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STRUCTURAL BREAKS IN FOREIGN CAPITAL INFLOWS AND OUTPUT GROWTH: A ZIVOT-ANDREWS TEST

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Abstract:

Several financial and macroeconomic historical series display consistent trends until there is observed sudden permanent departure. With such occurrence traditional unit root test gives misleading inferences about the null ignoring the divergence in conventional stationarity test. This study detects single most significant structural break in foreign capital inflow series and domestic Nigerian outputs whose data originate with the World Bank. We further estimate class of two case models to establish two comparative regressions by first testing relationships vis-à-vis output growth using standard financial aggregates and later integrating single structural break into same series with dummy. This is implemented using endogenous Zivot-Andrew structural breakpoint estimator complemented with Chow breakpoint test before proceeding to perform Ordinary Least Square regression. Findings confirm breakpoint in historical series with 2005 as break date for major variants of foreign capital, while year 2010 represents break date in GDP. The dates rightly coincide with real structural policy implementation and political optimism. However, the null of unit root with break stands unrejected in GDP and external debt series but invalid in FDI and official development assistance. Further evidence reports positive influence of foreign capital inflows on GDP when break is ignored, however, including structural breaks modified the result such that official development assistance exerts negative influence on GDP.

Keywords: Official Development Assistance, External Debt, Economic Growth, Zivot-Andrews, FDI JEL Classification: P33, H63, O40, C2

INTRODUCTION

Government fiscal, monetary or structural policies might play roles that produce swings in many economic and financial time series. Beyond home economy fundamentals, cross-border economic interactions expose financial variables to shocks with powerful momentum. This destabilizes equilibrium such that long periods departure from consistent trend is forced to react to major occurrences of reasonable importance which contemporaneously generate outliers. The observation takes a form of instantaneous change at natural trend and may have permanent effects on the system (Perron, 1989). The breaks could be observed in any macroeconomic series and financial aggregates. The evolution of the breaks might be highly impacting on specific macroeconomic fundamental. Conditions substantial enough to drive refraction in trended series have been recognized to emanate majorly from spillover events in reference to global financial crisis which resultantly fueled economic meltdown (Baker & Collins, 1999; Gerlach, Wilson & Zurbruegg, 2006; Castles & Vezzoli, 2009); or most recently the COVID-19 pandemic that altered the social world (Chang & Li, 2022; Adenomon & Idowu, 2022; Mareeswaran, Sen & Deb,

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2023; Karavias, Narayan & Westerlund, 2023). Exogenous shocks could be preventable if economies remain isolated from rest of the world[2]; but this is apparently impossible as the governments deepen emphasis on interconnectivity (Samimi & Jenatabadi, 2014; Ying, Chang & Lee, 2014). The world is a domain of imperfection in factor and goods markets, a dynamic which cannot be rationally avoided nor defeated under any conventional trade isolation policy. In the contemporary times, insulation from unexpected possibilities has not been feasible even when autarky seemed the best option. For several years inefficient method of autarky[3] collapsed with the realization that economic isolation is not a "true" reflection of self-sufficiency nor a preventive mechanism against deadly disadvantageous random shocks. As a system embedded with obsolete features, autarky in its mirage encouraged countries to rather endure lack of necessary resources in domestic economy despite being available in foreign lands.

Open external sector enhances cross-country trade as well as flow of capital resources between nations. This is a matter of policy. However, implementation of economic programmes or policy alteration potentially have some distortionary effects on financial series. Nigeria opened up domestic economy to rest of the world and further advanced it with deregulation policy to revive weakening economy. Liberalization of external trade and payments system is one in multiple measures of deregulation (Sanusi, 1988); meanwhile packaged in Structural Adjustments Programme (Okoye *et al.* 2016). Nigeria trade policies have followed the fundamentals present in structural adjustment since 1986 (Adenikinju & Chete, 2002). For centuries the merits of contemporary open economy are multidimensional, but strong cross-border interlinkage may expose or impede resilience to shocks and there have been strong indications[4] from random events. Some classic instances in this direction (Correia *et al.* (1995), Cesa-Bianchi *et al.* (2016), Hałka and Kotłowski (2017); Fernández *et al.* (2017), Luk *et al.* (2020)) are largely known. Nigeria crude oil economy reaped remarkable foreign exchange in the 1973 oil price shock with reflection in balance of payment. Conversely, the country suffers the pains in bad times. Nigeria economy did not show outstanding growth in gross national income with oil glut (Olofin & Iyaniwura, 1983).

Shocks from oil crisis, economic depression or multiplicity of random variables often emanate from exogenous environment but their distortionary effects are breaks that render the traditional unit root test invalid such that hypothetical inference favours the null. Nelson and Plosser (1982) seminal contribution[5] and Perron (1989) influential paper noted the significance of structural break in testing unit root. Several outstanding situations can plunge a consistent series into breaks. Internal structural dynamics in Nigeria initiated observable structural break in foreign capital parameters and in domestic outputs.

[2] The modern economic order runs on formation of formidable economic blocs in the same manner as political alliance. Outwardly induced structural changes has potential to explain structural breaks in unified economic structure of EU, ECOWAS, G7 and others. Emergence of BRICS geopolitical bloc and the recent admission of six new members in the BRICS economic alliance would carry unique national benefits for members. Iran has been under Western punishments of which BRICS provides escape outlet that reshapes its economic misfortune from sanctions. See for instance, Reuters on- The BRICS group of nations has decided to invite six countries - Argentina, Egypt, Iran, Ethiopia, Saudi Arabia and the United Arab Emirates - to become new members of the bloc.

[3] Autarky is a policy method of closed economic system to conservatively insulate national economy from shocks originating in foreign countries but potentially spilling into trade partner states. Autarky failed to yield efficient result in a world where natural and capital endowments are not totally uniform nor evenly distributed nor equally sufficiently available to feed the industry and domestic market.

[4] Energy crisis from Gulf war; Financial Crisis from US Mortgage banks and later global economic meltdown; Covid-19 pandemic causing shrinking global economy and current Russia-Ukraine war damaging Europe, US economies and other Russian gas dependent countries.

[5] Nelson and Plosser (1982) observe that permanent distortions in the 14 macroeconomic series investigated have been occasioned from exogenous shocks if one considers in retrospect the economic consequences of the Great Crash of 1929. This firm conclusion has been drawn from analysis of average annual data series with start dates from 1860 to 1909 and ending in 1970 in all cases. Perron (1989) test whether such shocks possess persistent effect that does not vanish over a long horizon. The paper advocates for a one-time break under both the null and alternative hypotheses in the level or slope of the trend function.

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The goal of this study is to launch empirical tests on structural breaks in major foreign capital components and further investigate their relationship with output level in the economy. Specifically, we provide supporting historical evidence supplemented by foreign capital data series to justify significant break date. This approach is missing in the literature discussing foreign capital flows in a developing economy like Nigeria. It is unknown whether structural break in foreign capital series and output could be hypothetically explained from random exogenous shocks or a consequence of its endogenous alternative. The intuitive idea behind our strategy is that historic moment causing breaks whether endogenous from the perspective of Zivot and Andrews (1992) or exogenous as insightfully discussed in Nelson-Plosser and later in Perron occurred in definite date and therefore would logically take a nonzero or a unitary value in break date for a plausible slope estimate. Our finding has limitation especially in the archiving and summation of data series for foreign aid capital inflow to Nigeria. The reason is that aids to Nigeria in the last decades have included military support[6] packages and humanitarian assistance in volatile regions of the country which does not support manufacturing industry. We only relied on soft loans and concessional financial packages of donors.

The remaining part of this paper is structured into sections. Section 2 discusses conceptual backgrounds of capital inflow and surveys literature on structural breaks. Section 3 presents data and linear specifications introducing structural break models. Section 4 covers implementation of methods and results analysis as well as discussions. Finally, the paper is concluded in section 5 with policy suggestion.

2 RELATED LITERATURE REVIEWS

Foreign capitals are class of financial inflows from non-residents in rest of the world- government, individuals or institutions invested into another economy for assistance or to gain lasting financial interest in economic activities of host country. Thus, foreign capital has several dimensions. The foreign direct investment (FDI) aspect of foreign capital represents direct presence of investors into an economy as Multinational Corporation (MNCs). A different and close variant is foreign portfolio investments (FPI) which represent claims in foreign corporation income accounts. Official Development Assistance (ODA) and external debts which individually represents concessional grants from Development Assistance Countries (DAC) or bilateral and other multilateral agencies investments in government of debtor countries. Savvides (1992) conceptual method presents a summation of *commercial* and *non- commercial* foreign inflows. According to the author, commercial inflows are disbursements from private creditors (from financial markets and suppliers) and FDI. Noncommercial inflows include disbursements from official creditors and unrequited transfers (private and official). We further conceptualize financial flows from Official Development Assistance (ODA) view.

[6] The United States government reports military aids to countries under challenging moments of insecurity and terrorism. As we have seen in Russian-Ukraine war several military aid packages have been flowing to Ukraine to defend itself against aggression. Moreover, other rich economies of Netherlands, Denmark and the Britain have followed similar pattern of aids flow in military supports.

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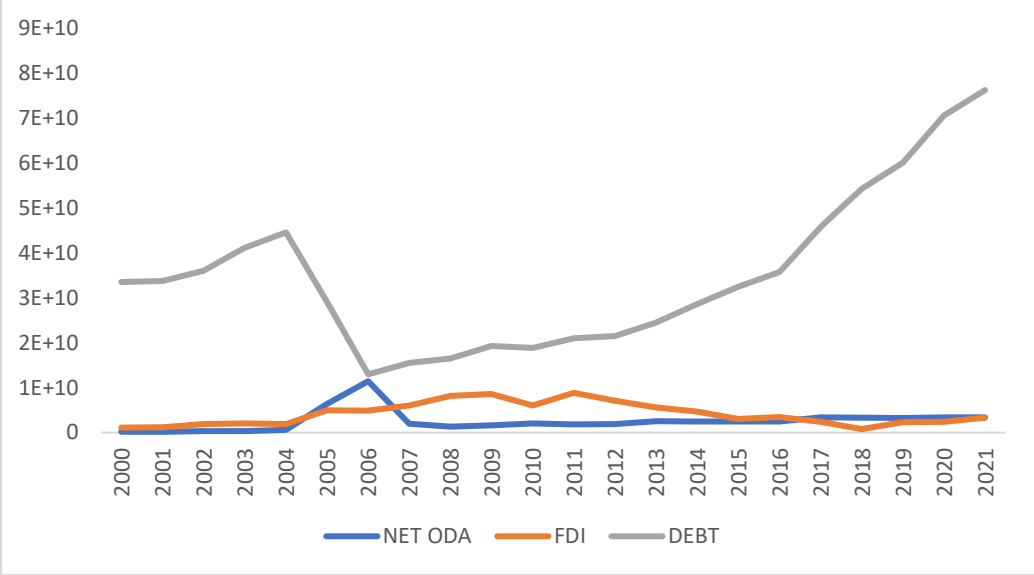

Figure 1: Foreign capitals inflow to Nigeria with data from World Bank

The class of foreign capital inflows to Nigeria are in form of assistance, direct foreign private sector investments and sovereign obligations. Fig. 1 reveals significant entry of external debt obligations into the Nigerian economy far more than other alternatives. FDI has been on decline while debts grow steadily. ODA in Nigeria has been inferior in quantity even though it is almost similar to FDI. Nigeria faces difficulty attracting large volume of financial supports from donors and could not be relied upon to pursue meaningful development.

2.1 Foreign Direct Investments Theory and Regional Comparison

Foreign direct investments in Nigeria are found across many sectors and information about the quantum of FDI in Nigeria capital account with rest of the world. FDI is inseparable from Multinational Corporations (MNCs outward looking firms) who are the primary carriers of FDI global manufacturing and delivery activities. FDI through MNCs is primarily about transfer of nonfinancial and ownership specific intangible assets, which thereafter needs to appropriate and control the rate of its internalized advantages (Dunning & Rugman, 1985). The identical nature of these concepts implies that the theory of FDI is certainly, a theory of MNCs. Early theoretical underpinnings explaining existence and influence of FDI explicitly centres on MNCs and also vastly applicable to international trades[7]. Production Cycle theory developed by Vernon in 1966 explains phases of production cycles: innovation, growth, maturity and decline. In Vernon's view the innovative capacity of US companies to develop new products by possessing technological advantage above international competitors reigning in the manufacturing industry of foreign markets (Denisia, 2010). Successful innovation at the first production cycle stage in home market implies carrying the innovation to new economies by US transnational enterprises. Internalization theory offers explanation on determining reasons for foreign production and sales businesses of Multinational Enterprises[8] (MNEs). Rugman (1980) argues that other theories are sub-set of internalization theory because activities of MNEs are motivated as a response to imperfections in goods and factor markets. Nevertheless, varieties of available theories unanimously conclude that transnational firms relocated abroad to reap

[7] Hymer (1960) laid essential theoretical foundation of FDI in the theory of firm-specific advantages. Vernon (1966) developed the product-life cycle. Other approaches have since emerged but rarely departed from connecting FDI to trade and ownership-based views. Dunning (1981), Dunning (1988), Dunning and Lundan (2008) created runner up theories of investment development path which is a dynamic approach within the so-called eclectic theory (also OLI paradigm).

[8] MNEs are part of Multinational Corporations but with decentralized management and ownership structure. International companies are multinationals conducting global business activities across the globe. These firms originate with the US, Western Europe, China and other emerging market economies.

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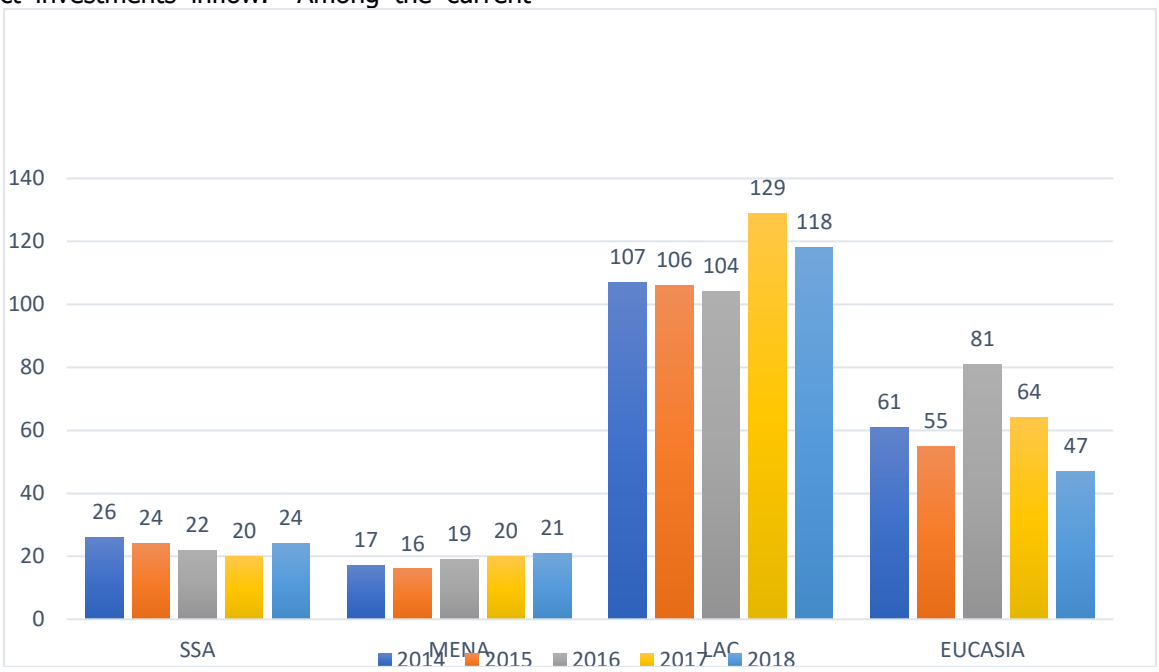
the benefits of the advantages in the form of location, firm-specific or internationalization of markets (Nayak & Choudhury, 2014).

The key sources of FDI reside with the OECD countries. The net position has shown downward trend dropping to US$1,997 in 2018 from US$4,444 and US$3,495 recorded in 2016 and 2017 (World Bank, 2020p.105). Despite the level of available natural resources, Sub-Sahara Africa (SSA) and Middle-East and North Africa (MENA) attract less of direct investments inflow. Among the current biggest beneficiaries of FDI is the Latin America and Caribbeans (LAC). The sum of US$24 billion entered SSA in 2018 compared to US$118 billion in LAC. By all accounts, FDI in Africa is not quite enormous. SSA is the least destination even though it possesses comparative advantage for *resource and market seeking* multinationals (fig. 1). The share of LAC countries on FDI was at the peak in 2017 whereas EUCASIA received its highest inflow in 2016.



Source: Author's plot with data from International Debt Statistics 2020
Note: EUCASIA is an abbreviation meaning- Europe and Central Asia (this is for convenience)
† LAC is Latin America and Caribbean; SSA for Sub-Saharan Africa; MENA for Middle East and North America
Fig.2: FDI distribution across recipient regions

Figure 3 further shows differences in FDI position of African countries within same period. Egypt controls significant volume of FDI entry in comparison to other African economies. Angola recorded negative FDI in same period despite huge hydrocarbon deposits. Nigeria with vast solid and liquid minerals is not top in the preferred destinations of MNCs. Thus, other factors could be responsible. The MNCs in this period might be efficiency-seeking foreign corporations against resource or market-seeking MNCs.

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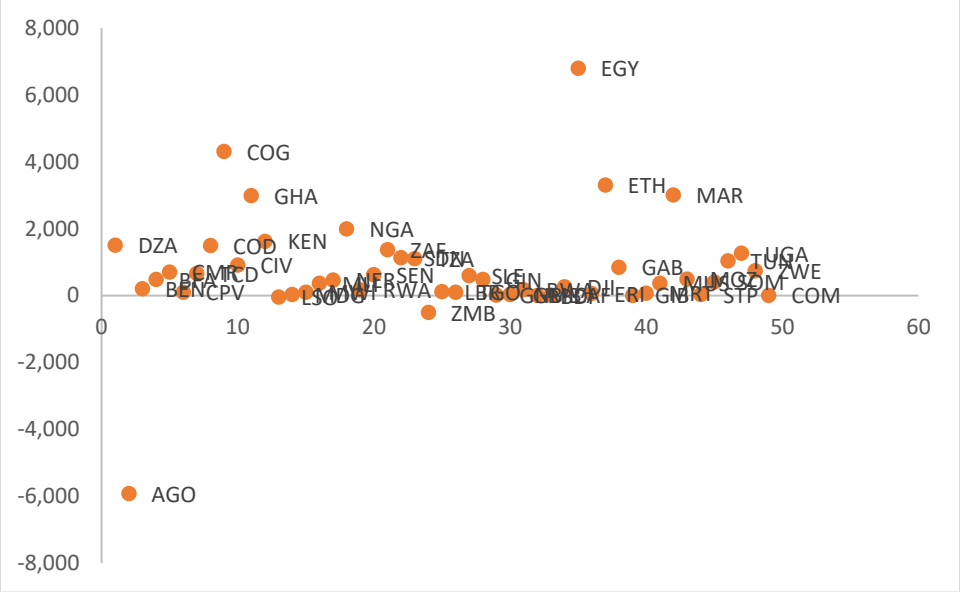

Plotted with data from International Debt Statistics

Country	Algeria	Angola	Benin	Burkina Faso	Cameroon	Cape Verde	Chad	Congo DR	Congo	Cote D'Ivoire	Ghana	Kenya	Lesotho
Code	DZA	AGO	BEN	BFA	CMR	CPV	TCD	COD	COG	CIV	GHA	KEN	LSO
Madagascar	Malawi	Mali	Niger	Nigeria	Rwanda	Senegal	South Africa	Sudan	Tanzania	Zambia	Liberia	Togo	Sierra Leone
Guinea	Guinea-Bissau	Gambia	Botswana	Burundi	Central African	Djibouti	Egypt	Eritrea	Ethiopia				
MDG	MWI	MLI	NER	NGA	RWA	SEN	ZAF	SDN	TZA	ZMB	LBR	TGO	SLE	GIN
GNB	GMB	BWA	BDI	CAF	DJI	EGY	ERI	ETH						
Gabon	Gibraltar	Mauritania	Mauritius	Morocco	Mozambique	Sao tome	Somalia	Tunisia	Uganda	Zimbabwe	Comoros			
GAB	GIB	MRT	MUS	MAR	MOZ	STP	SOM	TUN	UGA	ZWE	COM			

Fig. 3: Net foreign direct investment inflow to African countries

African countries do not enjoy equal entry of FDI. Nigeria is not a lead destination for FDI. Ghana, Congo, Ethiopia and Morocco have greater net inflows (fig. 3). Zambia and Angola have negative net FDI as the worst. Egypt has the largest net inflow even though it is not in the OPEC. It is evident that factors outside natural resource abundance and market may be driving FDI.

2.2 Nigeria External Debts and Compositions

Federal debt to rest of the world is composed of debts from multilateral bodies, bilateral and commercial sovereign obligations. The level of Nigeria external debts has been enormous especially in the current dispensation. The last three years of immediate past administration have been moments for foreign loans scramble. Finally, Nigeria debt profile to foreigners is standing in trillions of Naira[9]. Huge debt contract starts with government decision to engage in important fiscal expansion. Depending on the policy of the ruling government, some borrowings are claimed to be contracted for helping the

[9] under President Obasanjo in 1999 a partial write-off of Nigeria's international debt to the tune of $19 billion was achieved. In President Buhari tenure debt levels jumped from ₦12 trillion to ₦25 trillion. Total external debt outstanding is US$41,694.91 Million. See NIGERIA'S TOTAL PUBLIC DEBT PORTFOLIO AS AT DECEMBER 31, 2022 available at DMO.

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poor. External debts are sovereign obligations to international lending bodies or governments or people. This may often assist savings deficient economies to speed up adjustments to internal and external shocks.
Theoretical argument supporting external borrowing is that it increases a nation's access to resources for output growth. Its vast magnitude is expected to boosts countries' capacity for long-term financing of critical infrastructure, education, employment and health. Conversely, external debt is certainly risky if amassed recklessly. Experiences in Highly Indebted Poor Countries (HIPC) and domestic Nigeria indicates that sovereign debts almost retards economies of borrower nations. Panizza and Presbitero (2012) assert that important fiscal expansions that further raise the level of debt can decline growth in the long-run, and thus partly (or fully) negate positive effect of fiscal stimulus. Some policy-makers and theorists seem to conclude by evidence of experiences in the Third World that debt is precarious in the long-run (Pattillo, Poirson & Ricci, 2011). Savvides (1992) prominent contribution constitutes portion of systematic investigations that successfully popularized *debt overhang* to a wider audience. Latter empirical commentaries and estimation beginning with Reinhart and Rogoff (2010) emphasize determining debt-threshold effect on growth as a special fiscal consideration. What constitutes exceptionally high sovereign debts according to ground breaking literature is defined to be debt over 90% of nominal GDP on a sustained basis and ultimately concluded to have growth-reducing effect (Reinhart & Rogoff, 2012). Findings in advanced and emerging markets reveal that beyond a certain threshold the negative correlation becomes strong when debt approaches 100 percent of GDP (Kumar & Woo, 2010; Checherita & Rother, 2010; Cecchetti, Mohanty & Zampolli, 2011).

Historically Nigeria started approaching foreign governments, multilateral agencies and commercial banks under the London Club of creditors to fast track planned developments in the 1980s. External debts are sovereign obligations to international lending bodies or governments. A new alternative is the China loans which the Federal Government of Nigeria. Federal outstanding debt to China is worth US$3,519.12 (DMO, 2021). Currently, bonds traded in the financial market formed new Federal sovereign debt component. Nigeria's Eurobonds[10] maturing at September 2028 worth US$1.25billion at 6.125% (DMO, 2023). Growing civil concern is the tendency for current national indebtedness to worsen fragile per capita income as output level is not on rapid increase and OPEC oil quota is not met by Nigeria. Another policy question is whether size of Nigeria's export built around oil sales in the energy market can service this episode of high debt burden with minimum harm to the economy.

2.3 Official Development Assistance inflow to Nigeria

Official Development Assistance (ODA) represents foreign financial aids package from Development Assistance Countries (DAC for short). Nigeria is one of the beneficiaries. ODA enters Nigeria as transfers from the US or other donor countries in the OECD. Foreign aid or economic assistance to developing countries is defined as foreign aid for programs with a development or humanitarian objective (USAID, 2018p.2). The essence of foreign aid is for development of critical infrastructure to support vast macroeconomic development. However, it is a practical approach to foreign policy[11] projects of industrial nations. According to donor government developments, aid programs of the US facilitate sustainable, broad-based economic progress and sociopolitical stability in developing countries[12].

[10] The breakdown of Eurobond yield, closing prices, cost, interest and tenure are found in the website of Debt Management Office. The DMO further displays project descriptions for which China loans are contracted.

[11] World Bank provides elaborate definition and reasons for development assistance. According to the global institution net official development assistance disbursements consists of loans made on concessional terms (net of repayments of principal and grant by official agencies of members of DAC of OECD, geographical distribution of financial flows to developing countries etc. On the other hand, OECD (2019) asserts that ODA flows to countries and territories on the DAC List of ODA Recipients and to multilateral development institutions. Providers include: official agencies, including state and local governments, or by their executive agencies. OECD provides data on ODA.

[12] The US and the UK governments implement aid programmes via USAID and FCDO. The US and counterpart UK have since added military supplies and humanitarian assistance commitments in their international aids package. According to US Department of Defense the government has provided more than $46.7 billion in security assistance for training and equipment to help Ukraine preserve in conflict.

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The objective of ODA points to growth supporting role in developing economies and this is discernable from a standpoint of concessional grants and soft loan. These are administered for the promotion of the economic development and welfare of countries in the Sub-Sahara Africa. Longstanding empirical conclusion of Chenery and Strout (1966) indicates that foreign assistance has become a separate factor of production. Empirical finding of Izuka and Chetachukwu (2019) shows that ODA positively adds to output growth rate in Nigeria. Nigeria is among list of beneficiaries of foreign assistance from OECD, and at the same time a donor nation. As it is well known countries in early stages of development have greater need for massive investment in social services and infrastructure. Conversely, Boone (1995) observes negative foreign development assistance on growth and investments.

2.4 Empirical Underpinning

In what can be inferred to be pioneer discussion on structural breaks, Nelson and Plosser (1982) use GNP that accommodates "Great Depression" but decomposed fluctuations into a secular or growth and a cyclical components coupled with rest of 13 US historical data series, the study investigates whether macroeconomic time series are better characterized as stationary fluctuations around a deterministic trend or as non-stationary processes that displays no tendency to revert to a deterministic path. It is inferred that growth component is associated with real disturbances, and thus contributes significantly to changes in observed GNP. Consolidating on Nelson-Plosser dataset complemented with postwar quarterly real GNP, Perron (1989) further considers Great Crash, oil price shock and unit root hypothesis. The study conclusively reveals that break recorded in GNP occurred at 1973 oil price shocks marking rejection of null of a unit root and when considered with 1929 stock market crash both events possess persistent shock effects. Zivot and Andrew (1992) retain Nelson-Plosser and Perron datasets to provide further evidence on Great Crash and oil price shock by treating breakpoint as endogenous. The authors develop a unit-root testing technique that allows for estimated break in the trend function under the alternative hypothesis. Finding reveals less conclusive evidence against the unit-root hypothesis than Perron found for most of the datasets. Wallack (2003) investigates structural breaks in Indian macroeconomic data. The study observes break in 1992 in trade, transport, storage, and communication and that there is clear indication that 1980s reforms evidently increased India's growth rate. Karavias *et al.* (2022) investigate if structural breaks had occurred during COVID-19 pandemic in panel of 61 countries. The study ended concluding that structural breaks occurred first week of April 2020 whereas stock market reaction was short-lived. Glynn *et al.* (2007) survey empirical studies, describe tests for both single and multiple breaks and an application. Leading structural breaks test models Nelson and Plosser (1982); Perron (1989); Zivot and Andrews (1992) form part of prominent exogenous and endogenous tests to detect structural breaks. The paper concludes absence of uniform consensus on the most appropriate methodology to perform unit root tests or no consensus about the empirical results of unit root tests emerged from their survey. Lee and Strazicich (2003) endogenous two-break Lagrange multiplier (LM) unit root test that allows for breaks under both the null and alternative hypotheses. The paper concludes that the two-break minimum LM unit root test provides remedy for a limitation of the two-break minimum LP (Lumsdaine & Papell, 1997), test that includes the possibility of a unit root with break(s) in the alternative hypothesis. Tasos (2014) examines dynamic relationship between growth, FDI and export in the US with structural breaks. The Bai-Perron test reveal two structural breaks, one in 1981 and the other in 2000 coinciding with years of US recession. Pesaran (2004) provides a novel approach to forecasting time series subject to discrete structural breaks. Fasanya (2022) employ oil prices and exchange rate to show important roles of asymmetry and structural breaks. Result suggests that oil price asymmetries matter, implying that whether structural break exists or not positive and negative shocks to oil prices matter in causing substantial movement. Lastly, the paper concludes that disregarding the role of structural breaks and asymmetry will amount to serious biases and misleading results. Ditzen *et al.* (2021) on epidemiological relationship between COVID–19 cases and deaths conclude evidence of multiple breaks.

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3 Data and Linear Specifications

It is now time to turn attention to analysis of Nigeria long time data[13] series which covers measures of FDI, official development assistance, external debts. These are annual series spanning from 1970 ending in 2021 denominated on current US Dollar. With no exception all measures are transformed to natural logs. The Augmented Dickey-Fuller (ADF) test statistics is compared against 1%, 5%, and 10% critical values. For a variable to be stationary the ADF t-statistic in absolute value must be larger than the corresponding critical values reported in MacKinnon (1991). Classical ADF unit root test takes the following specification:

$$\Delta y_t = \beta \mathrm{D}_t + \emptyset y_{t-1} + \sum_{p=1}^{p} \psi_j \Delta y_{t-p} + \varepsilon_t \quad (1)$$

Where D_t is sector of deterministic terms (constant, trend). The p lagged difference terms, Δy_{t-p}, is used to approximate the ARMA structure of the errors to correct for higher- order correlation, and the value of p is set so that the error ε_t is serially uncorrelated. However, the null of the ADF could be biased in the midst of structural break. Zivot-Andrews and Chow test provide useful approaches in detecting breakpoint date and adjustments.

$$\Delta y_t = \mu + \beta t + \theta DU1_t + \gamma DT1_t + \alpha y_{t-1} + \sum_{j=1}^{k} C_i \Delta y_{t-j} + \varepsilon_t \quad (2)$$

Where; $DU1_t$ is a sustained dummy variable capturing a shift in the intercept. $DT1_t$ is a different dummy representing a shift in the trend occurring at break date. Model 2 has been implemented in Harvie, Pahlavani and Saleh (2006). It has advantage of accommodating the possibility of a change in the intercept simultaneously with broken trend. Break point date is naturally exempted from the first (1970) and last years (2021). However, date of possible change is not fixed *a* priori but considered unknown. The optimal lag length is determined on the basis of the Schwartz-Bayesian Criterion (SBC) and the most significant *t* ratio. We assume only a single break date against multiple breaks[14]. Using Zivot-Andrew estimator the timing of the structural breaks whether in intercept or trend of each financial series under investigation is detected considering the most significant *t* ratio.

3.1 Model Specification and Chow Structural Break Test

Using Chow test, it is expected that break point date be identified by using any of graphical plot or cumulative sum of square plot. Furthermore, where the *F*-statistic is significant, the null of no break point is rejected. It is otherwise the null of no break point is not rejected. Still, if CUMSUMSQ is adopted then we fix 5% significance level to examine where the plot deviates from the bounded region. Where structural break is confirmed a dummy variable which takes zero (0) for year without break and one (1) from the breakpoint year. Next a new series is generated with dummy as interaction term for all the explanatory variables in the model.

$$DU * GDP_t = \beta_0 + \beta_1 DU * FDI_t + \beta_2 DU * EXDEBT_t + \beta_3 DU * ODA_t + \varepsilon_t \quad (3)$$

Where, $DU * GDP_t$ represents dummy variable interacting with gross domestic product, $DU * FDI_t$ denotes dummy variable interacting with foreign direct investments, $DU * EXDEBT_t$ implies dummy variable interacting with external debts, $DU * ODA_t$ means dummy variable interacting with official development assistance. Inclusion of dummy and the interaction term in model (3) assumes presence of structural change in each series. Introducing GDP makes for structural equation for test of relationship. This classical approach is already applied in Tasos (2014) estimation of growth with FDI parameter under condition of structural break for the US.

Equation (3) specification follows exogenous growth theory, Solow Neoclassical growth model and dependency theory. It is augmented with empirical literature. Collin and Henry (2007), Bomschier, Chase-Dunn and Rubinson (1978); Senadza *et al.* (2017) are outstanding works on financial inflows and economic growth.

[13] The long historical series warrants sourcing data from World Bank database which conventionally supplies reliable global-scale data. OECD supplies official development assistance data

[14] Further econometric advances detect multiple breaks. Pesaran, Pettenuzzo and Timmermann (2004) developed statistic to forecast time series subject to multiple structural breaks. This is confirmed using US treasury bill rates.

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4 Implementation of Methods and Result Analyses

Table 1: ADF unit Root test result without allowing for structural break

	Test statistics Z(t) Model (1)*	***1% Critical value***	***5% Critical value***	***10% Critical value***	***Integration***
Gross Domestic Product	-5.102171 [0.0001]	-3.568308	-2.921175	-2.598551	I(1)
Δ External Debt	--4.239388 [0.0015]	-3.568308	-2.921175	-2.598551	I(1)
Δ Official Development Assistance	-7.700283 [0.0000]	-3.571310	-2.922449	-2.599224	I(1)
Δ Foreign Direct Investments	-8.576986 [0.0000]	-3.568308	-2.921175	-2.598551	I(1)

[ ] represents MacKinnon approximate *p*-value for *Z*(t); Δ first difference operator
*Assumes no break under the null of unit root

On the table 1 the null of unit root at level data remains valid, however, at first difference the alternative hypothesis across all series could not be rejected as series become stationary. Th statistical inference is accepted of the alternate hypothesis. The results suggest first order integration. We now turn attention to unit root with structural break statistic estimated with Zivot-Andrews.

Table 2: Zivot-Andrews Unit Root with Structural break

	Break Date	**ZA *t-stat***	***p-value***	**ZA Critical Values**		
				1%	5%	10%
Gross domestic product	2010	-3.281403	0.00533	-5.57	-5.08	-4.82
Foreign direct investments	2005	-6.134127	0.00035	-5.57	-5.08	-4.82
External Debt	2005	-5.056052	0.00000	-5.57	-5.08	-4.82
Official Development Assistance	2005	-7.860202	0.0000065	-5.57	-5.08	-4.82

*ZA denotes Zivot-Andrews but ZA *t-stat* represents the minimum *t*

Table 2 is a statistical output of Zivot-Andrew with break date and critical values. Nelson and Plosser (1982) utilized series converted to their natural logs except bond yield. Perron (1989) followed similar step in Nelson-Plosser by using same class of data but added interest rate analyzed at levels. When we estimated our foreign capital inflows and GDP data at their levels and further experimented in the log transformed state both estimations yielded similar results. The ZA model coincidentally identified identical most significant structural breaks in the foreign financial aggregates. In table 2 it is evident that year 2005 remains an outstanding break date where parameters of external debts, FDI and ODA display structural change. This iconic year is largely remarkable and represents an attempt to rebuild broken public confidence in the Nigerian banking system. The Federal Government principal approach to the reform was on recapitalization or consolidation of every licensed deposit money bank to generate capital requirement of 25 billion Naira. Ideally the reform in the banking sector began in 2004 marking a turning point in bank business and the entire financial system, however, year 2005 December was the peak. The shocking effect of the reform is relatively important considering the magnitude of the change. The entire result shows that the null hypothesis of at least one unit root is rejected for some of the financial series under investigation. Thus, the

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variables observed to possess unit root on conventional unit root test became stationary after accounting for the presence of structural breaks. A ZA t-test show statistical significance in the endogenous structural break model (column 3 and 4) only in FDI and ODA. ZA unit root did not produce minimum *t* in external debt and GDP hence the null hypothesis stands unrejected even though there is break.

Unlike capital inflow variables, the GDP series yet presents a different picture. The structural change at year 2010 with massive increase in the domestic output. This confirms the generally held view that the economy performed better stretching to 2014 of which the Nigerian economy was rebased. However, after the rebasing year date the slope of the trend persistently decreased. Further evidence on break is observed in fig. 3.

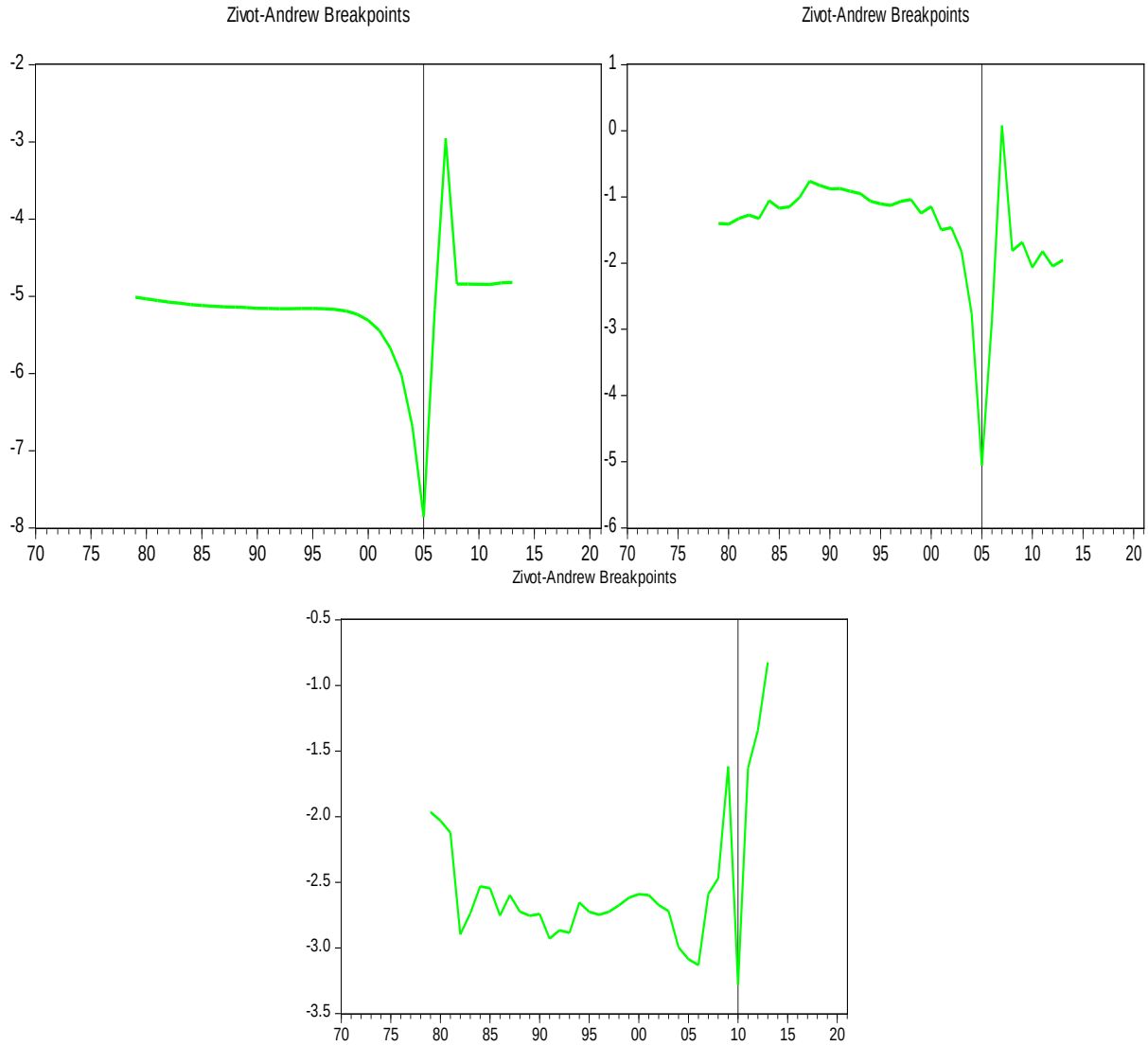

Fig. 3 : Plots of break dates with Zivot-Andrew incorporating intercepts and trends

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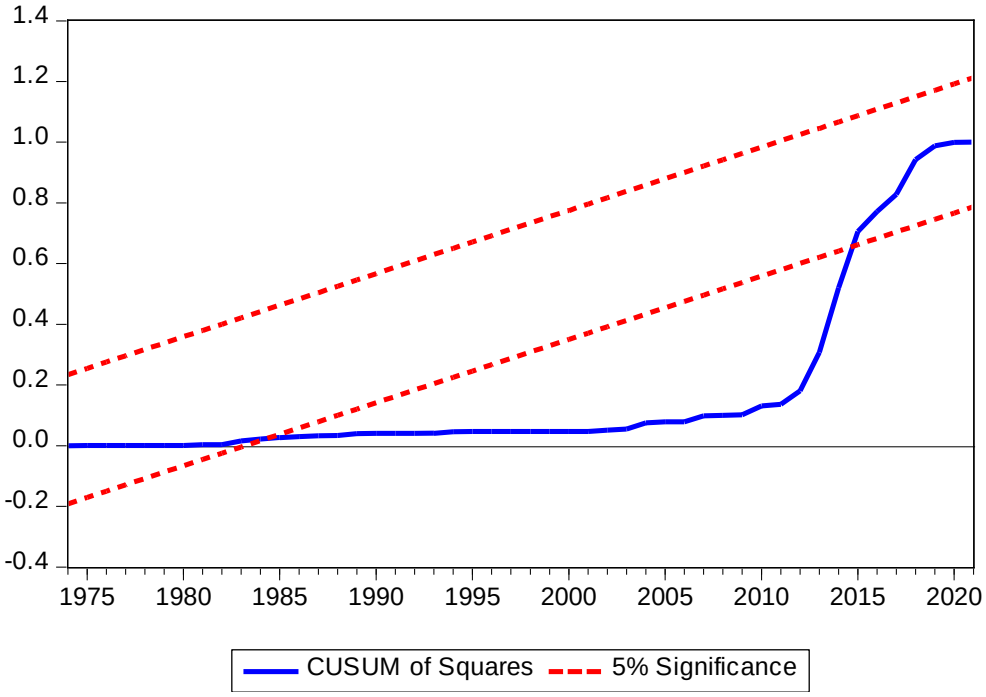

Fig. 4. Cumulative sum square test

In fig. 4 above the evidence of break is observed as CUSUM of square line is found outside the bounded region. Therefore at 5% significance level boundary there is clear digression indicating a break in the model. In table 3 the null of no break at specified breakpoints is invalid with an *F*-statistic of 50.86294 (*p-value* 0.0000 < 0.05). Nevertheless, strong structural changes in individual series highlight supports for Wallack (2003); Eke *et al.* (2015); Okere, Munoneke and Onuoha (2021); Fernandes *et al.* (2023); Zhang and Zhang (2023).

Table 3: Chow test Breakpoint test

***F*-statistic**	50.86294	Prob. *F*(4,44)	0.0000
Log likelihood ratio	89.80536	Prob. *Chi-Square* (4)	0.0000
Wald Statistic	203.4518	Prob. *Chi-Square* (4)	0.0000

For this purpose, we model the breaks observed in specific series using dummy and consequently interact the dummy with the series. Below is the estimate of two different models:

Table 4: Least square regression for Breakpoint empirical application

Dependent Variable: GDP

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	Beta	Standard Error	*p-value*
†Case I			
Foreign direct investments	40.42984	6.794829	0.0000
External Debt	3.348739	0.863663	0.0003
Official Development Assistance	15.51528	8.616465	0.0780
‡Case II			
Dummy*Foreign direct investments	17.23529	7.151259	0.0198
Dummy*External Debt	7.827613	0.999288	0.0000
Dummy*Official Development Assistance	-17.45776	10.14794	0.0918
Adj-R^2	0.678795		
N	52		
Prob(*F*-statistic)	0.000000		

† Regression estimates of FDI, debt and ODA against GDP macroeconomic time series with no breaks with assumption.
‡ Incorporates break detecting dummy with trend and intercepts that uniquely interacts with all the series. We use it to test and compare effectively how parameters of interest behave under condition of structural break.

Table 4 is a test result from empirical application of breakpoint of individual series consistent with model 3 specification by fitting GDP into FDI, external debts and official development assistance. Beginning with Case I result, it is evident that all the parameter estimates indicate positive influence on GDP, but official development assistance partially differs as null hypothesis appears valid. By sign, foreign direct investments beta to GDP is significant (p[0.0000<0.05]) indicating strong positive outcome in output growth and this is consistent with neoclassical theory. The same can be observed in external debt whose beta is hypothetically significant (p[0.0003<0.05]). However, official development assistance upholds non-rejection of hypothesis (p[0.0780>0.05]), hence the positive influence of ODA on output growth is not quite different from zero. Positive sign of development assistance parameter is consistent with Suphian and Kim (2016). In the Case II scenario, FDI and external debt exert positive and significant influence on GDP. Specifically, external debt is perfectly positively significant. However, official development assistance has a beta of -17.45776 which indicates decreasing effect on GDP. The decline is conclusively not significant. One of the potential causal factors for the negative influence could be the sudden decline in volume of ODA to Nigeria which almost recorded negative inflow from year 2007 (Fig. 1). The available concessional aids continued to decline in Nigeria and what is available might not be sufficient to stimulate growth in productivity. Obviously, aftermath of the break generated a decline in aid rather than growth whose impact is negative. Alternatively, negative effect could be a matter of Nigeria decision to invest such concessional soft loans or grants in investments that do not play supportive role to manufacturing. Major focus of government fiscal objective in the last decade is to defeat extremist groups which unfortunately substitutes for State Development Goals (SDGs) project. It is acknowledged that huge spending is required to carry on with deadweight expenditure to fight insecurity of the current magnitude. Vast resources are channeled to the military. Moreover, detecting structural break in our series supports Glynn, Perera and Verma (2007) which faults the traditional view of unit root hypothesis that current shocks only have a temporary effect and the long-run trend in the series is unaltered by such shocks.

5 CONCLUSION AND SUGGESTIONS

This paper discussed and tackled univariate issue of structural break and endogenously discovered unknown break date in a Zivot-Andrews test in foreign capital variables and aggregate national outputs within domestic economy. A backup test is the known Chow breakpoint stability analysis test implemented in dummy variable model (3). Inference on the null of macroeconomic series has a unit root with a structural break in intercept and trend was based on minimum t in ZA hypothesis. Rejection of null of no break informs acceptance of alternative hypothesis confirming presence of structural breaks with possibility of unit root. Findings point to year 2005 as historically turning point in the Nigerian economy having observed structural breaks in official development

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assistance, external debt and FDI. The date was different in GDP as break occurred in 2010. While reform of the banking system driven by government policy might have been significant causal condition behind the break. The reform produced resilient financial system signaling the bedrock of investor and donor confidence. There is scanty tangible information on 2010 break date seen in GDP. Still, a political change might be inferred. Therefore, structural change in all the series endogenously runs on domestic government policy force. Nevertheless, observing single most significant break is not sufficient as other distortionary conditions may cause massive and long-run drifts away from current trends. A multiple break possesses valuable information in different dimensions for a balanced view than single most significant break which is an obvious limitation. Thus, application of methods such as Lumsdaine and Papell formulated for capturing multiple breaks is suggested for further studies.

Dividing structural equation analysis into Case I and II without break and with break dummy in the series lead to mixed inferences about the response of GDP to changes in individual financial aggregates. Case I findings conclude existence of positive relationship between foreign capital inflow variables and output growth in Nigeria. Integration of structural change dummy in Case II indicates different consequence for GDP. Specifically, Case II result arrives at inverse relationship between official development assistance and GDP. Conclusively, structural break in official development assistance declines economic growth. Therefore, foreign aid is an international tool for development but has limitation in the midst of endogenously propagated break. Nevertheless, the expected advantage of development assistance despite break is still achievable. For official assistance of DAC to yield desired developmental objective donors within the DAC could insist on proper accountability by recipient countries. It implies release of future fund should be on the basis of agreed upon target investment capable of expanding the economy and the highest bank in the land can help. It should be the responsibility of Central Bank to manage the proceeds from foreign aids. External debts and FDI are foreign capitals that strongly improve level of national outputs in the activity sector reported in both models.

REFERENCES

1. Adenomon, M. O., & Idowu, R. A. (2022). Modelling the Impact of the COVID-19 Pandemic on Some Nigerian Sectorial Stocks: Evidence from GARCH Models with Structural Breaks. *FinTech*, *2*(1), 1-20.
2. Baker, M., & Collins, M. (1999). Financial crises and structural change in English commercial bank assets, 1860–1913. *Explorations in Economic History*, *36*(4), 428-444.
3. Bomschier, V., Chase-Dunn, C., & Rubinson, R. (1978). Cross-national Evidence of the Effects of Foreign Investment and Aid on Economic Growth and Inequality: a survey of findings and a reanalysis. *American Journal of Sociology*, *84*(3), 651-683.
4. Boone, P. (1996). Politics and the Effectiveness of Foreign FAGIA. *European Economic Review, 40*(2), 289–329.
5. Castles, S., & Vezzoli, S. (2009). The global economic crisis and migration: temporary interruption or structural change?. *Paradigmes: economia productiva i coneixement*.
6. Cecchetti, S. G., Mohanty, M. S., & Zampolli, F. (2011). The real effects of debt. *BIS Working papers No 352*
7. Cesa-Bianchi, A., Thwaites, G., & Vicondoa, A. (2016). Monetary policy transmission in an open economy: new data and evidence from the United Kingdom.
8. Chang, K., & Li, S. Z. (2022). Does COVID-19 pandemic event alter the dependence structure breaks between crude oil and stock markets in Europe and America. *Energy Reports*, *8*, 15106-15123.
9. Checherita-Westphal, C. D., & Rother, P. (2010). The impact of high and growing government debt on economic growth: an empirical investigation for the euro area. *ECB Working Paper* 1237/2010).
10. Chenery Hollis, B., & Strout Alan, M. (1966). Foreign Assistance and Economic Development. *American Economic Review,56*(4)*,* 679-733.
11. Collins, S. M., & Henry, P. B. (2007). Foreign Capital and Economic Growth. Comments and Discussion. *Brookings Papers on Economic Activity*, *2007*(1), 210-230.
12. Correia, I., Neves, J. C., & Rebelo, S. (1995). Business cycles in a small open economy. *European Economic Review*, *39*(6), 1089-1113.
13. Denisia, V. (2010). Foreign direct investment theories: An overview of the main FDI theories. *European journal of interdisciplinary studies,* (3).

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 31, February, 2024
ISSN: 2749-3628,

14. Ditzen, J., Karavias, Y., & Westerlund, J. (2021). Testing and estimating structural breaks in time series and panel data in stata. *arXiv preprint arXiv:2110.14550*.
15. Dunning, J. H., & Rugman, A. M. (1985). The influence of Hymer's dissertation on the theory of foreign direct investment. *The American Economic Review, 75*(2), 228-232.
16. DMO (2021). Loans obtained from China Exim as at September 30, 2021 amounts in millions. Available at: https://www.dmo.gov.ng/debt-profile/external-debts/3768-status-of-china-loans-as-at-september-30-2021/file
17. DMO (2023). Nigeria's Eurobonds closing prices and yields as at Tuesday, June 06, 2023. Accessed at: https://www.dmo.gov.ng/fgn-bonds/eurobonds-trading/4301-nigeria-s-eurobonds-closing-prices-and-yields-as-at-tuesday-june-06-2023/file
18. Eke, F.A., Eke, I.C., & Inyang, O.G. (2015). Interest rate and commercial banks' lending operations in Nigeria: a structural break analysis using chow test. G*lobal journal of social sciences 14, 2015: 9*-22
19. Fasanya, I. O., Oyewole, O. J., & Raheem, I. D. (2022). Oil prices and exchange rate dynamics: How important is the role of asymmetry and structural breaks?. *Journal of African Business*, *23*(3), 638-657.
20. Fernandes, M. C., Dutra, T. M., Dias, J. C., & Teixeira, J. C. (2023). Modelling output gaps in the Euro Area with structural breaks: The COVID-19 recession. *Economic Analysis and Policy*, *78*, 1046-1058.
21. Fernández, A., Schmitt-Grohé, S., & Uribe, M. (2017). World shocks, world prices, and business cycles: An empirical investigation. *Journal of International Economics*, *108*, S2-S14.
22. Gerlach, R., Wilson, P., & Zurbruegg, R. (2006). Structural breaks and diversification: the impact of the 1997 Asian financial crisis on the integration of Asia-Pacific real estate markets. *Journal of International Money and Finance*, *25*(6), 974-991.
23. Glynn, J., Perera, N., & Verma, R. (2007). Unit root tests and structural breaks: A survey with applications.
24. Hałka, A., & Kotłowski, J. (2017). Global or domestic? Which shocks drive inflation in European small open economies?. *Emerging Markets Finance and Trade*, *53*(8), 1812-1835.
25. Izuka, U. F., & Chetachukwu, O. I. (2019). Impact of International Development Assistances (Ida) On Economic Growth in Nigeria (1986-2016). *Saudi Journal of Economics and Finance, 3*(6), 237-247.
26. Karavias, Y., Narayan, P. K., & Westerlund, J. (2022). Structural breaks in interactive effects panels and the stock market reaction to COVID-19. *Journal of Business & Economic Statistics*, 1-14.
27. Karavias, Y., Narayan, P. K., & Westerlund, J. (2023). Structural breaks in interactive effects panels and the stock market reaction to COVID-19. *Journal of Business & Economic Statistics*, *41*(3), 653-666.
28. Kumar, M., & Woo, J. (2010). Public debt and growth. *IMF working paper.*
29. Lee, J., & Strazicich, M. C. (2003). Minimum Lagrange multiplier unit root test with two structural breaks. *Review of economics and statistics*, *85*(4), 1082-1089.
30. Luk, P., Cheng, M., Ng, P., & Wong, K. (2020). Economic policy uncertainty spillovers in small open economies: The case of Hong Kong. *Pacific Economic Review*, *25*(1), 21-46.
31. Mareeswaran, M., Sen, S., & Deb, S. (2023). New methods of structural break detection and an ensemble approach to analyse exchange rate volatility of Indian rupee during coronavirus pandemic. *Journal of the Royal Statistical Society Series A: Statistics in Society*, qnad078.
32. Muthuramu, P., & Maheswari, T. U. (2019). Tests for structural breaks in time series analysis: A review of recent development. *Shanlax International Journal of Economics*, *7*(4), 66-79.
33. Nayak, D., & Choudhury, R. N. (2014). A selective review of foreign direct investment theories. ARTNeT Working Paper Series, No. 143, Asia-Pacific Research and Training Network on Trade (ARTNeT), Bangkok.
34. Nelson, C. R., & Plosser, C. R. (1982). Trends and random walks in macroeconomic time series: some evidence and implications. *Journal of monetary economics*, *10*(2), 139-162.
35. OECD (2019). Official Development Assistance. April 2019.

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 31, February, 2024
ISSN: 2749-3628,

36. Okere, K. I., Muoneke, O. B., & Onuoha, F. C. (2021). Symmetric and asymmetric effects of crude oil price and exchange rate on stock market performance in Nigeria: Evidence from multiple structural break and NARDL analysis. *The Journal of International Trade & Economic Development*, *30*(6), 930-956.
37. Okoye, L. U., Nwakoby, C. I., & Okorie, E. U. (2016). Deregulating the Nigerian economy for enhanced real sector growth. *Journal of Policy and Development Studies*, *10*(2), 144-158.
38. Olofin, S., & Iyaniwura, J. O. (1983). From oil shortage to oil glut: Simulation of growth prospects in the Nigerian economy. *Journal of Policy Modeling, 5*(3), 363-378.
39. Panizza, U., & Presbitero, A. F. (2012). Is high public debt harmful for economic growth? New evidence. *Austerity: Too Much of a Good Thing?*, 91.
40. Pattillo, C., Poirson, H., & Ricci, L. (2011). External debt and growth. Review of Economics and Institutions, 2 (3), 1-30.
41. Perron, P. (1989). The great crash, the oil price shock, and the unit root hypothesis. *Econometrica: journal of the Econometric Society*, 1361-1401.
42. Pesaran, M. H., Pettenuzzo, D., & Timmermann, A. (2006). Forecasting time series subject to multiple structural breaks. *The Review of Economic Studies*, *73*(4), 1057-1084.
43. Reinhart, C. M., & Rogoff, K. S. (2010). Growth in a Time of Debt. *American economic review*, *100*(2), 573-578.
44. Reinhart, C. M., Reinhart, V. R., & Rogoff, K. S. (2012). Public debt overhangs: advanced-economy episodes since 1800. *Journal of Economic Perspectives*, *26*(3), 69-86.
45. Rugman, A. M. (1980). Internalization as a general theory of foreign direct investment: A re-appraisal of the literature. Weltwirtschaftliches Archiv, (H. 2), 365-379.
46. Samimi, P., & Jenatabadi, H. S. (2014). Globalization and economic growth: Empirical evidence on the role of complementarities. *PloS one*, *9*(4), e87824.
47. Sanusi, J.O. (1988). Deregulating the Nigerian economy: achievements and prospects. *Central Bank of Nigeria Economic and Financial Review, 26*(4). 32-46.
48. Savvides, A. (1992). Investment slowdown in developing countries during the 1980s: Debt overhang or foreign capital inflows?. *Kyklos*.
49. Senadza, B., Fiagbe, K., & Quartey, P. (2017). The effect of external debt on economic growth in Sub-Saharan Africa. *International Journal of Business and Economic Sciences Applied Research*, *11*(1).
50. Stylianou, T. (2014). Dynamic relationship between growth, foreign direct investment and exports in the US: an approach with structural breaks. *The IUP Journal of Applied Economics, Forthcoming*.
51. Suphian, R & Kim, S. (2016). Official Development Assistance and Economic Growth in East African Countries. *The journal of peace studies,* 18(2), 144-164.
52. World Bank (2020). *International debt statistics 2020*. Washington: International Bank for Reconstruction and Development / The World Bank.
53. Ying, Y. H., Chang, K., & Lee, C. H. (2014). The impact of globalization on economic growth. *Romanian Journal of Economic Forecasting*, *17*(2), 25-34.
54. Zhang, Y. J., & Zhang, H. (2023). Volatility forecasting of crude oil market: which structural change based GARCH models have better performance?. *The Energy Journal*, *44*(1).