International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume: 3 | Issue: 3 | Mar-Apr 2019 Available Online: www.ijtsrd.com e-ISSN: 2456 - 6470

Effect of Foreign Exchange Rate Volatility on Industrial Productivity in Nigeria, 1981- 2015

Olaleye John Olatunde PhD, Ojomolade Dele Jacob

Faculty of Environmental, Social and Management Sciences,
Department of Accounting and Finance, Lead City University, Ibadan, Nigeria, India

How to cite this paper: Olaleye John Olatunde | Ojomolade Dele Jacob "Effect of Foreign Exchange Rate Volatility on Industrial Productivity in Nigeria, 1981-2015" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-3 | Issue-3 , April 2019, pp.823-829, URL: https://www.ijtsrd.com/papers/ijtsrd22910.pdf

IJTSRD22910

ABSTRACT

Effect of exchange rate volatility on industrial productivity has been a controversial debate among academia and experts. This study examines effect of exchange rate volatility on industrial productivity, many studies have mixed results on the direction of exchange rate volatility and the scope of the thesis covers 35years (1981-2015), the pre-and post-Structural Adjustment Programme while primary and secondary data gathered from the Nigeria industrial sector by questionnaire and time series obtained from the Central Bank of Nigeria statistical bulletin, 2014/2016 were used. The data were estimated using descriptive statistical methods: chi-square and mean scores and Phillip Perron and Augmented Dickey Fuller used to determine the unit roots and non-stationarity among the variables. ARDL and Bound test was applied to determine short and long run co-integration among independent and dependent variables. Diagnostic and Normality test applied to test for stability. The F-statistics is 159.3 and the R-squared is 99.7 shown that variables are jointly significant and model a good fit. The Durbin Watson of 3.04 showed no serial correlation. The results shown that foreign exchange rate has a positive relationship with industrial performance, however, the exchange rate volatility crumbled industrial production as machinery and raw materials are imported for the industry productions, while bank lending rates, FDT, Inflation and PCI have negative coefficient. The ADRL and Bound test revealed a long run relationship among the variables at 5% significance level. The government should pursue currency appreciation as exporter of mono product and encourages non-oil exports and discourage Nigerian cosmopolitan pattern of consumptions.

KEYWORDS: *Exchange rate volatility, Exports, Industrial sector's output, Nigeria Economic*

INTRODUCTION

The exchange rate is a key macro-economic variable in the context of general economic policy making. The macroeconomic formulators have been facing continuous challenges on the issue of exchange rate volatility and the achievement of realistic exchange rate for Naira, due to its indisputable imperative in bringing about industrial growth and performance.

The exchange rate plays an important role in economic development and attainment of macroeconomic objectives such as economic growth, low inflation rate; favourable balance of payment conditions and equitable distribution of income, if it is well managed. Maintaining relative exchange rate stability is crucial to both internal and external balance and economic growth, thus, failure induces distortion in consumption and production patterns of the manufacturing industries with destabilizing effects on the macro-economy, Ojomolade,[3] stable exchange rates are beneficial in international trade. Thus, the analysis of exchange rate management and the unpredictability connected with exchange rate has been a recurring topic in international monetary economics. The debates on the management of exchange rate transcended the collapse of the gold standard in 1930s according to Oyejide, the emerging of Bretton Wood System of the adjustable peg from the 1940s through other various exchange rates regimes have been implemented. The debates on exchange rate volatility and its management have long divided the economists, one side supported fixed exchange rate while the other opposing side, flexible exchange rate. The effect of exchange rate volatility on industrial performance has preoccupied the minds of both the economists and public since the collapse of Gold Standard in 1930's. The adoption of flexible exchange rate regime in the 70's after the collapsed gold standard by the developing countries, including Nigeria, is that it gained acceptance

Theoretical and Literature Reviews

This study used lot theories to drive home the effect of exchange rate volatility on industrial productivity in Nigeria and such various theories are:

Theories of Exchange Rate:

Friedman[1], an early advocate of flexible exchange rates, argued that one advantage of floating rates is that they could allow rapid change in relative prices between countries: "A rise in the exchange rate makes foreign goods cheaper in terms of domestic currency, even though their prices are unchanged in terms of their own currency, and domestic goods more expensive in terms of foreign currency, even though their prices are unchanged in terms of domestic currency; this tends to increase imports and reduce exports". This theory makes two assumptions; that goods prices are unchanged in the currency of the producer of the good, and that there is significant pass-through of the exchange rate change to the buyer of the goods. On the nominal price stickiness, Friedman argues that the choice of exchange rate regime would matter little if nominal goods prices adjusted quickly to shocks. He argues that, "if internal prices were as flexible as exchange rates, it would make little economic difference whether adjustments were brought about by changes in exchange rates or by equivalent changes in internal prices. But this condition is clearly not fulfilled at least in the modern world, internal prices are highly inflexible".

In assessing this relative-price effect and its significant for the choice of exchange-rate regime, Friedman is certainly correct to emphasize the importance of normal goods price stickiness.

Capital Accumulation Theory.

Harrod and Domar developed the capital accumulation theory, known as Harrod and Domar model, Y=Kk, (K>0) that capital accumulation made by a nation enhances industrial productivity or activities, lacks of it cripples innovation and effective production. The capital accumulation of Nigeria dropped largely due to deliberate overvaluation of exchange rate during the 'oil boom' years, the resultant effect lower import prices, altered the structure of incentives in favour of imports and import competing sectors as against agriculture and export production.

Y=National incomes, K= total stock of capital and k=output/capital ratio, if output/capital ratio is constant, any increase in national output (Δy) must be equal to k times (ΔK) ie Δy =kΔK

The neo-classical economists contributed to the theory assuming a perfect competition, the Harrod and Domar model recognised one factor, capital while classical model assumes multi-factors of production function, capital (K), labour (L),and technology (T),the relationship can be expressed thus Y=*f* (K,L,T).

With technological progresses as ΔT/T, the production function can be rewritten as ΔY/Y =b (ΔK/KT) + (1-b)(ΔT/T). Neo-classical model assumes perfect competition in which prices factor equal to the marginal physical product times the MPk.K and MPl.L, denotes the total share of capital and labour in the industrial output, Y.

Dynamic Productivity theory

The theory examined companies (industrial sector) actual performance in the present of environmental factors; said the economic factors include interest rate, exchange rate, inflation rate, economic growth (GDP) and poverty level or per capita income. Productivity measures the relationship between the quantity and quality of goods and services produced and the resources (labour) needed to produce them which raise productivity within the trading country.

Theories of Exchange Rate Determination

The theory of exchange rate has assumed fundamental position in past and present discuss in the literature on economic development and growth strategies and in the more recent literature on structural adjustment and macroeconomic stabilization.

Presently, the exchange rate is almost a flexible variable even in the developing countries. According to exchange rate policies and real exchange rates are increasingly viewed as critical determinants of a country's performance from the view point of boosting export-led growth through Structural Adjustment Programme if well managed.

Fundamental Equilibrium Exchange Rate (FEER):

Ajao reviewed the work of the founder of FEER which involves the calculation of FEER and the approach known as the equilibrium exchange rate that is consistent with macroeconomic balance that is understood as when an economy is running at full employment and low inflation (internal balance) with a current account that is sustainable; which reflects the underlying and desired net capital flows (external balance).

The exchange rate theory known as 'fundamental' emphasized the determinants that are important from short term factors and over the medium term theoretically.

It is suggested, comparing country current level with the calculated FEER an evaluation of its exchange rate must be made. The concerned issue in the application of the FEER approach is the extent to which it is informed by both the theoretical and empirical literature on exchange rate determination.

The FEER model depended on the movement of macroeconomic balance, which are measured internal and external. Internal balance is known as the level of output comparable with both full employments, low and sustainable rate of inflation.

External balance is described as the sustainable desired of net flow of resources between countries when they are in internal balance. Accordingly, this approach intends at calculating exchange rates for a particular set of economic situation; it therefore summary from short-run cyclical conditions and temporary factors and focuses on "economic fundamentals identified as conditions or variables that are likely to persist over the medium term". These conditions are not necessary projected to occur in the future; rather the desirable outcomes may in fact never be realized. Accordingly, has distinguished the FEER as the equilibrium exchange rate that should be consistent with "ideal economic conditions". The normative aspect by itself is not a criticism of the approach, as it simply reflects the objective of standardizing the exchange rate at a set of well- defined economic conditions.

The core of the macroeconomic balance approach is the identifying equating the current account (CA) to the (negative of) capital account (KA)

CA = - KA …….. (1) Where; CA = current account KA = capital account

Rather than specifying the behavioural factors affecting the exchange rate, most of the attention as noted by in the FEER model is on the determinants of the current account, which is typically explained as a function of domestic and foreign aggregate output or demand yd and yf respectively, and the real effective exchange rate, q. In many applications of the FEER approach, the equilibrium capital account over the medium term (KA) is derived by taking into consideration a number of relevant economic factors. Equation 1 can then be transformed into an equilibrium relationship between the current and capital accounts, where the current account is expressed, as a linear function of its main determinants, which are set at their full employment levels;

CA = b0 + b1q + b 2yd + b 3yf = -KA ……. (2)

Where; CA = current account; b0 = intercept b 1, b 2, and b 3 = parameters of the functions

q = the real effective exchange rate.;Yd = domestic aggregate output; Yf = foreign aggregate output ; (KA) = negative capital account; b 1 < 0, b 2 < 0, and b3 < 0

Using the model of the current account on the left hand side of equilibrium (2), the exchange rate that is consistent with macroeconomic balance (the FEER), is the real effective exchange rate, q, which will bring the current account into equality with underlying or sustainable capital account, where the determinants of the current account have been set at their full employment values. Solving equation (2) for q gives the FEER as:

b0 + b1q + b2yd + b3yf = -KA
b0 + b1 FEER + b2yd + b3yf = KA
b1FEER = -KA – b0 – b2yd – b3yf
b1FEER = (-KA – b0 – b2yd – b3yf) ……. (3)

As it was expressed in emphasized that equation (3) shows that the FEER is a method of calculating a real exchange rate which is consistent with medium-term macroeconomic equilibrium. In other words, given the parameters of a model of the current account, adding in particular the sensitivity of current account flows to the real exchange rate, the FEER is real exchange rate which produces an external balance which is accurately matched with equilibrium medium-term capital flows and calculated using an exogenously given estimate of sustainable net capital flows. FEER as a measure of calculation does not embody a theory of exchange rate determination. Time series data have been used by obtain clear relationship between economic fundamentals and real effective exchange rates for the US dollar, Deutsche mark and the Japanese yen. From the perspective of emerging markets, the problem with the theoretical construct model may be that it does not have a long history like it does in the major industrialized countries

This lack of focus on the dynamics of adjustment of the real exchange rate reflects the fact that the FEER approach is primarily designed as a method of assessment of the current value of a country's real exchange rate. A comparison of qt with FEER is used to estimate whether current exchange rate is overvalued (qt > FEERt) or undervalued (qt < FEERt) making the assessment requires estimating what the current account would be if

A. qt were to persist over the medium-term
B. the country and its trading partners were at full employment levels of output.

The project current account Cat, is compared with the exogenously given net capital account KA, and the FEER is the real exchange rate which will bring the current account at full employment into equality with KA. By focusing explicitly on the current account, the FEER approach provides a transparent and systematic way for policymakers to base their assessments of exchange rates on their views regarding equilibrium or sustainable current account positions. It is clear from the above that a FEER calculation requires considerable parameter estimation and judgment involving; a. a current account model; b. estimates of potential output for the country concerned and its main trading partners; c. an estimate or judgment regarding KA

Literature and Empirical Review

Empirical evidence has shown strong effect of short run and long run effect of exchange rate management on industrial performance through the trade. The nature of the effect, however, runs in either positive or negative direction.

Exchange Rate Volatility and Exports:

Exports generate foreign currency earnings and boost economic growth. Demand for export depends on economic conditions in foreign country's prices (relative inflation and exchange rate). Devaluation competitiveness increases exports and bends demand towards domestically produce goods, thus expanding the production tradable.

It is observed that quantitative analysis of the role of export performance in achieving sustainable exchange rate of the Naira (EXR) has received relatively less attention from researchers. Admittedly, a series of recent academic papers have touched on sustainability of EXR in relation to such factors as FDI, inflation, interest rate, and similar macroeconomic variables, but it is worth noting that little or no emphasis has been given to the critical relationship between EXR and EXP growth in the Nigerian context. Some research has indicated that exchange rate is significant in influencing not only export growth, but indeed several other economic factors, interest rate, inflation, FDI, and agricultural production but non oil export growth as a variable was excluded from many of these investigations, hence the present attempt to fill-in the gap. It is further observed that many of the past studies harped on the agricultural sector as the largest employer of labour in Nigeria.

There are perhaps two schools of thoughts concerning the influence of exchange rate on export growth and this may be due to variations in data periods, analytical models and estimation methods. One school of thought argued that fixed exchange rate policy is significant in influencing export growth while the other school of thought postulated that market-driven exchange rate policy was significant in influencing export growth. Some analysts believe that market-driven exchange rate policy has been having undesirable influence on the trend in agricultural share of GDP in Nigeria and that it is imperative for government to fix the rate in order to improve the supply of exports. Basically, aimed at forecasting ability of the different models which were compared to identify which of the models perform better. Interestingly, it examined the causal relationship

between exchange rate deregulation and the agricultural share of the GDP in Nigeria from an econometric perspective, using time series data spanning a period of 26 years, 1986 – 2011. Data on export and GDP were analyzed using Augmented Dickey Fuller unit root test, unrestricted vector auto regression, pair-wise granger causality and vector error correction model. The authors" results showed the existence of unidirectional causality from exchange rate to agricultural share of GDP and also exchange rate deregulation had negative influence on agricultural share of GDP in Nigeria.

Methodology

Model Specification

The economic models have established relationship between industrial performance (average capacity utilisation) and exchange rate, inflation, exports, debt stock, interest rate, per capita income and energy and commercial loans distributed to the industrial sector of the economy.

To understand effect of exchange rate volatility on industrial performance, this study improved on the works and models of other researchers as average capacity utilisation, non –oil export and energy were added as additional variables to expand the previous models.

Model

Model

MOP=f(GDP,BLR,INF,CRIND,FDI,FX,ENER, NONOILXP,ACU)

$$MOP = a_0 + a_1GDP + a_{2F}X + a_3INF + a_4BKLR + a_5FDI + a_6Energ + a_7ACU + a_8CRIND + a_9NOILXP + e_2$$

Where: MOP =Manufacturing Industrial output; RGDP = Gross Domestic Product

FX=Foreign exchange rate; INF = Inflation; BLR= Bank Lending rate

FDI = Foreign Direct Investment; CRIND = Commercial bank loans to manufacturing industries; Energ watt= Energy watts. ACU =Average capacity utilisation; Noilxp = Non-oil export; e2 = error term. RGDP measures growth in the economy over time.

Manufacturing industry output indicates the amount of products the manufacturing companies are able to produce with the installed industry capacity utilising assets employed in the production.

The exchange rate is the rate at which one Naira is exchanged for a currency of another country. This is the conversion rate of one country's currency for another country's currency.

The model stated that the manufacturing industry's output is a linear function of the exchange rate, inflation, non-oil export, foreign direct investment, RGDP, bank lending rate, bank loans to manufacturing industries, and energy.

The model assumes that average manufacturing capacity utilization is influenced by exchange rate volatility. This assumption is predicated on the finding that the exchange rate has a positive relationship with average manufacturing capacity utilisation as the exchange rate varies, capacity utilisation is likely to change. Ben-Salha found a robust relationship between exchange rate stability and growth. The effect of exchange rate volatility on manufacturing performance can be either positive or negative depending on economic situation being examined. When an exchange rate goes upward the manufacturing performance is expected, as increase in exchange rate discourage importation, but increases exportation, this is where the industry inputs are sourced locally, and conversely, it will affect manufacturing production due to increase in the cost of goods produced since the inputs for productions are imported at a high exchange rate. .

The Independent Variables

The independent variables or the explanatory variables are explained below:

Exchange Rate Volatility

Exchange rate volatility is a variation or swing in exchange rates over time. Volatility clustering is an approached feature exchange rate changes. Taking this experience into account, one may expect the relationship between industrial production and volatility to differ across nations of lower and higher volatility. In measuring exchange rate volatility; the absolute percentage change of the exchange is adopted as shown in Appendix table 1.

The absolute percentage change method is computed thus:

$$Vt = \underline{[Et - Et\text{-}1]} \; X \; 1 \; Et\text{-}1$$

Where V_t is exchange rate volatility, Et is the spot exchange rate in the current year and Et-1is the spot exchange rate in the previous year.

Inflation Rate

Macroeconomic theories have confirmed that the general price level in an economy is a determinant of industrial production in an economy, which mean increase may change the demand pattern of the consumers and changes in the general price level affects the cost of industrial production and thereby reduced demand.

Thus, inflation rate is an explanatory variable that take care of changes in prices of general goods and services produced in the economy, and it's represented in the model as INF.

Non-Oil Exports

A country exports lead to an enhanced inflow of foreign capitals which is reinvested into the economy; leading to job creation, improved income and consumption which further bolsters the country industrial productions.

Exports measures the monetary value of all exports (both oil and non-oil exports) produced in the country over a given period, this is also an explanatory variable in the model, as it involves goods and services (non-oil exports) moving out of the country. The value of those good and services crossing borders are also determined by exchange rate volatility which in turn affects industrial sector and the economy.

Gross Dometic Products (GDP)

GDP measures the monetary value of all goods and services produced in a country for a period, usually one year (both oil and non-oil). However, to determine the per capita income of an individual in a country the GDP is divided by the population, GDP/population. It involves goods and services moving into the country. The value of those good and services are determined by exchange rate volatility.

Presentation of Data Analysis and Results

Co-Integration Test

It had been identified that the series of the variables are integrated of order zero and one. So we proceeded to the formal testing of long run co-integration by performing the Autoregressive Distribution Lag (ARDL) co-integration test between MOP, FDI, BLR, INF, FEX, NOILXP, CRIND, ENERG, GDP, and ACU. The optimal lag length was determined by the Akaike Information Criterion (AIC). Using AIC as a guide, a maximum lag order of 4 was chosen for the conditional ARDL ECM. The F-statistic tested for the joint null hypothesis that the coefficients of the lagged level variables are zero (i.e. no long run relationship exists between them).

Table

Dependent Variable: MOPUT
Method: ARDL Short run relationship
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic): NOILXP INF GDP FX FDI ENER CRIND BLR ACU
Number of models evalulated: 39366
Selected Model: ARDL(2, 1, 2, 2, 1, 2, 2, 2, 1, 0)

Variable	Coefficient	Std.Error	t-Statistic	Prob.*
MOPUT(-1)	-0.102378	0.157738	-0.649040	0.5345
MOPUT(-2)	0.641789	0.187715	3.418943	0.0091
NOILXP	0.252684	0.993456	0.254348	0.8056
NOILXP(-1)	7.709960	1.133157	6.803968	0.0001
INF	-31.86292	5.452971	-5.843222	0.0004
INF(-1)	16.89227	5.694918	2.966202	0.0180
INF(-2)	5.237297	4.603198	1.137752	0.2881
GDP	-0.866777	0.155030	-5.591032	0.0005
GDP(-1)	0.278569	0.140500	1.982707	0.0827
GDP(-2)	0.377496	0.153659	2.456705	0.0395
FX	-1.169408	4.873676	-0.239944	0.8164
FX(-1)	38.78512	6.028006	6.434154	0.0002
FDI	0.300459	0.155792	1.928585	0.0899
FDI(-1)	0.200921	0.155113	1.295316	0.2313
FDI(-2)	-0.501358	0.250945	-1.997879	0.0808
ENER	39.24004	9.593979	4.090069	0.0035
ENER(-1)	-9.068412	7.699061	-1.177859	0.2727
ENER(-2)	49.22145	7.326614	6.718172	0.0001
CRIND	3.848635	0.909791	4.230241	0.0029
CRIND(-1)	-8.290826	1.492623	-5.554533	0.0005
CRIND(-2)	13.56079	1.982041	6.841832	0.0001
BLR	-74.14012	18.61840	-3.982090	0.0040
BLR(-1)	50.08816	18.91705	2.647779	0.0294
ACU	1.293158	19.54320	0.066169	0.9489
C	-2520.454	1853.593	-1.359767	0.2110

R-squared	0.997910	Mean dependent var	9396.982
Adjusted R-squared	0.991640	S.D. dependent var	2472.121
S.E. of regression	226.0327	Akaike info criterion	13.77732
Sum squared resid	408726.4	Schwarz criterion	14.91104
Log likelihood	-202.3258	Hannan-Quinn criter.	14.15878
F-statistic	159.1574	Durbin-Watson stat	3.037859
Prob(F-statistic)	0.000000		

Table 4.6b Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NOILXP	17.287928	6.578553	2.627923	0.0303
INF	-21.132361	14.277748	-1.480091	0.1771
GDP	-0.457484	0.195276	-2.342752	0.0472
FX	81.668555	25.862073	3.157850	0.0134
FDI	0.000049	0.581829	0.000083	0.9999
ENER	172.372624	49.044433	3.514622	0.0079
CRIND	19.797654	6.732802	2.940478	0.0187
BLR	-52.219909	51.389150	-1.016166	0.3393
ACU	2.807614	42.923759	0.065409	0.9495
C	-5472.231622	5397.509243	-1.013844	0.3403

Source: Author's Computation

Table ADRL Co-integration Approach
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	12.85481	9

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	1.88	2.99
5%	2.14	3.3

Source: Author's Computation, E-view 9

Co-integration test examines how time series may be individually non stationarity and drifte extensively away from equilibrium can be paired, that is, co-integration involves a certain stationary linear combination of variables, which are individually non stationary but integrated to an order, hence, i examined the co-integration of the variables as presented in Table above. The result suggested that a long run relationship exists among the variables owing to the fact that value of 12.85481 of the F-statistic (test statistic)is greater than the upper bound and lower bound by all the reported conventional critical values. Thus the null hypothesis of no long run relationship was rejected and the alternative hypothesis of the long run relationship between the variables are accepted.

From the table above the P-value for the f-statistic is 0.00000 which is less than 0.05. At 5% significance level, we reject the null hypothesis and conclude that the estimated model is statistically significant. The t-test showed the significance of each parameter in the model, as seven variables in the model are significant while the remaining two variables' namely foreign direct investment and Average capacity utilisation are not significant. The coefficient of determination which is the adjusted R-squared is 99 and R-squared is 99.7 which indicates the independent variables considered and the remaining variation are captured by error term, therefore, we conclude that our estimated model is of good fit and reliable for policy making. The Durbin-Watson is 3.04 which are more than 2.5, which falls within acceptable value. The F-statistic is 159.

Conclusion and Recommendation

Research related to exchange rate volatility still remains an area of controversy to economists and finance experts, especially in developing countries, despite a relatively enormous body of literature in this area. This is largely because the exchange rate is not only an important relative price of one currency in term of other that connects domestic and world markets for goods and assets, but it also signals the competitiveness of a country's exchange power with the rest of the world in a global market. Besides, it also serves as an anchor which supports sustainable macroeconomic balances in the long run. There is, therefore, no simple answer to what determines the equilibrium real exchange rate, and estimating the degree of exchange rate volatility and misalignment remains one of the most challenging empirical problems in macroeconomics.

The study examined effect of exchange rate volatility on industrial performance in Nigeria with the research problem; exchange rate volatility has contributed greatly to the low performance of industrial sector. The objective was to examine the effect of exchange rate volatility on industrial performance in Nigeria.

Theoretically, the exchange rate management was embraced by government after the SAP to promote manufacturing exports, by not relying on oil exports only after realising that the (ISI) imports substitution industries embarked upon before SAP did not do Nigeria industrial sector and the economy any good, therefore, the government which to discourage importations; and enhanced local usage of inputs and industrial sector's performance (output) however, the exchange rate volatility disrupted the drive of the monetary authority to champion industrial development and growth.

Data used were collected from primary and secondary source and subjected to analysis using ADF and PPT to test for unit roots in order to determine non stationarity among the variables, likewise ARDL and bound test was carried out to test for short and long run co-integration between the dependent and independent variables. Diagnostic and normality test was done to for stability. The bound test established a long run relationship among the variables.

Chi-square and mean scores were used to analyse the primary data. The results from the primary data analysed show the existence of relationship between inflation, bank lending rate, exchange rate and industrial output. The results were supported by theoretical evidences.

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