long run relationship with two co integrating equations. This shows that there is presence of long run relationship among the variables employed for the regression analysis and specifically between petroleum pricing and manufacturing sector output. Hence, we reject the null hypothesis and accept the alternate hypothesis and conclude that there is presence of long run relationship between petroleum pricing and manufacturing sector output in Nigeria.

HYPOTHESIS THREE

H_o: There is no significant causal relationship between output of the Nigerian manufacturing sector and petroleum pricing in Nigeria.

This hypothesis was tested with the aid of pair wise granger causality test and the summary result is presented in table 5 below:

Table 5: Granger Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.
OILP does not Granger Cause MSO	32	27.8576	3.E-07
MSO does not Granger Cause OILP		3.78815	0.0355

Sources: *Researchers' compilation from E-view (version 7.0)*

From table 5 above, the null hypotheses that OILP does not Granger Cause MSO is accepted since its p-value of 3.E-07is greater than 0.05. On the contrary, the null hypothesis that MSO does not Granger Cause OILP isrejectedsince its p-value of 0.0355is less than 0.05. This confirms evidence of a uni-directional causality running from manufacturing sector's output to oil pricing.

IMPLICATION OF THE STUDY

From the estimated VECM output, the coefficient of OILP is positive. This entails that an increase in crude oil price will bring about an increase in the output of the manufacturing sector in Nigeria. With a standard error value of 237.755, the estimated coefficient of LOILP is statistically significant given that the standard error is smaller the value of the coefficient of LOILP (1482.281) divided by two. Similarly, the coefficient of EXR is negative which implies that an increase in the dollar worth of a naira will bring about a decrease in manufacturing productivity. From the analysis above, oil price (OILP) was found to be significant in impacting on manufacturing sector output and it equally possessed the correct sign. Hence, the relationship conforms to a priori expectations of a positive relationship between oil price and manufacturing sector output. The Implication of this is that any activity or activities in the oil sector which directly or indirectly increases the prices of crude oil in the international community will ultimately push manufacturing sector's growth of Nigeria up. The reason is not far-fetched since the Nigerian economy depends so much on crude oil revenues to implement most of her developmental programmes. Hence, its output via oil revenue is generally agreed to be a catalyst to economic growth via manufacturing sector's activities.

SUMMARY

Having estimated, analyzed and discussed the results in the preceding chapters, using the Augmented Dickey-Fuller (ADF) test, Johansen Co integration, Vector error correction mechanism (VECM), and Granger Causality test, these methods surface the following information below:

- The results of the unit root test conducted on the variables using Augmented Dickey Fuller test shows that at 5 percent level of significance, all the variables contains unit root but are integrated of order one. This is an indication that all variables used for estimation of specified equations at are fit for intended purposes.
- In testing for the long run relationship using the Johansen co integration approach, the result shows that the variables are co integrated with two co integrating

equation. Hence, there exists a long-run equilibrium relationship between between petroleum pricing and manufacturing sector output in Nigeria.

- To determine the short run impact of petroleum prices on manufacturing sector output in Nigeria, the study made use of vector error correction (VECM).The results from the VECM estimation show that oil price (OILP) was found to be significant in impacting on manufacturing sector output and it equally possessed the correct sign. Hence, the relationship conforms to a priori expectations of a positive relationship between oil price and manufacturing sector output.
- The test of causality conducted using Pairwise Granger causality test indicates that there is evidence of uni-directional causality running from manufacturing sector's output to oil pricing.

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