IMPACT OF FINANCIAL INCLUSION ON HOUSEHOLD WELFARE IN NIGERIA

Abstract

Developing countries such as Nigeria has continued to make negligible progress in enhancing household welfare and boosting prosperity with majority of her population still struggling to attain a minimum standard of living. Improving household welfare is essential to the attainment of numerous United Nations Sustainable Development Goals(SDGs).Policy makers has suggested that financial inclusion could be a panacea for welfare improvement. This study examined the impact of financial inclusion on household welfare using Findex 2017 data. The study is a Quantitative research. It made use of quasi experimental research design. The target population are households from 15 years and above. The study performing a counterfactual analysis using propensity score matching technique found that financial inclusion has a positive significant impact on household welfare. The study recommended among others that to achieve increased financial inclusion for all, government, regulatory agencies, financial service providers need to focus on strengthening the existing framework for branchless banking so that people can take advantage of these financial services without a physical bank.

Keywords: Financial inclusion, household welfare, Nigeria

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1. INTRODUCTION

Household welfare is the expression of the economic wellbeing of a household which could be measured by its ability or access to means of livelihood (Grootaert, 2013). In the study of household welfare, a common approach has been to look at well-being as the capacity of households to access essential and basic means of livelihood as well as other requirements for livability over its lifetime (Haughton & Khandker, 2009). Household welfare relates to the micro-level and how the utility of households can be maximized by choices made by the individual members of the household. According to Dimova and Adebowale (2018), it is one of the most focused goals of every government across the globe. The indicators include income, poverty, and health among others (Dimova & Adebowale, 2018). The persistence of poverty and high level of inequality (*both poverty and high level of inequality are considered as indicators of poor household welfare, Grootaert, 2013*) in Africa is very alarming because the continent is host to seven of the 10 most unequal countries in the world (World Bank, 2016). Accordingly, Africa is second after Latin America in terms of high inequality in the world (Klasen, 2016). Moreover, the challenge of poverty in Africa is well known, with about a third of the world's poor living on the continent. Accordingly, high levels of inequality and poverty persist in Africa despite being one of the most dynamic regions of the last decade (United Nations Development Programme, 2016; Asongu & le Roux, 2018).

Just like Africa, welfare indicators for Nigeria have been startling. For instance, the situation of poverty has lingered for decades in Nigeria as it can be traced to the late eighties. In 1996,

national poverty reached 66.9% from 28.1% in 1980 and then declined to 54.4% in 2004 after which it reached a peak of 69% in 2010 (Adeaga, Adelakun & Oyekunle, 2020). Moreover, Nigeria emerged 157th out of 187 countries captured in the Human Development Report with Human Development Index (HDI) of 0.532 indicating a low level of life expectancy, education and income (UNDP, 2018). According to a report by World Poverty Clock in 2018, Nigeria has overtaken India as the poverty capital of the world, with the highest number of people living in extreme poverty estimated at 91.6 million people (46.5% of the population) living on less than one dollar a day. Similarly, in the last five years, the Gini coefficient, which is an indicator of income inequality, averaged about 0.49. The nation's income distributive share by income quintile also reported that the poorest 20% of the population received just 5% of the nation's total income, compared to the top 20% of the population receiving 49%. (World Bank, 2019).

In recent times, the importance of financial inclusion on enhancing household welfare has become a vital developmental policy concern worldwide. Financial inclusion has been identified as a key pillar of the policies aimed at promoting household welfare across the globe (Dimova & Adebowale, 2018; Zhang & Posso, 2019). Financial inclusion can be said to be the proportion of individuals and firms that use financial services (GFDR, 2014). Financial inclusion encompasses the access, usage and availability of financial services to the underserved and the financially excluded (IFC, 2011). Financial inclusion has featured high on the agenda of development agencies, with the United Nations declaring 2005 as the Year of Microfinance, the Maya Declaration made by Alliance for Financial Inclusion (AFI) members and the G-20 Financial Inclusion Action Plan made in Pittsburgh in 2009. These commitments were made with the sole purpose of achieving inclusive financial systems.

With inclusive financial systems, a high proportion of the population will use financial services, and this affords both households and firms the opportunities for external finance which contributes to reducing poverty and income inequality thereby enhancing household welfare (GFDR, 2014).The literature documents some ways through which finance can directly affect household welfare. First, the development of the financial sector can ease the credit constraints hitherto faced by poor households and which limited their abilities to undertake productive investment (Fowowe, 2020). Secondly, the broadening of the financial sector and subsequent entrance of new players enhance competition between financial intermediaries, and this leads to a provision of better services and financial products which will improve the quality of lives of poor households (Beck, Demirguc-Kunt & Levine, 2007). Thirdly, because financial intermediaries help to pool and limit risk, the problems of asymmetric information peculiar to financial markets are reduced, and this results in a more stable macroeconomic environment which is beneficial to the poor. A developed financial system would also lead to better loan recovery rates because of an advanced supervisory and monitoring capacity. Finally, bigger and more powerful financial intermediaries have abilities to bear the high costs of small credits (Rajan & Zingales, 2001). Chigumira and Masiyandima (2003) noted that lending to the poor is more costly than to the rich, and consequently, the marginal cost of lending to the poor is higher

than that of lending to the rich. The financial intermediaries could bear such costs with the long-run in view, assuming small and medium scale enterprises will graduate into large-scale businesses in the future.

Admittedly, financial inclusion has evolved in Nigeria, with some stylized statistics pointing to an increase in financially included adults from 23.6% in 2008 to 48.6% in 2014 (EFInA, 2017). This was partly achieved as a result of the successful transition from a repressed to a liberalized financial system as well as the success recorded after the implementation of the National Financial Inclusion Strategy in 2012 (Dimova & Adebowale, 2018). Regrettably, the successful pace of these policies was not sustained beyond 2014, which reflected the period that marked the crash of crude oil prices (Ibrahim & Aliero, 2020). Some stylized statistics have, for instance, indicated that the proportion of Nigeria's financial inclusion has dropped from the record 48.6% achieved in 2014 to 38.3% in 2016 (CBN, 2017; EFInA, 2017). Similarly, in the rural areas where about 63.9% of the adult population are based, the proportion of banked adults dropped from 25% in 2014 to 24.4% in 2016 (EFInA, 2017; Ibrahim et al., 2019) due to some social and institutional challenges, such as the mounting dominance of the informal sector, low human development, demographic challenges (Aliero, Ibrahim, & Shuaibu, 2013), and infrastructural deficiencies (Gani & Ibrahim, 2015; Dimova & Adebowale, 2018).

Expectedly, economic theory predicts that household welfare is conditional on household endowment in the exchange economy. For example, Bergson–Samuelson social welfare (BSSW) framework predicts that increased access to fundamental endowments (such as wealth) and transactional capabilities (including access and usability of financial services) would engender improvement, first in individual welfare, and second in social welfare, insofar as no one is made worse off by such individual welfare improvements. However, Schreftm (2012) and Reed and Waller (2016) argue that such expected welfare improvement would be contingent on the offsetting effect between disutility and utility of financial inclusion. In other words, because financial inclusion is associated with both private and social costs, its impact on welfare requires an empirical investigation that models the real world situations. It is against this background that this study examines the nexus between financial inclusion and household welfare in Nigeria

1.1. Statement of the Problem

Enhancing household welfare is a critical issue across the globe. With the rapid upsurge in globalization and international commitment, countries across the globe continue to record improved household welfare. Undeniably, Nigeria has continued to make negligible progress in enhancing household welfare and boosting prosperity with a large portion of her population still struggling to attain a minimum standard of living (Adebowale & Dimova, 2017). World Development Indicator, WDI (2020) shows that household welfare measured by per capita income has not improved significantly in the last decade. The per capita income growth recorded negative growth of -13.3%, -19.0% and -9.5% in 2015, 2016 and

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2017 respectively. Although, there is a pick-up in 2018 and 2019 (3% and 10% respectively), the per capita income growth declined to 1% in 2020. The endemic poverty and entrenched inequalities have created openings for crimes and other forms of deviant behaviors which affects development (Oludayo, 2021).This explains why it may be a fall dream for the populous country to meet the attainment of numerous United Nations Sustainable Development Goals (SDGs) of eradicating inequality, unemployment, extreme poverty and hunger.

The concern over poor household welfare in Nigeria and the need for its improvement has led to the conceptualization and implementation of various programs by different governments in Nigeria. Notable among them is Operation Feed the Nation (OFN), the Green Revolution, establishment of the People's Bank of Nigeria (PBN), Directorate of Food Roads and Rural Infrastructure (DIFFRI), National Directorate of Employment (NDE), Family Economic Advancement Programme (FEAP), Better Life for Rural Women, Family Support Programme (FSP), National Poverty Eradication Programme (NAPEP), National Social Investment Programmes among others (Alfa, Otaida & Audu, 2014; Abbas, 2016; Adeaga, Adelakun & Oyekunle, 2020). In 2012, the CBN launched its Financial Inclusion Strategy with a target to reducing the percentage of adults excluded from financial services from 46.3% in 2010 to 20% in 2020 in order to bring individuals out of poverty. It was later reviewed to 5% exclusion by 2024 (CBN, 2018; CBN, 2020).

However, with the rate of development of financial institutions, and other financial services, it is of believe that the poor would have been included in order to achieve the aim of universal inclusion strategy of 2024. Egger1, Poggi and Rufrancos (2021) affirmed that household welfare in Nigeria has continued to worsen with 83 million Nigerians living in poverty.The rising prices has pushed many people into poverty as Nigeria sanked into the poverty capital of the world and has remained so since then (World bank, 2021)

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1.2. **Objective of the Study**

To ascertain the impact of financial inclusion on household welfare

2 Theoretical Framework

The theoretical framework is anchored on Bergson–Samuelson social welfare (BSSW) theory as propounded by (Bergon, 1938, 1954) and Samuelson (1956). Bergson–Samuelson social welfare theory emphasized that social choice is concerned with the existence of a social welfare or preference function which preserves certain rationality properties of preference and satisfies the normative criterion of Pareto optimality. In essence, the social choices of households are explicitly contingent on the social welfare gains revealed by social preferences. Although there

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are other social welfare models (such as Arrow social welfare function, Altkson social welfare function, Kaldor-Hicks compensation criterion and Amartya Sen's theory of welfare), the choice of Bergson–Samuelson social welfare theory is predicted on the following.

First, it defines a general social welfare function as a function either of the welfare of each member of the community or of the quantities of products consumed and services rendered by each member of the community. In other words, the BSSW is not intrinsically restrictive. It allows the researcher to analyze household welfare from different standpoints. Second, Bergson–Samuelson social welfare framework represents a collection of preferences of a society that accommodates everyone's preferences and provides the state of the entire society and distribution of welfare among the members of society. This allows for additive social ordering in a heterogeneous community of rational agents.

2.1 EMPIRICAL LITERATURE REVIEW.

So many research has been done in the area of financial inclusion and Household welfare. For instance, in a sample of 37 Asian economies, Park and Mercado (2015) found that financial inclusion significantly reduces poverty as well as income inequality in Asia. Using the ordinary least squares estimation technique, Nanziri (2016) examined the relationship between financial inclusion and welfare in South Africa. The results indicated that better financial inclusion is associated with higher welfare. The study further indicated that women who use non-formal credit have lower welfare.

Omojolaibi (2017) applied the Generalised Method of Moment (GMM) estimation technique to study the impact of financial inclusion and governance characteristics on economic progress via three major channels: investment in infrastructure, per capita GDP and income inequality over the period 1980 to 2014. Among other things, the study confirmed that financial inclusion tends to bridge the gap between the rich and the poor and reduce the prevalence of poverty in the economy.

Tita and Aziakpono (2017) examined the nexus between financial inclusion and welfare in sub-Saharan Africa by using disaggregated data for the analysis. The results showed that formal account use for business, electronic payment and formal savings have a positive relationship with welfare. Similarly, using nationally representative household finance survey data on China, Zhang (2017) examined the effect of financial inclusion on household income using ordinary least squares and quantile regressions methods. The cross-sectional data used was obtained from the China Household Financial Survey. First, the results from the ordinary least squares indicated that financial inclusion has a strong positive effect on household income across all households regardless of the income level. Given that income is a key determinant of household welfare, the outcome suggested that financial inclusion improves household welfare. Second, the quantile

regression approach showed that low-income households benefit more from financial inclusion than their richer counterparts.

Neaime and Gaysset (2018) analyzed the impact of financial inclusion on income inequality, poverty conditions and financial stability using panel data of eight countries in the Middle East and North Africa for the period 2002 to 2015. The authors measured the degree of financial inclusion by either the number of banks or ATMs per 100,000 adults. Using the generalized method of moments (GMM) estimation, they found that financial inclusion proxied by the number of banks reduces income inequality, whereas it has no significant effect on the poverty ratio. Using the generalized least squares method, they found evidence that financial inclusion measured by the number of ATMs contributes positively to financial stability in this region. Addury (2018) investigated the impact of financial inclusion on welfare using the three waves of the Indonesian Family Life Survey (IFLS) and the results of the study found that there is a significant effect of financial inclusion on household income. Mwangi and Atieno (2018) examined the determinants of financial inclusion on household's welfare in Kenya based on both the single (transactionary, credit, savings and investment, insurance and pension) and composite measures (portfolio usage) of financial inclusion and the study found that financial inclusion positively influences household welfare in Kenya

Ibrahim, Ozdeser and Cavusoglu (2018) utilized primary data collected between October 2014 and September 2015 from Northern Nigeria to examine the finance-welfare nexus by constructing a multi-variable financial inclusion index regressed against household welfare. As expected, the OLS result showed a strong positive effect of financial inclusion on household welfare. On the other hand, quantile regression reveals middle and high-income households benefitted relatively more from financial inclusion, compared to lower-income households.

Mallick and Zhang (2019) examined the implications of financial inclusion on household's welfare in China and they found that the welfare effects of financial inclusion varied across urban and rural areas and income groups. The study further found that financial inclusion significantly increased overall consumption, but the impact was greater among urban than rural households. The effect was stronger in the case of food consumption. Financial inclusion also decreased consumption inequality but only among urban households.

Ohiomu and Ogbeide-Osaretin (2020) employed the generalized method of moments (GMM) estimation method on panel data on some countries in sub-Saharan Africa to investigate the impact of financial inclusion on gender inequality in sub-Saharan Africa and the study found that financial inclusion substantially reduced gender inequality. Ababio, Attah-Botchwey, Osei-Assibey and Barnor (2020) appraised whether the level of human development drives greater financial inclusion, and vice versa in the contexts of frontier markets. The dynamic panel generalized methods of moments (System-GMM) methodology was employed to analyze data spanning from 2005 to 2014 for 20 frontier markets by Standard and Poor's Indices. The study

found that financial inclusion tends to cause higher levels of human development in the form of improved living standards, literacy, and healthy lives.

Ibrahim and Aliero (2020) utilized three waves of General Household Survey and instrumental variable quantile regression (IVQR) to study the effect of financial inclusion on income inequality in Nigeria and the study found that that financial inclusion is critical in reducing income inequality in Nigeria. N'dri and Kakinaka (2020) employed propensity score matching (PSM) and inverse-probability-weighted regression adjustment (IPWRA) to assess the impact of financial inclusion and mobile money use on an individual's nonmonetary welfare in Burkina Faso. The nonmonetary welfare indicators of nutrition, healthcare, and education were utilized in the study and the study found favourable effects of financial inclusion on poverty reduction in terms of individuals' nonmonetary welfares (nutrition, healthcare, and education). Okoye, Adetiloye, Erin and Modebe (2020) utilized OLS on a time series data spanning from 1986 to 2015 and the study found that financial inclusion is critical in poverty reduction in Nigeria. Churchill, Nahu and Smyth (2020) utilized the 2016 Financial Inclusion Insights (FII) program for Nigeria covering 6,352 adults to investigate the effect of financial inclusion on household poverty and the study found that financial inclusion alleviates poverty in Nigeria. Aribaba, Adedokun, Oladele, Babatunde, Ahmodu and Olassehinde (2020) studied the impact of financial inclusion scheme on poverty alleviation in Nigerian between 2004 and 2019 and the study showed that financial inclusion plays a significant effect on poverty alleviation among the low-income earners in Nigeria. It also reduces poverty level and increases per capita income thereby enhancing the standard of living. Menyelim, Babajide, Omankhanlen and Ehikioya (2021) assessed how financial inclusion can be utilized to moderate the influence of income inequality on economic growth. This study focuses on 48 nations of Sub-Saharan Africa (SSA) from 1995 to 2017. The result reveals the negative effect of financial access on the relationship between income inequality and economic growth. There is a positive net effect of inclusive financial access in moderating the impact of income inequality on economic growth

2.2 Justification for the Study

Globally, in recent times, there appears to be a surging interest in the concept of financial inclusion, especially among policymakers and financial sector actors. However, academic research studies in nations in Sub-Saharan Africa are barely emerging, focusing mostly on cross-country studies. These often lack country-specific details that could drive policy toward maximum expected outcomes. Financial inclusion is not well understood, especially within the context of lower-income countries (LICs) where structural constraints, institutional bottlenecks and financial system failures serve as setbacks to financial inclusion efforts. This tends to lead to policy formulations that lack a theoretical basis. This study contributes to the literature by focusing on Nigeria where the financial exclusion situation and poor household welfare is believed to be severe but the phenomenon has not been conclusively investigated. Similar studies in Nigeria are rare and the existing studies have majorly being macro (see Ugwuanyi, 2012; Omojolaibi, 2017; Okoroafor et al., 2018; Anthony-Orji et al., 2019; Okoye et al., 2020). While

we acknowledge the contributions of these studies, it is pertinent to note that the data we utilized provides a more robust contribution on current issues relating to financial inclusion and welfare using 2017 Findex Data by world bank which no study has used and this is more appropriate for policymaking.

3. Research method and Procedure

Given the nature of objectives set out in this study, this study adopts quasi-experimental research design. A quasi-experimental research design is a design that is used for carrying out an empirical (interventional) study used to estimate the causal impact of an intervention or socio-economic condition on target population without necessary having to do random assignment. In this study, quantitative research is adopted. The choice of quantitative research method is predicated on several factors. First, it aligns with the research design. Quasi-experimental design requires a quantitative research method which assists the research to evaluate the outcome of the experimental or counterfactual study. The target population for this study is the civilian, non-institutionalized population that are 15 years and above. In other words, only the households are covered in this study. However, the study excludes Borno, Yobe and Adamawa which according to Findex (2018) makes up about 7% of the population. Findex (2018) further noted that the three states were excluded due to high level of insecurity which makes it difficult to conduct survey in those states. Findex adopted probability sampling techniques. Particularly, Findex utilized both stratified and simple random sampling procedures. Findex applied stratified sampling technique by stratifying households by population size, geography, or both, and clustering is achieved through one or more stages of sampling. Further, sample selection is based on probabilities proportional to population size. In identifying each individual household within a stratum, simple random sampling is used. Random route procedures are used to select sampled households. In Findex survey of 2017, random selection of respondents is achieved by using either the latest birthday or household enumeration method. In all, about 1000 households or individuals were sampled in the Findex survey of 2017. The whole sample of 1000 is adopted in this study without any adjustment. The questionnaire used in Findex 2017 survey was designed by the World Bank, in conjunction with a Technical Advisory Board composed of leading academics, practitioners, and policy makers in the field of financial inclusion. To ensure reliability and validity of the instrument, the questionnaire was piloted in multiple countries, using focus groups, cognitive interviews, and field testing. Also, to ensure understandability and inclusion, the questionnaire was designed in English, Hausa, Yoruba, Igbo, and Pigin English. Data collection was carried out by Gallups Inc.. The data collection exercise was implemented between 4th April, 2017 and 28th April, 2017.

3.1 Model Specification

To ascertain the distinctive impact of financial inclusion on household welfare, households that are financially included (the treatment group) and those that are financially excluded (the control group) are included in the study. To distinctively ascertain the impact of treatment on the

treatment group, Nwokoye, Igbanugo and Dinwobi (2020) argue that it is expedient to equally ascertain what should have happened to the treatment group if the treatment was not applied. To effectively realize this goal will require that treatment and non-treatment groups are randomly selected. Nwokoye et al (2020) also opined that to achieve this kind of counterfactual analysis, propensity score matching (PSM) analysis could be a veritable tool. To set up the model, we proceed as follows.

In the PSM framework to be implemented, financial inclusion is defined as the treatment while financial exclusion is defined as the non-treatment or control. Given a sample of subjects and a treatment (financial inclusion), each subject (or household) has a pair of potential outcomes: $Y_i(1)$ and $Y_i(0)$ for treatment and control outcomes respectively. However, each subject receives either treatment or control, not both (if one if financially included, he cannot be financially excluded at the same time). Suppose Z_i indicates if a household i got treatment (i.e being financially included) such that:

$$Z = \begin{cases} 1 \; for \; treatment \\ 0 \; for \; control \end{cases} \qquad 3.10$$

Let X_i be a vector of observed pretreatment covariates for the ith household. The observations of X_i are made prior to treatment assignment, but the features in X_i may not include all (or any) of the ones used to decide on the treatment assignment.

The outcome equation to be estimated is:

$$Y_r = d_r(X_r, U_r) \qquad Z \in X = (X_1, X_2, \dots X_K) \qquad 3.11$$

$$R \in (0,1)$$

Where

r, which is the occurrence of the treatment, is indexed by the random variables $R \in (0,1)$,

X refers to the observed attributes of the household including being financially included,

Z and U denotes the unobserved attributes of the household. Y_d refers to the outcome of interest (household welfare). Specifically, Y_1 is the outcome if household is financially included and Y_0 is the outcome if the household is financially excluded. In other words, for each household, i, Y_i is specified as:

$$Y_i = Y_{0i} + R_i(Y_{1i} - Y_{0i}) \qquad 3.12$$

The major constraint in estimating Equation 3.12 is that it is difficult to observe a household that is financially included (treatment) and financially excluded (control) at the same time. Nwokoye

et al (2020) noted that a way out of this estimation constraint is to estimate the average treatment effect on the treated (ATT) which is the effect for those in the treatment group. In addition, one may proceed to alternatively estimate the 'average treatment effect' (ATE), which is the effect on all individuals (treatment and control). Since the research objective is to ascertain the impact of financial inclusion on the welfare of households that are financially included (as contrasted from those that are excluded), the ATT, no doubt, is most appropriate. The ATT equation is specified as follows:

$$\begin{aligned} ATT &= E((Y_{1i} - Y_{0i}/R = 1) \\ &= E[E\{Y_{1i} - Y_{0i}/R = 1, p(X_i)\}] \\ &= E[E\{Y_{1i}/R_i = 1, p(X_i)\} - E\{Y_{0i}/R = 0, p(X_i)\}/R_i = 1] \end{aligned} \quad 3.13$$

The first step in estimating ATT is to estimate the propensity score, $p(X_i)$. Rosenbaum and Rubin (1983) and Nwokoye et al noted that the propensity score is the probability of treatment assignment conditional on observed baseline covariate. Thus, the *p(X)* for *i = 1,..., K* is the conditional probability of being financially included given a vector of observed covariates $x_{i:}$

$$p(X_i) = prob(R_i = 1/X_i) = E(R/X) \quad 3.14$$

And

$$prob(R_i, \dots, X_1, X_2, \dots, X_k) = \sum_{i=1}^{K} prob(X_i)^r [1 - prob(X_i)]^{1-r} \quad 3.15$$

$r_i = 1$ for treatment, $r_i = 0$ for non-treatment and X_i = the vector of observed covariates for the i^{th} household. Employing logistic regression procedure,

$$P(X_i) = ln \frac{e(x_i)}{1-e(x_i} = ln \frac{prob(r_i=1/x_i)}{1-prob(r_i=1/x_i)} = \beta X_i \quad 3.16$$

One precondition for estimating the ATT is that the propensity score *p(X)* must be obtained. As proposed by Rosenbaum and Rubin (1983), the *p(X)* for *j = 1,..., K* is the conditional probability of participating in IEM given a vector of observed covariates $x_{i:}$

$$p(X_j) = \Pr(D_j = 1/X_j) = E(D/X) \quad 3.17$$

and

$$\Pr(D_j,...X_1,X_2,...X_k)=\sum_{j=1}^{K}e(X_j)^{d_j}\{1-e(X)\}^{1-d_j} \quad 3.18$$

Where

$d_j = 1$ for treatment, $d_j = 0$ for non-treatment and X_j = the vector of observed covariates for the j^{th} household.

Nwokoye et al further noted that it is required that ATT satisfies two conditions, namely, conditional independence assumption and common support assumption. The conditional independence condition states that conditional on observable characteristic of households (X), welfare outcomes are independent on the inclusion in financial services. Technically, the conditional independence condition is specified as:

$$Y_1, Y_0 \perp R/X$$

The second condition for the proficiency of the propensity score is the common support or overlap condition:

$Y_1, Y_0 \perp R/prob(X)$ Such that 0 < prob(R=1/X) < 1

Where $\perp$ denotes statistical independence

As noted by Heckman et al. (1999), this condition ensures that the treatment observations (financially included households) have comparison observations (financially excluded households) "nearby" in the propensity score distribution. Satisfying these conditions are important since it is only in areas of common support that inferences can be made about causality. It is also very important to conduct a balancing test, that is, to ascertain if:

$$Prob(X/R=1) = Prob(X/R=0) \quad 3.19$$

However, the ATT estimated from PSM can still suffer from biased results in the presence of misspecification in the propensity score model (Wooldridge, 2012, Nwokoye et al, 2020). The possibility of bias arises because a difference in the treatment outcome (such as the ATT) between treated and untreated groups may be caused by a factor that predicts treatment rather than the treatment itself. In randomized experiments, the randomization enables unbiased estimation of treatment effects; for each covariate, randomization implies that treatment-groups will be balanced on average, by the law of large numbers. Unfortunately, for observational studies, the assignment of treatments to research subjects is typically not random. One of the ways to ensure that the estimates are not biased is to ensure that treatment and control with similar attributes are considered in the counterfactual. To realize this end, an appropriate matching method could be used. Matching attempts to reduce the treatment assignment bias, and mimic randomization, by creating a sample of units that received the treatment that is

comparable on all observed covariates to a sample of units that did not receive the treatment (Caliendo & Kopeinig, 2005; Ogunniyi et al., 2017; Nwokoye et al 2020).

Let T and C be the set of K^T treated and K^C control households respectively and Y^T and Y^C are the observed continuous outcomes of the treated and control units, respectively. Denote by $C(i)$ the set of K^C control units matched (using kernel method based on PS scores) to the treated unit $i \in T$. Define the weights $w_i = \frac{1}{N_i^C}$ if $i \epsilon\ C(i)$ and $w_i = 0$ otherwise.

3.2 Measurement and Financial Inclusion Index

Camara and Tuesta (2015) argues that financial inclusion is multidimensional and should be treated as such. In this, we utilize the FINDEX (2017) to develop financial inclusion index for Nigeria. From the literature, we identified three dimensions for the modeling of financial inclusion index, namely, access to financial services, usage of financial services and availability of financial services. The correlation coefficients of the covariates are as shown on Table 1.

Table 1: Correlation Matrix

Variables	Branches	ATM	Mobile Money Agent	Deposit accounts	Mobile Money account	Deposits	Loans	Mobile Money Transactions
Branches	1							
ATM	0.495	1						
Mobile Money Agent	0.756	0.532	1					
Deposit accounts	0.635	0.308	0.504	1				
Mobile Money account	0.513	0.233	0.289	0.523	1			
Deposits	0.327	0.103	0.317	0.560	0.597	1		
Loans	0.411	0.009	0.327	0.420	0.196	0.373	1	
Mobile Money Transactions	0.420	0.233	0.252	0.364	0.243	0.280	0.373	1

Source: Estimated by the Researcher using Findex (2017)

Table 1 is divided into three sections namely Table 1 (a) for access to financial services (ATF), Table 1 (b) for availability of financial services (AOF) and Table 1 (c) for usage of financial services (UOF). Table 1 (a) shows that the PC with an eigenvalue 3.151 accounts for 78.8% of the total variation in ATF. With eigenvalues of 0.531, 0.172 and 0.146 for PC2, PC3 and PC4 respectively, PC2, PC3 and PC4 accounts for 13.3%, 4.3% and 3.65% respectively. Following Kaiser's criterion that one PC1 with eigenvalues greater than 1 would be considered, only the first component (PC1) will be further evaluated as the values of PC2, PC3 and PC4 are individually less than one and collectively less than one-third of the aggregate effects.

Table 1 (a) Estimates of First Stage of PCA

Principal Component Estimates: Access to Financial Services					
Variable	PC1	PC2	PC3	PC4	Normalization Weight
Branches	0.568	-0.433	0.629	-0.0067	0.33
ATM	0.488	0.808	0.116	0.0078	0.40
Mobile money agent	0.587	-0.253	0.67	0.2349	0.27
Eigenvalues	3.151	0.531	0.172	0.146	
Cum. Eigenvalues	3.151	3.682	3.854	4	
Proportion of Eigenvalues	0.78775	0.13275	0.043	0.0365	
Cum. Proportion of Eigenvalues	0.78775	0.9205	0.9635	1	
Variance	2.62	0.359	0.026	----	

Source: Estimated by the Researcher using Findex (2017)

Since weights are obtained from the information in the principal components and the corresponding eigenvalues, it is worth studying the composition of these components to understand the structure of our estimated indices. With regard to the weighting scheme, we observe that the contributions of the different indicators barely change over time. For the access dimension, the indicator for ATM has the highest weight (0.40), followed by bank branches (0.33) and mobile money agents (0.27). It is important to notice that although the weights are not evenly distributed, none of the indicators is dominant; this is a desirable condition for an index.

Table 1(b) Estimates of First Stage of PCA

Principal Component Estimates: Availability of Financial Services

Variable	PC1	PC2	PC3	PC4	Normalization Weight
Deposit Accounts	0.495	0.035	0.693	-0.423	0.61
Mobile Money Accounts	0.432	0.71	0.065	0.458	0.39
Eigenvalues	2.583	0.765	0.521	0.131	
Cum. Eigenvalues	2.583	3.348	3.869	4	
Proportion of eigenvalues	0.646	0.191	0.130	0.033	
Cum. Proportion of eigenvalues	0.646	0.837	0.96725	1	
Variance	1.818	0.244	0.39	0	

On the other hand, Table 1 (b) is the summary outcome for first stage PCA for availability dimension. It shows that only PC1 has eigenvalue that is greater than one. The eigenvalue is 2.583 which amounts to 64.6% of the cumulative value. As stated earlier, only PC1 would be considered. For the availability dimension, having deposit accounts have higher weight (0.61) than having mobile money accounts (0.39). This may be associated with the fact that in most cases having mobile money accounts is associated with first having a deposit account (whether demand deposit or saving deposit) . For the usage dimension, the eigenvalues for PC1, PC2, PC3 and PC4 are 2.976, 0.557, 0.343 and 0.124 respectively. Again, following Kaiser's criterion, we consider only PC1 which contributes about 74.4%. Also note that the weights across all the covariates are almost evenly distributed with deposit having normalized weigth of 0.42, loan having 0.25 and mobile money transactions being assigned 0.33.

Table 1 (c) Estimates of First Stage of PCA

Principal Component Estimates: Usage of Financial Services					
Variable	PC1	PC2	PC3	PC4	Normalization Weight
Deposit	0.494	0.331	0.329	0.7	0.42
Loan	0.51	0.012	0.559	0.566	0.25
mobile money transaction	0.493	0.324	0.255	0.255	0.33
Eigenvalues	2.976	0.557	0.343	0.124	
Cum. Eigenvalues	2.976	3.533	3.876	4	

Proportion of eigenvalues	0.744	0.13925	0.08575	0.031
Cum. Proportion of eigenvalues	0.744	0.88325	0.969	1
Variance	2.419	0.214	0.219	0

Source: Estimated by the Researcher using Findex (2017)

In the second stage, we apply PCA on the three sub-indices (access, availability, and usage) to compute their weights in the overall index. Table 2 presents the composition of the principal components and the normalized weights for each dimension or sub-index. The weighting scheme loaded through information contained in the PCA shows that availability has the highest weight of 0.39. This is followed by access (0.34) and usage (0.27). This suggests that availability is the most important dimension for explaining the degree of financial inclusion. Availability is followed in importance by access. This is quite intuitive. First, the banking services or bank branches will first be available before households consider making the choice of being financially included. Second, it will be accessible. The last criterion is that it will offer usage utility to households. In terms of the principal component structure, we observe that it is only the first component that has eigenvalue greater than one. Also, the first and the most important component accounts for 74.6 per cent of the total variation in the data. Table 2 also shows that overall financial inclusion index for Nigeria is 0.5163, which implies that about 51.6% of Nigerians are financially included

Table 2 Estimates of Second Stage of PCA

Principal Component Estimates				
Variable	PC1	PC2	PC3	Normalization Weight
Access	0.517	0.516	0.518	0.34
Availability	0.487	0.717	0.227	0.39
Usage	0.545	0.151	0.694	0.27
Eigenvalues	2.242	0.435	0.323	
cum. Eigenvalues	2.242	2.677	3	
Prop	0.747	0.145	0.108	
cum prop	0.747	0.892	1	
Variance	1.807	0.112	0	
Overall Financial Inclusion Index for Nigeria	0.5163			

Source: Estimated by the Researcher using Findex (2017)

Post Estimation Test for PCA

As suggested by Camara and Tuesta, (2015) and Mishra (2017), it is expedient to test for sampling adequacy when PCA is used for building an index. Mishra (2017) recommends the Kaiser Meyer Olkin (KMO) test and the Bartlett's test of sphericity (BTS). While both tests can be conducted individually, together they can be used as robust tests for the final PCA results. The KMO and BTS test whether the variables in a correlation matrix are significantly different from an identity matrix. An identity matrix is when the diagonal values are 1 and the non-diagonal values are 0. This condition implies that the variables selected for building the index are completely unrelated and independent of each other, as such the use of PCA as an indexing tool would be unsuitable and inappropriate. Both tests are often used in parametric tests where the rejection of the null hypothesis of an identity matrix is an indication that the data are well suited for PCA.

Test Hypotheses: The test hypotheses are stated below

H_0: Correlation matrix is an Identity Matrix

H_1: Correlation matrix is not an Identity Matrix

Decision Rule: According to Mishra (2017), the guidelines for ascertaining the KMO result is given as:

In the 0.90s Marvelous

In the 0.80s Meritorious

In the 0.70s Middling

In the 0.60s Mediocre

In the 0.50s Miserable

Below 0.50 Unacceptable

From Table 4.9, the KMO would be said to be meritorious. Thus, we reject the null hypothesis and conclude that the sample is adequate for PCA.

Similarly, Camara and Tuesta, (2015) stated that in the case of the BTS test, when the P-value of the BTS is lower than the critical value of 0.05, the null hypothesis can be rejected.

Table 3 Results of the TMO and BTS tests

Kaiser-Meyer-Olkin Measure of sampling adequacy		0.826
Bartlett's Test of Sphericity	Approx. Chi-Square	9012.90
	p-value	0.000

Source: Estimated by the Researcher using Findex (2017)

3.3 Measurement of Household Welfare

Thus, in this study, the use of income quintile as a measure of welfare was adopted. First, in line with the Bergson–Samuelson social welfare function, income quintile aptly depicts where an individual could be on the welfare function. Second, it is a comprehensive measure of welfare that depicts affordability of all indicators of wellbeing. Finally, it is chosen due to availability of data. In the Findex, there is no data on consumption. However, there is data on each individual's income quintile.

4. Estimation and Discussion of findings

The main thrust of this section is to estimate the impact of financial inclusion on household welfare in Nigeria using FINDEX (2017). To ascertain the welfare effect of being financially included may require a counterfactual analysis that could net out the impact of financial inclusion on the household welfare. This requires that those who are financially included be distinctively separated from those that are financially excluded.

Table 4 Likelihood of being financially included

	Coefficient	Standard error
Gender: male	0.01064**	0.00498
Gender: female	0.03556***	0.0133
Age (15-34)	0.02504***	0.0028
Age (34 and above)	0.05628***	0.007
Primary education	-0.10108***	0.01904
Secondary education	0.51456***	0.14466
Tertiary education	0.40098***	0.10956
Unemployed head of household	-0.08736***	0.01624
Employed head of household	0.01602***	0.00532
Receipt: Government transfers	0.02506	0.042
receipt of remittance	0.03136***	0.00848
Ownership of mobile phone/internet	0.0242***	0.00322
Payment bills	0.0497***	0.01708
Obs	1,000	

LR (χ^2)	725.89	
LR (Prob)		0.0000
Pseudo R		0.433

Source: Researcher's estimations (2021)

Those that are financially included are referred to as treatment group while the financially excluded are referred to as control group. To achieve this goal, we utilized propensity score matching as utilized in Nwokoye et al (2020). To enter the treatment group, we utilized 25% cut-off. That is, all respondent who obtained 25% of the financial inclusion index are included in the treatment group. Others are grouped as control group. There are total 529 treatment candidates and 491 control group candidates. In other to estimate the propensity score, the likelihood of being financially included is first computed. The result is shown on Table 5. The result shows that all education, age, employment status, receipt of remittance, payment of bills and ownership of mobile phones have the likelihood of increasing the chances of being financially included. While most variables increase the likelihood of inclusion, being unemployed and having only primary education reduces the likelihood of financial inclusion. From the likelihood estimation, the propensity scores are estimated as shown on Table 5.

Table 5 Estimated Propensity Scores

	Estimated Propensity Score	
	Percentile	Smallest
1%	0.0010694	0.000914
5%	0.0014751	0.000914
10%	0.0020168	0.000914
25%	0.0048323	0.000918
50%	0.277077	0.519671
75%	0.534804	0.753737
90%	0.3288462	0.768188
95%	0.4279398	0.789753
99%	0.645166	0.803323
Std Dev	0.144896	
Variance	0.0209948	
Obs: Treated 529; Control 491		

Source: Researcher's estimations (2021)

The estimated propensity score is used for matching of the treated and control groups in the counterfactual analysis. We also estimated the Rosenbaun bounds (RB) to test the validity of conditional independence assumption. First we estimated the overall impact of financial inclusion on household welfare using alternative matching methods. The results obtained show that the nearest neighborhood estimates is 0.415 irrespective of the nearest neighborhood used.

Similarly, the estimates of radius matching, kernel matching and local linear matching are 0.421, 0.412 and 0.416 respectively. This implies that irrespective of the matching technique used financial inclusion increases household welfare by approximately 42%.

Table 6 PSM Estimate of Impact of Financial Inclusion on Household Welfare

		Coefficients	Standard error
Nearest Neighborhood Matching	1-NN	0.415**	0.196
	2-NN	0.415***	0.141
	3-NN	0.415***	0.156
Radius Matching		0.421**	0.196
Kernel Matching		0.418**	0.206
Local Linear Matching		0.416**	0.194
PSM estimates by Demography (Kernel)			
Gender: male		0.277**	0.117
Gender: female		0.328***	0.129
Age (15-34)		0.296***	0.112
Age (34 and above)		0.166***	0.039
Primary education		0.275**	0.131
Secondary education		0.256***	0.090
Tertiary education		0.308***	0.106
unemployed head of household		0.054	0.042
employed head of household		0.280***	0.076
Ψ (RB)		1.0998	
σ (Sigma)		2.9087	
ρ (Rho)		-3.8762	

Source: Researcher's estimations (2021)

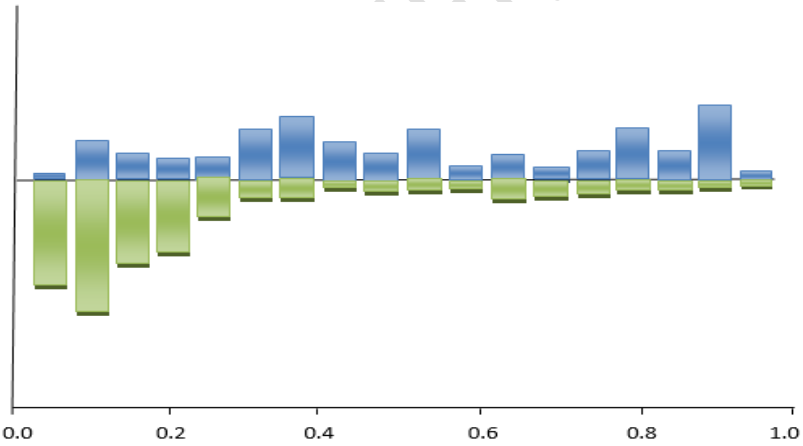
Second, we estimated the impact of financial inclusion on male respondents, female respondents, persons with primary education, persons with secondary education, persons with tertiary education, unemployed persons and employed persons using the nearest neighborhood technique. The results obtained indicate that the estimated coefficients are 0.27716 (for male gender), 0.32776 (for female gender), 0.29572 (for age bracket of 15 to 34 years), 0.16596 (for age bracket of 34 years and above), 0.27459 (for primary school certificate holders), 0.25553 (for secondary school certificate holders), 0.30833 (for holders of post-secondary education/tertiary certification, eg BSc.), 0.05446 (for the unemployed) and 0.28038 (for the employed). This suggest that male gender and female gender experience 27.7% and 32.8% increase in welfare

respectively due to being financially included. Similarly, the results suggests that persons within the age bracket of 15 to 34 years old (that is, youths) and persons between the age bracket of 34 years and above (adults) experience 29.6% and 16.6% improvement in welfare respectively due to being financially included. Also, persons with primary school education, secondary school education and tertiary education experience 27.5%, 25.6% and 30.8% increase in welfare respectively. In the same vein, unemployed persons and employed persons experience 5.4% and 28.0% increase in welfare respectively due to being financially included.

Post Estimation Evaluation of PSM

Estimating the PSM requires two major assumptions, namely, common support assumption (CSA) and conditional independence assumption (CIA).The CSA ensures that there is sufficient overlap in the characteristics of treated and untreated units to find adequate matches. When these assumptions are satisfied, the treatment assignment is said to be robust. The common support graph in Figure 1 shows the visual presentation of overlap in propensity scores between treatment group and the control group. The overlap depicted by Figure 4.1 suggests that the match is good and balanced.

Figure 1 The visual presentation of overlap in propensity scores between treatment group and the control group



Source: Researcher's estimations (2021)

The second assumption requires that there is conditional independence. This assumption requires that there exists a set X of observable covariates such that after controlling for these covariates, the potential outcomes are independent of treatment status. This requires that the after and before matching bias would not be statistically significant. To ascertain the success of the matching of

treatment and control groups based on the covariates, a test of difference of mean was conducted on the hypothesis that the mean value of each variable is the same in the treatment group and the control group. The test was done before and after matching. The result shown on Table 7 indicates that the biases are not statistically significant even at 10% significant level. This could be substantiated using the RB (Ψ) parameter. The RB for household welfare is 1.0998

This implies that an unobserved covariate could raise the odd of selection into financial inclusion by 9.98% so as to cause the estimated ATT to be statistically insignificant at 5% significance level. Also, given that the Ψ is approximately 1, one can conclude that the PSM estimated ATT is not sensitive to a confounding covariate. Put differently, it suggests that the CIA holds for the PSM estimation.

Table 7 Test of covariate balance

Variable	Mean			t test	
	Treated	Control	%bias	T	P>/t/
Gender	0.233	0.246	-2.7	-0.32	0.749
Age_hh1	24.171	24.904	-6.1	-0.62	0.533
Age_hh2	48.089	48.445	-5.1	-0.53	0.598
Edu_hh1	4.263	4.508	-9.8	-1.04	0.3
Edu_hh2	12.012	12.207	-11	-1.21	0.225
Edu_hh3	16.101	16.342	-11.1	-0.98	0.329
Religion	0.271	0.213	14	1.49	0.136
Fin_lit	0.204	0.208	-1	-0.11	0.91
Dependence	0.225	0.238	-2.7	-0.32	0.746
Employment_hh	0.108	0.133	-7.7	-0.84	0.402
Receipt_Transfer	0.192	0.158	7.5	0.96	0.338

Source: Researcher's estimations (2021)

5. Conclusion and Recommendation

The UN Sustainable Development Goal targets that by 2030, poverty gaps are closed in all nations (Goal 1), hunger is eradicated from all nations (Goal 2) and all nations attain good health and well-being (goal 3) for its citizens. Achieving these goals is synonymous to improving the welfare of households. In other words, household welfare improvement is a global goal. One phenomenon that has been identified as critical for development of third world countries is financial inclusion. In this study, we examined the role of financial inclusion on household welfare improvement. Using several micro econometric estimation procedures within the framework of quantitative research method we conclude that financial inclusion exerts significant positive impact on household welfare. Although it exerts positive impact on persons of all ages, gender and employment status, the impact is greater for women and youths.

The key finding of this study is that financial inclusion is critical for household welfare improvement on one hand and achieving the SDGs on the other hand. Thus, there must be a concerted efforts by all stakeholders to improve financial inclusion in Nigeria. To achieve increased financial inclusion for all, government, regulatory agencies and private sector participants (such as financial service providers (FSPs)) need to focus on strengthening the existing framework for branchless banking. Branchless banking is a strategy for delivering financial services without relying on physical bank locations. In many parts of the world, physical banks are few and far between. Often, people in these bank less communities lack access to much-needed financial services. However, through branchless banking alternatives, people can take advantage of these financial services without a physical bank. Often, branchless banking involves creating third-party bank outposts (such as a retail store) and implementing mobile banking platforms. The retailer may act as "ATM," and branchless banking customers can make banking transactions via their mobile phones and then deposit or withdraw cash through the retailer. Card-based systems are another way to deploy branchless banking.

Given that agent banking plays a critical role in driving branchless banking, the CBN should implement unified and comprehensive agent banking frameworks. This will ensure that services offered by financial service providers (FSPs) are made available to all Nigerians, especially in rural areas. This is key to tackling the problem of distance which discourages financial inclusion. The CBN should also promote linkages between microfinance banks (MFBs) and deposit money banks (DMBs) to obtain wholesale funds for on lending. This linkage can also enable the MFBs to provide DMBs financial services to its clients on behalf of the DMBs. In a similar consideration, the CBN should develop guidelines for DMBs to be operating mini-branches. This will increase access of FSPs to the people thereby increasing financial inclusion

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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