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Trade Openness, Economic Growth, and Environmental Concern In Nigeria

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Abstract
This study is an attempt to analyze the relationship between trade openness, economic growth, and environmental pollution in Nigeria. The study introduces urbanization and ruralization as measures of the growth of urban and rural sectors to analyze their contributions to pollution in the country. Using Vector Error Correction Mechanism (VECM) and co-integration techniques, the result confirms the existence of the Environmental Kuznets curve in Nigeria. Also, there is a positive relationship between ruralization and environmental pollution both in the short and long run. However, there is a negative relationship between urbanization and environmental pollution in the long run, but positive in the short run. The study concludes with the recommendation that there is a need for policy makers to enact and enforce environmental laws that are aimed at regulating various sources of environmental pollution in the country.
Key Words: EKC, Trade Openness, Urbanization, Ruralization, VECM

1.1 MOTIVATION

The increasing globalization of the world today has made it impossible for countries to be totally independent. Countries trade with one another more intensively and frequently today than it was in the past. One important drivers of globalization is trade openness (Obadan, 2004). Trade openness helps to stimulate trade, and consequently, economic growth. It consists of policies aimed at opening up the economy to foreign investment and lowering trade barriers in the form of tariff reduction, and removal of restriction to trade. To developing countries, it is a great opportunity to earn foreign exchange through exports; this is needed for the purchase of imported capital goods and raw materials necessary for rapid growth. However, while trade may stimulate growth, it may simultaneously increase environmental pollution. Through trade liberalization, increased industrialization may lead to increased use of energy. This will ultimately result in environmental pollution. Also, increased industrialization could lead to environmental degradation through excessive use of environmental resources. Through trade openness, dumping of harmful goods is also possible.

The pollution effect of trade openness is more noticeable in developing countries where there are little or no environmental laws. Trade liberalization will increase industrial pollution in such countries through the displacement of dirty industries from developed countries where stricter environmental regulations are in place. This is called Pollution Heaven Hypothesis.

The relationship between environmental quality and measures of economic activities such as economic growth has long been investigated in the literature in what is known as Environmental Kuznets Curve (EKC). According to the EKC, there is an inverted U-shaped relationship between economic growth and pollution levels (Dinda, 2004). This means that environmental quality first deteriorates with increase in economic activities but to a certain threshold, and then improves.

Trade policy in Nigeria has witnessed different policy swings from high protectionism in the first few decades after independence to its current more liberal stance (Adenikinju, 2005). The country embarked on different forms of reforms like granting tax incentives, reducing border tariffs and import duties, partial abolition of import license scheme, reviewing trade regulations etc.(Oyejide, 2003). These were to encourage increased production of domestic firms, and encourage export. The export performance of the country has been nothing to write home about, with the oil sector contributing about 90% of the total export (Abogan, Akinola, and Baruwa, 2014; Onodugo, Ikpe, and Anowor, 2013).The over-dependence on the oil sector has led to the neglect of other sectors. As a result, the country's growth performance is susceptible to volatility in the world oil market. Achieving a sustainable growth that is not dependent on oil is therefore imperative to government of the country (Adenikinju, 2002). The structural adjustment program(SAP) which was adopted to achieve the sustainable growth helped in opening up the economy to foreign investors, and led to increased economic activities (Adenikinju and Olofin, 2002).This brings with it increased use of energy, and consequently, increased environmental problems. Environmental pollution results from the use of fossil fuels for power generation, and as inputs for industrial sectors' production. Various studies have examined the trade-growth relationship in Nigeria. However, the study on the effect of trade openness on environmental pollution is still relatively scarce in the country. The few studies available have focused on panel analysis. There are no country-specific studies that have examined the issue. This study fills this gap by examining the effect of trade openness and economic growth on environmental quality in Nigeria. The rest of the paper is organized in sections as follows: The next section reviews some related previous studies; In section three, the data sources and methodology will be

discussed; In section four, the results will be presented and discussed. Section five will conclude with some recommendations

2.0 LITERATURE REVIEW

Various studies have examined the relationship between trade openness and economic growth in the literatures. In a study on the impact of trade flows on economic growth in Brazilian states, Daumal and Ozyurt (2011) used the dynamic regression with a system of GMM estimator to show that trade openness is more beneficial to states with a high level of initial per capita income. Also, Shan (2002) studied the relationship between FDI and economic growth in China. Using vector autoregressive method, he found out that economic growth and FDI have a bi-directional relationship together, but the impact of the economic growth on FDI is greater than that of FDI on economic growth. Adhikary (2011) examined the relationship between FDI, trade openness, capital formation, and economic growth in Bangladesh over a period 1986 to 2008. Using co-integration and vector error correction model, he found out that trade openness impedes economic growth while FDI and capital formation has significant impact on economic growth. Yusuf, Malarvizhi, and Khin (2013), examined the relationship between trade liberalization, economic growth and poverty in Nigeria. They employed the ARDL approach, and showed that trade liberalization does not reduce poverty in Nigeria. They conclude with the recommendation that countries should focus on trade policies that are peculiar to their environment, which can deliver growth and translate growth into a meaningful poverty reduction. Also, Osabuohien (2007) investigated the impact of trade openness on economic performance in Ghana and Nigeria from 1975 to 2004. Employing co-integration and vector error correction techniques, he found a positive long-run relationship between economic performance and trade openness for both countries. Adelowokan and Maku (2013) investigated the effect of trade openness and foreign investment on economic growth in Nigeria between 1960 and 2011. They used dynamic regression model, and found out that trade openness has a positive effect on economic growth. However, the result shows foreign investment has negative effect on economic growth .They conclude with the recommendation that structural trade oriented policy should be adopted to enhance economic growth in Nigeria through high exports flows.

On the relationship between trade openness and environmental pollution, Baek and Kim (2011) investigated the dynamic interrelationships between trade, income growth, energy consumption and CO2 emissions for G-20 economies. Using co-integrated vector auto-regression (CVAR) and Johansen's maximum likelihood, they found out that trade and income growth positively affect environmental quality for the developed G-20 member countries, while they have an adverse effect on the environment for the developing countries. However, energy consumption has adverse effect on the environmental quality for both the developed and developing countries.

On a study on the relationship between environmental quality and economic growth in Nigeria between the period of 1970 and 2011, Alege, Adeyemi, and Ogundipe (2013) used fractional co-integration analysis, and found out that the development of the country in the early stage heightens environmental pollution in the country. The result also shows that uncontrolled trade openness increases the level of environmental degradation through environmental dumping. Feridun,

Ayad and Baloug (2006) investigated the impact of trade openness on pollution and resource depletion in Nigeria. They employed ordinary least squares (OLS) and generalized least squares (GLS) in the analysis. The results show that pollution is positively related to trade openness. Also, real GDP per square kilometer, as a proxy for economic growth, was negatively related to pollution. This paper differs from the previous works in that it introduces urbanization and ruralization (growth of the urban areas and rural areas) as specific explanatory variables. This is to analyze the specific effects of both the rural and urban areas on pollution in the country. This is because rural dwellers in Nigeria use mostly fossil fuels. The continued overlook of the contribution of the rural dwellers to environmental pollution may distort policy effectiveness. This is the first attempt to analyze this using Nigeria data. The results from this study will be beneficial to policy makers in that it will help them make informed decisions on trade policies and on how to reduce pollution in country.

3.0 METHODOLOGY

This section discusses the methodology used in this work. It includes the data sources, specification of the model, explanation of variables, and estimation methods used.

3.1 Data Type and Sources

The study uses annual time series data from 1960 to 2010. The data is sourced from the World Bank's World Development Indicators (2013). The data are collected on variables like carbon dioxide emissions (Co2) used as proxy for environmental pollution, real GDP (constant 2005) used as proxy for economic growth, import and export, urbanization, and ruralization.

3.2 The Model

This work adopts the model used by Saboori et. al. (2012) but modified for the purpose of this study. The model is presented in log form below;

$$LEP_t = \partial_0 + \partial_1 LY_t + \partial_2 LY^2{}_t + \partial_3 LOP_t + \partial_4 LUB_t + \partial_5 LRUR_t + \varepsilon_t \quad \text{.....(1)}$$

Where LEP is log of environmental pollution proxy by per capita CO_2 emission, LY is log of economic growth proxy by GDP, LOP is the log of openness of the economy proxy by imports plus exports in year t divided by GDP in year t, thus: (IMt+ EXt) / GDPt),LUB is the log of Urbanization, proxied by the growth of urban centers, LRUR is ruralization, proxied by the growth of the rural areas. The square of the real GDP is used to capture the EKC (Saboori, 2012). Based on the EKC hypothesis the coefficient of real GDP squared ($\mathbf{Y^2}$) is expected to be negative in order to reflect the inverted U-shaped curve.

3.3 Analytical Framework

This work is analyzed using Vector Error Correction Model (VECM). Johansen co-integration test is used to analyze the long run relationship among the variables. The first step in the analysis is to examine the time-series properties of the individual series. This is to ascertain the order of -integration of each series. To do this, the Augmented Dickey-Fuller unit root test is employed. This is followed with the co-integration test. The presence of the co-integrating equation helps to determine the basis for the VECM. Granger causality test is used to determine the direction of causality among the variables in a tri-variate form between environmental pollution, economic growth, and trade openness.

The vector error-correction model (VECM) with a lag order of p is modeled as below:

$$\Delta LEP_t = c_1 + \sum_{j=1}^{p} \alpha_j^{EP} \Delta LEP_{t-i} + \sum_{i=1}^{p} \beta_i^{EP} \Delta Y_{t-j} + \sum_{k=1}^{p} \delta_k^{EP} \Delta LY^2_{t-k} + \sum_{h=1}^{p} \beta_h^{EP} \Delta LOPEN_{t-h} +$$

$$\sum_{u=1}^{p} \beta_u^{EP} \Delta LUB_{t-u} + \sum_{v=1}^{p} \beta_v^{EP} \Delta LRUR_{t-v} + \emptyset_t ECM_{it-1} + \varepsilon_{1t}$$

All the variables are as defined already. $ECM_{it-1}$is the error correction term. Δ is the first differenced form of the variables in the model. The coefficients measure the impact of a change in each of the independent variables on a change in the dependent variable in the short run. The lag length in this research is chosen based on Schwarz's information criterion (SIC)

4.0 PRESENTATION AND INTERPRETATION OF RESULTS

In this section, the results of the empirical findings are presented and discussed. It begins with the results of the time-series properties of the variables.

4.1 Unit Root Test

As noted in the methodology, the method for testing for the presence of unit root in the series is the ADF unit root test. The results are presented in the table 4.1 below:

Table 4.1: Augmented Dickey-Fuller Stationarity Test Result

Series	Level I(0)			First Difference I(1)		
	Critical value (5%)	ADF	P-value	Critical value (5%)	ADF	P-value
LGDP	-2.921175	-0.448521*	0.9831	-2.922449	-5.031774	0.0001
LPOLL	-3.502373	-2.174224*	0.4930	-3.504330	-6.666050	0.0011
LOPEN	-2.921175	-2.006335*	0.2833	-2.922449	-8.822433	0.0000
LURB	-2.923780	-1.925210*	0.3183	-3.520787	-4.225908	0.0092
LRUR	-2.923780	-1.642583*	0.4535	-1.947816	-4.011849	0.0002

Note: the asterisk * stands for non-rejection of the null hypothesis at the 5% significance level, and MacKinnon (1996) one-sided p-values

The results of the ADF test show the presence of unit root in all the series. This shows that all the variables are not stationary at level. They are however stationary at the first difference. We next proceed to the estimation of the co-integration test.

4.2 Co-integration Analysis

The ADF stationarity test results demonstrate that all of the variables are stationary at first difference, and this result can be further strengthened by the Johansen Co-integration test. Thus, the presence and the number of such co-integrating relationships are evaluated with the trace and the maximum Eigenvalue. The result is presented in table 4.2 below:

Table 4.2: **Results for Co-integration test**

Variables	LGDP, LPOLL, LOPEN, LURB,LRUR						
HYPOTHESIZED NO OF CE(s)	Eigenvalue	TRACE Statistics	0.05 Critical Value	Prob. Value	Max-Eigen Statistic	0.05 Critical Value	Max-Eigen Statistic
None *	0.538728	108.4288	69.81889	0.0000	0.538728	37.14082*	33.87687
At most 1*	0.429961	71.28797	47.85613	0.0001	0.429961	26.97846	27.58434
At most 2 *	0.341802	44.30952	29.79707	0.0006	0.341802	20.07598	21.13162
At most 3*	0.305299	24.23353	15.49471	0.0019	0.305299	17.48511*	14.26460
At most 4*	0.131156	6.748425	3.841466	0.0094	0.131156	6.748425*	3.841466

* denotes rejection of the hypothesis at the 0.05 level

Trace test indicates at least 5 co-integrating eqn(s) at the 0.05 level, while Max- eigenvalue test indicates at least 3 co-integrating eqn(s) at the 0.05level.

Both the trace and the Maximal-Eigen value tests identified five and three co-integrating relationships at the 5% level of significance respectively. This shows that there is long-run relationship among economic growth, trade openness, pollution, urbanization, and ruralization. The presence of at least one co-integrating equation necessitates the analysis of the VECM. The result is presented below.

4.3 Vector Error Correction Model (VECM)

The VECM consists of two parts: the matrix of long-run co-integrating coefficients (used to derive the long-run co-integrating relationship), and the short-run coefficients (for the short-run analysis). The results are presented in table 4.3 and 4.4 respectively.

4.3.1 Long-run Relationship Result

Table 4.3 Normalised Co-integration Coefficients

Normalized co-integrating coefficients (standard error in parentheses)						
Variables	LPOLL	LGDP	LOPEN	$LGDP^2$	LURB	LRUR
Coefficients	1.0000	13.60438	0.959670	-0.186188	-14.00412	28.12133
		(12.8036)	(0.18796)	(0.20655)	(3.00373)	(8.03375)
		[1.06254]	[5.10577]	[-0.90140]	[-4.66225]	[3.50040]

Standard errors in ( ) & t-statistics in [ ]

The presence of co-integrating equations show that in the long run, environmental pollution can be explained by economic growth, openness of the economy, urbanization, and growth of rural population. The long-run impact of economic growth on pollution is found to be positive. A 1% increase in economic growth will increase pollution by 13.6%. This shows that increased growth of the economy contributes leads to increase in pollution. This is consistent with apriori expectation. Also, the long run relationship between openness of the economy and pollution is also positive. Increased openness contributes to environmental pollution in the country in the long run. The squared GDP has a negative relationship with pollution. This confirms the existence of the Environmental Kuznets curve in Nigeria. There is also a positive relationship between ruralization and environmental pollution. However, there is a negative relationship between urbanization and environmental

pollution. This is against the expected result of a positive relationship. The result of the short run analysis is presented below:

4.3.2 Short-run Relationship

The table below shows the results of short-run relationship among the variables. The coefficients of the one-period lagged differences in the table can be interpreted as the short-run parameters representing the short-run impact of trade openness, economic growth, urbanization, and ruralization on environmental pollution. The result is presented in table 4.4 below.

Table 4.4: Short-run coefficients of LGDP

Error Correction	Dependent Variable: D(LPOLL)	
	Coefficient	t-value
$D(LGDP)^2(-1))$	-1.417094	-2.78925
D(LOPEN(-1))	-0.045472	-0.24804
D(LRUR(-1))	31.25605	0.53097
D(LURB(-1))	10.49713	0.47399
D(LGDP(-1))	87.35777	2.81574

The short-run impact of economic growth on pollution is found to be positive. This shows that increased growth of the economy contributes to increase in pollution. This is consistent with the apriori expectation. The squared GDP also has a negative relationship with pollution. This confirms the existence of the Environmental Kuznets curve in the short-run in the country. As the economy grows, environmental pollution increases, but reaches a level and begins to fall. There is also a positive relationship between ruralization and environmental pollution. Also, there is a positive relationship between urbanization and environmental pollution in the short run. This is consistent with the expected result of a positive relationship. However, the short-run relationship between openness of the economy and pollution is negative. This is against the expected result. However, the result is in line with the finding of Grossman and Krueger (1995) that showed that the effect of expanded trade openness on the environment will often be positive and negative.

4.4 Impulse Response

Impulse response functions could further confirm the VECM results. It tells us how the environmental pollution at any point in time may respond to a one standard deviation (impulse) generated from any of the explanatory variables. The result is reported graphically in appendix 1.

The IRF shows a positive effect of squared GDP on pollution initially till the sixth period, but beyond that, it becomes negative. This is also consistent with the EKC. Also, the response of pollution to increased rural population is positive. It however becomes marginal at the end of the seventh period. This also the same for urbanization. There is also a positive relationship between pollution and the growth of the economy. The response of pollution to the deviation in openness is negative.

4.5 Variance Decomposition

The variance decomposition analysis indicates how much of the uncertainty surrounding the predictions of pollution can be explained by those of the other variables. The result is presented in appendix 2. Apart from own shock, the most dominant variable that affect pollution is economic growth. Though it was marginal at the beginning, it became pronounced with consecutive periods with average of 24%. The openness of the economy has the least influence on pollution in the country. The result also shows that urbanization has a higher influence on pollution than ruralization.

4.6 Granger Causality/Block Exogeneity Wald Tests.

The granger causality test was also carried out to determine the direction of causality among the variables. According to Engel and Granger (1987), the presence of co-integrating equations shows that there may be causality among the variables. The result is presented in table 4.5 below:

Table 4.5: Results of the Granger Causality/Block Exogeneity Wald Tests.

Equation Excluded	LPOLL	LGDP	LURB	LRUR	lOPEN	$LGDP^2$
LPOLL		2.597624 (0.2729)	3.143826 (0.2076)	3.325814 (0.1896)	2.200567 (0.3328)	2.572798 {0.2763}
LGDP	12.71733 (0.0017)		0.850466 (0.6536)	0.123490 (0.9401)	3.189412 (0.2030)	8.147010 (0.0170)
LURB	3.368601 (0.1856)	3.993000 (0.1358)		23.07545 (0.0000)	3.416039 (0.1812)	4.026013 (0.1336)
LRUR	1.747119 (0.4175)	3.461098 (0.1772)	8.469402 0.0145		4.262782 (0.1187)	3.487038 (0.1749)
lOPEN	2.007258 (0.0665)	0.382218 (0.8260)	0.195088 0.9071	1.033823 (0.5964)		0.394134 (0.8211)
$LGDP^2$	12.64238 (0.0018)	8.063719 (0.0177)	0.797526 (0.6711)	0.117976 (0.9427)	3.289735 (0.1930)	

NB: The numbers in parenthesis show the P-values for the corresponding Chi-square statistics
The result shows a unidirectional Granger causality running from economic growth to pollution. There is also a bi-directional causality between urbanization and ruralization. The causality between openness of the economy and pollution is unidirectional, running from openness to pollution.

5.1 CONCLUSIONS AND RECOMMENDATION

This study is an attempt to analyze the relationship between trade openness, economic growth, and environment pollution in Nigeria. The study introduces urbanization (a measure of the growth of urban sector), and ruralization (a measure of the growth of rural sector) to analyze the contribution of the rural and urban areas to pollution in the country. The result shows that there is a positive relationship between economic growth and pollution in both the long-run and short run. This shows that increased growth of the economy contributes to increase in pollution. Also, the short-run relationship between trade openness and pollution is negative, but positive in the long run. This shows that there is support for the Pollution Haven Hypothesis (PHH). The study also tests the existence of EKC in Nigeria by introducing the square of the GDP. The result confirms the existence of the Environmental Kuznets curve in both long and short-run. There is also a positive relationship between ruralization and environmental pollution both in short and long run. However, there is a negative relationship between urbanization and environmental pollution in the long run, but positive in the short run. The result also shows that openness of the economy has the least influence on pollution in the country. Urbanization has a higher influence on pollution than ruralization does. Granger causality test implies a unidirectional granger causality running from economic growth to pollution. There is a bi-directional causality between urbanization and ruralization. There is a unidirectional causality between openness of the economy and pollution running from openness to pollution.

5.2 RECOMMENDATIONS

Given the findings of this work, this paper concludes with the recommendation that there is a need for policy makers to enact and enforce environmental laws that are aimed at regulating various sources of environmental pollution in the country.

5.3 LIMITATIONS OF THE STUDY

This work has been carried out using aggregate data. A sectorial analysis will help to provide an insightful analysis into the contribution of various sectors to pollution in Nigeria. Further analysis can also look at the state-level contributions to pollution in the country.

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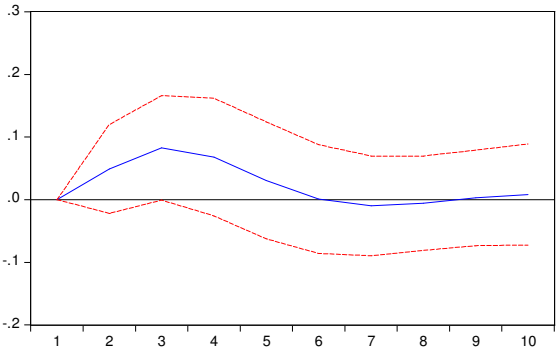
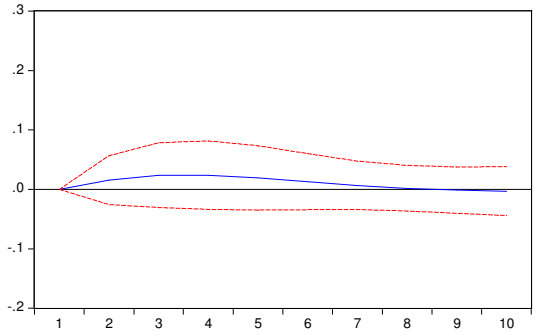
Appendix 1

Impulse Response Functions for LPOLL

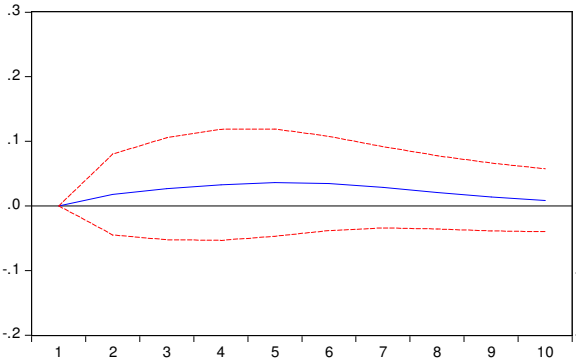
Response of LPOLL to LGDPP



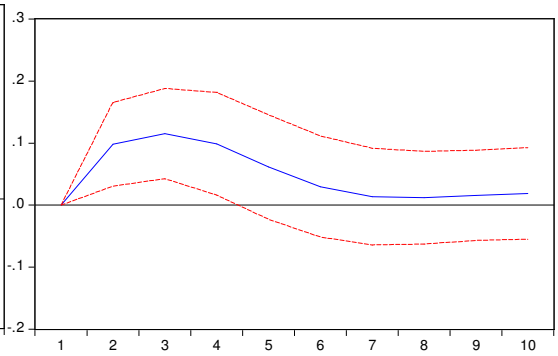
Response of LPOLL to LRUR



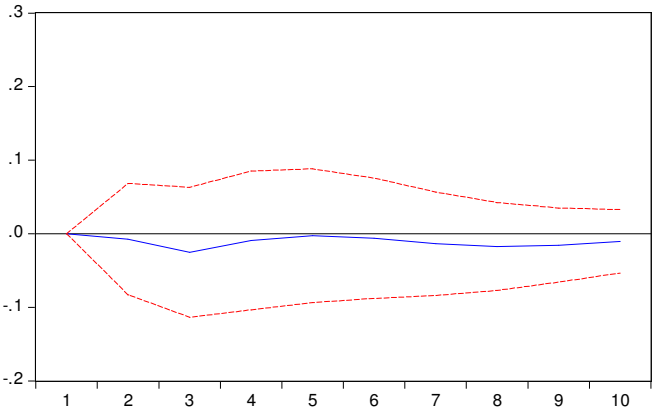
Response of LPOLL to LURB



Response of LPOLL to LGDP



Response of LPOLL to LOPEN



Appendix 2

Variance Decomposition Result for LPOLL

Period	S.E.	LPOLL	LGDPP	LOPEN	LRUR	LURB	LGDP
1	0.214142	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.281441	84.09954	3.018230	0.065215	0.304748	0.393284	12.11898
3	0.334499	69.02144	8.270190	0.612199	0.724760	0.913678	20.45773
4	0.365345	61.98047	10.38476	0.575905	1.033739	1.560970	24.46415
5	0.378562	60.11976	10.33496	0.541745	1.222515	2.366875	25.41414
6	0.384227	59.72164	10.03296	0.552145	1.300002	3.118553	25.27470
7	0.387510	59.50048	9.928565	0.667213	1.307858	3.619968	24.97592
8	0.389640	59.34138	9.842163	0.857094	1.295696	3.868027	24.79564
9	0.391181	59.21214	9.770260	1.006193	1.286702	3.960801	24.76390
10	0.392425	59.07383	9.751850	1.068798	1.284248	3.984893	24.83638

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