The Impact of Tariffs on Nigerian Economy (2000-2020)

Abstract
This study examined the impact of tariffs on Nigeria's economic growth. It examines the extent to which tariffs have contributed to economic growth in Nigeria in 2000-2020. Tariffs, which are a form of tax or trade restrictions imposed on imported goods to discourage fledgling industries from international competition, can boost economic growth. The Ordinary Least Squares regression method was used to analyze the relationship between tariffs and economic growth. An econometric analysis was also used to determine the impact of tariff and other variables such as trade openness and exchange rate on economic growth in Nigeria. The results of the regression result showed that tariffs have a positive, statistically significant impact on economic growth in Nigeria. It was recommended that a trade policy be designed to improve the imposition of tariffs in Nigeria.

1. Introduction

The endless long debate in international economic theory and history has always revolved around free trade and protectionism (Ugwuja, 2018). However, it can be said that the exact relationship between trade barriers in the form of tariffs or free trade in long-term economic growth remains a difficult theoretical question, which is studied in a variety of ways (Orji &Ugwuanyi, 2017). Ajewole, Beckman, Gerval, Johnson, Morgan, and Sabala (2022) also recommends that free trade are generally described as beneficial to a country as they generally lower prices. This doctrine, which focuses on improving income levels, is based on a static framework that can limit the interpretation of the long-term effect.

The relationship between economic growth and tariffs mainly depends on a country's characteristics. According to Eugster, Jaumotte, MacDonald, and Piazza (2022) tariffs have significant effects on economic outcomes, including on countries and sectors not directly targeted. Customs duties are levied on imported goods and refer to the customs tariffs applicable to a list of goods as imported or exported goods. These taxes could be calculated either as a percentage of the volume of the goods concerned (ad valorem) or based on some physical characteristics such as weight, length and specific weight

However, according to Japan Ministry of Economy, Trade and Industry, Tariffs are the most common kind of barrier to trade. In this case, tariffs increase transaction costs and reduce trade between countries. In fact, one of the purposes of the World Trade Organization (WTO) is to negotiate reciprocal tariff reductions. Apparently, since 1947, the (GATT) has been at the forefront in an ongoing process of lowering tariff levels (Ugwuja, 2018).

Protectionists believe that fledgling industries must be protected in order for them to grow to a point where they can compete with the larger, mature industries abroad (Orji &Ugwuanyi, 2017). They believe that without tariffs, fledgling industries will die before they achieve economies of scale, industrial infrastructure and manufacturing skills are advanced enough to enable the industry to compete in the global marketplace. They argue that governments have a responsibility to protect their companies through tariffs and to put their companies at a competitive disadvantage by legislating on social goods. They believe that these laws ultimately lead to destroying domestic businesses and ultimately harming citizens, even if these laws were designed to protect.

According to Orji &Ugwuanyi (2017), tariffs are always viewed as offsetting the social and economic costs of trade or as a way to enhance economic benefits. However, in most cases, economists argue that the imposition of barriers to trade incurs costs to the economy that outweigh the benefits achieved. These costs can be compounded by under-allocation of resources, unresolvable implementation, and foreign retaliation. The precise link between tariffs and economic growth has long been a difficult theoretical question that has been studied in a variety of ways. The question frequently asked by international and development economists and their supporters is: Do open economies grow faster than closed ones? Economic historians have yet to comment on this question, as there is as yet no generally convincing answer.

Statement of the Problem

One of the most striking features of the global economy over the past thirty years is that both developing and developed countries have experienced rapid trade liberalization either unilaterally or through a multilateral arrangement with the WTO, IMF and World Bank (Ugwuja, 2018). Tariffs can be used to protect fledgling industries, and this tariff brings its problem (Orji &Ugwuanyi, 2017). High tariffs and other forms of trade barriers are seen as obstacles to economic growth. The use of tariffs to protect and stimulate import-substitution production in Nigeria is obviously problematic. Protecting these industries can encourage inefficiency. High tariffs and other forms have burdened consumers with high prices and shielded producers from international competition. Nigerian customs policy faced major challenges due to cumbersome and lengthy import procedures and frequent customs changes. High tariffs on consumer goods widen the gap between applied and bound tariffs and thus have a negative impact on the economy.

The Nigerian government can have an appropriate and reliable tariff policy and also encourage these fledgling industries to produce the goods on which tariffs have been levied. The quality of these goods should correspond to officially imported ones. This study is designed to show how the tariff that has been put in place and the structure of that tariff is affecting Nigeria's economic growth and how this can improve the economy as a whole.

Research Questions

1. What is the connection between tariffs and economic growth in Nigeria?
2. Does the tariff rate actually lead to economic growth in Nigeria?

Objectives of the Study

The overall objective of the study is to analyze the impact of tariffs on economic growth in Nigeria. The specific objectives are as follows:

1. To determine the nature of the relationship that exists between tariffs and economic growth in Nigeria.
2. To examine whether tariffs rate actually lead to economic growth in Nigeria.

Statement of Hypothesis

H_{01}: There is no significant relationship between tariffs rate and economic growth economic growth in Nigeria.
H_{11}: There is a significant relationship between tariffs rate and economic growth economic growth in Nigeria.

H_{02}: Tariff rate has no significant impact on economic growth of Nigeria.
H_{12}: Tariff rate has a significant impact on economic growth of Nigeria.

Significance of the Study

Nigeria which is considered to be less developed or undeveloped will be the subject of this study. Trade is widely regarded as a catalyst for growth both on the demand and supply side of the economy. The findings of the study have theoretical, empirical and pragmatic importance.

Theoretically, the results of the study would be useful for validating basic theories on trade.

Empirically, the inclusion of trade indicators such as trade openness and exchange rate is further extension of studies in the area of tariffs-growth relationships. Results on the impact of tariffs on the selected variables would be of immense benefit in channeling the tariffs to most preferred industries of the economies.

Pragmatically, policy makers in Nigeria and other developing countries would find the results of the study useful for devising measures on the kind of tariffs to be placed. Additionally, it will broaden researchers' understanding in this area of study.

Review of Related Literature

Review of Basic Theory

Over the years, many theories have been proposed to explain the relationship between tariffs and economic growth such as Jesam (2013), Schularick and Solomou (2011) and Persarvet and Viktor (2019). Nevertheless, in this section, the theory which is considered to be relevant to the present study has been discussed.

The neoclassical growth model argued that trade barriers such as tariffs do not affect the long-run growth rate of output, regardless of the existence of market imperfections (Ewusi, 1968). Analysis by neoclassical theorists concludes that tariffs tend to benefit B. domestic producers and government at the expense of consumers, and the net welfare effects of tariffs on the importing country are negative. Fishlow (1980) argues that given a particular market failure, such as B. positive external production effects in the import-competing sector, the GDP level can be higher in the long term with trade restrictions than without. In such a case, data sets covering a relatively short period show a positive relationship between tariffs and economic output growth.

.

Review of empirical literature

Orji &Ugwuanyi (2017) examines the extent to which tariff has brought about economic growth in Nigeria between the period of 1980-2013. Tariff which is a form of tax or trade restriction levied on imported goods, in order to encourage the infant industries from international competitions, can boost economic growth. The Ordinary Least Square method of regression was used to analysis the relationship between tariff and economic growth. The T-test was used to determine the individual parameter estimate. The F-test was used to determine significance of the entire regression. Econometric analysis also was used to determine the impact of the tariff and other variables like real gross domestic product as a proxy to economic growth, export, exchange rate and trade openness on economic growth in Nigeria. The findings from the regression result showed that tariff has a positive statistical significant impact on economic growth in Nigeria.

Ugwuja (2018)empirically examined the impact of tariff rate on trade openness in Nigeria, relying on annual time series data spanning the period 1985-2016 and using the Engel-Granger two step co-integration test to establish the existence of a stable long run equilibrium relationship among the variables at 5% level of significance. The study employed the Ordinary Least Square (OLS) regression technique and the pairwise granger causality test to validate the nature of the relationship existing between trade openness and tariff rate in Nigeria. Sequel to the regression result, we found that although tariff variable is statistically insignificant, it has a negative effect on the degree of openness. Similarly, the granger causality reveals a uni-directional causality existing between TOPEN and TARF running only from trade openness to the rate of tariff.
Fishlow,(1980) conducted a study on the impact of tariff on productivity growth; he used Korean industry data to estimate the impact of nominal tariff and non tariff barriers on growth productivity. This result shows that the barriers are negatively related to growth and it was also significant

2. Research Methodology

Research Design

Time series analysis method which requires economic linear model was applied for the purpose of this research. The problem a researcher strives to solve determines the choice of a research design. However, the study will use series design in order to establish the relationship between tariffs rate and economic growth in Nigeria. Therefore, the choice of this design is motivated by the variables spread over period of time. Meanwhile, in order to avoid spurious result, the study will first test the stationary state of all the variables using Augmented Dickey-Fuller and Philip Perron Unit root test while Johansen Cointegration Techniques and Error correction Model test will be used to test for long run and short run relationship.

Limitation of Study

Various factors may be considered in the model as what affects Impact of Tariffs on Nigerian Economy (2000-2020), but nevertheless, the study only covers a specific time frame, which may not be enough to capture long-term trends and patterns.

Theoretical Framework

The theoretical framework of this study is anchored on the work of Orji and Ugwuanyi (2017) based on the Neo-classical growth model which link tariffs rate to economic growth.

Empirical Model Specification

In this study, the time series data analysis will be used. Because of the relationship between labor and technology, an economy's production function is often re-stated as:

$RGDP = f(TAR, TOP, EXC)$. 2

Re-writing our model, we will have:-

$$RGDP = \beta o + \beta_1 TAR_{it} + \beta_2 TOP_{it} + \beta_3 EXC_{it} + \varepsilon_{it}$$

Where,

RGDP = Real Gross Domestic Product.

TAR = Tariff rate

EXC = Exchange rate,

βo = The intercept of the equation

ε = The stochastic term

T = Time

Data Sources

The data for this study were obtained from secondary sources. Specifically, annual time series data of the variables from 2000-2020 were obtained for the purpose of this paper. They were obtained from the World Bank Development indicator (2022).

3. Presentation and Analysis Of Data

Analysis of unit root tests

We start with the test for the order of integration of the variables, which appear in our model. Since most time series variables are non-stationary and using non-stationary variables in our model might lead to spurious regressions. The first or second differenced terms of most variables, will usually be stationary.

Stationarity Test Result

Table 1. Summary ADF Unit Root tests

Variables	1% Critical Value	5% Critical Value	10% Critical Value	ADF T- Statistic	Order
RGDP	-3.886751	-3.052169	-2.666593	-3.988956	I(1)
TAR	-3.959148	-3.081002	-2.681330	-5.409279	I(1)
TOP	-3.831511	-3.029970	-2.655194	-4.541729	I(1)
EXC	-3.831511	-3.029970	-2.655194	-4.541729	I(1)

Source: Researcher's Computation

Summary ADF Unit Root tests

The summarized result presented in Table 1, shows that at various levels of significance (1%, 5% and 10%), all the variables were found to be integrated of the same order precisely order 1, I(1) and are therefore seen to be stationary.

Analysis Of Cointegration Result

Following our findings in the unit root results, that all the variables of our interest are of I(1), we therefore, test for possible cointegration among the variables. Adopting Johansen's Cointegration model, we first estimated the long run relationship among the variables by Ordinary Least Square (OLS).

Cointegration Test Result

Date: 05/23/23 Time: 08:36
Sample (adjusted): 2002 2016
Included observations: 15 after adjustments
Trend assumption: Linear deterministic trend
Series: RGDP TAR TOP EXC
Lags interval (in first differences): 1 to 1

Table 2. Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.974860	104.4136	47.85613	0.0000
At most 1 *	0.837212	49.16419	29.79707	0.0001
At most 2 *	0.706992	21.93461	15.49471	0.0047
At most 3	0.209233	3.521274	3.841466	0.0606

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

From the result in Table 2, the cointegration test result revealed that there are three cointegrating equation between the series as indicated by the trace test. This suggests that a long run relationship exists between variables. In the light of this, error correction model is employed to ascertain the long-run impact of tariffs rate on economic growth in Nigeria, and appraise how short run deviations of the long-run analysis are corrected periodically.

Error Correction Model (ECM)

In order to develop the error correction model, the lagged residuals from the cointegrating regression are incorporated in an OLS estimation incorporating the first differences of all the variables and the differences of all the variables from the cointegrating vector as independent variable. The methodology employed in driving the preferred short-run dynamic model is the general specific approach. Initially, a highly general error correction model was specified, which included lags up to the second order. This general model was then tested in order to arrive at a parsimonious preferred short-run dynamic specification. The parsimonious results for the models are presented below.

Table 3. Short Run Regression Analysis

Dependent Variable: D(RGDP)
Method: Least Squares
Date: 05/23/23 Time: 15:31
Sample (adjusted): 2001 2016
Included observations: 16 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.009132	0.916783	1.100732	0.2945
D(TAR)	0.204253	0.274824	0.743214	0.4729
D(TOP)	-0.204340	0.111472	-1.833116	0.0940
D(EXC)	-0.828601	0.365899	-2.264562	0.0447
ECM(-1)	-0.948682	0.270679	-3.504817	0.0049

R-squared	0.676503	Mean dependent var	-0.415000
Adjusted R-squared	0.558867	S.D. dependent var	3.742108
S.E. of regression	2.485426	Akaike info criterion	4.909072
Sum squared resid	67.95079	Schwarz criterion	5.150506
Log likelihood	-34.27258	Hannan-Quinn criter.	4.921436
F-statistic	5.750845	Durbin-Watson stat	1.998431
Prob(F-statistic)	0.009513		

From the parsimonious short run dynamic adjustment model presented in table 3, the result shows that TAR has positive and insignificant impact on RGDP. This implies that a unit increase TAR will lead to 20% increase in RGDP. While TOP and EXC have negative and significant impact on RGDP at all levels.

Overall statistics is statistically significant and the model is a good fit since R^2 is about 67%, indicating that 67% of the total variation in RGDP is explained by the explanatory variables.

Also, the ECM is rightly signed and significant since the ECM is negative and significant. This implies that the lagged error correction term corrects about 95 percent of short run deviations periodically. This implies that in the long run, RGDP is a positive function of TAR. While in the long run also, RGDP is a negative function of TOP and EXC in Nigeria.

4. Discussion of Findings

The applications of various econometric tools engaged in this study reveal very interested results. The study first commenced by investigating the stationarity properties of the data using the Augmented Dickey-Fuller (ADF) test, and documented that all data engaged in the study were stationary after differencing them once, that is I(1), while Having confirmed the stationarity of these data, the study further proceeded to conduct a Johansen co-integration test and found that the dependent variables and the independent variable are positively co-integrated indicating a stable long-run relationship existing among the variables. The result of parsimonious error correction shows that TAR has positive and insignificant impact on RGDP. This implies that a unit increase will lead to 20% increase in RGDP. While TOP and EXC have negative and significant impact on RGDP at all levels. This also implies that a unit increase will lead to 20% and 82% decrease in RGDP in Nigeria.

Overall statistics is statistically significant and the model is a good fit since R^2 is about 67%, indicating that 67% of the total variation in RGDP is explained by the explanatory variables.

Also, the ECM is rightly signed and significant since the ECM is negative and significant. This implies that the lagged error correction term corrects about 95 percent of short run deviations periodically. This implies that in the long run, RGDP is a positive function of TAR. While in the long run, RGDP is a negative function of TAR, TOP and EXC in Nigeria.

Summary of the Findings

Consistent with economic theory, this study found that tariffs have a positive impact on economic growth in Nigeria over the period 2000–2020 (20 years). This means that an increase in tariffs will lead to growth in the Nigerian economy. Additionally, Top and Exc have been found to have a negative and significant impact on the economy in Nigeria.

Conclusion

In conclusion, this study found that tariffs (TAR) have positive effects on economic growth in Nigeria. This means that tariffs are economic growth drivers in Nigeria from the research work. Therefore, special attention should be paid to its maintenance and development. Openness to trade (TOP) and exchange rate (EXC) also have a negative impact on economic growth in Nigeria. Going forward, trade barriers in form of tariff should be encouraged in order to boost export of locally produced products in Nigeria, which help boost the domestic economy. Policy makers should purse trade policies that accommodate tariff, softens the exchange rate, and also utilizes trade restrictions in Nigeria. Based on the above conclusion, it is recommended that researchers in this field further study on the relationship between tariff and echange rate fluctuation in Nigeria economy.

Policy Recommendations

Based on the research findings of this study, the following policy measures are hereby proffered for long-term sustenance of economic growth in Nigeria.

- The nature of the relationship between tariffs and economic growth in Nigeria was considered positive in this study. Since the tariff had a positive impact on economic growth in Nigeria. Therefore, tariffs are considered a source of government revenue and should be widely promoted to sustain economic growth.

- It turns out that tariffs are indeed a major contributor to determining economic growth in Nigeria and they cannot be ignored or overlooked. Since it contributes to economic growth, policy makers should include it in trade policies and measures should also be taken to improve and increase tariffs and reduce trade openness and the exchange rate to boost growth in Nigeria.
- Customs barriers in Nigeria have delayed the proper imposition of customs duties in Nigeria. This research study has shown that tariffs are positively related to economic growth. In order to reduce this obstacle, the government should take political measures and review the activities of the customs authorities in charge of customs to ensure that they are implementing the customs properly.

References

Ajewole K, Beckman J, Gerval A, Johnson W, Morgan S, and Sabala E (2022) Do Free Trade Agreements Benefit Developing Countries? An Examination of U.S. Agreements. Economic Research Service Economic Information Bulletin Number 240

Eugster J , Jaumotte F, MacDonald M, and Piazza R (2022) The Effect of Tariffs in Global Value Chains. IMF Working Paper Research Department

Ewusi, E. (1968). The Theory of Economic Growth. Homewood press, Jos.

Fishlow, S. (1980). "Brazilian Development in Long-term Perspective Brazil". American Economic Review

Jesam V., U (2013) Anaylsis Of The Impact Of Tariffs On Economic Growth In Ngeria (1980-2010)

Ministry of Economy, Trade and Industry (Japan). Tariffs. Retrieved from https://www.meti.go.jp/english/report/downloadfiles/gCT9904e.pdf

Orji, U. O. and Ugwuanyi, C. U. (2017), Analysis of the impact of tariffs on economic growth in Nigeria. IDOSR Journal of humanities and social sciences 2(1):1-25

Persarvet and Viktor (2019) Tariffs, Trade, and Economic Growth in Sweden 1858–1913. Uppsala University, Disciplinary Domain of Humanities and Social Sciences, Faculty of

Social Sciences, Department of Economic History. Doctoral thesis, monograph (Other academic)

Schularick M and Solomou S (2011) Tariffs and economic growth in the first era of globalization. Journal of Economic Growth Vol. 16, No. 1, pp. 33-70

Ugwuja, C. O. (2018), The Impact of Tariffs on Trade Openess in Nigeria From 1985 to 2016, Munich, GRIN Verlag,

World bank development Indicator (2022). DataBank World Development Indicators. Retrieved from. https://databank.worldbank.org/source/world-development-indicators

Appendix

Data for Analysis

Year	RGDP	TAR	TOP	EXC
2000	5.02	19.99	49	1.04
2001	5.92	21.47	49.68	1.31
2002	15.33	18.45	40.04	1.56
2003	7.35	20.62	49.33	1.77
2004	9.25	9.34	31.9	2.13
2005	6.44	9.4	33.06	2.61
2006	6.06	9.79	42.57	3.56
2007	6.59	9.83	39.34	6.69
2008	6.76	10.7	40.8	9.51
2009	8.04	10.15	36.06	10.93
2010	8.01	10.07	43.32	11.66
2011	5.31	11.34	53.28	14.19
2012	4.23	8.22	44.53	18.04
2013	6.67	8.52	31.05	20.62
2014	6.31	11.76	30.89	20.45
2015	2.65	8.22	21.33	21.29
2016	-1.62	8.52	20.72	28.08
2017	0.81		26.35	28.47

2018	1.92		33.01	32.74
2019	2.21		34.02	34.85
2020	-1.79	12.37	16.35	38.63

Source: World Bank

Unit Root Test for all the Variables at Level and First Difference

Null Hypothesis: RGDP has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.237818	0.9667
Test critical values:	1% level	-3.886751	
	5% level	-3.052169	
	10% level	-2.666593	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 17

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RGDP)
Method: Least Squares
Date: 05/23/23 Time: 08:13
Sample (adjusted): 2004 2020
Included observations: 17 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RGDP(-1)	0.051709	0.217432	0.237818	0.8160
D(RGDP(-1))	-0.352914	0.269440	-1.309805	0.2148
D(RGDP(-2))	-0.255396	0.221337	-1.153876	0.2710
D(RGDP(-3))	-0.321740	0.183707	-1.751369	0.1054
C	-1.214384	1.368817	-0.887178	0.3924

R-squared	0.257913	Mean dependent var	-0.537647
Adjusted R-squared	0.010551	S.D. dependent var	2.208997
S.E. of regression	2.197313	Akaike info criterion	4.652276
Sum squared resid	57.93819	Schwarz criterion	4.897338
Log likelihood	-34.54434	Hannan-Quinn criter.	4.676635
F-statistic	1.042655	Durbin-Watson stat	1.703094
Prob(F-statistic)	0.425440		

Null Hypothesis: D(RGDP) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=4)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.988956	0.0082

Test critical values:	1% level	-3.886751
	5% level	-3.052169
	10% level	-2.666593

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 17

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RGDP,2)
Method: Least Squares
Date: 05/23/23 Time: 08:15
Sample (adjusted): 2004 2020
Included observations: 17 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RGDP(-1))	-1.861807	0.466741	-3.988956	0.0015
D(RGDP(-1),2)	0.534194	0.296192	1.803540	0.0945
D(RGDP(-2),2)	0.302736	0.159302	1.900388	0.0798
C	-0.919920	0.561991	-1.636895	0.1256

R-squared	0.752957	Mean dependent var	0.234118
Adjusted R-squared	0.695947	S.D. dependent var	3.837579
S.E. of regression	2.116079	Akaike info criterion	4.539331
Sum squared resid	58.21126	Schwarz criterion	4.735381
Log likelihood	-34.58431	Hannan-Quinn criter.	4.558818
F-statistic	13.20748	Durbin-Watson stat	1.650699
Prob(F-statistic)	0.000304		

Null Hypothesis: TAR has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.942899	0.3062
Test critical values:	1% level	-3.920350	
	5% level	-3.065585	
	10% level	-2.673459	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 16

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(TAR)
Method: Least Squares
Date: 05/23/23 Time: 08:16
Sample (adjusted): 2001 2016
Included observations: 16 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

TAR(-1)	-0.326295	0.167943	-1.942899	0.0724
C	3.318381	2.216808	1.496918	0.1566

R-squared	0.212371	Mean dependent var	-0.716875
Adjusted R-squared	0.156111	S.D. dependent var	3.374563
S.E. of regression	3.099989	Akaike info criterion	5.217143
Sum squared resid	134.5390	Schwarz criterion	5.313716
Log likelihood	-39.73714	Hannan-Quinn criter.	5.222088
F-statistic	3.774857	Durbin-Watson stat	2.449936
Prob(F-statistic)	0.072416		

Null Hypothesis: D(TAR) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.409279	0.0007
Test critical values:	1% level	-3.959148	
	5% level	-3.081002	
	10% level	-2.681330	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 15

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(TAR,2)
Method: Least Squares
Date: 05/23/23 Time: 08:17
Sample (adjusted): 2002 2016
Included observations: 15 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(TAR(-1))	-1.372744	0.253776	-5.409279	0.0001
C	-1.155813	0.876531	-1.318621	0.2101

R-squared	0.692383	Mean dependent var	-0.078667
Adjusted R-squared	0.668720	S.D. dependent var	5.743926
S.E. of regression	3.306028	Akaike info criterion	5.352938
Sum squared resid	142.0877	Schwarz criterion	5.447345
Log likelihood	-38.14703	Hannan-Quinn criter.	5.351932
F-statistic	29.26030	Durbin-Watson stat	1.970092
Prob(F-statistic)	0.000119		

Null Hypothesis: TOP has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

	t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-1.769606	0.3835
Test critical values:	1% level	-3.808546	
	5% level	-3.020686	
	10% level	-2.650413	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(TOP)
Method: Least Squares
Date: 05/23/23 Time: 08:17
Sample (adjusted): 2001 2020
Included observations: 20 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TOP(-1)	-0.362050	0.204593	-1.769606	0.0937
C	11.94944	7.895208	1.513505	0.1475

R-squared	0.148191	Mean dependent var	-1.632500
Adjusted R-squared	0.100869	S.D. dependent var	8.730746
S.E. of regression	8.278715	Akaike info criterion	7.159892
Sum squared resid	1233.668	Schwarz criterion	7.259465
Log likelihood	-69.59892	Hannan-Quinn criter.	7.179330
F-statistic	3.131506	Durbin-Watson stat	1.824723
Prob(F-statistic)	0.093731		

Null Hypothesis: D(TOP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.541729	0.0023
Test critical values:	1% level	-3.831511	
	5% level	-3.029970	
	10% level	-2.655194	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 19

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(TOP,2)
Method: Least Squares
Date: 05/23/23 Time: 08:20
Sample (adjusted): 2002 2020
Included observations: 19 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(TOP(-1))	-1.199309	0.264065	-4.541729	0.0003
C	-1.911350	2.089252	-0.914849	0.3731

R-squared	0.548200	Mean dependent var	-0.965789
Adjusted R-squared	0.521624	S.D. dependent var	13.10134
S.E. of regression	9.061509	Akaike info criterion	7.345249
Sum squared resid	1395.886	Schwarz criterion	7.444664
Log likelihood	-67.77987	Hannan-Quinn criter.	7.362074
F-statistic	20.62730	Durbin-Watson stat	1.842114
Prob(F-statistic)	0.000289		

Null Hypothesis: EXC has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		2.017770	0.9997
Test critical values:	1% level	-3.808546	
	5% level	-3.020686	
	10% level	-2.650413	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXC)
Method: Least Squares
Date: 05/23/23 Time: 08:26
Sample (adjusted): 2001 2020
Included observations: 20 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXC(-1)	0.068888	0.034141	2.017770	0.0588
C	0.944342	0.597801	1.579694	0.1316

R-squared	0.184465	Mean dependent var	1.879500
Adjusted R-squared	0.139157	S.D. dependent var	1.819978
S.E. of regression	1.688605	Akaike info criterion	3.980322
Sum squared resid	51.32497	Schwarz criterion	4.079895
Log likelihood	-37.80322	Hannan-Quinn criter.	3.999760
F-statistic	4.071397	Durbin-Watson stat	2.524248
Prob(F-statistic)	0.058775		

Null Hypothesis: D(EXC) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.141986	0.0052
Test critical values:	1% level	-3.831511	
	5% level	-3.029970	
	10% level	-2.655194	

*MacKinnon (1996) one-sided p-values.

Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 19

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXC,2)
Method: Least Squares
Date: 05/23/23 Time: 08:26
Sample (adjusted): 2002 2020
Included observations: 19 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXC(-1))	-1.013579	0.244708	-4.141986	0.0007
C	1.988374	0.613176	3.242745	0.0048

R-squared	0.502284	Mean dependent var	0.184737
Adjusted R-squared	0.473007	S.D. dependent var	2.592138
S.E. of regression	1.881744	Akaike info criterion	4.201576
Sum squared resid	60.19636	Schwarz criterion	4.300991
Log likelihood	-37.91497	Hannan-Quinn criter.	4.218401
F-statistic	17.15605	Durbin-Watson stat	1.990126
Prob(F-statistic)	0.000682		

OLS Regression test Result

Dependent Variable: RGDP
Method: Least Squares
Date: 05/23/23 Time: 08:29
Sample: 2000 2020
Included observations: 18

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.31087	4.493207	2.294769	0.0377
TAR	-0.054731	0.177371	-0.308570	0.7622
TOP	-0.011825	0.095183	-0.124239	0.9029
EXC	-0.276223	0.091459	-3.020187	0.0092

R-squared	0.541833	Mean dependent var	5.918333
Adjusted R-squared	0.443655	S.D. dependent var	3.786433
S.E. of regression	2.824245	Akaike info criterion	5.107489
Sum squared resid	111.6690	Schwarz criterion	5.305350
Log likelihood	-41.96740	Hannan-Quinn criter.	5.134771
F-statistic	5.518859	Durbin-Watson stat	1.810961
Prob(F-statistic)	0.010298		

Cointegration Test

Date: 05/23/23 Time: 08:36
Sample (adjusted): 2002 2016
Included observations: 15 after adjustments
Trend assumption: Linear deterministic trend
Series: RGDP TAR TOP EXC
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.974860	104.4136	47.85613	0.0000
At most 1 *	0.837212	49.16419	29.79707	0.0001
At most 2 *	0.706992	21.93461	15.49471	0.0047
At most 3	0.209233	3.521274	3.841466	0.0606

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.974860	55.24941	27.58434	0.0000
At most 1 *	0.837212	27.22957	21.13162	0.0061
At most 2 *	0.706992	18.41334	14.26460	0.0104
At most 3	0.209233	3.521274	3.841466	0.0606

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

RGDP	TAR	TOP	EXC
-0.707788	0.231930	-0.027751	-0.016969
0.082043	-0.156613	0.187736	-0.106364
0.215483	0.532526	-0.183477	0.158399
0.050428	-0.316851	0.291298	0.121034

Unrestricted Adjustment Coefficients (alpha):

D(RGDP)	2.108759	2.067940	-0.868862	-0.046596
D(TAR)	0.046410	-1.314044	-1.212024	-0.234078
D(TOP)	-2.868865	-2.352701	-2.882620	-2.027129
D(EXC)	0.532945	-1.222754	0.312961	-0.185168

1 Cointegrating Equation(s): Log likelihood -109.6414

Normalized cointegrating coefficients (standard error in parentheses)

RGDP	TAR	TOP	EXC
1.000000	-0.327684	0.039208	0.023974
	(0.05081)	(0.02971)	(0.01656)

Adjustment coefficients (standard error in parentheses)

D(RGDP)	-1.492553
	(0.59221)
D(TAR)	-0.032849
	(0.49501)

D(TOP)	2.030547			
	(1.45851)			
D(EXC)	-0.377212			
	(0.34153)			

2 Cointegrating Equation(s): Log likelihood -96.02659

Normalized cointegrating coefficients (standard error in parentheses)

RGDP	TAR	TOP	EXC
1.000000	0.000000	-0.426872	0.297610
		(0.07906)	(0.07514)
0.000000	1.000000	-1.422347	0.835061
		(0.23450)	(0.22287)

Adjustment coefficients (standard error in parentheses)

D(RGDP)	-1.322894	0.165220		
	(0.33793)	(0.13273)		
D(TAR)	-0.140656	0.216560		
	(0.38849)	(0.15259)		
D(TOP)	1.837525	-0.296914		
	(1.35778)	(0.53329)		
D(EXC)	-0.477530	0.315105		
	(0.18404)	(0.07229)		

3 Cointegrating Equation(s): Log likelihood -86.81992

Normalized cointegrating coefficients (standard error in parentheses)

RGDP	TAR	TOP	EXC
1.000000	0.000000	0.000000	0.072988
			(0.02904)
0.000000	1.000000	0.000000	0.086615
			(0.09933)
0.000000	0.000000	1.000000	-0.526205
			(0.18952)

Adjustment coefficients (standard error in parentheses)

D(RGDP)	-1.510119	-0.297472	0.489122
	(0.27957)	(0.22593)	(0.09914)
D(TAR)	-0.401827	-0.428875	-0.025603
	(0.27255)	(0.22026)	(0.09665)
D(TOP)	1.216370	-1.831985	0.166821
	(1.22498)	(0.98997)	(0.43438)
D(EXC)	-0.410092	0.481765	-0.301766
	(0.17589)	(0.14215)	(0.06237)

ECM Test

Dependent Variable: D(RGDP)
Method: Least Squares
Date: 05/23/23 Time: 15:31
Sample (adjusted): 2001 2016
Included observations: 16 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

C	1.009132	0.916783	1.100732	0.2945
D(TAR)	0.204253	0.274824	0.743214	0.4729
D(TOP)	-0.204340	0.111472	-1.833116	0.0940
D(EXC)	-0.828601	0.365899	-2.264562	0.0447
ECM(-1)	-0.948682	0.270679	-3.504817	0.0049

R-squared	0.676503	Mean dependent var	-0.415000
Adjusted R-squared	0.558867	S.D. dependent var	3.742108
S.E. of regression	2.485426	Akaike info criterion	4.909072
Sum squared resid	67.95079	Schwarz criterion	5.150506
Log likelihood	-34.27258	Hannan-Quinn criter.	4.921436
F-statistic	5.750845	Durbin-Watson stat	1.998431
Prob(F-statistic)	0.009513		

Source: E-view 9.0