FINANCIAL INCLUSION AND LABOUR MARKET PARTICIPATION OF WOMEN IN SELECTED COUNTRIES IN AFRICA

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Abstract

Research purpose: This study investigates the impact of financial inclusion on female labour force participation in Africa. It also complements the existing studies by evaluating how advancement in information and communication technology (ICT) and Trade openness (TO) modulate the relationship between financial inclusion and female economic participation in selected African countries.

Design/methodology/approach: The study focuses on twelve African countries while the empirical evidence is based on Fixed Effects, Random Effects and Generalised Least Square estimators (GLS). Data over the period of 2005-2016 are sourced from the World Bank Development database and IMF international Financial Statistics.

Findings: The results show that financial inclusion has a non-monotonic relationship with female labour force participation. The study establishes that if the level of financial inclusion can be increased to the range of 33-57 per cent, it would improve the level of women participation in economic activities. The results further show that ICT moderates the nexus between financial inclusion and female economic participation at a threshold level of 38.17 per cent. These findings persist when the TO is used as the moderating factor at a threshold value of 80.90 per cent. The results are robust enough to suggest an alternative proxy for female labour force participation and alternative estimation techniques.

Originality/value/practical implications: Ending gender inequality has become one of the priorities in the global development policies in which most African nations domesticate the same for their national planning. There are voices at every corner in Africa demanding the possibility of achieving gender equality in employment, among others. This article is one of the few articles that evaluate whether financial inclusion can be used to accelerate female economic participation in Africa.

Keywords: Financial inclusion; Female empowerment; Africa.

JEL Codes: E02, G20.

Introduction

In this study, we examine the impact of financial inclusion on female labour force participation in Africa. It also complements the existing studies by evaluating how advancement in information and communication technology (ICT) and Trade openness (TO) modulate the relationship between financial inclusion and female economic participation in selected African countries. It is no longer a revelation that women have limited access to formal financial services in Africa. One of the major reasons is the inability to provide collateral required by banks and other financial services. Most African women engage in small scale businesses while borrowing to finance such businesses increase their transaction costs. To further accelerate their economic engagement, financial inclusion is proposed due to its opportunity to encourage financial access at a lower cost. Financial inclusion policy focuses on bringing less privileged groups, including women, into the formal financial system of the economy. Through

financial inclusion, financial institutions can provide comprehensive packages at a cheaper rate to women, including small loans, saving facilities, payment services, money transfers and insurance packages to the formally excluded households (Fofana, *et al.* 2015; Cooray, *et al.* 2017; Ajide, 2020; Ajide 2021).

Financial inclusion is seen as a means of achieving poverty alleviation in African nations because it enables individuals to build up physical and financial assets, start a new business and further enhance women's financial education. Providing these serves empowers more women and strengthens the African economic, social and cultural settings (Fofana, *et al.* 2015). Furthermore, female economic participation through financial inclusion has become one of the components of international labour organisation's agenda of promoting decent work, derived from sustainable development goals (International Labour Organisation, ILO, 2019). Encouraging women's access to employment opportunities is a move towards gender equality which has attracted the attention of scholars and policymakers in Africa (Anyanwu & Augustine, 2013). Scholars show that economic growth, information and communication technology, country openness, among others, influence female economic participation (Cooray, *et al.* 2017; Efobi *et al.* 2018; Altuzarra, *et al.* 2019). The recent study of Morsy (2020) shows that access to a bank account can influence the economic participation of women.

In the present study, we advance our understanding of the nexus between finance and female economic participation by investigating the impact of financial inclusion on female economic participation in Africa. There are wide disparities between females and males' labour force participation rate in Africa. Within the same region, there are gender gaps in financial inclusion that vary across countries (Cooray, *et al.* 2017; Morsy, 2020). For instance, Tanzania, Mali and Mauritania have a low rate of female participation. In the same vein, this variation continues to persist across the African continent (Cooray, *et al.* 2017). It has been discovered that the traditional services of financial institutions are not really serving the poor, including the women (Arnold & Gammage, 2019). More than 65 per cent of the female population have no access to financial services, and less than this percentage own small business enterprises compared to about 72 per cent of male counterparts. This gender gap persists despite the impressive development in access to finance in Africa. This gap is wider among poor households (Demirgüç-Kunt *et al.* 2018).

Meanwhile, it has been acknowledged that the financial exclusion of women is a global issue, but there is wider gender gap in Africa compared to other regions (Demirguc-Kunt, Klapper & Singer, 2013). More than 70 per cent of African women are financially excluded. Even where they have access to finance, it is behind that of males' counterparts. Improving African women's access to finance requires sustained efforts to ensure that economic opportunities and their rights are enhanced, which will improve the level of their economic participation. Reducing the wider financial inclusion gap can encourage female labour force participation rate, as pointed out by previous studies (Cooray, *et al.* 2017; Morsy, 2020). For instance, it has been well documented that countries with little or no financial inclusion gap have experienced an improvement in female labour participation. In Albania, there is about 4 percentage points reduction in the gender economic participation gap, while in Bahrain, it is about 6 percentage points reduction. In Malta, it reduces from 32 to 26 percentage points. The World Bank's analysis indicates that a reduction of 10 percentage points in the labour force participation gap can improve financial inclusion equity by 6 percentage points (World Bank, 2019). Despite this development, there is little or no study that empirically investigates whether financial inclusion can be used as part of toolkits to influence women economic participation in Africa.

Our study contributes to the existing literature in a number of ways. First, we formulate financial inclusion using Sarma (2008) normalisation procedures after considering six financial inclusion dimensions for Africa. The financial inclusion index is measured by normalising the inverse of Euclidean distance from the ideal point. Financial inclusion provides the basic skills to have a financial education. Improving the level of financial access can make women manage business risks better and smooth their consumption, most importantly, in the face of economic shocks (Dupas & Robinson 2013). Financial inclusion can provide low-income women with the adequate financial tools to save, borrow, make and receive payments, and, most importantly, be self-employed within the formal economic

systems, which would eventually reduce the African poverty population (Holloway, Niazi, & Rouse, 2017).

Second, it has been established by Asongu and Odhiambo (2018) that information and Communication Technology (ICT) moderates the relationship between access to finance (by deposit and credits channels) and female labour force participation rate. Our study complements the established findings by investigating the modulating effect of ICT infrastructure (by African ICT composite index) in the relationship between financial inclusion and female economic participation. It is also of a significant benefit to further reinforce the existing prepositions that finance improves the investment opportunities for household and women in business which is capable of uplifting the African women's standards of living (Wale & Makina, 2017; Hendriks, 2019). Third, we take a further step to examine the non-monotonic relationship between financial inclusion and female labour participation rate in Africa. Most economic literature document the U-shape relationship between economic variables and female labour force participation (Altuzarra, *et al.* 2019). This means that during the early stage of economies, female labour participation rate declines due to structural changes, while in a later stage, it improves with the level of economic opportunities. Since financial inclusion brings more structural changes and transitional impacts in the financial system of an economy, it is worthwhile to test for the non-monotonic relationship, especially now that financial inclusion in Africa is still at the developing stage. In addition, this paper is within the realms of Sustainable Development Goals (SDGs) that preaches that empowering African females financially is very important at this time because of the low rate of female labour force participation in Africa. Financial inclusion policy can further empower women to make economic decisions and have better control over the allocation of resources (Karlan *et al.* 2016). Women's access to funds and personal savings foster economic resilience by allowing them to make financial choices within the households (Dupas *et al.* 2016). Inclusive finance as a policy intervention has the tendency of encouraging more female labour participation through female entrepreneurial financial supports. Female entrepreneurial activities not only create employment for themselves but may also increase job opportunities in Africa. Policymakers need to be advised adequately with empirical evidence on improving the present position of female empowerment in Africa. Hendriks (2019) opines that female financial inclusion can lead to better outcomes for children, household nutrition and society in general. Digital transfer can improve both dietary options and conventional cash transfer. In this case, most females living in poor households with pensioners would demonstrate better nutrition with good financial education and empowerment (Duflo, 2003).

This paper is organised into 6 sections. The next section explains the rationale for the study, followed by a literature review. In section 4, we discuss the methodology of the study. Section 5 reports the empirical results, while section 6 concludes the paper.

Literature review

The hypothesis that explains the relationship among economic variables and economic participation of women is theoretically embedded in the feminisation U-curve that suggests that female participation in the labour market reduces in the first stage of development and then increases as economic development opportunities emerge. However, apart from economic development opportunities, women's decisions to participate in the labour market are affected by many factors. These factors may include current and future market conditions, educations, fertility rate, marital status and spacing for childbearing (Altuzarra, 2019). Meanwhile, studies on female labour force participation in Africa are diverse, ranging from the role of education (Khanie, 2019), information and communication technology (Efobi *et al.* 2018) to general determinants (Anyanwu & Augustine, 2013). In recent studies, finance plays a prominent role in the economic participation of women, and it is generally considered to have an important impact on female labour force participation. Armendariz and Roome (2008) show that microfinance loans improve income generation of women and, at the same time, increases the standard of living. This is called an empowering effect. Asongu and Odhiambo (2018) analyse how financial access improves female labour force participation in Africa through ICT as a modulating factor. Their study relies on theoretical and empirical literature that stress that finance creates and improves

investment opportunities for both male and female households which eventually reduces gender inequality and improve the standard of living (Wale & Makina, 2017; Tchamyou *et al.* 2019).

The study of Arouri and Nguyen (2017) examines the impact of microcredit on men and women's labour supply in Egypt with the intent to investigate whether microcredit reduces the employment gap. Their study documents that microcredit improves women participation in economic activities and reduces gender employment gap. This opposes the submission of Taha (2001), who investigates the impact of microcredit in Cairo. The author documents that there is no significant impact of microcredit on empowerment. The study of Niaz and Iqbal (2019) considers and tests the impact of microfinance on women empowerment in Pakistan empirically, using OLS and Propensity Score Matching for the data of 670 respondents. They find that exposure to such financial tools positively impacts women empowerment. The recent study of Khan *et al.* (2020) analyses how microfinance influences female entrepreneurs in Pakistan. They confirm that microfinance improves the level of female participation in economic activities and as well makes them financially stable. Furthermore, Fofana, *et al.* (2015) examine the effect of microcredits on women's livelihood and empowerment in Co'te d'Ivoire's rural areas. Using a cross-section survey, the study reveals that microcredits have significantly increased female empowerment. The work of Samant *et al.* (2019) investigates the impact of microcredit on women empowerment indicators in the Haridwar district of Uttarakhand. Using structured questionnaires to source data from 362 samples, they reveal that there is no association between empowerment and microcredits.

In addition, some recent studies provide that financial inclusion plays a significant role in income inequality and gender gaps in the economy. For instance, Cihak and Sahay (2020) relate finance to inequality. Their work establishes that (1) financial depth reduces income inequality, and (2) financial inclusion reduces inequality, especially when women gain more access to finance. Signorelli *et al.* (2012) show that financial constraints or crisis play a role in the agenda of improving female labour participation rate between 1980-2005 in about 86 countries. Their study presents new econometric reports categorised based on income level. According to their submission, "it provides information about the persistence and severity of crisis impact for women".

On other factors that determine female economic participation, the current literature has established that culture, institutions, financial crisis, unemployment rate, foreign direct investment and other macroeconomic factors affect economic participation of women in developed and developing countries. The economic impact of unemployment on economic participation of women is ambiguous. An increase in the unemployment rate may lower female participation. Furthermore, an increase of the rate may as well improve the level of female participation in economic activities in order to compensate for the decline in household income, especially from a husband. There are other factors that include gender norms that affect female participation. In Africa, women are excluded in some industries due to social stigma, while the urbanisation rate can also be a force affecting female labour participation. Cooke (2010) demonstrates the pattern of women empowerment in Asian economies by comparing the women empowerment situation in China, Japan, India and South Korea. The study demonstrates the heterogeneous features inherent in political regimes, institutional factors and societal values as they manifest in employment and human development in Asian countries. In conclusion, the study reveals that all these factors demonstrate similar outcome in each country. The study of Anyanwu and Augustine (2013) analyses the features of gender equality in Africa and empirically examines factors that drive gender equality in the region. Using a cross-sectional data of African countries, their study establishes that democracy, domestic investment, education, urbanisation improve the level of gender equality in Africa while real GDP per capita, higher foreign direct investment, sex population ratio lower gender equality in oil-exporting countries in Africa.

Cooray *et al.* (2017) employ data of 48 Sub-Saharan African countries over a period of 1985-2012 to examine the impact of trade openness on labour force participation rate. They explore the role of democracy, political rights and civil liberties in driving the relationship between trade openness and labour force participation in Africa. The results confirm that all these institutional variables enhance the positive relationship between labour force participation and trade openness. Democracy and political rights play major roles in improving the beneficial effect of trade openness in SSA. Khanie (2019)

examines the role of education in female labour market participation in Botswana. Using the 2015/2016 Botswana Multi-Topic Household Survey data and a multinomial logit model, the study finds that women with higher qualifications are more likely to be employed. In the study of Yusnandar *et al.* (2020), it was revealed that there are striking differences in the effect of major determinants of economic participation of men and women in various age cohorts in Indonesia after using a survey conducted in the year 2018. Marital status positively influences men, while education is the major determinant for women. They also discover a U-shaped relationship in the impact of various determinants of female labour participation likewise males. Education and training as well encourage a decent standard of living. Li *et al.* (2019) provide evidence for the existence of threshold effects in trade openness, which affect the female labour force participation rate (FLFPR) in Asian countries. Using panel threshold regression, they document that there is an optimal value in the correlation between trade openness and female labour participation. The study further demonstrates that below the threshold an increase in trade openness increases female labour participation.

Although there are studies that examine the impact of finance on female economic participation, little or nothing is known on the roles of financial inclusion on economic participation of women in Africa. This present study builds on the existing literature and advances the previous studies by empirically examining the relationship between financial inclusion and female labour force participation rate in African nations. The following hypotheses have been formulated in this study to achieve the mentioned objective with regard to the theoretical framework and literature review:

- H1.* Financial inclusion has a significant impact on female labour market participation.
- H2.* There is a non-monotonic relationship between financial inclusion and female labour participation.
- H3:* ICT modulates the impact of financial inclusion on female labour market participation.
- H4.* Trade Openness modulates the impact of financial inclusion on female labour market participation.

To sum up, Figure 1 presents the key variables of the study and their interactions. It illustrates the hypotheses of the study. It shows that financial inclusion may impact female labour participation directly and indirectly through ICT and trade openness, as described above.

Fig. 1. The conceptual framework (Source: designed by author)

Research methodology

The main objective of this paper is to investigate the impact of financial inclusion on female labour force participation in Africa. To do this, we consider the fixed effect and random effect panel estimation techniques while Hausman Test is conducted for the selection of the appropriate estimations. We also examine the reliability of the goodness of fit and models' overall significance via Adjusted R-square and Wald Test (F-statistics). Robustness checks are also performed via alternative dependent variables

and the Generalised Least Square (GLS) estimation technique. Following the previous studies (Tam, 2011; Anyanwu & Augustine, 2013; Asongu & Odhiambo, 2018), our empirical model to test hypothesis 1 and 2 is stated in equation (1):

$$FLFP_{i,t} = \beta_0 + \beta_1 FII_{i,t} + \beta_2 FII_{i,t}^2 + \sum_{k=1}^5 \delta_k X_{k,i,t} + e_{i,t} \quad (1)$$

where *FLFP* is female labour force participation rate, and it is the dependent variable.

We also use Female Employment to population ratio as a robustness check in the alternative estimation. The key independent variable is financial inclusion. In the specification above, *FII* is the financial inclusion index. At the initial stage, Morsy (2020) notes that females may probably be excluded from the financial system in a region where there is little or no presence of foreign banks, the state owns a substantial portion of ordinary shares in most existing financial institutions, credit information is less available and, most importantly, there is a large difference in education attainment between males and females. This means that it is possible to have a U-shaped relationship between female labour participation and financial inclusion in Africa. As the country's financial inclusion grows, female labour force participation rate may not increase. Because in Africa, women face discrimination, and they are disproportionately vulnerable as far as employability is concerned. Discrimination in gender roles has implications for self-determination, dignity, freedom, and it influences financial inclusion or lack thereof. Women are likely to get engaged in the informal sector, and they are vulnerable to low-paid or undervalued employments. Females do not enjoy the same access to financial services as males. About 56 per cent of all those without a bank account are females. This means that most females are unbanked in Africa, and those with bank accounts do not necessarily have control over them, but this could be a starting point towards financial inclusion in Africa (ILO, 2019).

However, a number of hypotheses have been put forward to explain why female labour force participation rate may initially fall after reaching a certain point of increase in association with financial or macroeconomic variables. This is often termed female labour force participation U-shaped trajectory (Tam, 2011; Anyanwu & Augustine, 2013). It has been suggested that males' greater access to finances, education, and mobile phone financial technology may deter females from the labour market during the early stage in the economy. As these structural changes continue and females gain more access to finances, education and mobile phone financial technology, the female labour market participation rate increases (Boserup, 1970). We can also relate this relationship to the 'income and substitution effect'. As financial development in an economy occurs, access to more liquidity improves, and households' unearned incomes increase. This reduces women's incentive to participate in formal economic activities. This negative implication is called the 'income effect', since more household income implies that households are able to afford more female leisure time. Meanwhile, the substitution effect operates in the opposite direction—as female wages rise, more women have the incentive to enter the labour market (Bloom *et al.* 2009; Chaudhuri, 2009; Tam, 2011). In order to properly capture financial inclusion impact on female labour force participation rate, the study includes a non-linear term for financial inclusion (FII^2) to evaluate any possible potential threshold level of financial inclusion. We use this variable to examine any potential optimal financial inclusion as prescribed by Ozili (2020).

Furthermore, *X* represents a matrix of control variables. Our choice of control variables is guided by the current literature and economic theory. The control variables include Trade Openness, Inflation rate, Female Unemployment rate, Democracy variable, GDP per capita growth rate, Foreign Direct investment (as a percentage of GDP), Information and Communication Technology, Financial Crisis and Remittance (as a percentage of GDP), *e* is the error terms. Anyanwu (2012), Asongu and Odhiambo (2018), and Meniago and Asongu (2018) suggest the inclusion of remittances in women economic participation model because it has the tendency to increase income and gender inequality in Africa. The majority of the migrants are from wealthy families who can afford the financial constraints and administrative bottleneck of visas' processing. This implies that remittances have a negative redistributive effect because of their tendency to skew towards the direction of improving the wealth of the rich in African society. We also consider democratic accountability in our study because political

freedom and accountability are expected to promote gender economic empowerment and economic inclusion. It provides enabling atmosphere for investment on the part of women in society (Anyanwu & Augustine, 2013). Furthermore, the study considers ICT as a control variable due to the recent evidence established in the study of Asongu and Odhiambo (2018). They show that ICT modulates the relationship between finance and female labour force participation rates. We consider trade openness and FDI in this study because previous studies show that globalisation through international trade and FDI can generate employment opportunity for women, most specifically in multinational corporations (Richards & Gelleny, 2007; Oostendorp, 2009). However, FDI is likely to make women lose their jobs or push them down the production process due to advancement in technical development in which men may have faster access to (Parpart *et al*, 2000; Ernesto, 2011). The financial crisis, *CRISIS*, is included because women (including housewives) are vulnerable to crisis, especially when it affects the husband employability, as documented by Signorelli, *et al* (2012). The inflation rate is included in our model to take care of price adjustments in the economy (Jacobsen, 1999). The impact of the unemployment rate on female labour force participation is ambiguous (Altuzarra, *et al*, 2019). Vlasblom and Schippers (2004) argue that a higher level of unemployment rate may lower the women's economic participation rate due to the inability to find a good job in the labour market, thereby lowering their incentives to participate in economic activities. Furthermore, an increase in the male unemployment rate may lower the chances of female participation rate in economic activities (Ozerkek, 2013). However, an increase in male unemployment can encourage females to participate in order to get compensation for a decrease in household income (Fatima & Sultana, 2009). Due to the influence of the unemployment rate on female economic empowerment, we include the variables in our model. This study takes a further step to test the third and fourth hypothesis of the study by examining the modulating and the interaction impact of ICT and TO with financial inclusion in Africa. In order to do this, we specify equations (2) and (3). Hypothesis Testing Equation 2:

$$FLFP_{i,t} = \beta_0 + \beta_1 FII_{i,t} + \beta_2 ICT_{i,t} + \beta_3 (ICT_{i,t} \times FII_{i,t}) + \sum_{k=1}^4 \delta_k X_{k,i,t} + e_{i,t} \quad (2)$$

Hypothesis Testing Equation 3:

$$FLFP_{i,t} = \beta_0 + \beta_1 FII_{i,t} + \beta_2 TO_{i,t} + \beta_3 (TO_{i,t} \times FII_{i,t}) + \sum_{k=1}^4 \delta_k X_{k,i,t} + e_{i,t} \quad (3)$$

$(ICT_{it} \times FII_{it})$ is the interaction term to test if ICT could influence financial inclusion impact on the labour participation of women. $(TO_{it} \times FII_{it})$ is the interaction term to test if trade openness could influence financial inclusion impact on the labour participation of women. X is the vector of $k=4$ control variables as discussed above, i is the index of countries, t is the years, and e_{it} is the error term.

On Data and variable measurements, this study covers a period of 2005-2016. The sources of the data are the World Bank development indicators, IMF International Financial Statistics and the African Infrastructure Development Index of the African Development Bank. The sources and the data structures are explained in Table 1. The study considers twelve (12) countries in Africa due to the non-availability of data to meaningfully calculate the financial inclusion index and to have balanced panel data. We consider the following countries: Tunisia, Botswana, Nigeria, Algeria, Ghana, Gabon, Uganda, Malawi, Zambia, Sierra Leone, Republic of Congo and Ethiopia. We compute the financial inclusion index to follow the methodology of Sarma (2008) (*see Appendix*). We use six financial inclusion dimensions to compute the index. These dimensions include automated teller machines per 100,000 adults, commercial bank branches per 1000 adults, depositors with commercial banks per 1000 adults, domestic credit to GDP ratio, bank borrower per 1000 adults and number of commercial bank accounts per 1000 adults. All indicators are sourced from World Bank Development Indicators and International Financial Statistics of IMF.

Table 1. Sources of data and measurements of variables (Source: author's compilation)

Variables	Definitions	Sources
FLFP	Female Labour Force Participation rate (% of female population ages 15+) (modelled ILO estimate)	World Bank Development Indicators.
IF	Inflation rate	World Bank Development Indicators
UN	Unemployment rate, Female	World Bank Development Indicators
GR	GDP Per capita growth rate	World Bank Development Indicators
ICT	Information and Communication Technology	ICT Composite Index (Consists of Telephone subscription, Internet penetrations. The data were sourced from African Infrastructure Development Index (2019)
FDI	FDI inflows (as a percentage of GDP)	World Bank Development Indicators
REM	Remittance (as a percentage of GDP)	World Bank Development Indicators
TO	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.	World Bank national accounts data, and OECD National Accounts data files.
CRISIS	Systematic Banking crisis	Laeven and Valencia (2008)
DA	Democratic Accountability index	International Country Risk Guide
EMP	Employment to population ratio, ages 15-24, female (%) (modelled ILO estimate)	World Bank Development Indicators
FII	Financial inclusion index	Computed by the author using Sarma (2008)'s formula (See Appendix)
ATM	Automated teller machines per 100,000 adults	World Bank Development Indicators and International Financial Statistics of IMF
BRAN	Commercial bank branches per 1000 adults	World Bank Development Indicators/ International Financial Statistics of IMF
DEPO	Depositors with commercial banks per 1000 adults	World Bank Development Indicators /International Financial Statistics of IMF
DOME	Domestic credit to GDP ratio	World Bank Development Indicators /International Financial Statistics of IMF
BORR	Bank borrower per 1000 adults	International Financial Statistics of IMF
ACCT	Number of commercial bank accounts per 1000 adults	International Financial Statistics of IMF

Research results

Table 2 presents the descriptive statistics of the variables, while Table 3 presents the correlation matrix. The female labour force participation rate seems to be about 55 per cent on average, while the financial inclusion index is about 22 per cent on average. The female employment rate is about 33 per cent. When compared with female labour participation rate, it means about 22 per cent difference is either related to the female self-employment rate or those that are engaged outside formal employment in Africa.

Furthermore, the inflation rate is about 9 per cent, while the economic growth is on average 6 per cent in Africa. In addition, the FDI as a percentage of GDP is about 4.9 per cent, while the trade openness as a percentage of GDP is very high in Africa. This means that most countries in Africa are trade-dependent. With the exception of the association between female labour participation rate and female employment rate, it is very clear that the correlation among the variables is within the toleration rate. Meanwhile, the correlation between the financial inclusion index and female labour force participation rate is positive but to gain a good understanding of the relationship we present our estimated results in Table 4 as discussed in the next section.

Table 2. Descriptive Statistics (Source: author's computation)

	FLFP	EMP	FII	GR	INF	DA
Mean	54.755	33.486	0.226	6.007	8.891	3.409
Median	60.421	34.081	0.153	5.568	7.503	3.500
Maximum	74.435	67.960	0.851	20.715	44.356	5.000
Minimum	12.842	4.8470	0.020	-7.652	-1.409	1.040
Observations	144	144	144	144	144	144
	TO	FDI	ICT	CRISIS	UN	REM
Mean	74.361	4.914	4.864	0.166	8.816	1.883
Median	70.430	3.287	1.130	0.000	6.446	0.425
Maximum	165.645	50.018	44.570	1.000	20.390	13.270
Minimum	20.722	-0.506	0.000	0.000	1.870	0.000
Observations	144	144	144	144	144	144

Note: FII, GR, INF, DA, TO, FDI, ICT, CRISIS, UN, REM denote: financial inclusion, growth rate of GDP per capita, inflation, democracy, trade openness, foreign direct investment, ICT infrastructure, unemployment and remittance respectively.

Table 3. Correlation (Source: author's computation)

	FLFP	EMP	FII	GR	INF	DA
FLFP	1.000					
EMP	0.808	1.000				
FII	-0.547	-0.584	1.000			
GR	0.439	0.463	-0.324	1.000		
INF	0.456	0.544	-0.316	0.212	1.000	
DA	0.118	0.134	-0.080	0.172	0.199	1.000
TO	-0.097	-0.367	0.249	-0.199	-0.221	-0.382
FDI	0.240	0.049	-0.223	0.068	-0.073	-0.123
ICT	-0.349	-0.372	0.570	-0.208	-0.273	-0.043
CRISIS	0.001	0.012	-0.044	-0.097	0.138	0.014
UN	-0.280	-0.576	0.451	-0.320	-0.313	-0.373
REM	-0.079	-0.112	0.336	-0.011	0.014	0.064
	TO	FDI	ICT	CRISIS	UN	REM
FLFP						
EMP						
FII						
GR						
INF						
DA						
TO	1.000					
FDI	0.431	1.000				
ICT	0.123	-0.087	1.000			
CRISIS	-0.065	0.001	-0.254	1.000		
UN	0.661	0.089	0.256	-0.024	1.000	
REM	-0.249	-0.081	0.137	-0.009	-0.227	1.000

Note: FII, GR, INF, DA, TO, FDI, ICT, CRISIS, UN, REM denote: financial inclusion, growth rate of GDP per capita, inflation, democracy, trade openness, foreign direct investment, ICT infrastructure, unemployment and remittance respectively.

In Table 4, we present the fixed effect panel estimation results after observing the Hausman Test. The results column (1-2) show that financial inclusion significantly reduces female labour force participation rate. So it can be concluded that financial inclusion has a significant impact on labour force participation of women in Africa. Accordingly, hypothesis one (H1) is supported at 5 per cent significance level. We further examine the non-linear impact of the financial inclusion variable, we discover that the square of FII becomes positive and significant. This means that there is a threshold at which, if reached, financial inclusion would start to improve the level of female participation in economic activities in Africa.

Table 4. Results from Estimated Model (Dependent Variable: FLFP) (Source: created by author)

Variables	(1)	(2)	(3)	(4)	(5)
C	55.719*** (0.000)	59.321*** (0.000)	60.523*** (0.000)	62.902*** (0.000)	61.228*** (0.000)
FII	-10.311*** (0.067)	-14.898** (0.014)	-9.5674** (0.038)	-37.129*** (0.0000)	-21.212*** (0.001)
FII-square	15.584** (0.012)	20.174*** (0.002)			18.570*** (0.009)
ICT×FII			0.248** (0.011)		
TO× FII				0.458*** (0.000)	
GR		-0.025 (0.645)	-0.049 (0.366)	-0.025 (0.587)	-0.027 (0.626)
INF		-0.010 (0.743)	-0.007 (0.816)	0.024 (0.368)	-0.006 (0.848)
DA		-1.012** (0.011)	-1.443*** (0.001)	-0.341 (0.296)	-1.233*** (0.003)
TO		0.012 (0.460)		-0.092*** (0.000)	0.020 (0.260)
FDI		-0.036 (0.306)	-0.045 (0.219)	-0.022 (0.456)	-0.040 (0.254)
ICT			-0.024 (0.656)		0.081** (0.034)
CRISIS					0.368 (0.441)
UN					-0.061 (0.597)
REM					-0.057 (0.551)
Adjusted R-squared	0.988	0.989	0.989	0.992	0.131
F-statistic	972.414*** (0.000)	719.147*** (0.000)	690.530*** (0.00000)	987.950*** (0.0000)	18.238*** (0.005)
Hausman Test	4.879* (0.0872)	22.738*** (0.001)	22.655*** (0.003)	15.483** (0.030)	11.715 (0.385)
Threshold (FII)	0.331	0.369	-	-	0.571
Threshold (ICT)	-	-	38.17		-
Threshold (TO)	-	-	-	80.90	-
No. of obs	144	144	144	144	144
No. of Countries	12	12	12	12	12

Note: *, **, *** mean significant at 10%, 5%, 1% FII, GR, INF, DA, TO, FDI, ICT, CRISIS, UN, REM denote: financial inclusion, growth rate of GDP per capita, inflation, democracy, trade openness, foreign direct investment, ICT infrastructure, unemployment and remittance respectively.

In other words, we test a hypothesis that financial inclusion in Africa has a non-monotonic relationship with female participation in economic activities; the squared financial inclusion index is included as an independent variable. The quadratic term is positive in sign and significant at the 1 per cent level in Africa. In this case, hypothesis 2 (*H2*) is supported. This result provides evidence of a U-shaped relationship between the financial inclusion index and female labour force participation rate. This suggests that although a higher level of financial inclusion is negatively associated with female labour force participation, the impact is not constant. Rather, for levels of financial inclusion above a certain point, higher levels of financial inclusion act to increase the level of female labour force participation rate in Africa, holding other factors constant. This association between the two variables suggests that the marginal effect of financial inclusion exhibits increasing returns for female labour force participation rate in Africa. Thus, this is consistent with the submission of Boserup (1970), who states that a

curvilinear relationship may exist between economic variables and female economic participation. However, this U-shaped relationship contradicts the findings of Eastin and Prakash (2013).

In addition, to test the third and fourth hypothesis, we interact the ICT index with the financial inclusion index (FII). The coefficient is positive and significant at 5 per cent level of significance, which is consistent with the submission of Asongu and Odhiambo (2018). These authors confirm that ICT modulates the negative effect of the financial system in Africa on female labour force participation rate. Moreover, significant positive impacts are also apparent from interactions between Trade openness and the financial inclusion index. These results support the third and fourth hypothesis (*H3 and H4*) of the study. Furthermore, the democracy variable has a negative and statistically significant effect on female labour force participation rate. This result, therefore, does not support the proposition that democracy enhances gender equality participation in formal employment. Other control variables are not significant.

In addition, it is important to note that it is possible, using equation (1) to calculate the threshold value of financial inclusion. We also use equations (2) and (3) to calculate the marginal impact and thresholds of Trade openness and ICT through partial derivatives of the equations to follow existing literature (Efobi, *et al*, 2018; Asongu, & Nwachukwu, 2018a; Asongu, & Nwachukwu, 2018b). To do this, we follow Ehigiamusoe *et al.* (2019), Ehigiamusoe *et al.* (2020) in our computation of threshold. The results of partial derivatives of Eq. (1), (2) and (3) are expressed as follows:

$$\frac{\partial(FLPL)}{\partial FII} = -14.898 + 40.348FII \quad (4)$$

$$\frac{\partial(FLPL)}{\partial FII} = -9.567 + 0.248ICT \quad (5)$$

$$\frac{\partial(FLPL)}{\partial FII} = -37.129 + 0.458TO \quad (6)$$

We use the results in Table 4 (columns 2, 3, and 4) for the computations. The two equations connote that the interactive impacts of ICT and financial inclusion complement each other in mitigating female labour force participation in Africa. Similarly, financial inclusion and trade openness (TO) perform complementary roles in improving the level of female labour force participation in Africa. In addition, if we set these resultant partial derivatives equal to zero, we have the following

$$\frac{\beta_1}{\beta_2} = \text{Threshold for value for FII} \quad (7)$$

$$\frac{\beta_1}{\beta_3} = \text{Threshold for values for (TO and ICT)} \quad (8)$$

Consequently, we obtain the threshold value of 0.369 for financial inclusion while the current average value is 0.226. The threshold value for ICT is 38.47, while the threshold value of 80.90 is attributed to trade openness. It follows that the marginal impact of financial inclusion on female labour force participation is conditional on the ICT and trade openness. However, if the above thresholds could be reached, financial inclusion would contribute meaningfully to the improvement of labour force participation of women in Africa. Meanwhile, these thresholds need to be persistently sustained over time.

Table 5 presents the robustness test of the analysis. For this purpose, (1) we change our dependent variable to the female employment rate. This is measured as female employed as a percentage of the total female population. It has been established that this variable serves as an important policy variable in the case of female economic participation (Kabeer *et al.*, 2013, Eforb, *et al*, 2018). (2) We further estimate our model using Generalised Least Square (GLS). This estimating technique controls autocorrelation and heteroskedasticity. The findings from the estimations are not different from the earlier estimations, with the exception that the inflation rate is now positive and significant at 1 per cent. This means that the inflation rate increases the level of inclusive finance; this is because inflation reduces people's real income. Moreover, to maintain the same standard of living, they would resort to the use of

financial institutions to borrow for the purpose of making up for the shortfall in their real income (Anarfo et al. 2019).

Table 5. Results from GLS Estimated Model (Dependent Variable: *Emp*) (Source: created by author)

Variables	(1)	(2)	(3)
C	3.942*** (0.000)	3.324*** (0.000)	3.627*** (0.000)
FII	-2.638*** (0.000)	-3.032*** (0.000)	-2.747*** (0.000)
FII-square	1.100*** (0.040)	2.241*** (0.000)	2.662*** (0.000)
GR		0.027*** (0.003)	0.016* (0.052)
INF		0.021*** (0.000)	0.018*** (0.000)
DA		0.067** (0.030)	0.044 (0.112)
TO		-0.001 (0.607)	0.002* (0.042)
FDI		0.003 (0.608)	0.003 (0.516)
ICT			-0.003 (0.382)
CRISIS			-0.072 (0.307)
UN			-0.057*** (0.000)
REM			-0.005 (0.516)
Adjusted R-squared	0.673	0.644	37.656
F-statistic	148.474*** (0.000)	38.091*** (0.000)	37.656*** (0.000)
Threshold value (FII)	1.12	0.676	0.516
No. of Obs	144	144	144
No. of Countries	12	12	12

Note: *, **, *** mean significant at 10%, 5%, 1% FII, GR, INF, DA, TO, FDI, ICT, CRISIS, UN, REM denote: financial inclusion, growth rate of GDP per capita, inflation, democracy, trade openness, foreign direct investment, ICT infrastructure, unemployment and remittance respectively.

Although financial inclusion is known to be a globally acclaimed policy objective (Johnson & Williams, 2016), this study heightens the need for inclusive financial policy in the African economies, especially in light of the pressures to improve the level of female economic participation in developing countries. Financial inclusion is a policy that seeks to provide the less-privileged with effective access to credit, savings, and payment and insurance services through a formal financial system (Pearce, 2011). As evidenced in the results, although at an earlier stage, financial inclusion may not be effective in improving women empowerment. This is because a large number of women is still financially excluded in Africa. According to World Bank (2011), more than 2 billion adults still remain unbanked in which half of them are female adults. This reflects the urgent needs for new development in the financial sector.

In response to this, many countries in Africa are now committed to promoting effective financial development through financial inclusion policy based on its suitability in the features of their economies. For instance, in Nigeria and some other African nations, agent banking initiatives have been embraced

which serves as one of the hallmark initiatives which leverages on advanced technology and provides effective financial services to rural and other groups of the unbanked population. Furthermore, the financial inclusion development has been boosted in most African countries because it has been accepted as part of national policy development. One of the benefits of these policy actions is that the financial inclusion structure becomes developed. As evidenced in our results, a mature and effective financial development would encourage women to be meaningfully engaged in economic activities by giving them access to useful and affordable financial products and services that meet their needs, including effective payment system, savings, credit and insurance services in a responsible and sustainable way. Meanwhile, for financial inclusion to be more meaningful and to improve the level of African women economic participation, the development of financial inclusion sustainability would deserve more attention (Yin, *et al*, 2019). This is because most African regions are without sufficient financial resources, and financial inclusion can play an important role in income growth and industrial gender balance that would enhance female labour force participation. Therefore, financial inclusion may assist policymakers to provide solutions to the agenda of women's poverty reduction and gender inequality in Africa. It can also help African citizens to invest in future, smoother consumption and management of financial risk. Financial inclusion also assists in climbing women out of poverty and ensuring investment in quality education and small businesses. It may also assist households by providing adequate ways of managing income shocks such as unemployment or a loss of a breadwinner (Allen, *et al*, 2012). In a more practical explanation, a digital payment system, which is one of the technologies of the financial inclusion, has consistently helped the government in reducing poverty and enhancing the transfer of welfare and palliative packages to women in most African countries. For instance, in Niger, a study shows that mobile transfers assist in attending to urgent social welfare. It cuts the administrative expenses by 20 per cent compared to manual distribution (Aker *et al.*, 2013). In South Africa, the cost of disbursing social grants in 2011 by smart card was a third that of a manual cash disbursement (Consultative Group to Assist the Poor, 2011). To round up, our study demonstrates that financial inclusion has a potential developmental outcome for women and encourages their adequate economic participation only if optimal attention is given to the workability of the policy in Africa.

Conclusions

In this study, we investigate the impact of financial inclusion on female labour force participation in Africa. It also complements the existing study by evaluating how advancement in ICT and Trade openness modulate the relationship between financial inclusion and female labour force participation rate for a period of 2005-2016. The study focuses on twelve African countries while the empirical evidence is based on Fixed Effects, Random Effects and Generalised Least Square estimators (GLS). The results show that financial inclusion has a non-monotonic relationship with female labour force participation rate. This means that improving the level of financial inclusion to a certain threshold would improve women's participation in economic activities in Africa. The results further show that improving Information and Communication Technology moderates the nexus between financial inclusion and female economic participation in Africa. This result is also similar when trade openness is used as the modulating factor. These findings are robust enough to suggest an alternative proxy for female labour force participation and alternative estimation techniques.

What policy can we derive from this? First, it would be a starting point for all African policymakers to encourage female economic participation through inclusive financial policy. Equipping African females with proper ICT training would enable them to explore the opportunities created by ICT and further improve their level of economic participation coupled with effective implementation of financial inclusion policy. They also need to be encouraged by giving them less-restricted access to low-cost financing to enable them to take risks and start businesses instead of waiting for employment opportunities. In addition, it is also very important to reach a formal relationship with industries (such as banking industries) by African governments to encourage the creation of employment opportunities for African women through strategic skill repositioning development to suit what is needed in African countries. According to Anyanwu and Augustine (2013), it is necessary to address skills mismatch so as to improve the level of employability of African women. Furthermore, the government needs to

develop an innovative public-private partnership to ease the training of females and, in particular, to encourage on-the-job training (Ncube & Anyanwu, 2012). Since our results support the fact that ICT can modulate the impact of financial inclusion in improving female economic participation, we encourage policy measures that can promote access to ICT.

Our results support the complementary role of trade openness and financial inclusion in enhancing female economic participation. Policies that increase the admission of female labour to the trade sector are very important in Africa. There still is a gender gap in the financial inclusion process in Africa; most females are still lagging behind their male counterparts. In this case, a policy that can focus on female financial inclusion would help in this regards. A simple and easy way of opening bank account at a formal bank and non-bank financial institutions may improve female inclusion (Morsy, 2020). Formal financial inclusion should be encouraged to bring more females on board. Microfinance institutions are doing their best, but they still need to do more in Africa in bringing more females to the formal financial system and equip them to have good financial awareness. The major limitation of this study is the use of only twelve African countries due to the non-availability of data; future studies can overcome these challenges when data are available. They can further examine other venues for encouraging female labour force participation in Africa.

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Appendix

The Sarma (2008)'s financial inclusion index is formulated as:

$$d_i = \frac{A_i - m_i}{M_i - m_i} \quad (*)$$

A_i is the actual value of dimension i , m_i represents minimum value of dimension i , M_i is the maximum value of dimension i . The financial inclusion index is measured by normalising the inverse of Euclidean distance of point d_i , computed in equation (*) from ideal point I is one. The formula is hereby given as:

$$FII = 1 - \frac{\sqrt{(1 - d_i)^2 + \dots + (1 - d_n)^2}}{\sqrt{n}} \quad (**)$$

The normalisation equation (**) makes the index lie between 0 and 1.