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Determinants of women's empowerment through rural finance in Kongo central, Democratic Republic of Congo

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ABSTRACT

This study examines women's empowerment in Kongo Central Province, Democratic Republic of the Congo focusing on rural financing. A survey of 500 households analyzed through regression shows a significant impact of rural especially informal, finance on women's autonomy. Access to finance boosts women's economic activity, family income contribution, decision-making power and independence. The study reveals socio-economic disparities influenced by education, marital status, age and income. Education, marital status and income are important to empowering women in Central Kongo. Structural reforms are needed to remove systemic barriers to equitable financial inclusion. Key findings suggest that targeted policy interventions could improve rural women's living conditions. Policymakers and stakeholders in rural development should adopt a systemic approach to promote gender equality and sustainable development. This research highlights the importance of tailored policies that meet rural women's unique needs advocating for inclusive financial systems that empower women in economic and decision-making roles. This study offers crucial insights for enhancing women's empowerment in rural areas emphasizing the need for focused interventions to achieve gender equality and sustainable progress in Kongo Central. These findings highlight rural finance as a powerful tool for boosting women's autonomy and fostering broader socio-economic development in the region.

Contribution/ Originality: This article examines Central Kongo in the DRC, a rural and agricultural region under-represented in women's empowerment research. It introduces a unique perspective and fills a research gap by using the Generalized Least Squares (GLS) method for data analysis. This approach enhances result robustness and reliability by addressing potential data biases.

1. INTRODUCTION

Improving women's living conditions in developing countries is a major challenge highlighted by Kabamba (2023) and integrated into the fifth Sustainable Development Goal (SDG). Women face limitations in terms of status, participation in decision-making and economic activities marked by persistent obstacles such as inequalities, prejudicial gender norms, and structural impediments despite their crucial role (Carli, Cavone, Pippia, De Schutter, & Dotoli, 2022). An innovative perspective underpins the new rural finance paradigm affirming the intrinsic bankability of rural populations including women (Greetha & Meyers, 2006). However, these populations continue to be the greatest unexplored financial market regardless of their importance. Financial inclusion of rural communities especially women would unlock considerable economic potential. Improved access to rural financial services generates positive microeconomic and macroeconomic impacts fostering growth (Saleh & Moussa, 2023).

The term "rural finance" encompasses the provision of financial services in rural areas supporting various economic activities and providing assistance to households with diversified incomes for this research. It is divided into formal and informal rural finance, the former includes formally established and regulated financial institutions and the latter relies on unregulated mechanisms based on interpersonal relationships within communities (Hugon, 2006; Mutagoma, 2023). Women's economic advancement, facilitated by the use of rural finance is of crucial importance to the achievement of the gender equality and women's empowerment SDGs (Chekrouni, 2023; Deshpande & Kabeer, 2019; Monnoyer & Lorioux, 2017).

However, the gaps in this area are numerous and complex with studies highlighting the importance of socio-economic and cultural determinants on women's ability to make decisions and act autonomously (Frimousse & Peretti, 2020). Geographical, cultural and economic disparities create gaps in understanding women's empowerment requiring a region-specific approach (Deshpande & Kabeer, 2019; Duflo, 2012).

In the African context specifically in the province of Kongo Central (KC) in the Democratic Republic of the Congo (DRC), disparities persist between men and women. Gender inequalities mark various areas such as labor market participation, agricultural performance, entrepreneurial profits and wages. Literature on women's empowerment in this region is limited despite gender-focused projects. This study aims to fill this gap by examining the determinants of access to rural finance for women's empowerment (Bitasimwa & Kabanga, 2023; Mapapa & Milando, 2023).

To answer this question, two questions will guide our investigation: What are the factors empowering women in the context of rural finance? How can rural finance contribute to improving women's living conditions?

This article will be presented using a well-defined five-section structure. First, the introduction sets out the framework of the research topic and states its objectives followed by a comprehensive review of the literature. The third section describes the data collection and analysis methods used, thus ensuring the reliability and validity of the results. The results of the study are then presented and discussed in the fourth section. The final section summarizes the main findings of the study discussing their practical implications and suggesting avenues for future research.

2. LITERATURE REVIEW

The interconnection between women's empowerment and rural finance is emerging as an essential area of research demonstrating a dynamic link conducive to socio-economic development. Acting as a catalyst, rural finance provides women with economic tools promoting access to financial resources and economic independence. Additionally, it fosters laws that reduce gender disparities, promote education and ensure food security which supports the success of women in rural areas both personally and professionally (Mapapa & Milando, 2023).

Several studies such as Bourdache (2023), Duflo (2012), Kabeer (2005a) and Leroy (2024) underline the persistent marginalization of women in sub-Saharan Africa in household decision-making processes and in their quest for financial autonomy. This marginalization stems largely from the traditional division of roles where men are primarily associated with income generation and women are often confined to domestic tasks and childcare. However, it is widely recognized that women's fulfillment is closely linked to their financial empowerment, a condition that can only be achieved if they have access to the financial resources needed to engage in income-generating activities.

Previous research by Benyacoub and Azirar (2021) and Sahu, Agarwala, and Maity (2024) has established a significant correlation between access to rural finance whether formal or informal and women's empowerment.

However, some studies by Mbaye (2023) caution against the simplistic view that access to finance automatically leads to women's empowerment stressing the importance of taking contextual and structural factors into account for a critical and nuanced understanding. Women's empowerment variously defined by authors such as Elson (2010) and Hakim (2001) covers aspects ranging from the transformation of social structures to individual freedom of choice and the active participation of women in both professional and public spheres. Indicators of women's empowerment such as education, economic participation, health autonomy, political participation, freedom of movement and expression, access to technology, levels of violence and security, access to land ownership and community participation offer a multidimensional and contextual assessment.

The literature on access to rural finance and women's empowerment features significant contributions from researchers such as Garcia, Berché, and Román (2020) and Shah et al. (2021) highlighting gender disparities in access to formal financial services, the effectiveness of formal microfinance programs and the impact of microcredit initiatives in the context of formal finance. The findings of Gupta and Vegelin (2016) offer an in-depth institutional perspective on government policies to promote women's formal access to finance highlighting the structural reforms needed. Nguyen and Van den Berg (2008) examine the mechanisms highlighting the impact of community networks on women's economic empowerment regarding access to informal rural finance. Ridaura et al. (2018) examine the dynamics of informal savings groups while Zhang, Song, and Chen (2012) take an integrated approach to explore the links between access to formal and informal finance and women's overall empowerment. Other studies such as Benlabbah (2022) and Maugiron (2021) look at the cultural factors influencing women's empowerment.

In this study, women's empowerment measured through indicators such as education, marital status, age, income-generating activity and income level offers an enriching insight into the socio-economic dynamics in Central Kongo. The importance of freedom to use and control resources for women's empowerment is emphasized (Fofana, 2022).

Finally, the methodology used to examine women's empowerment on a global scale combining quantitative and qualitative methods is diverse with researchers such as Banerjee & Duflo, 2009, Kabeer, 2005b, Yunus, (2014). The least-squares regression technique has been widely used by Kabeer (2005b) analyzing causal relationships between different determinants of women's empowerment. In this study, we intend to use a particular methodology in the robust analysis of data by the Generalized Least Squares (GLS) method to enhance the reliability of the results and account for potential biases in the data.

3. METHODOLOGY

3.1. Sampling

The methodology of this study is based on primary data from a survey of female heads of household or spouses of heads of household in the province of Central Kongo in the Democratic Republic of Congo.

The survey was deployed in the three districts of Kongo Central encompassing eleven territories, ten of which (Lukula, Sekebanza, Madimba, Luozi, Moanda, Songololo, Mbanza, Ngungu, Tshela and Kimvula) were mainly rural and focused on agriculture with the exception of Kasangulu territory which has lost its agricultural orientation.

The aim of the survey was to target women living in rural areas mainly farm and non-farm operators. The snowball method was used to gather information through a questionnaire using farm registers identifying 783 women farmers and 500 women were successfully interviewed.

The data were analyzed using Stata software. For each study area, approximately 10% of the initial samples of 500 heads of household were selected to participate in the study, thus ensuring a balanced representation of the different sub-populations of the Central Kongo region.

3.2. Construction of the Women's Empowerment Composite Index (WECI)

Assessing women's empowerment is a complex undertaking given the diversity of the indicators involved. A multidimensional approach is favored enabling an in-depth analysis of the issue to grasp this complexity. The creation of a Composite Women's Empowerment Index (CWEI) is an efficient way of synthesizing a complex reality into a global measure responding to the need to present simplified, comprehensible information to a wide audience, a practice increasingly adopted by researchers.

However, it is crucial to note that the construction of composite indices can sometimes lead to excessively simplistic conclusions resulting in misinterpretation or misunderstanding of the phenomena studied. This simplification is often based on the assumption that the different components of the index are directly comparable, thus constituting its main weakness as highlighted by Saltelli et al. (2008) in their work. Therefore, composite indices can offer a useful overview. It is essential to interpret them with caution and to take into account the diversity of dimensions of women's empowerment. A holistic approach remains essential for a fair and comprehensive assessment of their empowerment taking into account the complexity and diversity of women's experiences. For the purposes of this study, the Women's Empowerment Composite Index (WECI) is based on a rigorous approach incorporating four key dimensions and ten relevant indicators summarized in Table 1. These dimensions have been carefully selected to capture various aspects of women's empowerment in the Central Kongo region offering a comprehensive perspective of their situation. The first dimension "women's activity" focuses on women's participation in the labor market and income-generating activities (IGAs). It is assessed using two indicators: women's employment revealing their current involvement in a professional activity and participation in an IGA indicating their involvement in initiatives aimed at generating additional household income.

The second dimension "women's contribution to household income" highlights women's financial role within the household. It comprises three indicators: income mobilization which examines the distribution of financial responsibilities among household members, financial participation, assessing women's specific monetary contribution to household income and income centralization identifying whether women are responsible for centralizing income within the household. The third dimension "women's decision-making power" explores the degree of women's participation in family decision-making. Although more difficult to quantify, this dimension is essential to understanding women's empowerment. Indicators included in this dimension may include participation in decisions concerning family expenses, children's education and other important household issues.

Finally, the fourth dimension, "women's degree of autonomy" assesses women's level of independence in various aspects of their daily lives. This may include indicators such as freedom of movement, access to resources and control over their own health and well-being.

WECI offers a comprehensive measure of women's empowerment in Central Kongo enabling an in-depth and nuanced assessment of their socio-economic situation and decision-making power by combining these dimensions and indicators. The "women's decision-making power" dimension is assessed through three specific variables, each offering a unique insight into the degree of women's participation in household decision-making. The first variable, "authority in decision-making" examines whether the woman has a direct influence on decisions made within the household or whether these are mainly made by the man, thus reflecting the woman's level of authority in the family decision-making process. The second variable, "place of the woman in the decision-making process" explores whether the woman is consulted and involved before decisions are made within the household highlighting her role and contribution in family decision-making processes. The third variable "women's participation in household transactions" examines whether women are actively involved in household financial and economic transactions demonstrating their commitment to managing family resources and finances. Two specific variables are used to assess women's freedom of action and autonomy with regard to the "autonomy and freedom" dimension: The first variable, autonomy in carrying out an IGA assesses the woman's ability to carry out an income-generating activity independently, thus underlining her level of economic and professional autonomy. The second variable, "freedom of movement and action examines whether the woman enjoys unconstrained freedom of movement and action enabling us to understand the extent to which she is free to make decisions and act according to her own choices and preferences. This multidimensional approach offers a comprehensive and nuanced analysis of women's empowerment in the context of this study taking into account a diverse range of factors contributing to their economic, social and personal emancipation.

Table 1. Dimensions and indicators used in the construction of the WECI.

Dimensions	Indicators	Measuring variables
Women's activity	Women's employment	It takes 1 if the woman does not work and 2 if she does.
	Exercising an IGA	It takes the value 1 if yes and 0 if it is exercised unofficially.
Women's contribution to income	Mobilizing income	It takes value 1 if female and 2 if male only.
	Financial participation in the household	It takes the value 1 if the woman contributes to household expenses and 2 otherwise.
	Centralized revenues	It takes value 1 if female and 2 if male only.
Decision-making power	Authority in decision-making	It takes the value 1 if it's with the woman and 2 if it's the man alone.
	Women in decision-making	It takes the value 1 if the woman is consulted and 2 if she is less consulted.
	Participation in household transactions	It takes the value 1 if yes and 2 otherwise.
Autonomy and freedom	Autonomy	It takes value 1 if required and 2 if not required.
	Women's freedom of action and movement	It takes the value 1 if the woman's freedom is limited and 2 if there is no freedom.

3.3. Using Multiple Correspondence Analysis

Multiple correspondence analysis is a descriptive technique designed to summarize the information contained in a large number of variables to facilitate interpretation of the correlations existing between these different variables. The aim is to determine which modalities are correlated with each other. Q is the number of variables used in the Multiple Correspondence Analysis (MCA) and K is the number of modalities associated with each variable. According to Cahuzac and Bontemps (2008) and Terracol and Bontemps (2008) the influence of a variable depends strongly on the number of modalities, it is important to consider variables that do not have an excessive number of modalities. The total inertia noted (Φ^3) depends on the modalities and variables used in the analysis. Total inertia is given by the following formula:

$$\Phi^3 = \frac{(K-Q)}{Q} \quad (1)$$

Table 2. WECI eigenvalues.

Dimensions	Main inertia	%	Cumulative
dim 1	0.199	19.93%	19.93
dim 2	0.168	16.78%	36.71
dim 3	0.136	13.59%	50.29
dim 4	0.102	10.15%	60.44
dim 5	0 .090	8.98%	69.42
Sun 6	0 .076	7.59%	77.02
Sun 7	0.071	7.08%	84.10
Sun 8	0 .063	6.31%	90.41
Sun 9	0.056	5.59%	96.00
Sun 10	0.040	4.00%	100.00
Total	1	100%	

Table 1 shows K=20 and Q=10 based on the dimensions used in this analysis. Thus, by applying formula (1), the total inertia of the scatterplot gives the value 1. This value is also the resultant of the various eigenvalues (λ) calculated at most $K - Q = 10$. Table 2 also shows the various eigenvalues. Their sum is equal to the total inertia. It can be seen that the eigenvalues (dim) are low attesting to a weak explanation of the total inertia with the variables taken into account in the construction of the WECI. A number of data analysis studies in particular Beaudouin (2016) and Benzécri (1975) stipulate that it is possible to discriminate by retaining only those eigenvalues that are greater than the mean eigenvalue. Thus, we have

$$\lambda_m = {}^{1}/_{Q} \qquad (2)$$

The factorial analysis procedure resulted in a value of 0.1 leading us to retain only the first four dimensions with the highest eigenvalues. Table 1 presents the results relating to variable modalities and their contribution to total inertia. Table 2 provides data on the coordinates, the quality of the representation and the relative inertia of each modality in relation to the first two principal axes. It also indicates the weight of each modality and its contribution to the total inertia of the scatterplot. Focusing first on the modalities offering the best quality of representation of the factorial axes (with a high sqcorr value) and contributing most to the formation of the axes (with a high contribution value), we observe that for axis 1, the contribution of all modalities is less than their contribution to the total inertia. However, for axis 2, the "doesn't work" and "doesn't contribute" modalities have a contribution greater than their contribution to total inertia.

We can determine the variable's total contribution to an axis or scatterplot by summing the relative contributions of the different modalities within each variable. Looking at axis 1, we see that the variable "woman's place in household decisions" contributes most to the formation of this axis, accounting for 8.6%. The second most significant variable is "woman's participation in household transactions with a contribution of 8.3%. The "income mobilization" variable contributed 6.6% while "income centralization" and "household decision-making authority" contributed 5.8% and 5.5% respectively. The contributions of the other variables are relatively low. With regard to axis 2, the "female employment" variable is the main contributor with a contribution of 13.5% followed by the "female financial participation in the household" variable with 11.2%.

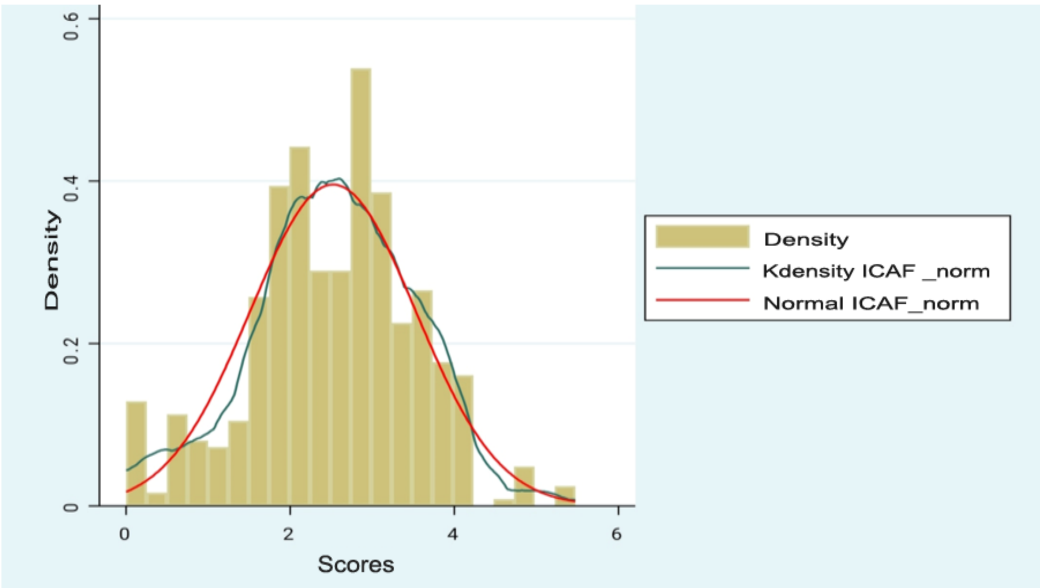

Figure 1. Distribution of WECI scores.

In Figure 1, the distribution of scores follows an almost normal shape. The mean score is 0.006 with values ranging from -2.514 to 2.959.

At the end of this second principal component analysis (PCA), the WECI score was calculated for each woman using the average of the item values weighted by their factor contribution on the first axis. The first result shows that the distribution of scores follows an almost normal shape.

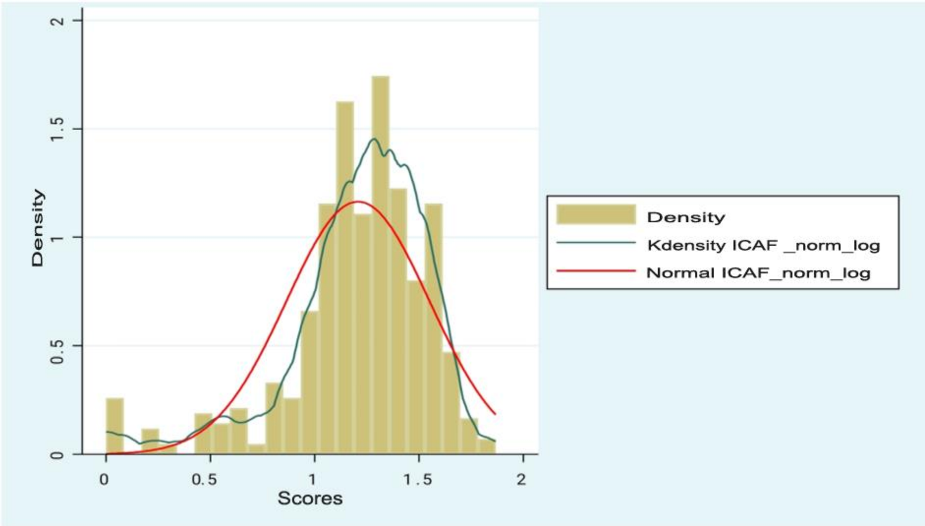

Figure 2. Distribution of WECI scores.

A review of Figure 2 reveals that the estimated scores were logarithmically transformed using the formula ln[(score-min) +1] where min is the lowest score to obtain a score distribution closer to normality and ensure that the final work quality index assumes only positive values.

In this way, a mean WECI of 1.21 was obtained with values ranging from 0 to 1.87. Higher WECI values indicate greater autonomy for women.

3.4. Empirical Model

The econometric analysis in this article is carried out using a linear regression model whose form is described by Equation 3.

$$ICAF_i = \beta_0 + X_i\delta + \varepsilon_i \qquad (3)$$

In this equation, WECI is the dependent variable giving information on the composite female empowerment index associated with each individual i with $i = 1, 2, \dots, n$. $X$is the vector of independent variables (characteristics of individuals in the sample and characteristics of rural finance) providing information on the potential determinants of women's empowerment, and ε is the error term, a normally distributed random variable controlling for other variables influencing WECI that are either unobservable or not taken into account in the regression.

Individual characteristics include age, marital status and level of education. Other characteristics concern employment and labor income. The variable of interest is access to rural finance. It takes the value 1 when the woman has access to finance and 0 otherwise. This variable of interest also differentiates access to rural finance between formal and informal rural finance.

3.5. Analysis Method

The methodological approach adopted in this study is based initially on econometric analysis using Ordinary Least Squares (OLS). This selection stems from the continuous nature of the dependent variable. However, aware of the limitations of OLS in the context of a composite dependent variable, we seek to strengthen the robustness of the results. In contrast to previous studies that have used OLS exclusively, our approach takes an innovative approach to test the robustness of the conclusions obtained.

Previous studies by Papke and Wooldridge (1996) and Semykina and Wooldridge (2010) point out that OLS can produce less reliable results when estimating models with composite dependent variables. To address this challenge, we extend our methodology by incorporating quasi-likelihood-based estimation techniques. The literature offers various options including the use of Tobit models by Crespo, Simões, and Pinto (2017) or techniques based on Generalized Least Squares (GLS) also developed by Antonakis and House (2014) considered to generate more robust results.

In the specific framework of our analysis where the dependent variable is influenced by composite indices, we consider the specificities of individuals from surveyed households in the form of clusters. In response to this, some works suggest controlling for fixed effects at the household level. This approach aims to obtain consistent estimators taking into account potential endogeneity bias and to ensure appropriate standard deviations for statistical inference (Antonakis & House, 2014; Cameron, 2011).

Thus, in our analysis, we adopt a two-stage approach. We begin by using OLS to identify the determinants of women's empowerment specifically isolating the role of rural finance. These preliminary results are then complemented by an analysis using the Generalized Least Squares (GLS) method enabling a more in-depth and nuanced assessment of the underlying relationships. This differentiated approach is intended to guarantee the reliability and robustness of the results obtained in the specific context of our study.

4. RESULTS AND DISCUSSION

4.1. Descriptive Analysis

Figure 3 shows that the average WECI in Kongo Central is 1.19. There is a great disparity between territories with WECI ranging from 1.05 to 1.3. The territories of Lukula and Sekebanza have the highest WECI scores indicating a higher than average level of financial empowerment for women. The territories of Moanda, Songololo, Mbanza-Ngungu and Tshela have the lowest WECI scores indicating a lower than average level of women's financial empowerment. Lukula and Sekebanza stand out with WECI scores significantly above average. This could be explained by factors such as access to women-friendly financial services, greater economic opportunities and local initiatives promoting women's financial empowerment. A level of financial empowerment for women comparable to the Kongo Central average is indicated by Madimba, Luozi, and Moyenne WECI values that are approximately average. Moanda, Songololo, Mbanza-Ngungu and Tshela have below average WECI scores. It is important to identify the factors contributing to this low level of financial empowerment in these territories in order to implement targeted interventions.

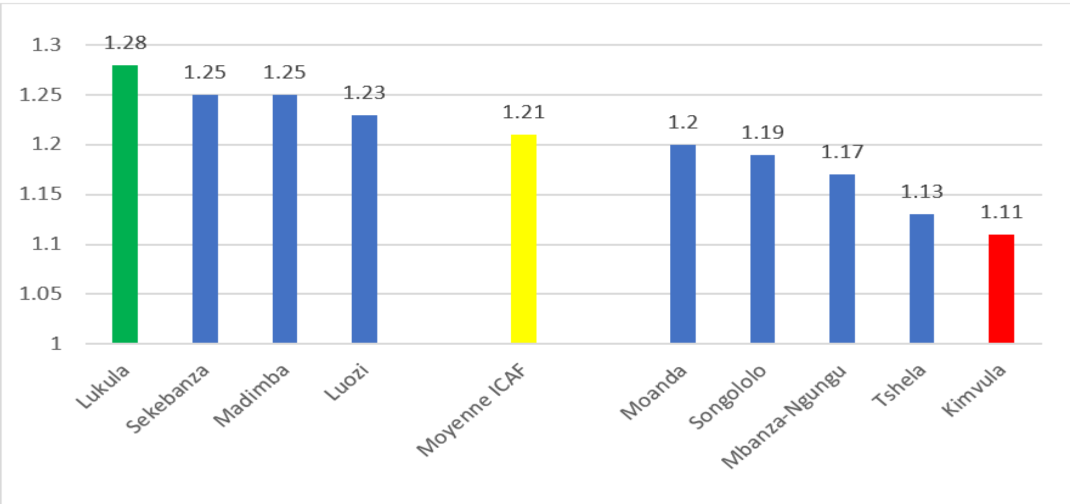

Figure 3. WECI in the territories of Central Kongo.

The results of describing the WECI according to certain characteristics of the women in the sample are presented in Figure 3. This illustration of the WECI by territory shown in this graph reveals that the degree of women's empowerment remains worrying in many of the territories examined. Indeed, in less than 50% of the territories, there are women with a relatively high level of empowerment. In particular, Lukula stands out as the territory where this index is the highest. Of the nine territories studied, only four have WECI above the provincial average. Moreover, Lukula, Sekebanza, Madimba and Luozi are all above this average. Conversely, in 55% of territories, the WECI is below the observed average. The territory of Kimvula in particular stands out as having the lowest level of empowerment.

In a nutshell, this graph highlights the need to reduce disparities between territories in terms of women's financial empowerment. Efforts must be made to improve access to financial services adapted to women particularly in territories where WECI is low. It is important to promote financial inclusion and financial education for women to enable them to better manage their finances and make more informed economic decisions. Local initiatives promoting women's entrepreneurship and access to markets can also contribute to women's financial empowerment.

Marked disparities in women's degree of empowerment emerge by exploring other characteristics. Bartlett's test for equality of variance indicates that differences in empowerment levels vary in a statistically significant way according to the different characteristics considered among household heads in Table 3.

Table 3. Description of WECI by individual and activity characteristics.

Features	Degree of empowerment	T-statistics
Education level	-	49.869***
No level	1.175 (0.435)	-
Primary	1.191 (0.229)	-
Secondary	1.219 (0.229)	-
University	1.220 (0.329)	-
Marital status	-	111.226***
In couple	1.062 (0.568)	-
Only	1.238 (0.263)	-
Age group	-	9.537***
Between 19 and 40	1.166 (0.362)	-
Between 41 and 60	1.284 (0.296)	-
Over 60	1.271 (0.289)	-
Type of activity	-	3.424*
Non-agricultural	1.226 (0.308)	-
Agricultural	1.201 (0.354)	-
Income from business activity	-	21.546***
Less than FC 80,000	1.196 (0.357)	-
80,000 and 170,000 FC	1.204 (0.365)	-
170,001 and 340,000 FC	1.295 (0.192)	-
340,001 FC and more	1.239 (0.245)	-

Note: *** $p<0.01$ and *$p<0.1$. Figures in brackets are variances.

The results in Table 3 show that there is a significant correlation between level of education and women's degree of empowerment. Women with secondary or university education had higher WECI scores than those with no education or primary education. This finding underlines the importance of education in empowering women. Marital status also has a significant impact on women's empowerment. Women living alone have a significantly higher level of empowerment than those in couples. This disparity highlights the influence of marital status on women's financial empowerment. An inverted U-shaped relationship is observed with age. Women between the ages of 19 and 40 have a lower than average level of empowerment while those over 40 have higher than average empowerment scores. This dynamic highlights generational variation in women's empowerment levels.

Women working in the agricultural sector have a slightly lower level of empowerment than those in the non-agricultural sector. This could be attributed to the predominant power and decision-making dynamics in the agricultural context where women are often subordinate to their spouses.

There is a significant correlation between income level and degree of empowerment. Women with higher incomes have higher WECI scores. This underlines the crucial importance of income in empowering women particularly in the context of the agricultural sector where women may be more dependent on decisions made by their spouses due to their generally lower incomes.

These results indicate that factors such as education, marital status, age, type of activity and income have significant implications for women's level of empowerment through rural finance in Central Kongo.

4.2. Regression Results

The analyses performed using Ordinary Least Squares (OLS) estimates are presented in Table 4.

Table 4. Determinants of women's empowerment.

Variables	Model 1 Rural finance	Model 2 Informal finance	Model 3 Formal finance
Individual features			
41-60 years	0.129*** (0.035)	0.142*** (0.034)	0.142*** (0.034)
Over 60 years	-0.025 (0.045)	-0.043 (0.050)	-0.043 (0.050)
In couple	-0.027** (0.013)	-0.010 (0.058)	-0.010 (0.058)
Education level			
Primary	-0.007 (0.036)	-0.003 (0.038)	-0.003 (0.038)
Secondary	0.073** (0.036)	0.045* (0.025)	0.045* (0.025)
Superior	0.065** (0.034)	0.035 (0.091)	0.035 (0.091)
Employment and income			
Agricultural employment	-0.034** (0.014)	-0.028*** (0.011)	-0.028*** (0.011)
80,000 and 170,000 FC	0.003 (0.033)	0.038* (0.020)	0.038* (0.020)
170,001 and 340,000 FC	0.048** (0.018)	0.016 (0.062)	0.016 (0.062)
340.001 FC and more	0.020** (0.010)	0.025 (0.048)	0.025 (0.048)
Access to finance			
Rural finance	0.065** (0.032)	0.078** (0.033)	0.022 (0.053)
Constant	1.318*** (0.061)	1.306*** (0.066)	1.306*** (0.066)
R2	0.166	0.179	0.179
Prob > F	0.000	0.000	0.000

Note: *** p<0.01; **p<0.05; *p<0.1. Standard deviations in brackets

The results presented in Table 4 demonstrate that only the informal finance variable is significant while access to formal finance has no significant effect on women's empowerment in the Central Kongo region. In the context of rural finance, this result is of particular importance given the low proportion of individuals and in particular women with access to formal rural finance. Model 1 (rural finance): Age between 41 and 60 shows a significant positive correlation with the degree of empowerment indicating an improvement of 12.9%. Individuals above 60 years show a non-significant and negative correlation suggesting a slight though not statistically significant decrease in the level of empowerment. Marital status "in couple" shows a significant and negative correlation suggesting a 2.7% reduction in empowerment compared to those who are single. With regard to education level, women with secondary or higher education show a significant positive correlation indicating a 7.3% and 6.5% improvement in empowerment levels respectively compared to those with primary education. Agricultural employment is associated with a significant and negative correlation showing a 3.4% decrease in empowerment compared to other types of employment. Income above 170,000 Congolese Francs (CF) showed a significant and positive correlation indicating an improvement in the level of empowerment.

Model 2 (informal finance): The results in this model are similar to model 1 with regard to individual characteristics showing similar correlations for age, marital status, educational level, agricultural employment and income from activity. However, access to informal finance has a significant positive correlation indicating a 7.8% improvement in the level of empowerment.

Model 3 (formal finance): Individual characteristics show similar correlations to the previous models. However, it is important to note that access to formal finance did not demonstrate a significant impact on women's level of empowerment in the Central Kongo region. This finding can be explained by the fact that women do not have significant access to formal financial services.

In a nutshell, model results suggest that access to rural finance particularly informal finance is associated with a significant improvement in women's level of empowerment. Factors such as age, education level, marital status, agricultural employment and income play an important role in women's empowerment. Formal finance showed no significant effect perhaps highlighting access barriers or specific dynamics linked to this type of financing in the region.

4.3. Robustness Analysis

The results of this robustness analysis carried out using the generalized least squares method provide further insights into the influence of rural finance whether informal or formal on the degree of women's empowerment.

Table 5. Determinants of women's empowerment.

Variables	**Model 1 Rural finance**	**Model 2 Informal finance**	**Model 3 Formal finance**
Individual features			
Primary education	-0.006 (0.034)	-0.007 (0.038)	-0.023 (0.052)
Secondary education	0.029** (0.014)	0.040* (0.0213)	0.072** (0.0309)
Higher education	0.030** (0.014)	0.037** (0.018)	0.050*** (0.016)
In couple	-0.001 (0.053)	-0.034 (0.047)	-0.104 (0.084)
Access to finance			
Rural finance	0.063** (0.030)	0.075** (0.029)	0.027 (0.071)
Constant	0.265*** (0.064)	0.263*** (0.067)	0.376*** (0.103)
Comments	500	433	219
AIC	2.446	2.463	2.486
BIC	-2938.674	-2468.756	-1050.725

Note: *** p<0.01; **p<0.05; *p<0.1. Standard deviations in parentheses.
We present here only the variable of interest (access to rural finance) and a few variables. AIC: Akaike information criterion and BIC: Bayesian information criterion. Smaller values reflect model quality.
Source: Result obtained from survey data.

The results of the robustness test for the three models are presented in Table 5. They concern rural finance as a whole (model 1), informal finance (model 2) and formal finance (model 3). In fact, in model 1 (rural finance as a whole), the results show that the impact of primary education on women's empowerment through rural finance is not significant. In contrast, women with secondary education show a significant and positive effect on their empowerment suggesting that this level of education is associated with greater empowerment through rural finance. Similarly, women with higher levels of education also show a significant positive effect indicating a positive association between this level of education and women's empowerment through rural finance. With regard to marital status, the effect is not significant suggesting that marital status does not significantly influence women's empowerment through rural finance. On the other hand, with regard to access to rural finance, the variable is significant and positive indicating that access to rural finance is associated with greater empowerment of women.

Model 2 (informal finance): The effects of individual variables such as education and marital status did not change significantly compared to model 1. As for access to informal finance, the variable is not significant suggesting that it is not significantly associated with women's empowerment.

Model 3 (formal finance): The effects of individual variables remain similar to models 1 and 2. The variable is not significant suggesting that access to formal finance is not significantly associated with women's empowerment.

In a nutshell, access to rural finance is significantly associated with greater female empowerment, particularly for those with secondary or higher education. In contrast, access to informal or formal finance shows no significant association with women's empowerment in this specific context. These results underline the importance of rural finance in promoting women's empowerment in the Central Kongo region.

4.4. Discussion

Access to rural finance is a crucial element in women's empowerment in line with the findings of several previous studies (Bentaleb, 2023; Sahu et al., 2024). Indeed, according to Bentaleb (2023) access to finance, particularly informal finance enables women to acquire resources and develop economic activities, thus contributing to their financial independence and decision-making.

However, access to rural finance alone is not enough to guarantee real empowerment for women, as Mayoux and Palier (2007) warn. Other factors such as education and marital status also play a crucial role.

The study shows that women with a secondary or higher level of education and those who are not in a couple have a higher level of empowerment. This confirms the work of Hakim (2001) and Kabeer (2001) who define women's empowerment as a multidimensional process involving the transformation of social structures and individual freedom of choice. Education and marital status influence women's ability to participate in economic and social life and to make decisions about their own lives.

The lack of any significant effect of formal finance on women's empowerment is an important point to highlight. This observation contrasts with the findings of some studies by Garcia et al. (2020) and Shah et al. (2021) that have highlighted the effectiveness of formal microfinance programs. Further research is needed to better understand this situation and identify the contextual factors specific to Kongo Central.

5. CONCLUSION

This study reveals significant evidence of the influence of various factors on the degree of women's empowerment. Access to rural finance emerges as an essential catalyst demonstrating a positive correlation with women's empowerment. At the same time, women's level of education emerges as another determining factor. Women with secondary or higher education also show higher levels of empowerment underlining the importance of educational programs in fostering women's financial autonomy. However, access to informal or formal finance does not appear to have a significant impact in this context. This nuance underlines the importance of designing financial policies adapted to local realities to maximize their effectiveness.

The results underline the importance of investing in targeted rural finance initiatives combined with educational efforts aimed at increasing women's educational levels as powerful levers for creating a significant impact on the lives of rural women in the region. Public policies should encourage the development of financial services tailored to the specific needs of rural women as an effective strategy for their financial empowerment. Promoting access to secondary education, supporting women-led income-generating activities, raising awareness of gender and the weight of tradition on women's discrimination and facilitating access to formal rural finance are all essential.

As policy implications reinforce this empowerment process, decision-makers need to recognize the importance of secondary education and design programs to promote women's empowerment and access to informal and formal rural finance. Specific policies and collaborative programs with local communities are needed.

Despite these conclusions, it is essential to recognize the study's limitations. The results are specific to the Central Kongo context and cannot be directly generalized to other regions. Further research in different geographical areas would deepen the understanding of contextual variations to gain a more holistic perspective. In addition, exploring specific cultural influences that might moderate the impact of rural finance on women's empowerment represents an interesting avenue for further study. Finally, longitudinal studies could track the evolution of women's empowerment over time, offering a more dynamic perspective on the effect of financial interventions.

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