'Financial Inclusion-Income Inequality' Nexus in Nigeria: Evidence from Dynamic Ordinary Least Square (DOLS) Modeling Approach

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Abstract: High level of exclusion from the financial system could be a consequence of low level of financial development evident in such economy. Low financial access and access to financial services/products is a one of the contributory factors to the level of income generated by households and businesses and by extension the level of income inequality in such economy. To examine the "Financial Inclusion-Income Inequality" nexus in Nigeria, this paper specifies income inequality in Nigeria as a function of deposit money banks' loans to SMEs, banks' credit to the private sector, number of bank branches, and broad money supply-to-GDP ratio. The data used in this study are annual time series data from 1992 to 2018. Specifically, data on financial access (measured by having a number of commercial banks branches and broad money supply-to-GDP); and access to financial services and products (measured by deposit money banks' loans to SMEs and deposit money banks' credit to the private sector) were collected from the Central Bank of Nigeria (CBN) Statistical Bulletin. Data on level of inequality (measured by the Gini index) was collected from the National Bureau of Statistics (NBS). The unit root tests (i.e., ADF and PP) shows that the time series are non-stationary until after first differencing. To empirically analyze the impact of financial inclusion on inclusive growth, the Dynamic Ordinary Least Square (DOLS) econometric technique was employed. The results show that the coefficients of financial access variables are significantly different from zero. That is, the improvement in the financial access component of financial inclusion will prove to be more effective in reducing the income inequality gap in Nigeria. This may not be unrelated to the reality on ground as it affects the cost of credit and the stringent requirements often included as pre-condition for granting of loans and supply of credits by deposit money banks and other business financing institutions. This paper therefore recommends policy that increases awareness among citizens on the importance of owning and maintaining a bank account; and establishment of more branches in the rural areas to serve the high and growing rural population.

Keywords: Inclusion, Financial Access, Access to Financial Services/Products, Gini Index, Inequality

I. INTRODUCTION

Inequality in income distribution and unequal financial stability have been long-standing issues in developing countries, with African countries in particular suffering from these issues (Levine, 2008; Maasoumi, Heshmati, Wan, Batuo, & Asongu, 2015; Neaime, 2015; Neaime & Gaysset, 2017). An increasing number of studies have emphasized the adoption of "financial inclusion" as a means of increasing access to financial services for a larger segment of the population (Maune, Matanda, & Mundonde, 2020; Omar & Inaba, 2020; Sha'ban, Girardone, & Sarkisyan, 2020) in order to address these issues. Financial inclusion refers to all of the efforts made to bring poor people into the financial system so that they can take advantage of financial services. Currently, financial inclusion is regarded as a policy tool for the achievement of a wide range of macroeconomic objectives. Money movement, investment, and increased savings are all made possible through financial inclusion. Financial systems are also more stable when people have access to financial inclusion services. It also contributes to economic development and long-term development (Beck, Demirgüç-Kunt, & Levine, 2007; Cumming, Johan, & Zhang, 2014; Klapper, El-Zoghbi, & Hess, 2016; Levine, 2005; Morgan & Pontines, 2014; Park & Mercado, 2015, 2018). Nonetheless, financial inclusion has a variety of positive implications for economic development, but it may be hampered by a lack of financial literacy, which prevents people from taking advantage of financial services at their full potential and dilutes the impact of such inclusion (Ardic, Heimann, Mylenko, 2011; Chikalipah, 2017; Nyarko, 2018). Because it has a negative impact on economic outcomes in the form of poverty and inequality, low financial literacy is critical in financial decision-making and must be addressed (Refera, Dhaliwal, & Kaur, 2016). The African Development Bank published a report in 2013 stating that African countries had not performed well in terms of financial and economic reforms aimed at eradicating poverty and inequality. These findings are supported by Tchamyou, Erreygers, and Cassimon (2019) and Tchamyou (2020), who state that a large segment of the African population has yet to be financially included in the economy. According to a report published by the World Bank in 2016, African countries account for more than half of the world's poor. According to the World Bank's report (Africa Development Bank, 2012), Africa is also the second-most unequal region in terms of income distribution after Latin America in terms of per capita income. The implications of this are that financial inclusion may be one of the factors that contribute to the African population's ability to lift themselves out of poverty and inequality. Also, of concern to policymakers in developing countries generally, and Africa specifically, is the stability of the financial system. Following

policies of financial inclusion and financial stability, on the other hand, does not lead to the same result. In contrast to financial stability, which aims to improve asset quality by adhering to stringent regulations while providing financial services, the goal of financial inclusion is to broaden and enable financial access to a larger segment of the population, allowing financial institutions to make some concessions in terms of regulatory requirements. It would be interesting to conduct research in order to better understand how financial inclusion and financial stability interact in African countries.

It is debatable whether the realization of the importance of financial inclusion has served as a major impetus for the adoption of policies and measures aimed at increasing global financial inclusion in the recent past (Sakanko, Abu & David, 2019). Despite this global consensus, achieving widespread financial inclusion has remained a global challenge, particularly in Sub-Saharan Africa and low-income countries (Kama & Adigun, 2013; Demirgüç-Kunt, Klapper, Singer, Ansar & Hess, 2018). However, despite the fact that economists are generally in agreement that financial development stimulates economic growth and employment (Swamy, 2010; Adediran, Oduntan, and Matthew, 2017), there is a lack of consensus on the role of financial inclusion in poverty, inequality, and household welfare in relation to inclusive growth in developing countries (Odeleye & Olusoji, 2016; Van & Linh, 2019; Raichoudhury, 2016; Gul, Usman, & Majeed, 2018; Swamy, 2010). Although the empirical literature on the role of financial inclusion on poverty, inequality, and household welfare, among other things, in relation to inclusive growth and national development (see, for example, Sakanko et al., 2019; Otiwu, Okere, Uzowuru, & Ozuzu, 2018; Okoye, Adetiloye, Erin, & Modebe, 2017; Oyewo & Oyewole, 2014; Adeola (David et al., 2019). Taking this into consideration, the purpose of this study is to investigate the role that financial inclusion has played in closing the gap between rich and poor in Nigeria by examining the impact of financial access and access to financial products and services on income inequality. The following is the structure of the remainder of this paper: The second section contains a review of relevant literature (both theoretical and empirical); section three contains information on the types of data and econometric techniques used; section four contains the presentation and discussion of the results; and the final section, section five, contains the conclusion and recommendations.

II. LITERATURE

2.1 Definition of Concepts

Financial Inclusion

The task of defining financial inclusion is not an easy one to accomplish. It can be defined as the availability and utilization of formal financial services by all people, including those who are most vulnerable (Fouejieu, Sahay, Cihak & Chen, 2020). Demirgüç-Kunt, Beck, and Honohan (2008) define financial inclusion as the absence of any (price or nonprice) barriers to accessing financial services in a given community. Generally speaking, financial inclusion is defined as the establishment, promotion, and regulation of a financial environment that is safe, accessible, and affordable for all members of society (Carballo, 2017). As a result, according to Carballo (2017), "financial inclusion" is a broad, multidimensional term that changes all the time. In their definition of financial inclusion, Ramananda and Sankharaj (2015) stated that it is the process of ensuring that vulnerable groups, such as the weaker sections of society and low-income groups, have access to financial services and timely and adequate credit when they are needed by mainstream financial institutions at an affordable cost. It is not only banking products that are included in financial services, but also a slew of other financial services such as credit, insurance, and various other types of equity products (Ramananda & Sankharaj, 2015). The "financially excluded" are those who are unable to obtain timely credit and other financial services from formal sources. This is a problem for the government and policy makers, which must address it. Access to banking services is one of the most important elements or dimensions of financial inclusion. Others include having access to affordable and timely credit, as well as access to financial literacy programs that teach people how to live a financially healthy life. In his definition of financial inclusion, Leeladhar (2005) refers to the provision of banking services at a reasonable cost.

Income Inequality

An indicator of how society's resources are divided is income inequality. High levels of income disparity are viewed as ethically repugnant by some. Others perceive wealth inequality as harmful for practical reasons, seeing it as a source of conflict, a barrier to cooperation, or a source of stress on people's mental and physical health (Wilkinson & Pickett, 2009). We tend to focus on the direction of change in inequality rather than its amount. People's household disposable income is used to measure income disparity. The Gini coefficient is the most commonly used measure of income distribution. According to the Gini coefficient, there is a wide range of values between 0 and 1 in the case of "perfect equality" (everyone receives an equal income) and 1 in the case of "perfect inequality" (OECD, n.d). Inequality is not the same as poverty, but it is closely linked. Inequality is characterized by wide disparities in the standard of life among a group of people. Only those who fall below an acceptable standard of living are considered to be in poverty (such as those below the poverty line). In either absolute or relative terms, this threshold can be specified (for example, a fraction of the overall average standard of living). Relative poverty is directly linked to inequality because the definition of poverty is based on the current state of the population. Inequality, on the other hand, will have an impact on both definitions of poverty (McKay, 2002).

2.2 Theoretical Literature

This study is, among others, guided by the Galor-Zeira theory/model. Detail of the model was first published in their

paper titled "Income Distribution and Macroeconomics" in the year 1993. According to the Galor-Zeira model, imperfections in the financial market prevent poor people from escaping poverty by restricting their access to formal financial products and services (Galor & Zeira, 1993; Kim, 2016). In their model, Galor and Zeira demonstrated that imperfect credit markets restrict the access of poor people to financial services. Due to the fact that increased financial inclusion is associated with lower levels of income inequality (Aslan, Deléchat, Newiak, and Yang, 2017; Park & Mercado, 2018; Turgeon & Herrero, 2018), increased access to finance has been criticized as one of the most effective tools in fighting poverty (Aslan, Deléchat, Newiak, & Yang, 2017). A wide theoretical literature exists on the relationship between finance and inequality (e.g., Seven & Coskun, 2016). A few classical economists, including Kuznets (Kuznets, 1955), argued that income inequality could boost capital accumulation and growth by directing resources toward agents with a high saving propensity (Kuznets, 1955). (Lewis, 1954; Kaldor, 1955). Studies began to explicitly model the link between finance and inequality in the 1990s. In this vein of research, several studies suggest that financial development can reduce income inequality and poverty by reducing informational asymmetries and credit enforcement costs, which may be particularly burdensome for poor households and entrepreneurs with limited internal funds and pledgeable collateral (Banerjee & Newman, 1993; Galor & Zeira, 1993; Aghion & Bolton, 1997; Galor & Moav, 2004). According to various theoretical models, financial development can reduce inequality through a variety of channels. Poor people are unable to invest in their own education and, as a result, cannot find better-paying jobs. Inequality can be lessened if people with low incomes can afford to put money into their education (Galor & Zeira, 1993; Galor & Moav, 2004; Aghion & Bolton, 1997). Another channel focuses on the poor's ability to start their own businesses. Financial development may lower collateral requirements and borrowing costs, thereby encouraging new business ventures and the establishment of new firms (Banerjee & Newman, 1993). High-productivity projects, according to Matsuyama (2000), come with a hefty upfront investment. It is only the wealthy who can afford these costs because of a lack of credit. In Buera (2009), entrepreneurship is hindered by financial frictions, so wealthy agents can start businesses while the poor are confined to salaried positions. Increased demand for labor by firms may also alter the distribution of income rather than an increase in the poor's access to credit (Beck et al., 2010). Low-income workers may benefit from the increased demand for labor.

In contrast some authors have disagreed with scholars like Galor and Zeira, who theorized that financial development and inclusion are expected to close the income inequality gap. Some argue that the poor primarily rely on informal (e.g., family) connections to obtain money, and that the development of formal financial services specifically benefits the wealthy (Claessens & Perotti, 2007). In some theoretical models, the relationship between financial development and

the opportunities for the poor may not be linear and may depend on the degree of economic development. An inverted U-shaped relationship between financial and economic development is shown by Greenwood and Jovanovic (1990), which is similar to Kuznets' hypothesis that growth may lead to an increase in income inequality in the early stages of development and a decrease in it later on. According to Greenwood and Jovanovic (1990), financial intermediaries provide information on projects, but participating in their services has a fixed cost. Because only the wealthy can afford to bear this one-time expense in the early stages of development, economic progress tends to widen existing disparities. As the economy grows, the financial system becomes more accessible to the poor. Non-linearities in the financial development-inequality nexus have been highlighted by Greenwod and Smith (1997) and Townsend and Ueda (2006), who argue that the development of sophisticated financial institutions may entail large fixed costs (Bourguignon, 2001). Finance and equality may have different associations in different countries because of factors like the regulatory environment and quality of institutions, economic development, the nature of financial markets, and policies for financial inclusion in place, even though there are conflicting theoretical explanations for the link between finance and equality. This is even though there are conflicting theoretical explanations for the link between finance and equality.

2.2 Empirical Literature

2.2.1 Cross-Country/Cross-Subnational Studies

The results of empirical studies conducted on different continents have been inconsistent. For example, Omar and Inabar (2020) used unbalanced panel data from 2004 to 2016 to investigate the impact of financial inclusion on poverty and income inequality reduction in 116 developing countries. In addition, the findings provide compelling evidence that financial inclusion has a significant impact on poverty rates and income inequality in developing countries. Huang and Zhang (2020), along with Salazar-Cant, Jaramillo-Garza, and Rosa (2015) reached the conclusion that the possibility of an impact of financial inclusion varies over time. Six randomized controlled trials conducted in Mexico, Mongolia, Bosnia and Herzegovina, India, Ethiopia, and Morocco found no conclusive evidence that participation in microcredit programs has a positive impact on household income (Angelucci, Karlan & Zinman, 2015; Augsburg, De Haas, Harmgart & Meghir, 2015; Banerjee & Newman, 1993). A study conducted by Bkwayep and Tsafack (2020) using the generalized method of moments to investigate the interplay between financial inclusion, remittances, and income disparities in Africa confirmed the hypothesis that financial inclusion lowers income inequalities by a factor of 2. On the interplay between financial technology and income inequality in Africa, Chinoda and Mashamba (2021) investigated the mediating effects of financial inclusion on the interplay between these two variables. For the years 2011, 2014, and 2017, data from 25 countries were gathered and analyzed

using an eight-variable panel structural equation model for the years 2011–2014. There is evidence to suggest that financial inclusion mediates the relationship between financial technology and income inequality, and as a result, plays a critical role in reducing income inequality throughout Africa. Because of this, we can conclude that financial inclusion plays a mediating role in the interaction between financial technology and income inequalities in Africa, which is consistent with our findings. On the policy front, the study calls on African policymakers and regulators to develop policies that will promote fintech development and financial inclusion in the region. Zia and Prasetyo (2018) investigated the relationship between financial inclusion and poverty alleviation in 33 Indonesian provinces from 2014 to 2016. They used the Index Inclusion and regression-correlation of panel data analysis methods to conduct their research. As a result of the findings, it appears that there is a negative relationship between financial inclusion and poverty. Additional evidence suggests a non-significant positive relationship between financial inclusion and income inequality, according to the findings of the empirical study mentioned above. Kim et al. (2015) conducted a study in 37 developing economies in Asia to determine the impact of financial inclusion on poverty and inequality of income distribution. In this study, the findings confirm that financial inclusion has a statistically significant negative impact on poverty and income inequality. On the continent of Africa, Nyarko (2018) investigated the relationship between financial inclusion, financial literacy, and inclusive growth. In his paper, the author argues that evidence suggests that the access dimension (ATMs, bank branches, and mobile accounts) of financial inclusion has a statistically significant positive impact on employment and a statistically insignificant negative impact on poverty. He bases his argument on system-generalized methods of moments (S-GMM), ordinary least squares (OLS), causal step and bootstrap estimation techniques. Furthermore, the empirical evidence confirms the existence of a statistically significant positive relationship between financial literacy and job satisfaction. The impact of financial inclusion on poverty reduction in 49 Sub-Saharan African countries from 1980 to 2017 was examined by Bakari et al. (2019), who used a static panel data model to analyze the data. It is confirmed by the authors that savings, along with other indicators of financial inclusion, play a critical role in poverty alleviation. When Agyemang-Badu and Agyei (2018) used a fixed effect panel regression model to investigate the relationship between financial inclusion, poverty, and income inequality in 48 African countries, they discovered a positive relationship. The empirical findings indicate that financial inclusion has a significant and negative impact on poverty, as well as a positive and insignificant impact on inequality. With the help of the non-stationary heterogeneous panel model, Adamu and Suleiman (2018) investigated the relationship between financial inclusion and inclusive growth in 15 West and East African countries using data from the World Bank. Results show that domestic savings and credit (both indicators of financial inclusion) have

a negative impact on inclusive growth, which is measured by per capita household consumption expenditure.

2.2.2 Single-Country/Sub-national (Including Nigeria) Studies

Previous studies conducted in individual countries on the interaction between inequality and financial inclusion have yielded results that are both inconclusive and inconsistent. Kochar (2011) conducted an investigation into the relationship between financial inclusion and income inequality for households in the Indian state of Uttar Pradesh and found that increased access to formal financial services through local bank branches did not translate into increased actual usage of these financial services by low-income individuals. As an alternative, according to Zhang and Posso (2019), financial inclusion has a positive effect on income for Chinese families, and that this impact is greater for families in the lower quantiles of the income distribution, indicating that it helps to lower inequality. Swamy (2010) conducted an investigation into the impact of financial inclusion on inclusive growth in India from 1975 to 2007. He used the ordinary least square (OLS) estimation technique to do so. The findings indicate that indicators of financial inclusion (domestic savings and credit) have a statistically significant negative impact on inclusive growth (measured by poverty). When Sakanko, Abu, and David (2019) conducted an investigation into the impact of financial inclusion on national development in Nigeria between 1980 and 2018, they used the ARDL bounds testing approach to do so. Specifically, the authors argue that measures of financial inclusion (such as access to banks and ATMs, as well as credit availability) have a significant and positive impact on national development, both in the short and long term. As a result of their research, the authors discovered that there is a bi-directional causal relationship between financial inclusion and national development. Using the ordinary least square (OLS) estimation technique, Okoye, Adetiloye, Erin, and Modebe (2017) investigated the relationship between financial inclusion and economic growth and development in Nigeria between 1986 and 2015. According to the empirical evidence, financial inclusion (as measured by the number of bank branches, demand deposits from rural areas, and loans to rural areas) is positively and significantly related to income inequality in both the short and long terms.

According to the findings of an extensive literature search, there are very few studies on the impact of financial inclusion on income inequality in Nigeria. To put it bluntly, this paper adds to the body of knowledge by investigating the impact of financial inclusion on income inequality in Nigeria from the standpoints of financial access and access to financial services and products. It does so by employing the Dynamic Ordinary Least Square (DOLS) estimating technique, which is not used in most studies on financial inclusion but is used in this study. Specifically, the framework for this study is based on Galor and Zeira's model (Galor & Zeira, 1993), which demonstrates that imperfect credit markets restrict poor people's access to

financial services and products, as well as their ability to save and invest money.

III. RESEARCH METHOD

Table 1 Variables and sources

Variable	Description	Sources
Dependent Variable Income Inequality		
gini	The Gini index is a measure of the distribution of income across a population. A higher Gini index indicates greater inequality (Index)	NBS
Independent Variables		
Access to Financial Services/Products		
lsme	Deposit money banks' loans to SMEs (₦ Billions)	CBN
cpsg	Credit to the private sector growth (%)	CBN
Financial Access		
nbb	Number of commercial banks branches (Nos)	CBN
bmg	Broad money supply-to-GDP (% of GDP)	CBN

NB: NBS = National Bureau of Statistics; CBN = Central Bank of Nigeria

Annual time series data from 1992 to 2018 were used in this study. From table 1 above, data on financial access (measured by having a number of commercial banks branches and broad money supply-to-GDP); and access to financial services and products (measured by deposit money banks' loans to SMEs and deposit money banks' credit to the private sector) were collected from the Central Bank of Nigeria (CBN) Statistical Bulletin. Data on income inequality (measured by the Gini index) was collected from the National Bureau of Statistics (NBS). It is worthy of mention that data on deposit money banks' loans to SMEs is available for a substantial number of years (i.e., less than 30 years), thereby making it imperative to adjust the period of the study to accommodate all the variables without a gap in data. This shortcoming in data observation informed our choice of model estimation econometric technique. To empirically analyze the impact of financial inclusion on inclusive growth, the Dynamic Ordinary Least Square (DOLS) econometric technique was employed.

The purpose of this paper is to estimate inequality models in which financial inclusion is a determinant of income inequality. However, in order to avoid estimating a spurious regression, the time series properties of the variables under investigation must be determined before the estimation procedure is selected and applied. Each series is subjected to augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests in order to determine their order of integration. When unit root tests are performed, the results will be used to determine the procedure that will be used to estimate the income inequality models. As an example, if all of the series are integrated of order 0, the ordinary least squares (OLS) procedure can be used; however, if the series are unit root non-stationary, OLS would produce a spurious regression.

The ADF unit root test involves estimating regression (2) for each series and, then, testing the null hypothesis of a unit root, H_0: $\alpha = 0$, versus the alternative of a stationary process, H_1: $\alpha < 0$. The test is based on the typical t-ratio for α –Fuller (1976), Dickey and Fuller (1979). However, the t-statistic does not follow the t-distribution under the null; thus, critical values are simulated for each regression specification and sample size –MacKinnon (1996).

$$\Delta y_t = \alpha\, y_{t-1} + x_t \delta + \Sigma_{p=1}^{p} \Delta y_{t-p} + \varepsilon_t \qquad 3.1$$

x_t = exogenous regressors that may include a constant term only, a constant and a trend, or none.

Δy_{t-p} = terms included to correct for higher-order correlation.

The PP unit root test involves estimating a non-augmented version of regression (3.1); i.e., without the lagged difference terms. PP unit root test uses a non-parametric method to control for serial correlation under the null hypothesis. H_0 and H_1 are the same as in the ADF test; however, PP unit root test is based on its own statistic and corresponding distribution – Phillips (1987), Phillips and Perron (1988).

Provided all series are I(1) –as they are in this case–, then DOLS procedure is employed to estimate the single cointegrating vector that characterizes the long-run relationship among the variables in the income inequality functions: "one simply regress one of the variables – income inequality proxied by gini index, in this case– onto contemporaneous levels of the remaining variables, leads and lags of their first differences, and a constant, using" ordinary least squares (Stock & Watson, 1983, p. 784.).

Stock-Watson DOLS model is specified as follows:

$$Y_t = \beta_0 + \vec{\beta} X + \Sigma_{j=-q}^{p} \vec{d} \Delta X_{t-j} + u_t \qquad 3.2$$

Y_t = dependent variable

X = matrix of explanatory variables

$\vec{\beta}$ = cointegrating vector; i.e., represent the long-run cumulative multipliers or, alternatively, the

long-run effect of a change in X on Y

p = lag length

q = lead length

It is the goal of the lag and lead terms included in DOLS regression to ensure that its stochastic error term is independent of all previous innovations in stochastic regressors. Last but not least, unit root tests are conducted on the residuals of the estimated DOLS regression in order to determine whether or not it is a spurious regression. "In the unit-root literature, a regression is technically called a spurious regression when its stochastic error is unit-root

nonstationary (Choi et. al., 2008, p. 327). Unit root tests and DOLS estimation are performed using STATA 13.

Given that all the series in the income inequality models for Nigeria are unit root nonstationary; then, the cointegrating regressions to be estimated is the following:

$$gini_t = \beta_0 + \beta_1 \ln lsme_t + \beta_2 cpsg_t + \Sigma_{j=-q}^{p} \vec{d}_1 \Delta \ln lsme_{t-j} + \Sigma_{j=-q}^{p} \vec{d}_2 \Delta cpsg_{t-j} + u_t \qquad 3.3$$

And

$$gini_t = \beta_0 + \beta_1 \ln nbb_t + \beta_2 bmg_t + \Sigma_{j=-q}^{p} \vec{d}_1 \Delta \ln nbb_{t-j} + \Sigma_{j=-q}^{p} \vec{d}_2 \Delta bmg_{t-j} + u_t \qquad 3.4$$

Table 2 presents DOLS estimation results. The number of leads and lags were selected according to the Akaike information criterion.

IV. RESULTS

4.2. Stationarity Tests

The results presented in table 2 shows the stationarity of the time series collected for this study at levels and first difference. The result presented in panel A shows that both the ADF and PP test confirmed that all the time series variables were not stationary at levels. Hence none of the variables are integrated of order 0. Moreover, the results presented in panel B shows that the five (5) time series show stationarity at least under one of constant, constant plus trend, and none. Hence all of the time series variables are integrated of order 1.

Table 2: Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) Test Results at Levels and 1st Diff.

Panel A: Stationarity Test at Level							
Variables	Lag	ADF Test Statistics [Critical Value @ 5%]			PP Test Statistics [Critical Value @ 5%]		
		Constant	Constant + Trent	None	Constant	Constant + Trent	None
gini	2	2.07 [2.97]	2.01[3.56]	0.37[1.95]	1.85[2.97]	1.80[3.55]	0.48[1.95]
lnlsme	1	1.49 [3.00]	2.06[3.600]	0.30[1.95]	1.67[3.00]	1.82[3.60]	0.28[1.95]
cpsg	1	1.06 [2.97]	2.33[3.56]	0.23[1.95]	0.96[2.97]	2.02[3.55]	0.48[1.95]
lnnbb	1	1.65 [2.97]	2.08[3.56]	1.93[1.95]	2.00[2.97]	1.96[3.55]	2.99[1.95]
bmg	1	1.15[2.97]	2.62[3.56]	0.58[1.95]	1.12[2.97]	2.49[3.55]	0.65[1.95]
Panel B: Stationarity Test at 1st Difference							
Variables	Lag	ADF Test Statistics [Critical Value @ 5%]			PP Test Statistics [Critical Value @ 5%]		
		Constant	Constant + Trent	None	Constant	Constant + Trent	None
D.gini	2	2.80[2.98]	2.79[3.56]	2.99*[1.95]	3.17*[2.97]	3.15[3.56]	3.18*[1.95]
D.lnlsme	1	2.05[3.00]	1.67[3.60]	2.14*[1.95]	4.90*[3.00]	4.74*[3.60]	5.03*[1.95]
D.cpsg	1	4.97*[2.97]	4.93*[3.56]	4.81*[1.95]	4.91*[2.97]	4.84*[3.56]	4.88*[1.95]
D.lnnbb	1	3.49*[2.97]	3.65*[3.56]	2.90*[1.95]	4.50*[2.97]	4.69*[3.56]	3.78*[1.95]
D.bmg	1	3.98*[2.97]	3.93*[3.56]	3.91*[1.95]	5.64*[2.97]	5.56*[3.56]	5.58*[1.95]

Source: Authors' Computation

NB: (i) The test statistics and critical values are in absolute terms; (ii) * implies stationarity at 5%; (iii) The lags are selected based on AIC, HQIC, & SBIC

4.2 Dynamic Ordinary Least Square (DOLS) Inequality Models

Table 3 above shows results of the estimated DOLS inequality models to show the dynamic relationship between income inequality and the financial inclusion variables. While the first model estimated the impact of access to financial services/product (measured by commercial banks' loans to SMEs and credit to the private sector) on income inequality, the second model estimated the impact of financial access (measured by number of commercial banks branches and broad money supply-to-GDP ratio) on income inequality. Presented in table 2 are the parameter estimates i.e., coefficients, Newey-West standard error, t-statistics and probability of t-statistics of the estimators. Each of the estimated models result are presented in two sections.

Table 3: DOLS Inequality Models

Panel A: 'Access to Financial Services/Product-Income Inequality' Model Dep. Variable: Gini Index					Panel B: 'Financial Access-Income Inequality' Model Dep. Variable: Gini Index				
Ind. Variables	Coef.	Newey-West Std. Err	t-stat	p > |t-stat|	Ind. Variables	Coef.	Newey-West Std. Err	t-stat	p > |t-stat|
lnlsme	11.81	13.26	0.89	0.42	**lnnbb**	9.87**	1.19	8.31	0.00
cpsg	0.83	1.27	0.64	0.56	**bmg**	-1.59**	0.14	-11.66	0.00
lnlsme F2D.	1.43	2.31	0.62	0.57	**lnnbb** F2D.	-19.80**	3.81	-5.19	0.00
FD.	4.02	9.94	0.40	0.71	FD.	-16.81**	2.61	-6.44	0.00

D1.	-2.71	2.18	-1.25	0.28	D1.	-22.44**	4.25	-5.28	0.00
LD.	2.11	2.29	0.92	0.41	LD.	13.42**	3.43	-3.91	0.00
L2D.	1.82	3.02	0.60	0.58	L2D.	-4.37	3.62	-1.21	0.25
cpsg					**bmg**			
F2D.	-0.37	0.51	-0.72	0.51	F2D.	-0.35**	0.12	-3.01	0.01
FD.	-0.16	0.85	-0.18	0.86	FD.	-0.19	0.21	-0.90	0.38
D1.	-0.58	0.29	-2.04	0.11	D1.	1.19**	0.12	9.60	0.00
LD.	-0.25	0.38	-0.66	0.55	LD.	0.70**	0.18	4.06	0.00
L2D.	0.07	0.32	0.20	0.85	L2D.	0.34	0.19	1.80	0.09
const.	-84.30	152.13	-0.55	0.61	const.	-7.57	7.93	-0.96	0.36
F-stat. = 3315.37 | Prob > |F-stat.| = 0.000					F-stat. = 17.46 | Prob > |F-stat.| = 0.000			

Source: Author's Computation.

NB: ** and * signifies significance of coefficient at 1% and 5% respectively.

From the panel A (showing the model estimated to investigate the impact of access to financial services/product on income inequality), the coefficient (i.e., 11.811) of commercial banks' loans to SMEs appeared with a positive sign and was statistically insignificant since the Newey-West standard error (i.e., 13.26) is high, absolute value of the t-statistics (i.e., 0.89) is less than 2.00, and probability of t-statistics (i.e., 0.904) is greater than 0.05. Moreso, the coefficient of credit to the private sector (i.e., 0.816) appeared with a positive sign and was also statistically insignificant since the Newey-West standard error (i.e., 1.27) is high, absolute value of the t-statistics (i.e., 0.64) is less than 2.00, and probability of t-statistics (i.e., 0.55) is greater than 0.05. The second panel of the model estimated to investigate the impact of access to financial services/product on income inequality shows that a change in the stochastically trending 'commercial banks' loans to SMEs' explanator (i.e., D1.) led to a decrease in gini index (as shown by the sign of the coefficient i.e., -0.043). Moreover, the decrease is insignificant (based on a high Newey-West standard error, a t-statistics that is less than 2.00, and a probability of the t-statistics that is greater than 0.05). Secondly, the change in the first lead (i.e., FD) of stochastically trending 'commercial banks' loans to SMEs' explanator had a positive and insignificant impact on gini index; and the change in the second lead (i.e., F2D) of stochastically trending 'commercial banks' loans to SMEs' explanator had a positive and insignificant impact on gini index. Thirdly, the change in the first lag (i.e., LD) of stochastically trending 'commercial banks' loans to SMEs' explanator had a positive and insignificant impact on gini index; and the change in the second lag (i.e., L2D) of stochastically trending 'commercial banks' loans to SMEs' explanator had a positive and insignificant impact on gini index. Fourthly, a change in the stochastically trending 'credit to private sector to GDP ratio' explanator (i.e., D1.) led to a decrease in gini index (as shown by the sign of the coefficient i.e., -0.582). Moreover, the decrease is insignificant (based on a high Newey-West standard error, an absolute t-statistics values that is greater less 2.00, and a probability of the t-statistics that is greater than 0.05). Fifthly, the change in the first lead (i.e., FD) of stochastically trending 'credit to private sector to GDP ratio' explanator had a positive but insignificant impact on gini index; and the change in the

second lead (i.e., F2D) of stochastically trending 'credit to private sector to GDP ratio' explanator had a negative and insignificant impact on gini index. Sixthly, the change in the first lag (i.e., LD) of stochastically trending 'credit to private sector to GDP ratio' explanator had a negative and insignificant impact on gini index; and the change in the second lag (i.e., L2D) of stochastically trending 'credit to private sector to GDP ratio' explanator had a positive and insignificant impact on gini index. The last section of table 4.36 provides the F-statistics and probability of the F-statistics. The calculate F-statistics is 3315.37 and the probability of the F-statistics is 0.000. While the F-statistics is greater than the critical value of approximately 4.00, the probability of the F-statistics is less than 0.05. Hence, we can conclude that the entire model with gini index as dependent variable and commercial banks' loans to SMEs and credit to the private sector as the independent variables is statistically significant. Thus, all the changes combined to significantly influence inequality during the period under study.

Table 3 also shows results of the estimated DOLS model to investigate the impact of financial access on income inequality. From the first panel of the model estimated to investigate the impact of financial access on income inequality, the coefficient (i.e., 9.865) of number of commercial banks branches appeared with a positive sign and statistically significant since Newey-West standard error (i.e., 1.19) is low, absolute value of the t-statistics (i.e., 8.31) that is greater than the critical value 2.00, and probability of t-statistics (i.e., 0.00) that is less than 0.01. Moreso, the coefficient (i.e., -1.587) of broad money supply-to-GDP ratio appeared with a negative sign and is statistically significant since Newey-West standard error (i.e., 0.136) is low, absolute value of the t-statistics (i.e., 11.66) is greater than 2.00, and probability of t-statistics (i.e., 0.00) that is less than 0.01. The second panel of the model estimated to investigate the impact of financial access on income inequality shows the changes in the stochastically trending explanators and two leads and two lags of these change. First, a change in the stochastically trending 'number of commercial banks branches' explanator (i.e., D1.) led to a decrease in gini index (as shown by the sign of the coefficient i.e., -22.440). Moreover, the decrease is significant (based on a low Newey-West standard error, a t-

statistics that is greater than 2.00, and a probability of the t-statistics that is less than 0.05). Secondly, the change in the first lead (i.e., FD) of stochastically trending 'number of commercial banks branches' explanator had a negative and significant impact on gini index; and the change in the second lead (i.e., F2D) of stochastically trending 'number of commercial banks branches' explanator had a negative and significant impact on gini index. Thirdly, the change in the first lag (i.e., LD) of stochastically trending 'number of commercial banks branches' explanator had a positive and significant impact on gini index; and the change in the second lag (i.e., L2D) of stochastically trending 'number of commercial banks branches' explanator had a negative and insignificant impact on gini index. Fourthly, a change in the stochastically trending 'broad money supply-to-GDP ratio' explanator (i.e., D1.) led to an increase in gini index (as shown by the sign of the coefficient i.e., 1.189). Moreover, the increase is significant (based on a low Newey-West standard error, an absolute t-statistics that is greater than 2.00, and a probability of the t-statistics that is less than 0.05). Fifthly, the change in the first lead (i.e., FD) of stochastically trending 'broad money supply-to-GDP ratio' explanator had a negative but insignificant impact on gini index; and the change in the second lead (i.e., F2D) of stochastically trending 'broad money supply-to-GDP ratio' explanator had a negative and significant impact on gini index. Sixthly, the change in the first lag (i.e., LD) of stochastically trending 'broad money supply-to-GDP ratio' explanator had a positive and significant impact on gini index; and the change in the second lag (i.e., L2D) of stochastically trending 'credit to private sector to GDP ratio' explanator had a positive and slight significant impact on gini index. Lastly, table 4.40 provides the F-statistics and probability of the F-statistics. The calculate F-statistics is 17.46 and the probability of the F-statistics is 0.00. While the F-statistics is greater than the critical value of approximately 4.00, the probability of the F-statistics is less than 0.05. Hence, we can conclude that the entire model with gini index as dependent variable and number of commercial banks' branches and broad money supply-to-GDP ratio as the independent variables is statistically significant. Thus, all the changes combined significantly to influence inequality during the period under study.

4.3 Post-estimation Diagnostic Tests

Table 4 shows the result of the Breusch-Pagan/ Cook-Weisberg heteroskedasticity test on the DOLS inequality models estimated in this study. Firstly, the result shows that the computed chi-square statistics under the Breusch-Pagan/ Cook-Weisberg Test for Heteroskedasticity for the two models are not statistically significant. With a null hypothesis of no heteroskedasticity, we accept the null. Hence, we conclude that the DOLS inequality models estimated are free from the problem of heteroskedasticity. Homoskedasticity is present. Moreover, table 3 also shows that the probability of the computed statistics under the Skewness/Kurtosis Tests for Normality are not statistically significant. With a null hypothesis of normal distribution of residuals, we accept the

null. Hence, we conclude that the residuals of the estimated DOLS inequality models are normally distributed.

Table 4: Post-estimation Diagnostic Tests Result

'Access to Financial Services/Product-Income Inequality' Model					
Breusch-Pagan/ Cook-Weisberg Test for Heteroskedasticity		Skewness/Kurtosis Tests for Normality			
chi2 (1)	Prob > | chi2|	Prob (Skewness)	Prob (Kurtosis)	adj chi^2 (2)	Joint Prob > | chi^2|
3.79	0.0514	0.6951	0.4834	0.68	0.7128
'Financial Access-Income Inequality' Model					
Breusch-Pagan/ Cook-Weisberg Test for Heteroskedasticity		Skewness/Kurtosis Tests for Normality			
chi2 (1)	Prob > | chi2|	Prob (Skewness)	Prob (Kurtosis)	adj chi^2 (2)	Joint Prob > | chi^2|
0.04	0.8373	0.1087	0.2118	3.45	0.0841

Source: Authors' Computation.

4.4 Discussion of Findings

The study found a variation in the effect of the two categories of measures of financial inclusion on income inequality. Access to financial services/products impacted positively on income inequality. This implies that the level of access to financial services/products like credit has contributed to the inequality gap that existed in Nigeria during the period covered by the study. And this conforms with some theories that stresses that the poor primarily rely on informal (e.g., family) connections to obtain funds, so that the development of the formal financial sector especially helps the rich (Claessens & Perotti, 2007). Hence the concentration of income mainly in the hands of a few high-income earners. But this finding contrasts the findings of Bkwayep and Tsafack (2020) that confirmed the hypothesis that financial inclusion lowers income inequalities in Africa. More so, the findings relating to the impact of access to financial products/services on income inequality conform to the finding of Zia and Prasetyo (2018), in a study on 33 Indonesian provinces from 2014 to 2016, which found a non-significant positive relationship between financial inclusion and income inequality. The variations in findings may not be unconnected to the fact that the reviewed studies are either on cross-section of countries or other developing countries that may not have the same level of governance and political situation like Nigeria. Moreover, this study confirmed a negative statistically significant impact of financial access (another financial inclusion indicator) on income inequality. This finding conforms to the finding of Kim et al. (2015) which confirmed that financial inclusion has a statistically significant negative impact on poverty and income inequality. Contrastingly, Nyarko (2018) found access dimension (ATMs, bank branches, and mobile accounts) of financial inclusion to have statistically significant positive impact on employment and a statistically insignificant negative impact on poverty. Lastly, the findings on the impact of the financial

access dimension of financial inclusion impact on income inequality agrees with the findings of Swamy (2010) and Sakanko et al. (2019) who conducted an investigation in India from 1975 to 2007 and in Nigeria between 1980 and 2018 respectively. Disparity in the finding of the study with of Nyarko (2018) may be as result of the assumption of levels impact exhibited in the study of Nyarko (2018) as against the assumption of leads and lags impact of financial inclusion on income inequality included in this study.

V. CONCLUSION

This paper focuses on one of the most important sectors of every developing country (Nigeria in particular) in the quest for sustainable growth and development. The financial sector provides services and products that can boost development and reduce inequality gap through household income generation and multiplier effect of a well-financed private sector and small and medium scale enterprises. A developed financial sector, among other factors, is defined by its ability to improve the level of financial inclusion evident in the economy. This paper specifies income inequality in Nigeria as function of deposit money banks loans to SMEs, banks' credit to the private sector, number of bank branches and broad money supply-to-GDP ratio. From our results, financial access coefficients are statistically significant different from zero. That is, the improvement in the financial access dimension of financial inclusion proves to be more effective in reducing the income inequality gap in Nigeria. This may not be unrelated to the reality on ground as it relates to the cost of credit and the stringent requirements often included as pre-condition for granting of loans and supply of credits by deposit money banks and other business financing institutions. This paper therefore recommends policy that increases awareness among citizens on the importance of owning and maintaining a bank account. Moreover, it is recommended that deposit money banks should establish more branches in the rural areas to serve the high and growing rural population.

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