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INTERNATIONAL TRADE FLOWS DETERMINANTS: THE CASE OF NIGERIA

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Abstract

The Gravity model and the Madura & Fox approach was employed to investigate determinants of international trade flows in Nigeria for a period of 38 years. Secondary series were secured from the Central Bank of Nigeria statistical database; and devoid of bias. The ARDL test and Granger Causality techniques were adopted to test if any significant long run and short run relationship exist at the 5% level. For the gravity model, previous international trade flows, real gross domestic product, and distance affects trade flows; and a unidirectional causality from International trade flows to Real GDP as well as Distance; finding support for the ordinary gravity model. For the Madura and Fox approach, previous international trade flows and government restrictions affects international trade flows; and no causality exist among the variables. Thus, we recommend that the fiscal and monetary agencies of Government should employ feedback policies to address issues of distance and trade. Trade agreements should be seen to be effectively implemented so as to promote economic integration, and firms should be encouraged to hedge against currency risk in order to circumvent its adverse impact on trade flows in the Nigerian economy.

Keywords: Trade, International flows, Gravity model, ARDL, Causality Test

INTRODUCTION

Trade flows in the international frontier has tremendously increased in the past decades. Wei and Lui (2006) view international trade as the avenue through which the spillover of knowledge occurs across borders. These flows are mostly between developed or developing nation; and for some specified periods. Mostly, economies have longer periods of trade which are usually tied to trade agreements, distance and the size of the economy; in order to achieve significant economic growth. Zhang and Gao (2014) supports that the size of the economy and geographical distance promote trade flows. Diallo,Yin, Togo and Koivogui (2017) considered distance as the only factor that determines trade flows between African countries and China. Feenstra (1998) reveal that the factors responsible for the significant growth in trade flows include reduction in the cost of transportation, liberalization of trade, the convergence of countries economically and the increase in the trade of intermediate goods. Adekunle and Gitau (2013) observed that the increase in local manufacturing, management of the exchange rate as well as well-defined programs improves trade flows. Sidamor (2013) opine that exchange rate and foreign investments are responsible for growth of trade flows. Eisenman (2012) hold forth that a country's natural resource and the rapid growth in its economy determines trade flows and subsequent growth. Kuncic (2012) argued that countries with similar economic conditions tend to have more trade flows.

It is pertinent to note that trade between two or more countries can only be conducted if the factors that necessitate trade flows across national frontiers are reconciled within, between or among countries. According to the classical gravity model by Tinbergen (1962) and Poyhonen (1963), international trade flow is necessitated by means of economic size (GDP) and distance. Other factors are population, performance of stock market, level of inflation, exchange rate, international involvement in international trade relations such as ECOWAS, WTO, AU, political instability, product category, cultural similarity, colonial past, FDI, R&D etc. Consequently, the importance of international trade flow stems for the continual globalization of the world market, the inability of nations to rely completely on the goods produced locally, the need for business firms to widen their market share across national frontiers, consumption of high quality standard goods and the exposure to new and better technology and innovation.

In as much as international trade flow is pertinent for any nation to achieve development, this does not mean that there are no barriers that militate against the free flow and functioning of such flows. Mostly, language, political instability, different denomination of currencies, time factor etc. are responsible for such impediments in the international trade flow business. For instance, a volatile exchange or interest rate, level of inflation, government restrictions etc.

affects the stability of international transactions. Hence, the Nigerian economy has to pay attention to these factors that affects the free flow of trade across her national boundary.

Although, there has been extensive research on the determinants of international trade flows using the gravity model; much analysis has not been done adopting the Gravity model developed by Tinbergen (1962) and the Madura & Fox (2007) approach in the Nigerian economy. The gravity model is based on the Newton's (1687) law of gravitation which suggests that international trade flows between economies is a function of the size of the various economies and the distances that exist between them. In another development, the Madura and Fox (2007) approach view key international trade flow determinants as national income, exchange rate, inflation and government restrictions (tariffs and quotas). Accordingly, this research investigates international trade flow determinants in Nigeria using both models, to proffer useful solutions to improve on those key factors that affect international trade flows, which will help stir more economic activities.

LITERATURE REVIEW

The literature on international trade flows have been awash with numerous findings. In the classical gravity model by Tinbergen (1962) and Poyhonen (1963), international trade flow is necessitated by economic size (GDP) and distance. Ball and Linneman (1967) developed a trade flow model of trade-resisting variables such as tariffs, distance, GDP, population and preferential trade. Adopting a cross-sectional data, they found that distance and preferential trade arrangements are very important in explaining trade flows. Srivastava and Green (1986) examined the determinants of bilateral trade flows of 82 importing and 45 exporting countries. Variables utilized are GDP, population, political instability, colonial heritage and membership of an economic union. The findings from the linear-in-log model indicate that cultural similarity, exports and GDP have significant explanatory powers on trade flows. Koo and Karemera (1991) found that long term free trade agreements and credit sales are key in the flow of wheat from 34 exporting and 9 importing countries. Sanso, Guairan and Sanz (1993) employed a functional and log linear model on 16 OECD most developed countries and found out that the functional form is statistically different from zero in the period 1964-1987. Corporale and Doroodian (1994) examined exchange rate variability on international trade flows using a bi-variate Garch-M model on the US-Canada economy. The estimation reveal that uncertainties in the exchange rate have a negative but significant impact on international trade flows. Yu and Zietlow (1995) employed the gravity model of bilateral trade flows between 14 Asia-Pacific nations for a 9 year period. Their log-linear model indicate that the GDP market size, transportation cost, political stability, membership of union, cultural similarity and being a newly industrialized nation are

strong determinants of international trade flows among Asia-Pacific nations. Baltigi, Egger and Pfaffermayr (2003) are of the view that bilateral trade flows are measured by GDP, size, factor endowments and transportation cost. In addition, the interaction of these factors supports the Linder's hypothesis and New Trade theory. Lai and Chun Zhu (2004) utilized a monopolistic competition model on variables such as tariffs, distance and production cost; to know the determinants of bilateral trade. The result prove that low tariffs and smaller distances between countries makes trade to thrive better. Baxter and Kouparitsas (2006) applied three models to investigate the determinants of bilateral trade flows and prove that exchange rate volatility, currency union and sectorial similarity are among key determinants of bilateral trade flows. Baier and Bergstrand (2009) employed a cross-sectional data and nonparametric estimation to look into the long run treatment effects of free trade agreements on trade flow, and found a significant relationship. Hernandez and Taningco (2010) investigated the behind-the-border indicators of bilateral trade flows in East Asia region using the gravity model. Their result show that bilateral trade in food and transport equipment are only determined by time delays, quality of infrastructure at the ports, access to funding and telecommunication services. The study recommends that the cost of trading should be addressed to encourage a freer trade among partners. Deardorff (2011) used the Hecksher-Ohlin model and proved that countries trade excessively with themselves when there are no frictions. In addition, for countries that produce different products, trade flows are smaller when they are farther apart and bigger when they are relatively closer. Karemera, Managi, Reuben and Spann (2011) applied the commodity-specific gravity model in OECD countries on real exchange rate volatility of vegetables flows. Utilizing data from 1996-2002, they found that there exist long term and short term volatilities which have positive effect on vegetable trade flows. Nguyen and Yo (2017) embraced the gravity model to prove that exchange rate volatility is not a predictor of bilateral trade. Instead, the institutional characteristic of trading partners is key among ASEAN+3 nations. Guan and Ip Ping Sheong (2020) took on the gravity model to establish those factors that affect bilateral trade between African and China. The panel estimation of 40 countries over a 17 years period prove that GDP has a negative effect on exports to China and positive effect on imports from China; whereas, real effective exchange rate has a positive effect on exports to China and negative effect on imports from China.

METHODOLOGY

The research design employed is the *expost facto* which involves obtaining data from already concluded events and hence, is devoid of manipulation. The study utilized annual series from the Central Bank of Nigeria statistical database covering the period 1981 to 2019 for a

more generalized analysis; using robust techniques like the Unit root, Granger causality, and ARDL tests. The reason for the use of the data interval is to capture periods of varying trade agreements made by the Nigerian Government e.g. the African Union, ECOWAS, WTO, and ACFTA; and to conduct a proper estimation on her international trade flows. Like other studies, the gravity model was extended (Nguyen and Vo 2017; Wu and Liu 2017; Thorbecke 2011) to capture political stability and trade agreements. The Madura and Fox (2007) approach on trade flows was also examined in the Nigerian context and dummy variables were used to capture it (Wang, Wei and Liu, 2010; Davidova and Benacek, 2014). The use of dummy variables help to remove outliers from the data and increase its explanatory powers. Also, most of the variables were in logarithm for uniformity and to correct for autocorrelation (Brooks, 2014). Consistent with Nguyen and Vo (2017); Baxter and Kouparitsas (2006); and Broll and Eckwert (1999), Exchange rate volatility is valuable to international trade; hence, it was adopted in this study. Overall, our extended Gravity model is:

$$LnITF_t = \beta_o + \beta_1 LnRGDP_t + \beta_2 LnDIST_t + \beta_3 DmPOS_t + \beta_4 DmTA_t + \varepsilon_t \quad (1)$$

β_1, β_3 and $\beta_4 > 0$, $\beta_2 < 0$

The Madura and Fox approach is:

$$LnITF_t = \alpha_o + \alpha_1 RGDPgr_t + \alpha_2 EXGR_t + \alpha_3 INFR_t + \alpha_4 LnGR_t + \sigma_t \quad (2)$$

$\alpha_1 > 0$, α_2, α_3, and $\alpha_4 < 0$

Where, ITF = International trade flow, RGDP = Real gross domestic product, EXGR = Exchange rate volatility, INFR = Inflation rate, GR = government restrictions (customs duties), DIST = Transportation cost on freight by air, DmPOS = Dummy variable for political stability, DmTA = Dummy variable for trade agreement, α_0 and β_o = Intercept; β_1, β_2, β_3, β_4, α_1, α_2, α_3, α_4 = Constant parameters, Ln = Natural logarithm, ε_t and σ_t = Error term

The ARDL model is given as;

$$\Delta Y_t = \beta_{0i} + \sum_{i=1}^{p} \beta_{1i} \Delta Y_{t-i} + \sum_{i=1}^{q} \beta_{2i} \Delta X_{t-i} + e_{1t} \quad (3)$$

The Granger Causality model is given as;

$$Y_t = \alpha + \sum_{k=1}^{k} \beta_k Y_{t-1} + \sum_{k=1}^{i} \delta_k X_{t-1} + \epsilon_t \quad (4)$$

$$X_t = \alpha + \sum_{k=1}^{k} \beta_k X_{t-1} + \sum_{k=1}^{k} \delta_k Y_{t-1} + \epsilon_t \quad (5)$$

RESULTS AND DISCUSSIONS

Table 1: Summary of Descriptive Statistics

	ITF	RGDP	INF	EXR	GR	DIST
Mean	5.326255	10.29205	19.91487	92.91682	85295.40	18422.53
Std. Dev.	2.764799	0.572260	17.36654	96.66000	91349.56	12353.13
Skewness	-0.434251	0.297515	1.887557	0.893849	0.572107	1.686599
Kurtosis	1.817778	1.574363	5.535489	2.885356	1.601924	6.155679
Jarque-Bera	3.496910	3.878065	33.60530	5.214637	4.079801	26.67097
Probability	0.174043	0.143843	0.000000	0.073732	0.130042	0.000002

Source: E-views10 output

Table 1 shows that only exchange rate and government regulations has higher deviations from their mean values. This may not be unconnected with the continuous changes in government regulations on international transactions and high variability associated with the trading exchange rate (Guan and Ip Ping Sheong, 2020). Kurtosis was used to describe the level of peakedness of the distribution. International trade flows, Government restrictions, and the Real GDP were leptokurtic as their values were less than 3; Exchange rate was mesokurtic as its value is approximately 3; and Inflation and Distance were platykurtic as its value was greater than 3. The Jarque-Bera statistics determines the normality of the distribution, and from the estimation, all the variables except inflation and distance were not normally distributed as their probability values are less than the 5 per cent significance levels.

Table 2: Unit Root Test

Variables	**ADF Test Statistics**	**T-CRITICAL @ 5%**	**P-value**	**Order of Integration**
LNITF	-6.602395	-2.943427	0.0000	I(1)
LNRGDP	-3.415371	-2.943427	0.0167	I(1)
DUMTA	-3.189201	-2.941145	0.0285	I(0)
DUMPOS	-7.468781	-2.941145	0.0000	I(0)
RGDPGR	-3.282645	-2.941145	0.0228	I(0)
EXGR	-5.722157	-2.941145	0.0000	I(0)
INFGR	-6.976322	-2.941145	0.0000	I(0)
LNDIST	-5.668833	-2.943427	0.0000	I(1)
LNGR	-5.181713	-2.971853	0.0002	I(1)

Source: E-views10 output

Table 2 shows that at 5% level of significance all the variables were stationary; however, there exist a mixed order of integrated. This necessitated the employment of an Autoregressive

Distributed Lag (ARDL) F-bound test to disentangle long run relationships from short run dynamics (Pesaran, Shin and Smith, 2001).

Test of Co-integration

The ARDL F-Bound test was used to test the long run form. The decision criteria for long run form is that the F-statistics and t-statistics value must be greater than their I(0) and I(1) bound values; but if there exist no long form of co-integration among the variables, then only the short run dynamic model should be estimated.

Table 3: ARDL Bound Cointegration Test - Gravity Model

ARDL Long Run Form and Bounds Test				
F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	1.702632	10%	2.45	3.52
K	4	5%	2.86	4.01
		2.5%	3.25	4.49
		1%	3.74	5.06
t-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-2.372711	10%	-2.57	-3.66
		5%	-2.86	-3.99
		2.5%	-3.13	-4.26
		1%	-3.43	-4.6

Source: E-views10 output

Table 3 shows the application of the Gravity model of equation 1 on the ARDL model in equation 3. From the estimation, the f-statistics value of 1.702632 is less than the I(0) and I(1) bound values of 2.86 and 4.01; and the t-statistics value of -2.372711 is less than the I(0) and I(1) bound values of -2.86 and -3.99 respectively; all at 5% levels of significance. Therefore, there is no co-integrating relationship between the independent and dependent variables.

Table 4: ARDL Bound Cointegration Test - Madura and Fox Approach

ARDL Long Run Form and Bounds Test				
F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	2.62391	10%	2.45	3.52
K	4	5%	2.86	4.01
		2.5%	3.25	4.49
		1%	3.74	5.06

Table 4…

t-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-2.976721	10%	-2.57	-3.66
		5%	-2.86	-3.99
		2.5%	-3.13	-4.26
		1%	-3.43	-4.6

Source: E-views10 output

Table 4 shows the application of the Madura and Fox approach of equation 2 on the ARDL model in equation 3. From the estimation, the f-statistics value of 2.623910 is less than the I(0) and I(1) bound values of 2.86 and 4.01; and the t-statistics value of -2.976721 is less than the I(1) bound values of -3.99; all at 5% levels of significance. Therefore, there is no co-integrating relationship between the independent and dependent variables.

Short Run Dynamic Model

Table 5 shows the results of the estimation of the dynamic short run ARDL model for the response of the independent variables to the dependent variable. The estimation is based on Schwarz Information criterion (SIC).

Table 5: ARDL Short Run Model - Gravity Model

Dependent Variable: LNITF				
Method: ARDL				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LnITF(-1)	0.694473	0.128767	5.393249	0.0000
LnRGDP	1.588841	0.687502	2.311036	0.0274
LnDIST	-0.454981	0.174201	-2.611812	0.0136
DmPOS	0.053311	0.164312	0.324447	0.7477
DmTA	-0.008532	0.134575	-0.063399	0.9498
C	-9.458138	4.720521	-2.003622	0.0536
R-squared	0.985305	Mean dependent var		7.418693
Adjusted R-squared	0.983009	S.D. dependent var		2.612167
F-statistic	429.1159	Durbin-Watson stat		2.235673
Prob(F-statistic)	0.000000			

Source: E-views10 output

Table 5 gives the dependent variable coefficient of one lagged value of international trade flows as 0.694473, which is positively related to the current period and highly significant with p-value of 0.0000; indicating that previous changes in international trade flows can be predicted in the current period, and hence, auto regressive. Real gross domestic product and transportation cost have positive (1.588841) and negative (-0.454981) relationship with international trade flows;

and are both statistically significant. Furthermore, political stability and trade agreement also have positive (0.053311) and negative (-0.008532) relationship with international trade flows; but are both not statistically significant. The goodness of fit statistics indicate that the model is well fitted with an adjusted R-squared of 0.983009. This indicates that the explanatory variables were able to explain changes in the dependent variable. The other remaining percentage of about 1.7 not accounted for are explained by other variations not included in the model. The probability value of the f-statistic of 0.000000 shows that overall, the regression model is statistically significant at the 5 per cent level.

Table 6: ARDL Short Run Model - Madura and Fox Approach

Dependent Variable: LNITF				
Method: ARDL				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LnITF(-1)	0.734056	0.182910	4.013217	0.0006
RGDPgr	-0.372783	1.535474	-0.242780	0.8104
LnGR	1.032653	0.225190	4.585700	0.0001
LnGR(-1)	-0.656182	0.292551	-2.242969	0.0353
EXGR	0.014590	0.100558	0.145087	0.8860
INFR	0.050363	0.039726	1.267757	0.2181
C	-2.082050	1.363331	-1.527179	0.1410
R-squared	0.987625	Mean dependent var		6.577286
Adjusted R-squared	0.984250	S.D. dependent var		2.430754
F-statistic	292.6258	Durbin-Watson stat		2.285804
Prob(F-statistic)	0.000000			

Source: E-views10 output

Table 6 gave the dependent variable coefficient of one lagged value of international trade flows as 0.734056, which is positively related to the current period and highly significant with p-value of 0.0006 indicating that previous changes in international trade flows can be predicted in the current period, and hence, auto regressive. A 1% increase in real GDP growth rate will lead to 37.2% decrease in international trade flows. Government restrictions, exchange rate volatility and inflation rate have positive relationship with international trade flows; however, only government restrictions is statistically significant with p-value of 0.0001. This is same at lag 1 but with a negative value of 0.0353.

This means that 1% increase in previous period government restrictions led to a significant 65.6% decline in current year's international flows. Furthermore, the goodness of fit statistics prove that the model is well fitted with adjusted R-square of 0.984250. The overall significance of the regression model is proven with a probability of 0.000000; supporting the fact that the model is statistically significant from zero.

Granger Casualty Test

The granger casualty test was used to determine the causal effect and movements among the variables.

Table 7: Granger Casualty Test - Gravity Model

Pairwise Granger Causality Tests			
Null Hypothesis:	Obs	F-Statistic	Prob.
LnRGDP does not Granger Cause LnITF	38	0.09651	0.7579
LnITF does not Granger Cause LnRGDP		8.60742	0.0059
LnDIST does not Granger Cause LnITF	38	1.13309	0.2944
LnITF does not Granger Cause LnDIST		4.34984	0.0444
DmPOS does not Granger Cause LnITF	38	0.14329	0.7073
LnITF does not Granger Cause DmPOS		0.00490	0.9446
DmTA does not Granger Cause LnITF	38	2.06025	0.1601
LnITF does not Granger Cause DmTA		0.84951	0.3630

Source: E-views10 output

Table 7 shows the result of the Granger causality test at using the Gravity model. From the estimation, movements in international flows precede movements in real GDP and geographical distance.

Table 8: Granger Casualty Test - Madura and Fox Approach

Pairwise Granger Causality Tests			
Null Hypothesis:	Obs	F-Statistic	Prob.
RGDPgr does not Granger Cause LnITF	38	0.30178	0.5863
LnITF does not Granger Cause RGDPgr		0.66524	0.4202
LnGR does not Granger Cause LnITF	29	0.39931	0.5330
LnITF does not Granger Cause LnGR		0.82379	0.3724
EXGR does not Granger Cause LnITF	38	0.79982	0.3773
LnITF does not Granger Cause EXGR		1.80275	0.1880
INFR does not Granger Cause LnITF	38	0.00677	0.9349
LnITF does not Granger Cause INFR		3.64457	0.0645

Source: E-views10 output

Table 8 shows the result for the Granger causality using Madura and Fox approach. The result proves that there was no causal effect between the variables.

Discussion of Findings

Real GDP is an important determinant of trade indicating that nations with significant growth rate tend to stimulate international trade flows. This finding is consistent with Nguyen

and Vo (2017) that income level and country size are key factors for nations to be open to international trade. Also in support is the study by Wang (2000); Ghosh and Yamarik (2004) and Egger (2000) that the higher the GDP level, the higher the trade flows that a nation will experience. Transportation cost as a proxy for distance is negative but significant. This means that distance do not determine trade (Koo and Karemera, 1991). The study by Nguyen and Vo (2017) and Disdier and Head (2008) also reveal that distance is negative but significant. They however advise that countries should take advantage of trade agreements to promote trade flows. Also, Karemera *et al* (2009) opine that the reason distance is no longer an impairment to trade is because there have been improved means of communication and transportation channels. On the contrary, Wang *et al* (2010) confirm that geographical distance is a key determinant of trade flows but the cost of transportation is negatively related to trade flows. Political stability is positive but an insignificant determinant of trade. Srivastava and Green (1986) argue that nations that had colonial ties tend to trade more frequently and as such stable countries tend to be higher level exporters and importers than unstable ones. This is also consistent with the study by Yu and Zietlow (1995) that developing economies have more stable fiscal policies, hence, trade flows are not affected. Trade agreements has a negative sign which means that membership in the same economic union is not a significant factor of trade flows. Srivastava and Green (1986) found a weak effect which they attribute to the effect of distance which is usually incorporated when establishing trade ties. Exchange rate volatility is negative and insignificant. This finding is supported by Park and Pick (1996) that the volatility in exchange rate has no effect on trade flows. Nguyen and Vo (2017) argue that the reason exchange rate volatility is insignificant is because most countries hedge such risk or employ a common currency. As such, a nation with a sound financial market will be able to hedge against currency risk in order to make up for likely adverse effects of international trade flows. However, Cho, Sheldon and McCorriston (2002) suggest that both long and short term volatilities of the exchange rate affect trade flows; but volatility is specific to commodities and particular sectors of the economy (Karemera *et al*, 2009; Bacchetta and Van Wincoop, 2000; and De Grauwe and Skudelny, 2000.

CONCLUSION

The study aims to examine the determinants of international trade flows from 1981-2019; adopting the Gravity model and the Madura & Fox approach. The variables included in the analysis includes Real GDP, Distance, Political stability, Trade agreements. Government restrictions, Exchange rate volatility and inflation rate. For robustness of estimates, the study recognized several variables in the Nigerian economy by extending the simple gravity model of

the Size (GDP) and Geographical distance and found strong support that the ordinary gravity model of size and distance are major determinants in explaining international trade flows. This is consistent with other studies that applied the Gravity model on trade flows: Nguyen and Vo (2017); Wang *et al* (2010); Ghosh and Yamarik (2004); Egger (2000); Koo and Karemera (1991); Karemera *et al* (2009); Yu and Zietlow (1995); Srivastava and Green (1986).

Real GDP, Government restrictions, Political stability, volatile Exchange rate and the level of Inflation are significant determinants of trade flows; thus, they are viewed as stimulants. However, Distance and Trade agreements do not stimulate trade flows. This is attributed to more improved means of communication avenues and previously existing trade ties.

Overall, we recommend that the fiscal and monetary agencies of government should employ adequate feedback policies to address issues of distance, trade agreements and government restrictions. Trade agreements should be seen to be effectively implemented so as to promote economic integration and, firms should be encouraged to hedge against currency risk in order to circumvent the adverse impact of a volatile exchange rate on trade flows in the Nigerian economy. Also, is the employment of contractionary policies to address the issue of inflation with the intention of ensuring money has its real value. Finally, the electioneering system should be seen to be well-implemented to be free, fair and credible so that other nations can be encouraged to do business with us.

LIMITATIONS

This study is limited as not all the determinants of international trade flows are accounted for. For example is cultural differences and religion, intensity of trade between nations and the extent of trade restrictions, access to funding, and telecommunications services. Hence, the addition of more variables will establish a comprehensive approach on international trade flows determinants.

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