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Impact of Women's Empowerment on Female Account Ownership: A Case Study of Selected Sub-Saharan African Countries (2011 – 2021)

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Abstract. *This study investigated women's empowerment and its impact on female account ownership, using selected sub-Saharan African countries as a case study from 2011 to 2021. The central research question covers whether women's empowerment has any impact on the financial inclusion of women in sub-Saharan Africa, with an emphasis on account ownership by women as a yardstick to measure financial inclusion. The selected women empowerment variables comprised the percentage of the total labour force, namely female labour force (FLF), equality in the rights to ownership of property (EOR), non-discrimination of women in employment (NDW), choice of where to live by women (CWL), mean years of schooling of females (MYS), and women political empowerment (WPE). By means of pooled ordinary least square regression, using the fixed effects estimation model applied to the panel data from 38 sub-Saharan African (SSA) countries with available data for the period 2011 to 2021, as reported on the three-yearly database, this research was able to establish the impact of some of the selected variables of women empowerment on female account ownership in SSA. This study hinges on the undeniable potential of women to lift Africa from multi-dimensional poverty since a greater proportion of household consumption is contributed by the income of women rather than men in Africa. The authors, therefore, recommend, among others, that African governments should invest in policies that will encourage gender equality and women's emancipation to boost women's empowerment, which is the gateway to enhanced financial inclusion of African women and the attendant gain of accelerated poverty reduction in Africa.*

Keywords: Account-Ownership, Financial-Inclusion, Women-Empowerment

JEL Codes: J160, J710

1. Introduction

While most studies centre around the view that financial inclusion enhances women empowerment, this study joins the few researchers who believe that, conversely, the extent of a woman's empowerment determines the magnitude or level of her financial inclusion. The authors believe that women empowerment is the starting point or baseline for the financial inclusion of women. They further believe that the accelerated financial inclusion of women in SSA would contribute significantly to lifting the region from multi-dimensional poverty.

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Saluja et al. (2022) contend that women assume and contribute via various roles and at distinct levels of human life, including commercial processes, family and within society, broadly highlighting gender inequalities. Furthermore, G-20 nations have emphasized that to achieve gender equality and other sustainable development goals, financial inclusion must serve as a facilitator (Bhatia & Singh, 2019). The World Financial Inclusion Index is not gender sensitive currently, while the gender gap in account ownership has remained at 9% since 2011 (CGAP, 2021).

Women's empowerment ensures that women participate in decision-making regarding different societal matters (Rani, 2019). The Consultative Group to Assist the Poor (CGAP) recognizes the potential of gender empowerment and has hence updated its vision statement to capture the gender problem as: "a world where poor people, especially women, are empowered to capture opportunities and build resilience through financial services" (CGAP, 2020). According to Duflo (2012), women's ability to access health care, education, work, and other personal rights is indeed women empowerment. Financial inclusion entails bringing to the household financial services that are affordable for disadvantaged groups in society such as low-income groups and the underprivileged (Wakdok, 2018). Onaolapo (2015) avers that financial inclusion is a means to achieve access to financial services with its attendant poverty alleviation through increases in savings and investments.

According to the United Nations (2020), gender inequality is prevalent in sub-Saharan Africa (SSA). The World Bank's (2021) global poverty update declares that South Africa and Nigeria, the two largest economies in this region, saw output fall sharply in 2020, while agricultural growth slowed down, leading to decreases in per capita income. The report further states that living standards have fallen lower than a decade ago in some countries in the region.

2. Review of Related Literature

Loaba (2023) conducted an analysis of determinants that influence disparity in financial account access between males and females across 25 sub-Saharan African nations, using data from 2021. The outcomes revealed that, typically, 43.73% of males possess a financial account in contrast to a mere 32.7% of females. This demonstrates that the factors' impact on this gap varied based on a country's developmental stage. Nonetheless, it was noted that completion of secondary education emerged as the most crucial factor, with its significance fluctuating depending on the country's level of development. The above research study concluded that tailored financial inclusion strategies for females should align with the specific circumstances of each country. Additionally, to enable women to leverage the benefits of financial inclusion initiatives, it was deemed imperative to promote women's education up to at least secondary level by reducing or eliminating school fees while fostering an enabling environment to retain women in the education system for prolonged periods.

Elouardighi and Oubejja (2023) scrutinized the correlation between digital financial inclusion and the involvement of women in the labour force in Africa, while also shedding light on obstacles that hinder their access to digital financial services, using the 2021 Global Findex database. The research employed the Probit model estimation technique to analyze the empirical outcomes. The results unveiled a positive link between the two. The study also showed that various obstacles hinder women's access to financial services. These barriers include inflated costs of mobile financial services and a lack of mobile phones. A review conducted by Gammage et al. (2017) emphasizes that substantial financial inclusion for women can mitigate gender disparities, enabling women with saving mechanisms to exert greater control over their earnings and decisions, ranging from marital choices to professional endeavours, education, and leisure activities. In a recent investigation that Wandeda et al. (2023) conducted in Kenya, ownership of mobile phones and televisions indicated a higher probability of women engaging in digital finance. Furthermore, the research discovered that women in Kenya who use digital financial services exhibited a higher likelihood of financial well-being. Yeyouomo, Asongu and Agyemang-Mintah's (2022) findings indicate that fintechs lessen gender disparity with respect to access to and utilization of financial services in sub-Saharan Africa. Giron, Kazemikhasragh, Cicchiello and Panetti (2022) mention the exclusion of younger women and individuals from financial inclusion in Africa and Asia, citing education and income as pivotal elements that enhance financial inclusivity.

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The study also unveiled that heightened financial inclusion levels correlate with increased official savings, which foster national development. Zawaira et al. (2021) analyzed the connection between gender inequality in sub-Saharan Africa and financial inclusion, indicating a prevalent reliance on informal finance sources by individuals, particularly women, including saving clubs and borrowing from acquaintances rather than via formal financial channels. Ajide (2021) explored the influence of financial inclusion on the participation of the female gender in Africa's labour force, assessing the moderating impact of trade openness (TO) and advancements in information technology on this relationship in twelve African countries. The outcomes revealed a non-linear association between financial inclusion and female participation, proposing that an increase in financial inclusion within a range of 33-57 per cent could boost women's engagement in economic endeavours. Additionally, the study demonstrated that ICT acts as a moderator between the participation of females in economic activities and financial inclusion at a level of 38.17 per cent, with similar effects observed for TO at a value of 80.90 per cent. When alternative proxies for the participation of the female labour force and various estimation methodologies were employed, the results remained robust. Onyeoma and Ogbeide-Osaretin (2020) investigated gender inequality within sub-Saharan Africa, as impacted by financial inclusion. Using the moments' technique method, the study found that financial inclusion had a substantial mitigating effect on gender inequality. The study also discovered that accessibility to financial inclusion reduced gender inequality. Moreover, the research revealed a noteworthy negative correlation between female educational attainment levels and gender inequality. As a recommendation, the study emphasized the necessity for an expansion of commercial bank branches to enhance the accessibility of financial services. George and Thomachan (2018) examined women's empowerment in India as influenced by financial inclusion, with an emphasis on financial literacy. Data collection included a combination of primary and secondary sources, while the Chi-Square ($\chi 2$) test of association was employed for analysis purposes. The study's results underscored the significant enhancement of women's empowerment in India through improved accessibility to financial services. Notably, the results confirmed a direct correlation between women's financial security and access to financial services, thereby leading to women's empowerment. Eton et al. (2018) conducted a study on women's empowerment in Uganda and financial inclusion, focusing on the Lango sub-region. A five-point Likert scale facilitated the rating of responses for the structured questionnaire items. The questionnaire endured validation testing, yielding credible and reliable results. Financial data indicated a prevalence of 66.7% of mobile money account usage amongst participants, with the remaining not utilizing such accounts. Additionally, 46.8% possessed saving accounts, while 53.2% did not. Interestingly, among the women who had savings accounts, 67.8% were government employees. This highlighted the influence of a woman's educational level on her employment opportunities, suggesting a higher likelihood of formal sector employment for those with advanced educational qualifications. The Chi-square test for women empowerment and financial inclusion revealed a robust and statistically significant association between the two variables.

Wang (2019) investigated the potential of gender empowerment to enhance the financial inclusion of women by scrutinizing disparities in financial service access and utilization across approximately 120 countries from 2011 to 2017. Applying multivariate regression analysis on panel data while accounting for country-specific and temporal factors that relate to account ownership and digital payment usage, it was found that gender empowerment did indeed foster the financial inclusion of women. By employing cross-country regression, the findings validated that those nations where women represent a substantial portion of the workforce and hold significant political influence witnessed a rise in the number of women who have financial accounts and who engage in digital transactions. Consistent with these results, the study highlighted a positive association between educational attainment and women's demand for financial services. Furthermore, the research affirmed the proposition that legal safeguards pertaining to gender norms, like anti-discrimination measures in employment and equitable property ownership rights, elucidate part of the cross-country variances in digital payment utilization and female account ownership. Moreover, the study showed that factors such as a lack of security for women, exemplified by instances of violence against females, impeded women from harnessing the advantages of financial inclusion. From a policy viewpoint, the dissertation has certainly enriched the existing body of literature, exploring the nexus between women's financial inclusion and gender

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empowerment. Asaolu et al. (2018) conducted a study that measured women's empowerment in sub-Saharan Africa. The authors found that women's empowerment and status influenced their nutrition, health, and socio-economic conditions, as well as that of their children. Health surveys and demographic data from 19 countries in four African regions were utilized for the study. A total of 26 indicators covering education, economic, health and socio-cultural factors were studied with variables defined for the four categories in the different regions. The study indicated that education, attitude towards violence, labour force participation, and access to healthcare, were the major contributors to women empowerment. While education was the second highest factor in Central and West Africa, it was not important for women's empowerment in East Africa. Since labour force participation was a prominent indicator in the study, it was concluded that the economic empowerment of women is key for women's development in the SSA.

3. Methodology

This research was based on an *ex post facto* research design. Secondary data on selected women empowerment variables from 39 sub-Saharan African countries, whose data was available in the Global Findex database, was collected for 2011, 2014, 2017, and 2021. Due to the 2020 COVID-19 pandemic, the Global Findex data for that year was collected in 2021. At the time of this research study, the 2023 database had not yet been published. The selected variables for women empowerment in this study included the female labour force as a percentage of the total labour force (FLF), equal ownership rights to property (EOR), non-discrimination of women in employment (NDW), choice of where to live by women (CWL), female mean years of schooling (MYS), and women's political empowerment (WPE). Panel data regression was used for the studied 39 countries in sub-Saharan Africa, serving as cross-sectional units of the panel data and the years of observation as the time series. This study adopted the Wang (2019) model, which used multivariate regression analysis to explore the extent to which gender empowerment factors influenced women's account ownership and financial account usage, controlling region, and year characteristics, as shown below.

$$yk = \alpha Gender\ Empowermentk + \beta Controls + \gamma ak + \delta year + \varepsilon k,$$

where: yk was a financial inclusion variable, proxied by account ownership and making or receiving digital payments by women; *Gender Empowerment* represented a list of women empowerment and gender equality variables; the control variables were log GDP, log GDP per capita, GDP per capita annual growth, polity score, and financial globalization; ak represented a vector of region fixed effects; $year$ was a vector of time fixed effects; and εk was the error term.

Similarly, this research model was $Y_{it} = X_{it}^{(1)}\beta_1 + X_{it}^{(2)}\beta_{2+} \ldots + X_{it}^{(j)}\beta_j + \varepsilon_{it}$, where: i represented country; t referred to the years; j was the number of explanatory variables;

y_{it} was the dependent variable, and X_{it} was the jth gender empowerment (explanatory) variable for the country i in terms of time t. Applying the model to the specific objectives revealed the following:

$AO_{it} = \beta_0 + \beta_1 FLF_{it} + \beta_2\ EOR_{it} + \beta_3 NDW_{it} + \beta_4 CWL_{it} + \beta_5 MYS_{it} + \beta_6 WPEit + \varepsilon_{it}$, where: AO_{it} referred to account ownership for the country i at time t; FLF_{it} represented female labour force for the country i at time t; EOR_{it} was equal ownership rights to the property for the country i at t$t$he time; NDW_{it} referred to non-discrimination of women in employment for the country i at time t; CWL_{it} was the choice of where to live by women for the country i at time t; MYS_{it} represented mean years of schooling for the country i at the time;

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WPE_{it} referred to women political empowerment for the country $i$at the time$t$; and$\varepsilon_{it\ t}$ was the error of the model.

Testing for Heteroscedasticity Using the Lagrange Multiplier (LM) Test

Ho: Homoscedasticity or no heterogeneity (no panel effect).
Ha: Heteroscedasticity or heterogeneity (panel effect).
Decision rule: If the *p value* < 0.05, reject Ho and accept Ha.

Table 1: Breusch and Pagan Lagrangian multiplier test for random effects

ao [con, t] = Xb + u[con] + e[con, t]

The estimated results are shown below.

	Var	sd = sqrt(Var)
ao	493.5345	22.21564
e	97.10996	9.854438
u	130.8892	11.44068

Test: Var[u] = 0 chibar2(01) = 6.86 Prob > chibar2 = 0.0044
(Source: Authors' compilation using STATA)

Since the *p-value* (0.0044) <0.05, the authors accepted Ha and concluded that there was a panel effect on the model, rendering the model adequate for panel data analysis.

Testing for Autocorrelation Using the Baltagi - Wu LBI Test

This test is used for unequally-spaced panel data, which was the situation in this dataset owing to missing data.
Ho: There is no first-order autocorrelation. Ha: There is first-order autocorrelation.
Decision rule: Reject Ho if the *p value* < 0.05 and accept Ha.

Table 2: Using account ownership fixed effect AR (1) reminder disturbance

FE (within) regression with AR (1) disturbances Number of obs = **58**

Group variable = con Number of groups = 32
R-sq: within = 0.5165 between = 0.5370 overall = 0.4851
Obs per group: minimum = 1 average = 1.8 maximum = 3
F(4, 22) = 5.87
Corr (u_i, Xb) = -0.7050 Prob > F = 0.0023

Ao	**Coef.**	**Std. Err.**	**T**	**P>|t|**	**[95% Conf. Interval]**	
Flf	-1152355	.5471363	-0.21	0.835	-1.249927	1.019456
Ndw	40.43812	18.05932	2.24	0.036	2.985385	77.89086
Cwl	12.12237	8.134416	1.49	0.150	-4.747376	28.99212
Mys	8.634211	6.216269	1.39	0.179	-4.257542	21. 52597
_cons	-36. 53725	10.9366	-3.34	0.003	-59.21837	13.85614
rho_ar	.58429353					
sigma_u	19.808843					
sigma_e	7.147773					
rho_fov	.88479612	(Fraction of variance because of u_i)				

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(Source: Authors' compilation using STATA)

The F test revealed that all u_i = 0: F (31, 22) = 2.08
Modified by Bhargava et al. Durbin-Watson = 1.0039336
Baltagi-Wu LBI = 1.8924516 Prob > F = 0.0386

Since the *p value* (0.0386) < 0.05, there was a presence of autocorrelation. This affected the standard error, which would not be reliable if the autocorrelation were not controlled. The issue was resolved by using Robust (clustered) Standard Error, which was managed by the STATA software, as shown below.

Table 3: Robust (clustered) standard error

Fixed-effects (within) regression Number of obs = 96
Group variable = con Number of groups = 38
R-sq: within = 0.5635 between = 0.4729 overall = 0.4209
Obs per group: minimum = 1 average = 2.5 maximum = 4
F (4, 37) = 48.44
corr (u_i, Xb) = -0.9215 Prob > F = 0.0000

(Std. Err. adjusted to **38** clusters in con)

	Coef.	Robust Std. Err.	T	P>|t|	[95% Conf. Interval]	
Flf	1.475042	.1936651	-7.62	0.0	-1.867445	-1.08264
Ndw	-4.165774	3.220909	-1.29	0.204	-10.69196	2.360408
Cwl	16.77328	3.853422	4.35	0.000	8.965486	24.58104
Mys	18.31087	2.94682	6.21	0.000	12.34005	24.2817
_cons	29.08322	10.22593	2.84	0.007	8.363512	49.80294
sigma_u	39.810757					
sigma_e	9.8544384					
Rho	.9422654	(Fraction of variance because of u_i)				

(Source: Authors' compilation using STATA)

This study adopted the Listwise deletion method to manage missing data since the authors assumed that they had data that was missing randomly (MCAR). This was done by using the STATA software.

4. Results and Discussions

Table 4: Regression analysis of study variables on female account ownership

Dependent Variable: AO Number of obs: 95 F(6, 88): 20.25
Prob > F: 0.0000 R-squared: 0.5800 Adj R-squared: 0.5513 Root MSE: 14.932

Variable	**Coef.**	**Std. Err.**	**t-statistic**	**Probability**
FLF	-.3193859	.1206766	-2.65	0.010
EOR	-.9548892	3.719209	-0.26	0.798
NDW	12.92842	4.655528	2.8	0.007
CWL	14.06265	4.074093	3.45	0.001
MYS	5.505042	.7266237	7.58	0.000
WPE	21.0958	14.87886	1.42	0.160
_CONS	-9.870198	11.32003	-0.87	0.386

(Source: Authors' compilation using STATA)

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Table 4 above indicates that the following women empowerment variables, namely FLF, NDW, CWL and MYS, were significant since their probability values of 0.010, 0.007, 0.001 and 0.000, respectively, were all less than 0.05. EOR, with a probability of 0.798, and WPE, with a probability of 0.160, both above 0.05, were insignificant.

Country and Time Effects

To further study the impact of the significant women empowerment variables on account ownership, the model was re-specified without the statistically insignificant explanatory variables as a form of data reduction, as shown below:

$$AO_{it} = \beta_{0+} \ \beta_1 FLF_{it} + \beta_2 NDW_{it} + \beta_3 CWL_{it} + \beta_3 MYS_{it} + \ \varepsilon_{it}.$$

To analyze the re-specified model above, the authors considered the panel data models presented below.

Account Ownership Pooled Regression (the Constant Coefficients) Model

This model assumed that there were neither significant country nor time effects. This means that account ownership was the same across SSA and equally the same across the period. Hence, the data had to be pooled, and the OLS regression was applied. The pooled OLS had intercept and slope coefficients that were constant across countries and time.

Table 5: Pooled regression model

Dependent Variable: AO Number of obs: 96 F(4, 91): 29.01 Prob>F: 0.0000
R-squared: 0.5605 Adj R-squared: 0.5412 Root MSE: 15.048

Variable	Coef.	Std. Err.	t-statistic	Probability
FLF	-.2866132	.1168271	-2.45	0.016
NDW	14.60227	4.034292	3.62	0.000
CWL	14.19943	3.897386	3.64	0.000
MYS	5.711636	.6358805	8.98	0.000
_CONS	.3898044	7.363361	0.05	0.958

(Source: Authors' compilation using STATA)

According to the above table, the R-squared of 0.5605 shows that FLF, NDW, CWL and MYS accounted for about 56% of the variation in female account ownership for the sub-Saharan African countries under study, leaving 44% unexplained. The adjusted R-squared was 0.5412, while the root mean squared error (Root MSE) was 15.04. The marginal effects of NDW, CWL and MYS were all positive, as expected, and highly significant. However, when combining different countries at separate times, one may not see the uniqueness among the countries. Each country's individuality was subsumed in the disturbance term, u_{it} correlating the error term with some regressors and rendering the estimate of the pooled regression biased. To account for the uniqueness of the various countries, the authors applied the fixed effect dummy variables, as outlined below.

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Slope Coefficients Constant but Intercept Varied Across Countries

The above implies that there were no critical time effects but rather significant differences among the countries. Each country had a separate intercept, which was estimated by including a dummy variable for each country in the model.

Table 6: Account ownership least square dummy variable country effect

Dependent variable: AO Number of obs: 96 F(41, 54): 10.46 Prob > F: 0.0000
R-squared: 0.8882 Adj R-squared: 0.8032 Root MSE: 9.8544

Variable	**Coef.**	**Std. Err.**	**t-statistic**	**Probability**
FLF	-1.475042	.4317986	-3.42	0.001
NDW	-4.165774	13.55005	-0.31	0.760
CWL	16.77326	6.102016	2.75	0.008
MYS	18.31087	2.739714	6.68	0.000

Country	**Coef.**	**Std. Err.**	**t-static**	**Probability**
Angola (_cons)	73.48944	42.67842	1.72	0.091
Benin	-10.353	8.827054	-1.17	0.246
Botswana	-122.941	24.84978	-4.95	0.000
Burkina Faso	3.223714	12.14568	0.27	0.792
Burundi	9.173859	12.95875	0.71	0.482
Cameroon	-32.63407	19.18169	-1.70	0.095
Central African Republic	-34.25859	10.93011	-3.13	0.003
Chad	-26.44979	23.81633	-1.11	0.272
Comoros	-84.3266	22.13536	-3.81	0.000
Democratic Republic of Congo	-53.87568	22.23614	-2.42	0.019
Congo Republic	-64.36588	20.46545	-3.15	0.003
Cote d'Ivoire	-67.40395	21.08882	-3.20	0.002
Gabon	-126.6026	31.41099	-4.03	0.000
Gambia	-43.87355	16.0886	-2.73	0.009
Ghana	-75.53046	15.3886	-4.91	0.000
Guinea	5.982507	10.53432	0.57	0.572
Kenya	-14.1898	12.26565	-1.16	0.252
Lesotho	-86.94901	16.31033	-5.33	0.000
Liberia	-4.39225	10.5125	-0.42	0.678
Madagascar	-38.33388	11.12299	-3.45	0.001
Malawi	-23.18066	10.20365	-2.27	0.027
Mali	-2.862347	11.33815	-0.25	0.802
Mauritania	-105.1248	33.21021	-3.17	0.003
Mauritius	-106.3911	25.0983	-4.24	0.000
Mozambique	20.0883	12.34671	1.63	0.110
Namibia	-65.48579	18.72492	-3.50	0.001
Niger	-11.17495	19.61551	-0.57	0.571
Nigeria	-65.88103	17.74924	-3.71	0.000
Rwanda	10.18565	10.60624	0.96	0.341
Senegal	-25.135	19.1651	-1.31	0.195
Sierra Leone	-23.16868	12.72968	-1.82	0.074
South Africa	-109.3677	26.68046	-4.10	0.000

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Sudan	-70.48277	19.82341	-3.56	0.001
Tanzania	-31.0099	10.73038	-2.89	0.006
Togo	-29.85421	11.89866	-2.51	0.015
Uganda	-35.78249	11.15249	-3.21	0.002
Zambia	-69.87356	14.01561	-4.99	0.000
Zimbabwe	-71.08159	15.63548	-4.55	0.000

(Source: Authors' compilation using STATA)

The results shown above for FLF, NDW, CWL and MYS are different from those from the earlier pooled regression, which showed the country effect. The country heterogeneity was also highly significant. The intercept refers to the value of account ownership when other explanatory variables are zero. The country's account ownership for the 39 SSA countries under study is indicated in Table 6. The account ownership of countries with a *p-value* < 0.05 was significant, namely Botswana, Ghana, Nigeria, South Africa, and Zimbabwe, to mention a few. The account ownership of countries with a *p-value*> 0.05 was not significant at a 95% level of significance. Examples of these countries include Benin, Burkina Faso, and Niger. However, some were significant and positive, while others were significant and negative.

The intercept for the base country, Angola, was provided by the constant intercept of the model, namely 73.4894, while the intercepts of other countries were derived as follows:
Benin = 73.4894 – 10.353 = 63.1364; Nigeria = 73.4894 – 65.8810 = 7.6084; and
South Africa = 73.4894 – 109.3677 = -35.8783.

Slope Coefficients Constant but Intercept Varied Over Time

The above implies that there were no significant cross-country differences but significant time effects.

Table 7: Account ownership least square dummy variable time effect

Dependent Variable: AO Number of obs: 96 F(7, 88): 33.68 Prob > F: 0.0000
R-squared: 0.7282 Adj R-squared: 0.7066 Root MSE: 12.034

Variable	**Coef.**	**Std. Err.**	**t-statistic**	**Probability**
FLF	-.2128103	.0940232	-2.26	0.026
NDW	13.6448	3.235179	4.22	0.000
CWL	9.876151	3.181246	3.10	0.003
MYS	4.940085	.5198069	9.50	0.000
Time	**Coef.**	**Std. Err.**	**t-statistic**	**Probability**
2011	-7.742853	6.195264	-1.25	0.215
2014	5.528162	3.3805	1.64	0.106
2017	18.56347	3.553323	5.22	0.000
2021	22.91416	3.493982	6.56	0.000

(Source: Authors' compilation using STATA)

All the women empowerment variables were significant and positive, except FLF, which was significant and negative. The values of the coefficients were also significant. In terms of the time dummies, the earlier years, namely 2011 and 2014, were insignificant, while the later years, 2017 and 2021, were significant and positive with high coefficient values. This indicates that account ownership changed over time and was confirmed by R2 of 0.7282 against the pooled regression with R2 = 0.5650, rendering an increment of 0.1632 in R2 from the pooled OLS.

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Slope Coefficients Constant but Intercept Varied Over Country and Time

Table 8: Account ownership least square dummy variable country and time effect

Number of obs = 96 F (44, 51) = 18.05 Prob > F = 0.000
R-squared = 0.9397 Adj. R-Squared = 0.8876 Root MSE = 7.448

Source	Ss	df	MS
Model	44056.6878	44	1001.28836
Residual	2829.09259	51	55.4724037
Total	46885.7804	85	493.53453

ao	Coef.	Std. Err.	T	P>|t|	[95% Conf. Interval]	
Flf	-.6340566	.3542718	-1.79	0.079	-1.345287	.0771737
Ndw	-7.878146	10.39082	-0.76	0.452	-28.73858	12.98229
Cwl	3.070577	5.109266	0.60	0.551	-7.186702	13.32786
Mys	-6.17185	4.277763	-1.44	0.155	-14.75982	2.416117
Con						
2	-24.35452	7.006393	-3.48	0.001	-38.42044	-10.2886
3	34.87804	30.79959	1.13	0.263	-26.95472	96.71081
4	-41.51866	11.4278	-3.63	0.001	-64.46091	-18.5764
5	-33.58025	11.93466	-2.81	0.007	-57.54009	-9.620417
6	-16.03912	14.9379	-1.07	0.288	-46.0282	13.94997
7	-33.49008	8.27299	-4.05	0.000	-50.0988	-16.88136
8	-61.50098	18.88315	-3.26	0.002	-99.41049	-23.59417
9	-32.25331	18.85214	-1.71	0.093	-70.10056	5.593931
10	-26.11523	17.85556	-1.46	0.150	-61.96175	9.731293
11	-15.83992	17.57133	-0.90	0.372	-51.11584	19.436
12	-26.6306	17.28837	-1.54	0.130	-61.33845	8.077245
14	-4.624929	30.61571	-0.15	0.881	-66.08854	56.83868
16	23.43841	19.16868	1.22	0.227	-15.04431	61.92113
_cons	97.17188	33.02206	2.94	0.005	30.87733	163.4664

The complete table is attached as an appendix. All the women empowerment variables were insignificant, while all the time effects were significant and positive. The country effect had a stronger influence on the results than the time effect, as indicated by the results of the country effect alone. R-squared of 0.9397 was the highest of the four regression models, which implies that the country and time effect model is the best model since it explained about 94% of the variation in female account ownership.

To Test for Fixed Effect or Random Effect

Before the Hausman test, fixed effect and random effect regression tests were conducted.

Table 9: Fixed effects (within groups) regression for account ownership

Fixed effects (within) regression Number of obs: 96
Group variable: con Number of groups: 38
R-sq: within: 0.5635 between: 0.4729 overall: 0.4209
Obs per group: minimum: 1 average: 2.5 maximum: 4
corr(u_i, Xb): -0.9215 F(4, 54): 17.43 Prob > F: 0.0000
Dependent variable: AO

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Variable	Coef.	Std. Err.	t-statistic	Probability
FLF	-1.475042	.4317986	-3.42	0.001
NDW	-4.165774	13.55005	-0.31	0.760
CWL	16.77326	6.102016	2.75	0.008
MYS	18.31087	2.739714	6.68	0.000
_CONS	29.08322	34.37515	0.85	0.401
sigma_u	39.810757			
sigma_e	9.8544384			
Rho	.9422654			

(Source: Authors' compilation using STATA)

The F test revealed that all u_i=0: F(37, 54) = 4.29 Prob > F = 0.0000

Decision: If probability < 0.05, reject null and accept alternate hypothesis.

According to the above table, beta coefficients indicate changes in account ownership (AO) when the predictors, namely female labour force percentage (FLF), non-discrimination of women in employment (NDW), choice of where to live by women (CWL) and mean years of schooling (MYS) changed one unit over time. When CWL increased by one unit, account ownership of women increased by 16.77 units. Also, when MYS increased by one unit, account ownership increased by 18.31. FLF and NDW showed an inverse relationship with account ownership; a one-unit increase in FLF resulted in a corresponding 1.47-unit decrease in account ownership, and a one-unit increase in NDW yielded a 4.17-unit decrease in account ownership. This implies that an increase in mean years of schooling and choice of where to live by women would lead to a corresponding geometric increase in account ownership.

The above table shows that NDW and intercept were not significant, with *p-values* of 0.760 and 0.401, respectively. The *p values* of FLF, CWL and MYS were all significant at 0.001, 0.008 and 0.000, respectively, showing that the predictors impacted account ownership significantly. The *F* test was used to assess the model's overall significance, namely whether all the coefficients in the model were jointly different from zero. If the *F value* <0.05, the model would be significant. The *F value* from the data was 0.0000, showing that the model was adequate. The intraclass correlation (rho) indicated the percentage of variance in account ownership caused by country specifics, which amounted to 94%.

Table 10: Random effect regression for account ownership

Random-effects GLS regression Number of obs: 96
Group variable: con Number of groups: 38
R-sq: within: 0.4678 between: 0.6138 overall: 0.5570
Obs per group: minimum: 1 average: 2.5 maximum: 4
corr(u_i, X): 0 (assumed) Wald chi2(4): 80.24 Prob > chi2: 0.0000
Dependent variable: AO

Variable	Coef.	Std. Err.	t-statistic	Probability
FLF	-.3104787	.1534584	-2.02	0.043
NDW	13.37003	5.265865	2.54	0.011
CWL	16.47866	4.644508	3.55	0.000
MYS	6.933747	.9544831	7.26	0.000
_CONS	-4.682321	10.89979	-0.43	0.668
sigma_u	11.440681			
sigma_e	9.8544384			
Rho	.57407752			

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(Source: Authors' compilation using STATA)

Close examination of the fixed and random effects for account ownership in Tables 9 and 10, respectively, show that the NDW signs and the intercept changed for the two models. The beta coefficients also varied for the models, apart from CWL, which had approximate comparative values. The Hausman test was applied to select between the fixed or random effects models. The test determined whether the individual characteristics would correlate with the regressors.

Table 11: Hausman test for account ownership model

Hausman fe re

		Coefficients			
		(b)	**B**	**b – B**	**Sqrt(diag(V_b-V_B**
		fe	**re**	**Difference**	**S.E.**
	FLF	1.475042	0.3104787	-1.164564	0.4036094
	NDW	-4.165774	13.37003	-17.5358	12.48497
	CWL	16.77326	16.47866	0.2946038	3.957669
	MYS	18.31087	6.933747	11.37713	2.568072

(Source: Authors' compilation using STATA)

B = consistent under Ho and Ha: obtained from xtreg
B = inconsistent under Ha, efficient under Ho: obtained from xtreg
Test: Ho: difference in coefficients not systematic
Chi2(4) = (b-B)'[(V_b-V_B) ^(-1)](b-B)= 26.23
Prob>chi2= 0.0000 Ho: random effects Ha: fixed effects

Since *prob* > chi2 was < 0.05, the null hypothesis Ho was rejected, namely the random effect, while the Ha, namely the fixed effects, was accepted. The above analysis revealed that *prob* > chi2 =0.0000; therefore, the authors accepted the fixed effects model. By implication, the country effects present in the data set correlated with the explanatory variables; hence, the choice to use the fixed effects model.

The Principal Component Analysis (PCA) of the selected women empowerment variables corroborated the results of the pooled regression analysis since the variables, namely non-discrimination of women in employment (NDW), female mean years of schooling (MYS), and choice of where to live (CWL) explained 73% of the total variances.

5. Conclusion

Both the pooled regression and principal component analysis confirmed that the variables, namely non-discrimination of women in employment, choice of where to live and female mean years of schooling, had positive and significant impacts on account ownership by women in sub-Saharan Africa. Therefore, we concluded that women's empowerment positively and significantly impacts the financial inclusion of women in sub-Saharan Africa. This confirmed the findings of Wandeda et al. (2023), Giron et al. (2022), Zawaira et al. (2021), Onyeoma et al. (2020), Eton et al. (2018) and Asaolu et al. (2018), among others.

The female labour force variable had a negative and significant impact on account ownership. This counteracts a priori expectation of a positive and significant impact and opposes the findings of Elouardighi and Oubejja (2023), Ajide (2021), and others in this respect. Similarly, equal ownership rights to property and women's political empowerment had negative and not significant and positive and not significant impacts on

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account ownership in SSA, respectively, countering Wang's (2019) findings. This raises the question of the quality of data of these non-significant variables, as well as other women variables that relate to the region. Hence, the authors came to the conclusion that there is a dire need to improve the quality of data for women variables in sub-Saharan Africa. According to results from the *R-squared* values of the regression analysis of country and time effects, the authors concluded that the individual peculiarities of each country play a significant role in the financial inclusivity of its women. Hence, the outcome of the study strengthens Laoba (2023) and Wang (2019) findings, which led to their recommendation that policies on financial inclusion should be based on a country's realities.

Furthermore, enhancements in development and technology have had a strong positive and significant impact on the financial inclusion of women in sub-Saharan Africa. The results of the time effects on account ownership by women underscore this fact. Steming from the above analysis, the following recommendations should be taken into consideration:

1. For the fact that women empowerment has a significant and positive effect on the financial inclusion of women, governments within sub-Saharan Africa should enact policies with legal frameworks for women emancipation through gender equality. This will allow them to reap corresponding benefits, including the financial inclusion of women and the reduction of multi-dimensional poverty in the region.
2. SSA governments should establish female education as a priority at all levels owing to its strong positive impact on the financial inclusivity of females. Secondary education, which is the level of basic financial literacy, should be the minimum level of education for the girl child.
3. SSA governments should begin to invest in data collection in collaboration with academic and research institutions to gather effective and reliable data for productive research in the region and, subsequently, good policy and decision making for the region.
4. The authors echo Laoba (2023) recommendation that policies around financial inclusion should be based on country specifics and realities to yield the best results.
   Policies that work in developed economies may not work in developing economies.
5. Since the variables, namely equal ownership rights to property, non-discrimination of women in employment, and choice of where to live impacted positively and significantly on account ownership of women in SSA, African governments and policy makers should enact policies that encourage employers to recruit, train and develop more women.
6. African governments should establish policies and legal frameworks to deal with women's discrimination in the workplace.
7. African governments that do not have laws for equal ownership rights to property are encouraged to do so in order to reap the attendant benefits for their economies.

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