Impact of Microfinance on Financial Inclusion and Economic Welfare: A Panel Data Analysis

ABSTRACT

This study explores the relationship between microfinance, financial inclusion and economic welfare in a sample of 23 African countries for the period of 2004 to 2019 using annual time series data. We measured microfinance with the number of Branches of Microfinance banks (NOB), Microfinance Borrowers (MFBs), Microfinance outstanding deposits (MOD), Microfinance outstanding loans (MOL)); financial inclusion (number of registered mobile money accounts per 1,000 adults – NRMA; number of mobile money agent outlets par 1,000 adults – NAMO; and digital card ownership (DCO)); governance and institutional quality with (Rule of law (ROL), regulatory quality (REQ), and government effectiveness (GEF); and economic welfare with (household consumption (HHC)); while we controlled for inflation rate, interest rate and exchange rate.These variables were estimated using Panel Least Squares, Fully Modified OLS (FMOLS), Dynamic OLS (DOLS) and Panel Autoregressive Distributed Lag (ARDL) estimation techniques. The result of the cointegration revealed that cointegration exists between the variables of the model. Findings from the aforesaid estimation techniques shows that there is existence of long run relationships between microfinance, financial inclusion and economic welfare since the coefficients of the microfinance and financial inclusion variables are statistically significant. The coefficients of the error correction terms which measures the effects of the short-run dynamics of the model suggest that the speeds of adjustment from the long run to a short run in the models would be 76%, 61%, 83%, 67%, 68%, 34%, and 80% respectively for all the specified models. Following the findings of the study, conclusions were drawn and the study suggests that microfinance institutions should adapt to digitization of their products and services for wider coverage on one hand; government should provide digital financial amenities to create a fertile ground for micro-financial institutions to rely on to maximize the welfare of the economy.

Keywords: Microfinance, Financial Inclusion, and Economic Welfare.

1 INTRODUCTION

Even equitable income distribution in a nation has become one of the major policies in the world economies. Over the years, economists, scholars, researchers and policymakershave contended thatthe propagation of policies in areas such as microfinance and financial inclusion catalyzes economic welfare (see: El-Solh 1999; Hulme and Mosley 1996; Khalaf and Saqfalhait 2019; Amin and Uddin 2018; Mia 2017; Raihan et al. 2017; Rauf and Mahmood 2016; Park and Mercado 2018; Evans and Adeoye 2016; Jabir et al. 2017; and Zhang and Posso 2019). Microfinance provides needed financial services to poor and low-income households, entrepreneurs, and embryonic businesses, who would ordinarily not have access to such financial services/opportunities.However, following the 2018 report of the United Development Fund, financial inclusion was also seen as a means through which individuals and enterprises can use a range of appropriate and responsible financial services offered in a well-regulated environment. In the words of Beck, Demirguc-Kunt and Levine (2007), and Honohan and King (2012)“increase in financial assess correlates with a lower rate of poverty, income equality and increases households’ monthly income”.

Microfinance greatly contributes to economic welfare by delivering financial services (both savings and credit) to the poor, provides opportunity to increase their income, makes the poor to become self-employed and improve their economic situation. By replacing tangible collateral with social collateral, microfinance facilitates access to credit for individuals who normally could not take advantage of investment opportunities (Hussaini and Chibuzo, 2018; Egharevba et al., 2016; Milana and Ashta, 2020). It enhancesthe consumption of the households by encouraging borrowers to take investment risks. Microfinance provides poor individualswith training, skill acquisition opportunities and knowledge through learning collectively on the job (by acquiring the credit culture and investment experience through the guarantee of a long-term relationship and training provided by MIF – micro-financial institutions (Swain, 2006).

According to the findings from study conducted by Consultative Group to Assist the Poor (CGAP), over 750 million savings and loan accounts in Alternative Financial Institutions (AFIs) such as state-owned agricultural banks, development and postal banks, private and government-ownedmicro-financial institutions, low-capital local and/or rural banks, and given their age and size, MFIs accounts for an impressive share (about 33%) of loan accounts identified in the developing countries which creates means for financial inclusion to the poor (Christen et al. 2004).Thus, this is in line with some decrees of the World Development Agenda such as the G8 Declaration of 2004 and 2004; the Commission on Private Sector Development – the Microcredit Summit of 1997; the Declaration of the International Year for Eradication of Poverty in 1996 and the International Decade for Eradication of Poverty 1996, which emphasizes that microfinance reduce poverty and maximize economic welfare (Swain, 2006).

When viewed from developed countries perspective, it may seem like everyone has a bank account and involves in digital financial inclusion. However, when viewed globally, only 69% of the adult population has a bank account, (51% in 2011 and 62% in 2014), thus, the remaining 31% translates to 1.7 billion people lacking access to the most basic means of banking in the world (Holland FinTech, 2018). There is a strong correlation between financial depth, financial inclusion, digital inclusion and economic welfare, which has been one of the aims of microfinance to create an inclusive financial sector, which supports the participation and economic integration of the lower income levels of the people(Swain, 2006).

Financial Inclusion is an important driver of socio-economic welfare. United Nations have flagged financial inclusion as to priority to eradicate poverty, end hunger, achieve food security, ensuring healthy lives, achieving gender equality, economic welfare and women empowerment and inclusion. To drive financial inclusion, the World Bank launched a global vision for financial access in 2013 to enable adults to have worldwide access to a transaction account which they achieved by tracking financial inclusion numbers through the Global Findex database.

Findings from various studies show that conclusions from previous studies arenot exact. However, focusing on 23 selected African countries, we study microfinance, financial inclusion and economic welfare using dynamic OLS (DOLS), Fully Modified OLS (FMOLS) and Panel ARDL estimation techniques. We employed measures of microfinance which include (number of branches of microfinance banks (NOB), Microfinance Borrowers (MFBs), Microfinance outstanding deposits (MOD), and Microfinance outstanding loans (MOL)); measure of financial inclusion (number of registered mobile money accounts per 1,000 adults – NRMA; number of mobile money agent outlets par 1,000 adults – NAMO; and digital card ownership (DCO)); a measure of economic welfare (Household consumption – HHC) and measures of governance and institutional quality (rule of law (ROL), regulatory quality (REQ) and government effectiveness (GEF)); while controlling for the exchange rate, inflation rate and interest rate. Hence, other sections of the paper will be structured as follows: literature review (theoretical and empirical will be discussed in section 2, while data, methodology and model specification are contained in section 3, sections 4 and 5 house the discussion of the results from regression analysis, findings of the study and interpretations, summary conclusions and policy options of the study.

2 LITERATURE REVIEW ON FINANCIAL INCLUSION

Over the years, extensive research have been conducted by policymakers on the investigations of the nexus between microfinance, financial inclusion and economic welfare. This debate stems from numerous economic gains of microfinance and financial inclusion in economic welfare. In this section, the theories and empirical literature relating to microfinance and financial inclusion will be reviewed.

2.1 THEORETICAL LITERATURE

In the economic growth theory of microfinance proposed by Hulme and Mosley (1996), they argued that capital investments and other financial services constitute the key determinants of economic growth. Income improvement was seen as the driver of most development efforts. They assumed that there is a positive relationship between financial investment and economic growth. However, financial investment to the poor through microfinance services will lead to increased incomes for the poor and ultimately result in poverty reduction (Hulme, 1997). Furthermore,

El-solh (1999) argued that microfinance cannot by itself generate income but should be perceived as an important input in the process of developing micro-enterprises which are integral to the private sector, in turn, are perceived as an engine of growth for economies of developing countries which have moved from state-directed to market-oriented economies.

To reinforce the above theory, El-Solh (1999) postulated two theoretical propositions on the macro-level for microfinance interventions which are "economic and human resources theories". By enabling the establishment of new micro-enterprises, microfinance supports the efficient use of labour and capital as factors of production and therefore contributing to economic growth and sustainable development. The human resource theory is quite similar to the economic theory. Thus, since it is generally accepted that microfinance is labour-intensive, facilitating access to microfinance is likely to result in the acquisition of new skills and upgrading of existing onesand thus, improve on the capacity of the poor to generate income and improve their livelihood. Furthermore, theories underlying microfinance entails the empowerment of the poor when they participate in microfinance activities (Hashemi, Schuler and Ruley 1996; Chester and Kuhn, 2002). By self-selecting themselves into groups self-managing their groups, and gaining control over the means of making a living, poor people become empowered and independent. Empowerment has been particularly relevant for women who are perceived as being marginalized in most developing countries.

As proposed by Peterson K. Ozili (2018) in his Public good theory of financial inclusion, he argued that the delivery of formal financial services to the entire population and ensuring that there is unrestricted access to finance for everyone, should be treated as a public good for the benefit of all members of the population. As a public good, individuals cannot be excluded from gaining access to financial services. All individuals will enjoy basic financial services without paying for it. Access to financial services to one individual does not reduce its availability to others which means that all members of the population can be brought into the formal financial sector and everyone will be better off. Under this theory, all members of the population are beneficiaries of financial inclusion and nobody is left out.

Furthermore in his "Vulnerable group theory of financial inclusion", Peterson K. Ozili (2018) argued that financial inclusion activities or programs in a country should be targeted to the vulnerable members of society such as the poor people, women, elderly people who suffer the most from economic hardship and crises. Vulnerable people are often the most affected by financial crises and economic recession, therefore, it is pertinent to bring these vulnerable people into the formal financial sector. One way to achieve this is through government-to-person (G2P) social cash transfers into the formal accounts of vulnerable people. Making G2P social cash transfer payments into the formal account of poor people, young people, women and elderly people will encourage others in the same category to join the formal financial sector to own a formal account to take advantage of the social cash transfer benefits, thereby increasing the rate of financial inclusion for vulnerable groups. Theory implies that it identifies some members of the population to be vulnerable people in society.

2.2 EMPIRICAL LITERATURE

MICROFINANCE AND ECONOMIC WELFARE

In an extensive study carried out by Mia (2017), some microfinance institute contributes to socio-economic welfare of Bangladesh. Although the regulatory framework is still weak, but majority of the microfinance institutions – MFIs contributes to the welfare of households, the study further revealed that microfinance has made significant contributions on such growth and socio-economic development. Another study by Amin and Jala Uddin (2018), who examined the long run dynamic relationship between Grameen Bank loan financing and clients' deposits and economic growth using cointegration test, and the Granger causality test. They conclude that both financing and depositing aspects of Grameen Bank have positive effects on economic growth in the long run. Raihan et al. (2017) investigated the effect of microfinance on GDP in Bangladesh. They estimate that microfinance has added about 8.9% to 11.9% to GDP according to the assumptions about the working of the labour market. Furthermore, the results revealed that the contribution of rural GDP is even higher.

To ascertain the relationship that exists between economic welfare and microfinance, Rauf and Mahood (2016) examined the development processes adopted by the microfinance sector and its impact on the performance in microfinance institutions in Pakistan and the well-being of the people. To strike a balance between outreach and poverty alleviation, an intensive development technique was used and it shows that extra price is powerful at the initial levels of development which may reflect in improved efficiency, and productivity. As a substitute, the sector adopted huge progress procedure which creates huge investment in physical infrastructure and fast broaden in recruitment and department network. In the like manner, Idewele and Bein (2017) studied the impact of microfinance on socio-economic growth in Nigeria using multiple regression analysis to estimate time series data and cross-sectional data spanning from 1992 to 2012. Their main findings shows that microfinance investment has a significant impact on economic performance in Nigeria in the long run.

Most of the earlier studies contented that microfinance institutions have positive effect on economic performance while others refute it. For instance, Khalaf and Saqfalhait (2019) investigated the effect of microfinance institutions on economic growth in Arab countries using a panel model for six Arab countries from 1999 to 2016 and they discovered that micro-financial institutions (MFIs) do not affect improving economic growth in Arab countries. While Shabbir (2016) posits from his study on the impact of microfinance institutions have positive impact on economic growth in Morocco. Apere (2016) using the Augmented Dickey-Fuller Unit root test, Countegration test, Error correction model (ECM) and the parsimonious test to study the impact of microfinance banks on economic growth in Nigeria over the period of 1992-2013. They discovered that the activities of the microfinance bank can influence the entire economy if it is well coordinated. The results of the study further shows that microfinance bank loans and domestic investment are significantly and positively impact the growth of Nigeria's economy. In contradictory to this finding, Wachukwu et al. (2019) examined the impact of microfinance institutions on the economic growth of Nigeria, using per capita income as a measure of economic growth for the period covering 1992 – 2016 and Cochranorcutt regression model on time series annual. The results revealed that a very strong but negative relationship was found between microfinance banks' credit growth and per capita income.

FINANCIAL INCLUSION AND ECONOMIC WELFARE

Financial inclusion has numerous advantages in the welfare optimization process in an economy, it changes the way we save, transact, receive and spend money. Financial inclusion breaks the shackles of cross-border transactions, by integrating and globalizing financial system through digitalization. According to the World Bank (2019) report on financial inclusion, "being able to access a transaction account is a first step towards broader financial inclusion" because a transaction account enables people to store money, and send and receive payments. In other words, a transaction account serves as a gateway to other financial services. In light of this, in Evaluating the determinants of financial inclusion, Evans and Adeoye (2016) used a panel regression approach to study 15 countries of Africa from 2005-2014. The result shows that lagged financial inclusion implies "catch-up effects" showing that GDP per capita, money supply as a percentage of GDP, adult literacy rate, internet access and banking activities have great significance in explaining the level of financial inclusion in Africa. Focusing on economic welfare and financial inclusion, Park and Mercado (2018) assessed the cross-country impact of financial inclusion on poverty and income inequality across countries by introducing a new financial inclusion index for 151 economies, using principal component analysis and a cross-sectional approach. The results indicate that higher financial inclusion significantly co-varies with economic growth and lower poverty rates, but only for high and middle-income economies, not those that are low-income. However, they did not find a significant effect of financial inclusion on income inequality in any income group.

In an extensive research conducted by Jabir et al (2017), they analyzed the effect of financial inclusion on reducing poverty among the low-income household level for 35 countries in sub-Saharan Africa. Taking cross-sectional data of 2011, they found that financial inclusion significantly reduced the level of poverty in sub-Saharan Africa through providing net wealth and lager welfare benefits to the poor. Uddin et al. (2017) on their own part investigated the determinants of financial inclusion in Bangladesh from 2005 through 2014 by distinguishing between the supply and demand side determinants of financial inclusion using a quantile regression approach. The study established that size of a bank, efficiency, and the interest rates represents the supply side determinants, while literacy rate and age

dependency ratio were demand factors. In the same vein, Zins and Weill (2016) studied the determinants of financial inclusion in Africa using the World Bank's Global Findex data based on 37 African countries. The study employed the probit estimation method and found that financial inclusion was determined by gender, age and educational levels with a higher influence of education and income.

Zhang and Posso (2019) constructed an indicator of financial inclusion using the information on transactions and payments, savings, credit and insurance and they discovered a strong positive effect on household income in China. Dimova and Adebowale (2018), in the context of Nigeria, finds that financial inclusion, measure as owing a bank account increases per capita expenditure but also increases intra-household inequality. Adebowale and Lawson (2018) find that financial inclusion reduces transient poverty in the same context as Dimova and Olabimtan (2018). DeLoach and Smith-Lin (2018), in the Indonesian economy,find that financial inclusion measured in terms of access to savings and credit enables households to borrow or liquidate assets in response to adult health shock.

3 DATA AND METHODOLOGY

3.1 DATA AND SOURCES

We used annual time series data spanning from 2004 to 2019 which was sourced from IMF database, World Bank's Global Findex, World Bank's World Development Indicators (WDI) and World Governance Indicators (WGI). The data, definitions, and expected apriori economic signs are shown in Table 1 below.

Table 1: DEFINITION OF RESEARCH VARIABLES

Variable	Definition	Sign
EWM	Household Consumption (HHC) is all transaction of the national account representing consumption expenditure by resident households on individual consumption of goods and services.	---
MFM	Number of microfinance branches (NOB); Microfinance borrowers (MFBs); Microfinance outstanding deposits (MOD); Microfinance outstanding loans (MOL).	Positive
FIM	Numberregistered mobile money accounts per 1,000 Adults (NRMA); Number of mobile money agent outlets per 1,000 Adults (NAMO); and Digital Card Ownership (DCO).	Positive
GIM	Rule of Law (ROL); Regulatory Quality (REQ) and Government Effectiveness (GEF).	Positive
CONTROL VARIABLES		
EXR	The exchange rate (EXR) is defined as the rate at which one currency will be exchanged for another.	Positive
INF	Inflation is seen as a general rise in price level relative to available goods which results to substantial and continuing drop in purchasing power in an economy over a period of time.	Negative
INTR	Interest rate is the amount a lender charges for the use of his assets or money expressed as a percentage of the principal.	Positive

Source: Author's Conception. Note: EWM represents economic welfare measures; MFM denotes microfinance measures; FIM represents financial innovation measures; and GIM represents governance and institutional quality measures.

It will be very pertinent to converse with the selected countries for clearer understanding. Below in Table 2 is the list of the selected African countries.

TABLE 2: SELECTED COUNTRIES IN THE STUDY

LIST OF SELECTED COUNTRIES
Angola
Benin Republic
Burkina Faso
Burundi

Cameroon
Cote D'Ivoire
Gambia
Ghana
Guinea
Guinea-Bissau
Kenya
Madagascar
Mali
Niger
Nigeria
Rwanda
Senegal
Sudan
Tanzania
Togo
Uganda
Zambia
Zimbabwe

Source: Author's concept. Note: the availability of data informed the choices of the selected countries and the duration of the study (2004-2019).

To vividly investigate microfinance, financial inclusion and economic welfare, we measured economic welfare by using household consumption (HHC) following Gangopadhyay and Wadhwa (2004), Gandhimathi et al (2012) and Gupta Anil (1986); microfinance is measured with the number of microfinance branches (NOB), microfinance borrowers (MFBs), microfinance outstanding deposits (MOD) and microfinance outstanding loans (MOL)followingYaidoo, Lindsay & Kalaish, Vishwanatha (2018); financial inclusion was measured by the number of registered mobile money agents (NRMA), number of active mobile money agent outlets (NAMO) and digital card ownership following Peterson K. Ozili (2018); governance and institutional quality were measured by using rule of law (ROL), regulatory quality (REQ) and government effectiveness (GEF) following Mankiw, Romer et al (1992); while controlling for the exchange rate, inflation and interest rate. However, below in Table 3 are the outlay of descriptive statistics and the correlation matrix of the variables.

TABLE 3: NATURE OF VARIABLES USED IN THE STUDY

DESCRIPTIVE STATISTICS														
	HHC	NOB	MFBS	MOD	MOL	NRMA	NAMO	DCO	EXR	INF	INTR	ROL	REQ	GEF
Mean	0.8121	0.7686	6.5846	1.3456	3.7314	1.1484	-0.6913	1.6942	0.8317	0.9461	0.9099	-0.7798	-0.2936	-0.8183
Median	0.9627	0.9790	6.5137	1.4943	3.7100	1.1933	-0.3556	0.3179	1.1885	0.2286	0.9132	-0.6891	-0.4897	-0.7782
Maximum	4.1002	2.6205	9.0215	2.7193	5.0279	3.6261	3.9779	13.807	3.8617	10.628	2.6431	0.1491	1.9900	0.2668
Minimum	-6.4313	-6.3500	4.7178	-2.5124	2.7895	-4.0087	-33.543	0.0124	-2.3251	-1.6623	0.0000	-1.8522	-1.8483	-1.7660
Std. Dev.	1.2314	1.0266	0.8881	0.7431	0.4693	1.1317	3.7886	3.0093	1.5613	2.5453	0.4473	0.4653	0.9235	0.4000
Skewness	-1.1735	-2.0186	0.6266	-1.5787	0.6886	-0.6073	-6.0828	2.4150	-0.2463	2.5291	0.1993	-0.1497	0.9205	0.1401
Kurtosis	7.7461	12.028	3.4213	7.0495	3.4419	4.1674	51.383	7.8786	1.8717	9.0612	3.4058	2.1422	3.2728	2.5421
CORRELATION MATRIX														
HHC	1													
NOB	0.2119	1												
MFBS	0.6756	0.1200	1											
MOD	0.5354	0.9481	0.0490	1										
MOL	0.6907	0.1625	0.3163	0.0220	1									
NRMA	0.6298	0.0599	0.1693	0.0722	-0.1021	1								
NAMO	-0.3041	0.0239	-0.1569	0.0509	-0.2110	-0.0831	1							
DCO	-0.3903	0.2401	-0.1530	0.2437	0.0575	-0.1257	0.1671	1						

EXR	0.2948	-0.1028	-0.2327	-0.1172	0.3089	-0.0220	-0.0749	0.1257	1					
INF	-0.7340	0.0019	0.0174	0.0078	0.0157	-0.1199	-0.0353	0.1798	0.0497	1				
INTR	0.6087	0.0131	0.2088	-0.0012	0.1328	0.0151	-0.1585	-0.2324	0.0818	0.0416	1			
ROL	-0.5741	0.1002	0.0184	0.1953	0.1986	0.0788	0.0515	0.0983	0.2547	-0.1344	0.0416	1		
REQ	-0.3407	0.0447	-0.0193	-0.0552	0.4671	0.0138	-0.0738	0.1713	0.2758	0.1229	0.0040	0.3038	1	
GEF	0.6804	0.0288	0.1105	0.0388	0.1209	0.1197	0.0138	-0.1336	0.1803	-0.2275	0.1247	0.8352	0.1146	1

Source: Author's computation using Eviews 10

3.2 MODEL SPECIFICATION

In this study on microfinance, financial inclusion and economic welfare, we employed microfinance, financial inclusion, governance and institutional quality measures and economic welfare measures to investigate their nexus. However, the mathematical form of the model of the study is presented below:

$$EWM = f(MFM, FIM, GIM, Control) \quad (1)$$

Where EWM represents economic welfare measure; MFM denotes microfinance measures; FIM represents financial innovation measures; GIM represents governance and institutional quality measures; and control signifies the control variables. The econometric version of the model is expressed as follows:

$$EWM_t = \vartheta_0 + \vartheta_1 MFM_t + \vartheta_2 FIM_t + \vartheta_3 GIM_t + \vartheta_4 Control_t + \mu_t \quad (2)$$

Where t is time; ϑ_0 is the constant; $\vartheta_1 to \vartheta_4$ represents the coefficients and μ_t denotes the error term.

In empirical studies, the use of time series data is widely used by scholars and if not properly managed, it may lead to spurious regression. Thus, utilizing the fully modified OLS (FMOLS), Dynamic OLS (DOLS) and Panel Autoregressive Distributed Lag (ARDL) model we aim to provide optimal estimates of cointegrating regressions. It is highly beneficial to combine these models and the main reasons why we combined the three models in this study are explained as follows. To effectively assess the robustness of the parameter estimates of different specifications and also to account for the short run dynamics of the model. Although FMOLS and DOLS are nonparametric approaches, they are appropriate in dealing with nuisance parameters, which may sometimes be problematic, especially in small samples. To apply FMOLS, and DOLS for the estimation of long-run parameters, there must be existence of a cointegration relationship among the series of the variables at the order I(1). Based on this reason, we test for the presence of unit roots to determine the cointegrating status of the variables. We employed we employed Levine, Lin and Chu (2002), Im, Pesaran and Shin (2003) and Fisher-type tests using ADF and PP tests (Maddala and Wu, 1999). After this Pedroni (1999, 2004) and Kao (1999) cointegration tests were used to test the presence of cointegration relationships among the variables.

The advantage of the FMOLS is that to attain asymptotic efficiency, FMOLS modifies the least squares for serial correlation and endogeneity of the regressors, which arise as a result of a cointegrating relationship (Hansen and Kim, 1995; Phillip and Hansen, 1990). As developed by Phillips and Hansen (1990), Phillips and Moon (1999) and Pedroni (1995, 2000), the FMOLS estimators use initial estimates of the symmetric and one-sided long-term covariance matrices of the residuals. Consider the n+1 dimensional time series vector process (Y, X), with the cointegrating equation,

$$Yt = Xt\beta + D_{1t}\Psi + \mu_{1t} \quad (3)$$

Where Xt are the n stochastic regressors, $Dt = (D_{1t}, D_{2t})$ are deterministic trend regressors and μ_{1t} are the residuals. The μ_{2t} is obtained as $\mu_{2t} = \Delta\Sigma_{2t}$ from the levels regression.

$$Xt = \Gamma D_{1t} + \Gamma D_{2t} + \Sigma_{2t} \text{ ---------- } (4)$$

Alternatively, from differenced regressions

$$\Delta Xt = \Gamma \Delta D_{1t} + \Gamma \Delta D_{2t} + \mu_{2t} \text{ ---------- } (5)$$

Let φ and ζ be the long – run covariance matrices which can be calculated using the residuals $\mu_{2t} = (\mu_{1t}, \mu_{2t})$.

The modified data can be defined as follows:

$$Y_t = Y_t - \Phi_{12}\varphi_{22}\mu_2 \text{ ---------- } (6)$$

And the estimated bias correlation terms are

$$\zeta = \zeta_{12} - \Phi_{12}\varphi_{22}\zeta_{22} \text{ ---------- } (7)$$

The FMOLS estimator is therefore given by the following equations

$$\theta = \begin{bmatrix} \beta \\ \Psi_1 \end{bmatrix} = \left[\sum_{t=1}^{T} Z_t Z_t\right]^{-1} \left[\sum_{t=1}^{T} Z_t Y_t - T \begin{bmatrix} \zeta_{12} \\ 0 \end{bmatrix}\right] \text{ ---------- } (8)$$

Where $Zt = (X_t, D_t)$

The DOLS model as was developed by Stock and Watson (1993_, involves the regression of dependent variable on all independent variables, leads and lags of the first difference of all I(1) variables (Masih and Masih, 1996). The advantage is that it applies to a system of variables with different orders of integration, small samples bias are taken care of leads and lags of the differenced independent variables among regressors (Stock and Watson, 1993). According to Saikonnen (1991), the DOLS estimator corrects for serial correlation and endogeneity by including lags and leads of the differenced I(1) regressors in the regression. The DOLS model is derived by augmenting I(1) the cointegrating regression with leads and lags of ΔXt so that the resulting cointegrating equation term is orthogonal to the entire history of the stochastic innovations. However, the DOLS model is specified as follows:

$$Yt = X_t\beta + D_{1t}\gamma_1 + \sum_{j=-q}^{T} \Delta X_{t+j}\delta + V_{1t} \text{ ---------- } (9)$$

Where Yt is the dependent variable, Xt a vector of independent variables, and Δ is the lag operator. It is assumed that adding q lags and r leads of the differenced regressors absorbs all the long-run correlation between μ_{1t} and μ_{2t} Besides, least squares estimates of $\theta = (\beta, Y)$ using equation 7 possess equivalent asymptotic distribution as those from FMOLS.

The autoregressive distributed lag model (ARDL) is used in this study due to the fact that it allows for both long run and short run dynamic error correction model (ECM) using linear transformation (Banerjee et al. 1993). The basic features of ARDL model lies on its characteristics such as generating superior estimates regardless of the sample size which can be either small or finite (Ghatak and Siddiki, 2001); suitable for all variables regardless of their order of integration; when modeled with appropriate lags, it corrects both serial correlation and endogeniety problems (Pesara et al 2001); and ARDL model can simultaneously estimate both long run and short run cointegration

relationships and provide unbiased estimation for the study (Pearan et al. 2001). However, an ADRL model for a, b and c can be expressed as follows:

$$Gt = \sum_{f=0}^{e} \Omega_f G_{t-1} + \sum_{h=0}^{r} MhX_{t-1} + \mu_t \text{ ----------(10)}$$

In a differencing form, the equation can be re-written as follows:

$$\Delta G_t = \beta_1 G_t - 1 + \beta_2 X_t - 1 + \sum_{f-1}^{e-1} \Omega f \Delta Y_{t-f} + \sum_{h=0}^{r-1} M_h \Delta X_{t-h} + \mu_t \text{ ----------(11)}$$

$$\Delta G_t = \beta_1 V_{t-1} + \sum_{f-1}^{M-1} \Omega f \Delta Y_{t-f} + \sum_{h=0}^{r-1} M_h \Delta X_{t-h} + \mu_t \text{ ----------(12)}$$

Where $V_{t-1} = G_{t-1} + (\frac{\beta_2}{\beta_1}) X_{t-1}$ and this is based on the assumption that in the long run, $Y_t = Y_{t-1}$ and $X_t = X_{t-1}$.

Equation 10 signifies the standard ARDL model expressing the dependent variable (G_t) as a function of its lag $(Y_{t-1})(AR)$ and the lag of the dependent variables X_{t-h} DL. Equation 11, shows the short run and long run relationships between the dependent variable and the independent variables, where $\beta_1 and \beta_2$ are the long run parameters, M_f and Ωh are the short run parameters. For equation 12, $V_{t-1} = Y_{t-1} + (\frac{\beta_2}{\beta_1}) X_{t-1}$ - is based on the assumption that in the long run, there is convergence such that $Y_t = Y_{t-1}$ and $X_t = X_{t-1}$.

However, re-parameterizing equation 12 with the variables of the study, we have the following:

$$\begin{aligned}\Delta LHHCt = {} & \beta_1 V_{t-1} + \sum_{f=1}^{e-1} Gf \Delta LHHC_{t-f} + \sum_{h=0}^{r-1} M_h \Delta LNOB_{t-1} + \sum_{i=0}^{r-1} \rho i \Delta LMFBS_{t-1} \\ & + \sum_{m=0}^{s-1} \beta m \Delta LMOD_{t-1} + \sum_{e=0}^{w-1} \alpha e \Delta LMOL_{t-1} + \sum_{n=0}^{t-1} \delta n \Delta LNRMA_{t-1} + \sum_{i=0}^{r-1} \omega i \Delta LROL_{t-1} \\ & \sum_{i=0}^{c-1} \Phi i \Delta LREQ_{t-1} + \sum_{j=0}^{t-1} \gamma j \Delta LGEF_{t-1} + \sum_{k=0}^{t-1} \wp_k \Delta LEXR_{t-1} + \sum_{g=0}^{t-1} \hbar_g \Delta LINF_{t-1} + \\ & \sum_{x=0}^{t-1} \ell_x \Delta LINTR_{t-1} + \mu_t \text{ ----------(13)}\end{aligned}$$

In equation 13, $\beta_1 V_{t-1}$ measures the long run relationships, G_f is the parameter that measures the short run relationships between microfinance, financial inclusion and economic growth. M_k Measures the short run relationship between NOB and HHC; ρi measures the short run relationship between MFBS and HHC; βm measures the short run relationship between MOD and HHC; αe measures the short run relationship between MOL and HHC; δn measures the short run relationship between NRMA and HHC; ϕa measures the short run relationship between REQ and HHC; ψd measures the short run relationship between GEF and HHC; ϖi measures the short run relationship between ROL and HHC; γj measures the short run relationship between GEF and HHC; $\wp_k$ measures

the short run relationship between EXR and HHC; $\hbar_g$ measures the short run relationship between INF and HHC; ℓ_x measures the short run relationship between INTR and HHC; while μt is the error term.

4 DISCUSSION OF THE EMPIRICAL FINDINGS

4.1 TEST FOR STATIONARITY (UNIT ROOT TEST)

Granger and Newbold (1974) opined that if time series data are non-stationary, estimates of the regression result would be spurious. Based on this inference, we employed the following panel unit root tests Levine, Lin and Chu (2002); Im, Pesaran and Shin (2003); and Fisher-type tests using ADF and PP tests (Maddala and Wu, 1999) following Hurlin and Mignon (2007) to determine the level of Stationarity and order of integration of the variables of the model and the results are presented in table 4 below.

TABLE 4: SUMMARY OF UNIT ROOT TESTS

VARIABLES	LLC	IPS	ADF-FISHER	PP-FISHER	INTEG. ORDER	
					LEVEL	FIRST DIFF.
HHC	-5.05288***	-4.05449***	94.2513	162.338		
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	I(0)	-----
NOB	-5.77829***	-5.73790***	112.089***	179.436***		
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	I(0)	-----
MFBs	-8.74067***	-5.58494***	110.017***	173.293***		
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	-----	I(1)
MOD	-4.48482***	-4.63237***	94.9683***	146.373***		
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	I(0)	-----
MOL	-3.05091***	-1.74063**	70.0323**	70.7692**		
	(0.0011)	(0.0409)	(0.0127)	(0.0109)	I(0)	------
NRMA	-8.11417***	-4.71179***	97.3432***	95.9211***		
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	I(0)	------
NAMO	-4.35467***	-8.71124***	112.299***	130.875***		
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	I(0)	-----
DCO	-3.87763***	-2.89091***	85.4127***	89.3016***		
	(0.0001)	(0.0019)	(0.0004)	(0.0001)	I(0)	-----
EXR	-9.35465***	-3.76476	90.4371	108.883		
	(0.0000)	(0.0001)	(0.0001)	(0.0000)	I(0)	-----
INF	-8.52783***	-5.96371***	118.584***	132.131***		
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	I(0)	-----
INTR	-2.77802***	-	82.5832***	80.7520***		
	(0.0027)	3.07595***(0.0010)	(0.0007)	(0.0012)	I(0)	-----
ROL	-10.3935***	-9.37323***	194.508***	215.074***		
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	___	I(1)
REQ	-10.3935***	-9.37323***	171.240***	162.915***		
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	I(0)	----
GEF	-4.12816***	-3.11130***	84.2098***	91.8235***		
	(0.0000)	(0.0009)	(0.0005)	(0.0001)	I(0)	----

Source: Author's computation (.) represents the Probability values; while ***, ** and * represents 1%, 5% and 10% levels of significance

From table 4, all the variables are statistically significant at 1% level of significance except for MOL in IPS, ADF-Fisher and PP-Fisher tests, however, virtually all the variables are integrated at I(0) except MFBs and ROL which integrated at order I(1), and none of the variables integrated at I(2).

4.2 COINTEGRATION TEST

The result of unit root test came with a conclusion that all the variables are integrated at order I(0) or at first difference i.e. order I(1) but no variable integrated at order I(2). Thus, we set to investigate further whether cointegrating relationships exists between the variables of the model. We employed Pecroni (1999; 2004)

cointegration and also Kao (19990) tests as a robustness check. The null hypothesis for the test the test is "no cointegration" and decision rule is to reject the null hypothesis of the P-values of the calculated values are less that (0.05). Thus, the results are presented below.

TABLE 5: COINTEGRATION RESULTS

PEDRONI COINTEGRATION **TEST**				
WITHIN-DIMENSION				
	Statistic	Prob.	Weighted	Prob.
Panel v-Statistic	-2.601742	0.9954	-5.121118	1.0000
Panel rho-Statistic	3.867067	0.9999	5.004488	0.0000
Panel PP-Statistic	-9.879755	0.0000	-2.400909	0.0082
Panel ADF-Statistic	-6.518808	0.0000	-1.241994	0.1071
BETWEEN-DIMENSION				
Group rho-Statistic	6.850836	0.0000		
Group PP-Statistic	-9.601186	0.0000		
Group ADF-Statistic	-2.349019	0.0094		
ROBUSTNESS CHECK KAO COINTEGRATION TEST				
ADF-STATISIC	2.979764			
PROBABILITY	0.0014			

Source: Author's Computation. Decision made based on α=0.05

From results of Pedroni cointegration test in the table 5 above, the P-values of most of the estimates are less than 0.05 which led to rejection of the null hypothesis "no cointegration" and acceptance of the alternative hypothesis, thus, suggesting that there is existence of cointegration among the variables of the model. However, to truly ascertain if there is existence of cointegration among the variables, we also carried out Kao cointegration test as a robust check for the initial finding from Pedroni test. Findings from the test confirmed that there is existence of cointegration since the P-value of the ADF statisticis less than 0.05.

4.3 OLS ESTIMATION AND HAUSMAN TESTS FOR SPECIFIED MODELS

To fulfill the assumptions of OLS, all the specified models of the study was taken through pre and post OLS estimation tests to ensure that our result will yield desired estimates. Also, we conducted Hausman testfor panel ARDL regression analysis to enable us ascertain the suitable models for the specified equations. Thus, the results are presented in table 6 below.

TABLE 6: SUMMARY OF PRE AND POST OLS ESTIMATION TESTS AND HAUSMAN TEST

Model	Normality Test	Serial Correlation	Ramsey Test	Heteroskedasticity	Hausman Test
1A	6072.559 (0.000000)	0.134770 (0.8740)	-0.544835 (0.0037)	1.019596 (0.4184)	5.239191 (0.6308)
1B	6809.607 (0.0000000)	0.163188 (0.8495)	-0.061728 (0.0000)	0.464312 (0.9917)	3.044299 (0.8809)
2A	4911.602 (0.0000000)	0.060514 (0.9413)	-0.044773 (0.0000)	1.891259 (0.0818)	6.603412 (0.3591)
2B	5676.888 (0.0000000)	0.142129 (0.8676)	-0.413730 (0.0000)	1.721030 (0.1176)	4.794817 (0.5704)
3A	540.118 (0.0000000)	0.061423 (0.9404)	-0.317884 (0.0004)	0.913136 (0.6330)	7.230379 (0.6131)
3B	5342.345 (0.0000000)	0.054158 (0.9473)	0.445270 (0.0018)	0.762613 (0.8636)	1.444290 (0.9975)
3C	5393.479 (0.0000000)	0.054612 (0.9469)	-0.318748 (0.0088)	0.794083 (0.8237)	5.689157 (0.7706)

Source: Computed by the Author Using Eviews 10

Following wing the outcomes of the results in table 6, we drew conclusion from the normality test that the error terms of the specified models are normally distributed, since their P-values are less than 0.05; also evidence from

Breusch-Godfrey Serial Correlation test, White Heteroskedasticity test and Ramsey Reset test shows that there is no evidence of serial correlation, in the specified model; the variance distribution of the model are homoscedastic and the models are well specified. On the other hand, the result of the Hausman test shows that random effects is suitable for the specified models since their estimated P-values are greater than 0.05 (see table 6).

4.4 LONG RUN ESTIMATED RESULTS

Haven ascertained the existence of cointegration among the series, and that the models satisfied the assumptions of OLS, we therefore set to investigate the long run relationships that exists between the variables of the study. To do this, we employed the multiple regression techniques ranging from panel least squares model, fully modified OLS, dynamic OLS to panel autoregressive distributed lag (ARDL) model. Our study aimed at using the aforesaid estimation techniques to explore the long run relationship of microfinance, financial inclusion and economic welfare in selected African countries on one hand, and then using the short run component of the panel ARDL model to account for the short run error correction of the long run effects of the model. To lessen the ambiguity, the models was segmented into three parts namely: microfinance and economic welfare; financial inclusion and economic welfare; and microfinance, financial inclusion and economic welfare. Thus, the results are presented in table 7 below.

TABLE 7: RESULTS FOR EMPIRICAL MODELS OF THE STUDY

MICROFINANCE AND ECONOMIC WELFARE **MODEL 1A: DEPENDENT VARIABLE (HHC)**				
VARIABLE	P-LEAST SQUARE	FMOLS	DOLS	P-ARDL
NOB	0.301823 (0.0000)	0.131097 (0.0000)	-0.154106 (0.0007)	0.411237 (0.0006)
MOD	0.273749 (0.0000)	0.088616 (0.0000)	0.137270 (0.0020)	0.006751 (0.9398)
MOL	0.009608 (0.0001)	0.010755 (0.0000)	0.007661 (0.0006)	0.012497 (0.0004)
EXR	-0.188817 (0.0173)	-0.060231 (0.0000)	-0.010388 (0.0198)	0.141221 (0.0000)
INF	-0.018839 (0.7856)	-0.009531 (0.4082)	-0.006566 (0.8182)	0.069881 (0.0000)
INTR	0.008010 (0.9461)	0.331508 (0.0000)	0.218164 (0.1217)	0.736869 (0.0000)
D(MFBS)	0.000511 (0.0000)	0.000162 (0.0000)	0.000123 (0.0000)	0.001040 (0.0043)
MODEL 1B: DEPENDENT VARIABLE (HHC)				
NOB	0.120215 (0.0361)	0.058774 (0.0137)	0.120215 (0.0156)	0.532960 (0.0000)
MOD	0.098639 (0.0603)	0.001576 (0.9464)	0.098639 (0.0302)	0.331746 (0.0010}
MOL	0.010549 (0.0001)	0.009965 (0.0000)	0.010549 (0.0000)	0.010814 (0.0082)
REQ	-0.249911 (0.0185)	-0.352163 (0.0000)	0.249911 (0.0066)	0.273067 (0.1297)
GEF	-0.032988 (0.8517)	-0.284321 (0.0025)	-0.032988 (0.8289)	2.493319 (0.0000)
D(MFBS)	-0.000108 (0.0000)	-0.000108 (0.0003)	0.000108 (0.0007)	0.002822 (0.0002)
D(ROL)	0.609507 (0.0066)	1.084711 (0.0050)	0.609507 (0.0000)	4.039157 (0.0108)
FINANCIAL INCLUSION AND ECONOMIC WELFARE **MODEL 2A: DEPENDENT VARIABLE (HHC)**				
NRMA	0.014377 (0.0000)	0.025950 (0.0006)	0.014377 (0.1275)	0.401653 (0.0000)
NAMO	0.034476 (0.0049)	0.028664 (0.0006)	0.034476 (0.0070)	0.005969 (0.8561)
DCO	0.100268 (0.0018)	0.093780 (0.0088)	0.100268 (0.0422)	0.235922 (0.0000)
EXR	0.031751 (0.0323)	0.016428 (0.0298)	0.031751 (0.0271)	0.108378 (0.0000)

INF	0.038307 (0.2687)	0.032660 (0.1563)	0.038307 (0.2636)	0.109936 (0.0004)
INTR	0.526987 (0.0000)	0.564662 (0.0000)	0.526987 (0.0000)	0.529486 (0.0000)
MODEL 2B: DEPENDENT VARIABLE (HHC)				
NRMA	0.018140 (0.0001)	0.031722 (0.0086)	0.018140 (0.0099)	0.006103 (0.0000
NAMO	0.026549 (0.0000)	0.013172 (0.0772)	0.026549 (0.0237)	-0.001318 (0.0009)
DCO	-0.109224 (0.0009)	-0.112344 (0.0000)	-0.109224 (0.0001)	0.029765 (0.0067)
REQ	-0.001314 (0.9892)	-0.032659 (0.4412)	-0.001314 (0.9873)	-0.915005 (0.0000)
GEF	-0.827049 (0.0000)	-0.746137 (0.0000)	-0.827049 (0.0000)	2.615400 (0.0000)
D(ROL)	1.363000 (0.1463)	2.094754 (0.0000)	1.363000 (0.0889)	-4.913585 (0.0000)
MICROFINANCE, FINANCIAL INCLUSION AND ECONOMIC WELFARE **MODEL 3A: DEPENDENT VARIABLE (HHC)**				
NOB	0.175710 (0.0004)	0.348000 (0.0000)	0.175710 (0.0001)	0.277577 (0.0390)
MOD	0.169035 (0.0002)	0.249878 (0.0000)	0.169035 (0.0000)	-0.096370 (0.2652)
MOL	0.010607 (0.0000)	0.026734 (0.0000)	0.010607 (0.0000)	-0.005126 (0.0151)
NRMA	0.004347 (0.7197)	0.038225 (0.0000)	0.004347 (0.6811)	0.443222 (0.0000)
NAMO	0.026929 (0.0383)	0.043137 (0.0000)	0.026929 (0.0179)	0.023813 (0.6145)
DCO	-0.131672 (0.0000)	0.097541 (0.0000)	-0.131672 (0.0000)	-0.210697 (0.0000)
EXR	0.006485 (0.6860)	0.149879 (0.0000)	0.006485 (0.6434)	0.087571 (0.0097)
D(ROL)	0.864933 (0.0000)	0.662571 (0.0846)	0.864933 (0.2725)	0.000492 (0.6523)
D(MFBS)	-0.000114 (0.0000)	0.000386 (0.2533)	-0.000114 (0.0043)	-2.654722 (0.3493)
MODEL 3B: DEPENDENT VARIABLE (HHC)				
NOB	0.132371 (0.0174)	0.179928 (0.0000)	-0.132371 (0.0068)	0.277577 (0.0390)
MOD	0.123414 (0.0194)	0.142778 (0.0000)	0.123414 (0.0078)	-0.096370 (0.2652)
MOL	0.012168 {0.0000)	0.009859 (0.0000)	0.012168 (0.0000)	-0.005126 (0.0151)
NRMA	0.007081 (0.5586)	-0.016167 (0.0000)	0.007081 (0.5045)	0.443222 (0.0000)
NAMO	0.024729 (0.0566)	0.051965 (0.0000)	0.024729 (0.0298)	0.023813 (0.6145)
DCO	0.134056 (0.0000)	-0.162195 (0.0000)	-0.134056 (0.0000)	-0.355114 (0.0000)
INF	0.046781 (0.0009)	0.065209 (0.0000)	0.046781 (0.1124)	-0.396063 (0.0004)
REQ	0.164836 (0.0073)	-0.054008 (0.0904)	-0.164836 (0.0742)	-1.237953 (0.0003)
D(MFBS)	0.000149 (0.0000)	-0.000628 (0.0000)	-0.000149 (0.2078)	0.000858 (0.2299)
MODEL 3C: DEPENDENT VARIABLE (HHC)				
NOB	0.144683 (0.0092)	0.147392 (0.0000)	0.144683 (0.0030)	0.277577 (0.0390)
MOD	0.141006 (0.0053)	0.096812 (0.0000)	0.141006 (0.0015)	-0.096370 (0.2652)
MOL	0.009656 (0.0000)	0.002612 (0.0000)	0.009656 (0.0000)	-0.005126 (0.0151)
NRMA	0.003451 (0.0133)	0.041207 (0.0000)	0.003451 (0.7468)	0.443222 (0.0000)

NAMO	0.024926 (0.0563)	0.035423 (0.0000)	0.024926 (0.0295)	0.023813 (0.6145)
DCO	0.146763 (0.0000)	0.261327 (0.0000)	0.146763 (0.0000)	0.343263 (0.0000)
INF	0.031441 (0.3655)	0.008706 (0.5360)	0.031441 (0.3017)	0.320797 (0.0000)
GEF	0.212062 (0.0000)	1.323287 (0.0000)	0.212062 (0.0015)	6.577887 (0.0000)
D(MFBS)	0.000153 (0.2594)	0.001546 (0.0000)	0.000153 (0.1980)	0.001528 (0.0027)

Source: Author's Computation Aided by Eviews 10. Note: [.] denotes the standard error; {.} denotes T-Statistics; while (.) denotes P-values

We employed the measures of microfinance such as (Number of Branches of Microfinance banks (NOB), Microfinance Borrowers (MFBs), Microfinance outstanding deposits (MOD), Microfinance outstanding loans (MOL)); measures of financial inclusion (number of registered mobile money accounts per 1,000 adults – NRMA; number of mobile money agent outlets par 1,000 adults – NAMO; and digital card ownership (DCO)); measures of governance and institutional quality (Rule of law (ROL), regulatory quality (REQ), and government effectiveness (GEF); and economic welfare measure (household consumption (HHC)) while controlling for inflation rate, interest rate and exchange rate. The main finding of this study is that there is existence of positive long run relationship between microfinance, financial inclusion and economic welfare since the coefficients of the microfinance, and financial inclusion are positive and statistically significant. This finding however is in line with some extensive studies conducted by Mai (2017), Amin and Jala Uddin (2018), Rauf and Mahood (2016), Raihan et al (2017), Idewele and Bein (2017), Shabbir (2016), Apere (2016), DeLoach and Smith-Lin (2018), Zhang and Posso (2018) and Adebowale and Lawson (2018) among others.

4.5 SHORT RUN DYNAMICS

To account for the short run dynamics of the model, emanating from the long run components of the specified equations, we employed the short run compartment of our earlier specified panel autoregressive distributed lag model (ARDL) and the results are presented below.

TABLE 8: SHORT RUN ERROR CORRECTION MODEL

Variables	Model 1A	Model 1B	Model 2A	Model 2B	Model 3A	Model 3B	Model 3C
COINTEQ01	-0.765452 (0.0000)	-0.613848 (0.0000)	-0.831767 (0.0000)	-0.677393 (0.0000)	-0.683577 (0.0000)	-0.348685 (0.0000)	-0.805167 (0.0000)
D(NOB)	-5.504472 (0.3236)	-2.841160 (0.6158)			-12.03234 (0.3115)	19.04783 (0.0000)	-5.200030 (0.4342)
D(MOD)	5.506813 (0.3105)	2.914734 (0.5950)			11.70149 (0.3106)	14.70879 (0.3106)	5.025419 (0.4420)
D(MOL)	-0.045592 (0.4046)	-0.060805 (0.4978)			0.054358 (0.4600)	-2.424162 (0.4600)	0.036314 (0.6143)
D(NRMA)			0.213699 (0.3991)	0.258795 (0.2783)	0.079218 (0.6504)	0.770485 (0.9372)	0.280068 (0.3355)
D(NAMO)			3.984446 (0.0321)	2.664810 (0.1182)	3.443464 (0.1157)	3.999343 (0.9197)	3.836816 (0.0580)
D(DCO)			1.239514 [7.894853] {0.157003} (0.8754)	-0.504239 [8.696497] {-0.057982 (0.9538)	4.618519 [5.151200] {0.896591} (0.3710)	4.5566789 [5.95848] {0.773821} (0.9940)	-0.532632 [6.757139] {-0.078825} (0.9373)
D(REQ)		0.696162 (0.7712)		0.948473 (0.0006)		0.562642 (0.7232)	
D(GEF)		15.21645 (0.0807)		7.045535 (0.2228)			12.78597 (0.0873)
D(EXR)	0.303011 (0.8192)		1.154797 (0.3964)		-0.564853 (0.5482)		
D(INF)	0.803336 (0.4664)		1.315886 (0.0355)			-0.754905 (0.5502)	
D(INTR)	0.094275		0.047362				7.407089

	(0.9874)		(0.0005)			(0.2145)
D(ROL,2)		10.16733	3.621220	7.917651		
		(0.0419)	(0.5886)	(0.0318)		
D(MFBS,2)	-0.009366	0.000283		0.010295	0.005640	-2.434705
	(0.3677)	(0.9307)		(0.0724)	(0.2286)	(0.9979)

Source: Author's concept

The cointegrating equation (COINTEQ01) or the error correction term (ECT) measures the speed of adjustment from short run to long run. Following the findings made by Phalavani et al (2005), an error correction term should possess negative sign and statistically significant. In our study, the coefficients of the error correction terms for the specified models have negative signs and statistically significant at 1% level. This implies that the speeds of adjustment from long run to short run in the models would be 76%, 61%, 83%, 67%, 68%, 34%, and 80% respectively for all the specified models. Thus these findings tallied with previous study such as (Zhang and Posso (2019), Idewele and Lawson (2018), DeLoach and Smith-Lin (2018) among others.

5 SUMMARY AND CONCLUSION

Our study focus on microfinance, financial inclusion and economic welfare in the 23 selected African countries (see table 2 for list of countries) and annual time series data spanning from 2004 to 2019 was utilized. We employed Panel Least Square, Fully modified OLS, Dynamic OLS and Panel Autoregressive distributed lag model (ARDL) techniques. And our major aim was to investigate the long run relationship between microfinance, financial inclusion and economic welfare as well as the short run dynamics of the model using the short run component of the panel ARDL model. The following variables was utilized in the study; the measures of microfinance such as (Number of Branches of Microfinance banks (NOB), Microfinance Borrowers (MFBs), Microfinance outstanding deposits (MOD), Microfinance outstanding loans (MOL)); measures of financial inclusion (number of registered mobile money accounts per 1,000 adults – NRMA; number of mobile money agent outlets par 1,000 adults – NAMO; and digital card ownership (DCO)); measures of governance and institutional quality (Rule of law (ROL), regulatory quality (REQ), and government effectiveness (GEF); and economic welfare measure (household consumption (HHC)) while controlling for inflation rate, interest rate and exchange rate.

Evidence from Pedroni cointegration test shows that there is cointegration among the variables of the study since the P-values of 5 out of 7 tests of Pedroni (1999, 2004) cointegration tests are less than 0.05 which led to rejection of the null hypothesis "no cointegration" and the acceptance of the alternative. In addition, the result of the robustness check (Kao cointegration test as proposed by Kao (1999) also confirmed the existence of cointegraion among the variables since the ADF-statistic is statistically significant at 1%, which connotes the presence of cointgration between the variables. Before estimating the model, pre and post OLS estimation tests (Normality test, Breusch-Godfrey Serial correlation test, Whit Heteroskedasticity test and Ramsey Reset test were carried out to ensure the model satisfies the basic assumptions of the OLS. Findings from the results shows that, the error terms of the specified models are normally distributed and serially uncorrelated, the variance of the error terms are homoscedastic and the models are correctly specified (see table 6). The result of Hausman test also shows that random effects are suitable for the estimation process since their P-values are greater than 0.05. Findings from Panel least square, DOLS, FMOLS and Panel ARDL results shows that there is existence of positive long run relationships between microfinance, financial inclusion and economic welfare since most of the coefficients of the microfinance and financial inclusion are positive and statistically significant in the studied countries which is in line with studies by Amin and Jala Uddin (2018), Rauf and Mahood (2016), Raihan et al (2017), Idewele and Bein (2017), Shabbir (2016), Apere (2016), DeLoach and Smith-Lin (2018), Zhang and Posso (2018) and Adebowale and Lawson (2018). We further investigated the error correction of the long run effects of the model using the short run components of the panel ARDL model. The outcome of the result shows that the speeds of adjustment from long run to short run in the models would be 76%, 61%, 83%, 67%, 68%, 34%, and 80% respectively for all the specified models.

Based on these findings, we therefore recommend that the government should make policies that would enhance management of micro financial institutions since they can easily transcends inclusive financial access in the society. The level of their capital stock should be increased. Also digitalizing most of the African micro financial institutions will broaden access to gainful financial opportunities for people to assess. Therefore government provide amenities

like power supply, internet broadband connections, and other digital financial tools to enable the microfinance institutions to have digital presence which would make them to reach wider coverage thereby promoting the welfare of the economy.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc have been used during writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.

2.

3.

REFERENCE

Adebowale, Olabimtan, and David Lawson (2018). 2018. "How Does Access to Formal Finance Affect Household Welfare Dynamics? Micro Evidence from Nigeria." GDI Working Papers 2018-024. The Global Development Institute: Manchester, UK.

Amendola, Alessandra, Marinella Boccia, Gianluca Mele, and Luca Sensini (2016), "Financial Access and Household Welfare." The World Bank Policy Research Working Papers 7533. The World Bank: Washington DC.

Amin, Md., &Jalal Uddin, S. (2018). Microfinance-economic growth nexus: A case study on Grameenbank in Bangladesh. International Journal of Islamic Economics and Finance, 1(1).

Apere, T.O. (2016). The Impact of Microfinance Banks on Economic Growth in Nigeria. International Journal of Academic Research in Economics and Management Sciences2016, Vol.5, No. 4ISSN:2226-362453www.hrmars.com

DeLoach, Stephen B., and Marquessa Smith-Lin. 2018. "The Role of Savings and Credit in Coping with Idiosyncratic Household Shocks." Journal of Development Studies 54(9): 1513-1533.

Dimova, Ralitza, and Olabimtan Adebowale. (2018). "Does Access to Formal Finance Matter for Welfare and Inequality? Micro Level Evidence from Nigeria." Journal of Development Studies 54(9): 1534-1550.

Evans O, Adeoye B (2016) Determinants of financial inclusion in Africa: a dynamic panel data approach. Univ Maurit Res J 22:310–336

Gangopadhay Shubhashis and Wadhwa Wilima (2004) Changing Pattern of Household Consumption Expenditure.

Ganadhimathi S; Ambigadevi P.K. Thirubhuvana Sundari (2012). Private Final Consumption Expenditure on Food Item in Pre and Post Reform Period. IJPSS Volume 2, Issue 9.

Gupta Anil (1986) Consumption Behaviour in India-A Study of All India Consumption Estimates, Anmol Publication Delhi P 12.

Hurlin, C. & Mignon, V. (2007). Second Generation Panel Unit Root Tests. Sourced from: HAL Id: halshs-00159842https://halshs.archives-ouvertes.fr/halshs-00159842

Idewele, I. E. O. & Murad, A. B. (2017).The Impact of Mıcrofinance Instıtutıon In Economıc Growth of A Country: International Journal of Development and Management Review (INJODEMAR) Vol.12No. 1 June, 2017

Jabir MI, Mensah L, Gyeke-Dako A (2017).Financial inclusion and poverty reduction in sub-Saharan Africa. Afr Fin J 19:1–22

Khalaf, L.S. & Saqfalhait (2019). The Effect of Microfinance Institutions Activities on Economic Growth in Arab Countries. Academy of Accounting and Financial Studies Journal (Print ISSN: 1096-3685; Online ISSN: 1528-2635).

Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A Contribution to the Empirics of Economic Growth. The Quarterly Journal of Economics, 107(2), 407-437.

Mia, Md. (2017). an overview of the microfinance sector in Bangladesh. East Asian Journal of Business Management, 7(2), 31-38.

Ozili, P.K. (2020). Financial inclusion research around the world: A review. Journal of Forum for Social Economics. DOI: 10.1080/07360932.2020.1715238

Park, C, Mercado RV (2018). financial inclusion: new measurement and cross-country impact assessment. ADB Economics Working Paper Series 539/2018. Manila, Philippines. https://www.adb.org/sites/default/files/publication/408621/ewp-539-financial-inclusion.pdf

Raihan, S., Osmani, S.R., & BaquiKhalily, M.A. (2017). The macro impact of microfinance in Bangladesh: A CGE analysis. Economic Modelling, 62, 1-15.

Shabbir (2016). The Impact of Micro Finance Institutions on Economic Growth of Morocco; Journal of Tourism & Hospitality pp. 5:2 DOI: 10.4172/2167-0269.1000210

Uddin, A.A., Chowdhury, M.A.F., Islam, N. (2017), Determinants of financial inclusion in Bangladesh: Dynamic GMM and quantile regression approach. Journal of Developing Areas, 51(2), 221-237.Zins, A., Weill, L. (2016), the determinants of financial inclusion in Africa. Review of Development Finance, 6(1), 46-57.

Wachukwu I.P, Onyema J.I, & Amadi S.N. (2019). Effects of microfinance banks and economic growth in Nigeria. Journal of Finance and Marketing. Volume 3, Issue 1 2019;3(1):15-19.

Yaidoo, Lindsay & Kalaish, Vishwanatha (2018). "Microfinance: A Review of the Literature - Development Strategy Recommendations for Improving Low Income and Poverty Reduction in Ghana. International Research Journal of Social Sciences ISSN 2319–3565 Vol. 7(4), 6-20, April (2018) Int. Res. J. Social Sci.

Zhang, Quanda, and Alberto Posso. (2019). “Thinking Inside the Box: A Closer Look at Financial Inclusion and Household Income." Journal of Development Studies 55(7): 1616-1631.

Hussaini U, Chibuzo IC. The effects of financial inclusion on poverty reduction: The moderating effects of microfinance. International Journal of Multidisciplinary Research and Development. 2018 Dec;5(12):188-98.

Egharevba ME, Eguavoen A, Azuh D, Iruonagbe TC, Chiazor IA. Microfinance and poverty reduction strategy for promoting national development: the challenge of social/financial inclusion. The Social Sciences. 2016;11(22):5373-86.

Milana C, Ashta A. Microfinance and financial inclusion: Challenges and opportunities. Strategic Change. 2020 May;29(3):257-66.