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Determinants of access to rural financing in the democratic republic of Congo: The case of Kongo central

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ABSTRACT

This article aims to identify the determinants influencing access to rural finance, focusing on a sample of 500 family farms in Kongo Central. This study revealed that membership in a financial solidarity group and awareness of the existence of a local development committee significantly influences access to credit using Probit and Logit regression methods. This study highlights the importance of supply and demand factors in accessing rural finance. Key demand-related determinants include gender, marital status, sector of activity, household size and high levels of education. This research suggests strengthening policies aimed at increasing financial education and women's empowerment to improve access to financing. These measures could enable more individuals especially women to effectively access and use financial services. By addressing these determinants can help policymakers better design interventions to support rural development in this province. The results underscore the need for a holistic approach considering both supply and demand factors to improve financial inclusion for rural populations.

Contribution/ Originality: The originality of this article lies in its focus on Central Kongo in the DRC which has been little studied in rural finance. An innovative methodology combining Probit and Logit models to test the robustness of the results was used distinguishing itself from previous research.

1. INTRODUCTION

There is no doubt that access to rural finance[1] can be a powerful tool for developing the rural economy where the majority of the population lives in sub-Saharan Africa (Djibo & Malam, 2024). A study led by the African Development Bank (BAD, 2000) shows that in Africa, poverty affects 72% of households in rural areas and 59% in urban areas. In the Democratic Republic of Congo (DRC), there are 65 million Congolese of whom 65% are unemployed young people living in rural areas (Kibala, 2020). The potential growth potential is enormous but unfortunately, the rural population faces a major challenge in accessing financial products from the conventional banking system whose conditions are highly restrictive. Indeed, in the DRC, several people have no savings accounts, do not take out loans with formal financial institutions and have no insurance policies. They rarely make payments

[1] Rural finance refers to the provision of financial services in rural areas.

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through financial institutions. As a result, there are significant financing needs that are still not covered by the traditional banking system or by decentralized financial systems (DFS) particularly in the fields of agriculture and local development. In the case of Kongo Central, for example, statistical data analysis shows that access to financial resources is the main constraint to the development and growth of income-generating activities particularly in rural areas. A large proportion of the population (74%) living in rural areas unfortunately do not have access to the financial resources needed to create or develop income-generating activities despite their entrepreneurial spirit (UNDP, 2018).

Yet the international community and development stakeholders are striving to achieve the Sustainable Development Goals (SDGs)[2] which provide a global framework to address various development issues, including financial inclusion and rural poverty reduction by 2030 in line with the United Nations 2030 agenda (United Nations, 2023).

A well-established factor to accomplish the Sustainable Development Goals is microfinance's ability to reduce poverty especially in sub-Saharan Africa (Tshiebue, 2023). Indeed, microfinance has experienced remarkable growth in sub-Saharan Africa due to the high number of small-scale economic activities in the informal sector over the last twenty years. In the case of the DRC, Nkenda, Mba, Merceron, and Torelli (2007) show that nearly 60% of tertiary sector activities take place in the informal sector in the DRC. Microenterprises turn to the decentralized financial system as they do not have access to the traditional banking system for various reasons (information asymmetry, branch problems, etc.) to finance their activities. In this sense, microfinance has proved to be an effective mechanism for reducing poverty and promoting social inclusion. In fact, microfinance was a response to the lack of access to financial services for thousands of people excluded from the formal financial system (Helms, 2006). On the other hand, although microfinance has been recognised for its ability to alleviate poverty, there have been worries regarding its real-world impact. The high interest rates charged by some microfinance institutions can lead to excessive indebtedness, posing a challenge to borrowers' financial stability (Karlan & Morduch, 2010). Moreover, microfinance does not solve the underlying problems of poverty such as limited access to basic services like education and healthcare (Duflo, 2012). In any case, access to credit for poor rural entrepreneurs is an obstacle course. Indeed, a rural farmer finds it extremely difficult to obtain official financing for his farming or non-farming businesses as is the case in the DRC's Kongo Central. This study investigates the variables influencing access and focuses on this concern.

The aim of this study is to analyze the determinants of access to rural finance whether formal or informal in the case of Kongo Central. This article is structured into three main sections. The first section reviews the literature on the factors influencing access to credit in rural areas. Next, the methodological approach and analytical data are presented in the second section. The results obtained and their interpretations are developed in the third section followed by the conclusion and future prospects.

It makes sense to examine the several widely used credit sources before delving into the factors that influence credit availability. According to Linh et al. (2020) there are three primary sources of credit that may be identified through their mapping of credit sources. Formal credit is generally provided by commercial banks and certain credit funds. Semi-formal credit comes from microfinance institutions, non-governmental organizations (NGOs), government-supported loan programs targeting specific segments of the population and other non-governmental projects. Informal credit comes from relatives, individual lenders and associations.

Exploring the determinants of access to decentralized financial services is an approach aimed at taking stock of the current state of the available literature. Four distinct currents have emerged concerning the determinants of access to credit. Individual and social variables constitute the first stream of these determinants. Individual factors include aspects such as the age of the household head, average household size and occupation while social factors include elements such as marriage, birth, illness and bereavement. The second stream with researchers such as Foltz

[2] https://www.un.org/sustainabledevelopment/fr/objectifs-de-developpement-durable/.

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(2004); Linh, Long, Chi, Tam, and Lebailly (2019) and Ololade and Olagunju (2013) have grouped the determinants of access to credit according to socio-economic characteristics, including marital status, gender, collateral offered, marital status and interest rate. The third trend led by Linh et al. (2020) classifies determinants in terms of observable and unobservable factors. Observable factors are household socio-economic characteristics and elements influencing lenders' decisions while unobservable factors include social capital and networks interacting with the two aforementioned actors. Finally, a last trend established by Lassana and Thione (2020) groups these factors into three categories: the financial environment, the lending conditions imposed by lending institutions and the social and economic characteristics of borrowers.

However, we present an innovative approach by classifying the determinants according to the supply and demand of decentralized financial services. This model is divided into two main groups: first, the supply of decentralized financial services encompasses the financial environment and lending conditions imposed by lending institutions. Secondly, the demand for decentralized financial services encompassing the social and economic characteristics of borrowers. In the first group which depends on the supply of financial services, two classifications of "demand" and "supply" have been defined. The shortcomings in the market as well as the kind of financial institution and its policies are revealed by Lassana and Thione (2020). These factors contribute significantly to the non-participation of many potential borrowers in the credit market including interest rates, monopoly power, high transaction costs, adverse incentive and selection effects as well as discrimination against vulnerable farms. The second group dependent on the demand for financial services focuses on the social and economic characteristics of borrowers. These determinants include farm yield, age, level of farm income, sources of income, farm assets, farm size, gender, level of education, distance from potential sources of credit, history of relationship with the institution, group membership and collateral.

In terms of scope, studies are mainly focused on many developing countries (Cheng, 2007; Kodjo, Abiassi, & Allagbé, 2003; Nanéma, Nassè, & Ouédraogo, 2021; Soro, 2019) and developed countries (Barry, 2013; Roblain, 2015) with a particular focus on the agricultural sector in developing countries.

In the specific case of Kongo Central Province, the data clearly show that informal financing accounts for 56.2%, formal financing for 13.4% and self-financing by rural farmers for 30.4% as illustrated in Figure 1.

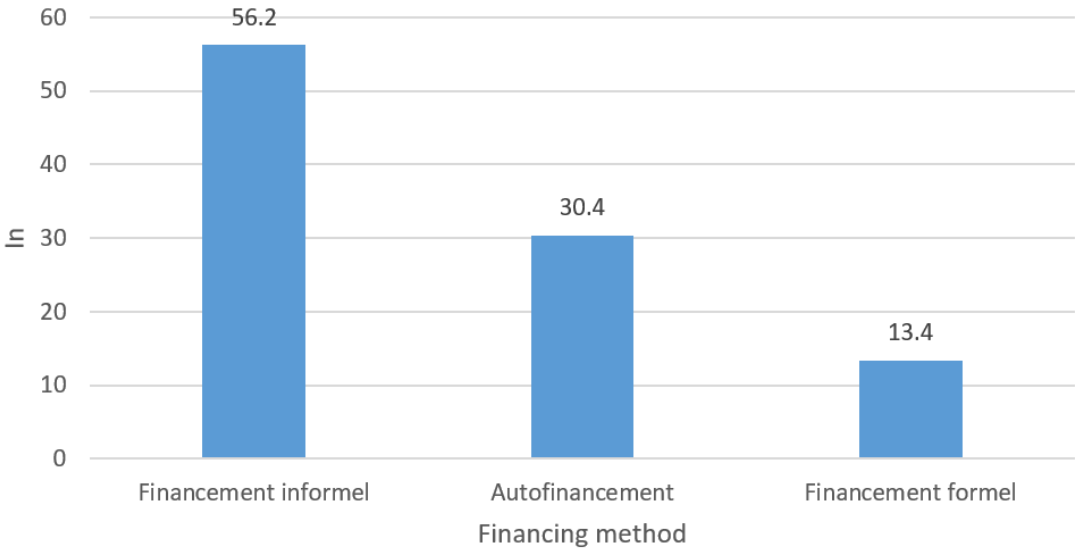

Figure 1. Financing methods used by farmers in the case of Kongo Central.
Source: Based on survey data.

The factors that determine informal financing such as "membership of a financial solidarity group or a solidarity group" are clearly crucial to rural finance in the context of the previous data. This is due to several key factors: it facilitates access to informal credit, it reduces risk and it builds trust through proximity, flexibility, adaptability, learning and knowledge-sharing.

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Three primary streams may be identified from a methodological perspective when analyzing the factors that impact access to decentralized financing systems (DFS). The first examines the possibility that rural and household people in the country will have access to DFS (Awunyo, 2012; Cheng, 2007; Heino, 2006). The second seeks to estimate the probability of repayment of a microcredit as a function of different variables or characteristics (Bentaleb, 2023; Derban, Binner, & Mullineux, 2005; Njoku & Odii, 2019; Sharma & Zeller, 1997; Vandi, Mshelia, Michael, & Kwaji, 2022). Finally, a rarer and more recent literature seeks to estimate the probability or propensity to borrow or more precisely to take out a microcredit in the future (hence the term "potential demand") or publications that come close. In this respect, Mrani and Adil (2023) have used multivariate conditional probability models (probit) to estimate the determinants of access to formal and informal credit or the determinants of dissaving. Similarly, Vizhñay and Aurora (2019) estimated a Logit model based on household surveys in Bolivia.

2. FIELD, MATERIALS AND METHODS

This study focuses on the province of Kongo Central in the west of the DRC considering 9 of the 10 territories of the three districts that make up the province: Bas-Fleuve, Cataractes and Lukaya. With a surface area of 53,947 km², i.e. 2.3% of the DRC's total surface area and a population density of 103 inhabitants/km², its main activities are agriculture and commerce. It is worth noting that there are no in-depth studies of the demand for rural finance in the case of Kongo Central, most of which focus mainly on measuring access to financial services by DRC's SFDs. This scarcity of studies can be explained by the difficulty of collecting data.

2.1. Study Variables

The data collected with the collaboration of the Kongo Central agricultural statistics service targeted households whether farmers or non-farmers, heads of household or spouses of heads of household, residing in rural areas. Ten inventories of farm and non-farm operators were used to identify these individuals. The snowball method was also used to identify key participants or informants where accessibility was limited. In all, 604 out of 783 individuals were identified using this method. The final survey sample is made up of 500 individuals after excluding the Kasangulu territory due to the significant reduction in agricultural activities. This selection was carried out successfully, achieving a high success rate of 96.7%. On average, this represents around 12% of the 500 farms per territory. It is important to note that the Kimvula territory is under-represented with only 4% of participants due to its isolation and particular characteristics. In a nutshell, this survey aims to fill a data gap on rural finance in the case of Kongo Central focusing on both supply and demand for financial services and highlighting needs and opportunities for the region's economic development. The socio-demographic characteristics of the respondents are described in Table 1.

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Table 1. Socio-demographic characteristics of respondents.

Variables	1. Sex		2. Age (year)			3. Civil status			4. Household size			5. Education level		
	H	F												
Frequency	180	36	- 20ans	9	1.8	Monogamous married	246	49.2	Less than 5 per	178	35.6	Illiterate	168	33.6
Percentage	320	64	20 to 40	191	38	Married polygamous	14	2.8	6 to 10 people	281	56.2	Primary	76	15.2
-	-	-	41 to 60	261	52	Single	75	15	11 to 15 people	33	6.6	Secondary	236	47.2
-	-	-	61 and over	39	7.8	Widow	37	7.4	16 pers and over	8,0	1.6	University	20	4.0
-	-	-	-	-	-	Divorced	11	2.2	-	-	-	-	-	-
-	-	-	-	-	-	Concubinage	117	23.4	-	-	-	-	-	-
Total	500	100	Total	500	100	Total	500	100	Total	500	100	Total	500	100

Note : Legend: M: Male, F: Female.
Source: Survey data.

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Table 1 shows the following:

- Gender: Men have easier access to rural finance than women. Indeed, 64% of men have access to rural finance compared with only 36% of women. This difference is probably due to several factors, including social norms, differences in education and income, and the specific obstacles women face in accessing financial services.
- Age: Older people have easier access to rural finance than younger people. In fact, 65% of people aged 41 and over have access to rural finance compared with just 35% of people under 40. This difference is probably due to the fact that older people have more experience, knowledge and resources enabling them to access financial services more easily.
- Marital status: Married people have easier access to rural finance than single, widowed or divorced people. Indeed, 74% of married people have access to rural finance compared with only 46% of single people, 33% of widows and 22% of divorcees. This difference is probably due to the fact that married people have a more stable income and greater financial needs making them more likely to be eligible for financial services.
- Household size: Larger households have easier access to rural finance than smaller ones. Indeed, 61% of households with more than 10 people have access to rural finance compared with only 44% of households with fewer than 5 people. This difference is probably due to the fact that larger households have greater financial needs making them more likely to be eligible for financial services.
- Level of education: People with higher levels of education have easier access to rural finance than those with lower levels. Indeed, 63% of people with a university education have access to rural finance compared with just 27% of illiterate people. This difference is probably due to the fact that people with higher levels of education have better literacy and numeracy skills enabling them to better understand financial products and services.

These results are important for understanding the barriers to access to rural finance in the Democratic Republic of Congo. Financial institutions can improve access to financial services for rural populations by targeting these obstacles.

The determinants of rural finance have been classified into two distinct categories: supply-side determinants and demand-side determinants.

From the supply side, we considered variables such as affiliation with a financial solidarity group (FSG), knowledge of a solidarity group (KSG), and participation in a local development committee (LDC). These variables play a crucial role in facilitating access to credit particularly in the informal sector. With regard to demand, the variables retained concern the gender of the head of household, his or her level of education, age and marital status. These variables constitute the characteristics of the head of household. In addition to this group of variables, the study also retained household characteristics, notably household size, the number of active individuals in the household, and the household's overall income. In addition to these variables, the household head's sector of activity and income from the main activity were also taken into account.

Mpanzu, Lebailly, and Kinkela (2011) stated that the study examines both "formal" and "informal" forms of financing. The formal mode of financing alone meets only a very small proportion of rural financing needs in the case of Kongo Central (13.4%) and the aggregation of these two modes of financing represents 69.6% of rural finance in Kongo Central.

Indeed, the characteristics of demand for access to rural finance presented in Table 2 reveal several interesting trends:

1. Women have a slightly higher rate of access to rural finance than men although this difference is not statistically significant. This suggests that opportunities for access to rural finance are relatively balanced between the sexes.
2. Household heads with a university education have better access to rural finance than those with no university education. This difference is statistically significant indicating that education plays an important role in access to rural finance.

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3. Age is a key determinant of access to rural finance. Younger heads of households (aged between 19 and 40) have a significantly higher access rate than older individuals. This may be due to the fact that younger people are often more productive and physically capable of generating income.
4. Household size influences access to rural finance. Households of different sizes have varying rates of access, although the number of active individuals in the household has no significant impact.

The sector of activity of household heads has a marked impact on access to rural finance. Civil servants have the highest access rate, closely followed by heads of households in the agricultural sector. This difference suggests that the type of employment or activity may influence access to rural finance. In a nutshell, this analysis highlights the importance of factors such as education, age, household size and sector of activity in determining access to rural finance. These results can guide policies aimed at improving access to rural finance by taking these different factors into account to meet the needs of the rural population.

Table 2. Profile of access to rural finance by demand characteristics.

		Set		Formal finance		Informal finance	
Variables	**Share**	**Access rate**	**F-stat**	**Access rate**	**F-stat**	**Access rate**	**F-stat**
CM features							
Type	-	-	2.27		0.24		3.63**
Men	85.20	68.31 (0.466)	-	0.311 (0.464)	-	0.630(0.483)	-
Woman	14.80	77.03 (0.424)	-	0.261 (0.449)	-	0.750 (0.436)	-
Education	-	-	3.18**		5.63***		2.66***
No level	33.60	72.62 (0.447)	-	0.3134 (0.467)	-	0.6871 (0.465)	-
Primary	15.20	71.05 (0.457)	-	0.2143 (0.418)	-	0.686 (.468)	-
Secondary	47.20	64.83 (0.479)	-	0.2783 (0.450)	-	0.5931 (0.492)	-
Superior or university	4.00	95.00 (0.224)	-	0.8888 (0.333)	-	0.917 (0.289)	-
Age group			4.49***		0.72		1.43
Between 19 and 40	24.40	0.7131 (0.454)	-	0.2857 (0.456)	-	0.6759 (0.470)	-
Between 41 and 60	63.60	0.7075 (0.456)	-	0.3309 (0.472)	-	0.6581 (0.475)	-
Over 60	12.00	0.600 (0.494)	-	0.2258 (0.425)	-	0.5471 (0.503)	-
Marital status	-	-	15.23***		0.82		0.03
Single	17.40	0.6782 (0.470)	-	0.2432 (0.435)	-	0.6410 (0.483)	-
In couple	82.60	0.6998 (0.459)	-	0.319 (0.467)	-	0.641 (0.651)	-
Household characteristics							
Household size	-	-	3.60**	-	0.36	-	4.29**
Less than 5 individuals	35.60	0.7191 (0.451)	-	0.3243 (0.471)	-	0.6753 (0.470)	-
Between 5 and 10 individuals	56.20	0.658 (0.475)	-	0.289 (0.455)	-	0.603 (0.490)	-
More than 10 individuals	8.20	0.854 (0.358)	-	0.400 (0.516)	-	0.838 (0.374)	-
People in employment	-	-	0.54	-	1.19	-	0.86
Less than 2 individuals	39.80	0.678 (0.468)	-	0.354 (0.481)	-	0.610 (0.489)	-
Between 2 and 4 individuals	33.00	0.733 (0.444)	-	0.313 (0.467)	-	0.697 (0.461)	-

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Variables	Share	Set		Formal finance		Informal finance	
		Access rate	F-stat	Access rate	F-stat	Access rate	F-stat
Between 5 and 6 individuals	15.40	0.675 (0.471)	-	0.242 (0.435)	-	0.638 (0.484)	-
More than 7 individuals	11.80	0.678 (0.4713)	-	0.1740 (0.388)	-	0.655 (.480)	-
Household income	-	-	1.44	-	-		2.49**
10,000 and 50,000 FC	44.60	0.709 (0.456)	-	0.288 (0.454)	-	0.6701 (0.471)	-
51,000 and 100,000 FC	27.20	0.669 (0.472)	-	0.224 (0.421)	-	0.634 (0.484)	-
101,000 and 200,000 FC	17.40	0.644 (0.482)	-	0.404 (0.496)	-	0.530 (0.503)	-
More than 200,000 FC	10.80	0.796 (0.407)	-	0.389 (0.502)	-	0.766 (0.428)	-
Sector of activity and employment income	-	-	-	-	-	-	-
Sector of activity	-	-	4.70***	-	5.97***	-	2.19**
Agricultural	75.00	0.709(0.455)	-	0.248 (0.434)	-	0.679 (0.468)	-
Trade	13.00	0.677 (0.4713)	-	0.432 (0.5022)	-	0.571 (.500)	-
Civil servant	2.60	0.846 (0.376)	-	0.800 (0.422)	-	0.600 (0.548)	-
Other	9.40	0.575 (0.491)	-	0.259 (0.447)	-	0.500 (0.506)	-
Income from business activity	-	-	-		4.49***	-	1.44
Less than Fc 80,000	50.00	0.688 (0.464)	-	0.204 (0.405)	-	0.661 (0.474)	-
80,000 and 170,000 FC	33.40	0.707 (0.457)	-	0.319 (0.470)	-	0.660 (0.476)	-
170,001 and 340,000 FC	13.20	0.824 (0.393)	-	0.571(0.535)	-	0.769 (0.439)	-
340,001 Fc and more	3.40	0.667 (0.475)	-	0.476 (0.506)	-	0.521 (0.505)	-

Note: Values are expressed as percentages. Figures in brackets are variances. *** p<0.01; **p<0.05.
Source: Based on survey.

The characteristics of access to rural finance show the following interesting trends in Table 3:

1. Individuals who are members of a Financial Solidarity Group (GSF) have a high rate of access to rural finance. The difference is statistically significant indicating that membership in a FSG is an important factor in facilitating access to rural finance.
2. Similarly, individuals who recognize the existence of a local development committee (LDC) have a higher rate of access to rural finance. This finding suggests that the presence of a LDC can play a key role in improving access to financial services in rural areas.

These results highlight the importance of financial solidarity networks such as financial solidarity groups as well as the existence of community development structures to promote access to rural finance. These factors can help strengthen the capacity of rural populations to benefit from financial services which is essential for economic development in these regions.

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Table 3. Profile of access to rural finance by supply characteristics.

Variables		Set		Formal finance		Informal finance	
	Share	Access rate	F-stat	Access rate	F-stat	Access rate	F-stat
GSF membership	-	-	9.10***		55.78***		1.60
Member	40.20	0.771 (0.421)	-	0. 535 (0.501)	-	0.689 (0.464)	-
Non member	59.80	0.646 (0.479)	-	0.117 (0.3224)	-	0.628 (0.484)	-
CARG knowledge	-	-	0.87		9.68***		0.01
Yes	7.60	0.763 (0.431)	-	0.591 (0.503)	-	0.640 (0.490)	-
No	92.40	0.691(0.463)	-	0.274 (0.447)	-	0.650 (0.478)	-
Knowledge of CLD	-	-	11.78***		44.58***		4.44**
Yes	13.00	0.877 (0.331)	-	0.758 (0.435)	-	0.800 (0.405)	-
No	87.00	0.669 (0.331)	-	0.226 (0.419)	-	0.634 (0.482)	-

Note: Values are expressed as percentages. Figures in brackets are variances. *** p<0.01; **p<0.05.
Source: Based on survey.

2.2. Methodological Approach

The methodology adopted makes it possible to analyze the dynamics of rural finance through the determinants of access to financing for the activities of rural people in Kongo Central. The results obtained will inform policies and other stakeholders to improve access to rural finance and strengthen economic development in Kongo Central.

We used Rohen's (2018) methods to achieve this. This approach is characterized by an initial estimation using the Logit model followed by the application of probit models to assess the robustness of the logistic results that will be obtained. Similarly, Goudjo (2023) also adopted this approach in their study of business start-ups in France. They carried out estimation using the Logit model followed by validation of the results using the Probit model. In our case, the Logit model is used to test the robustness of our results by modeling the distribution of the error term according to a logistic distribution using the probit model. In a nutshell, our methodological approach based on the work of Rohen (2018) and reflected in the study by Goudjo (2023) aims to shed light on the determinants of rural finance by judiciously combining Logit and Probit models to strengthen the validity of our conclusion using different perspectives.

The probit model estimates the probability of an individual accessing rural finance as:

$$Y_i^* = \beta' X_i + \delta Z_i + \varepsilon_i \quad (1)$$

Where X_i is a vector of the characteristics of the demand expressed by an individual. Z_i is a vector of the characteristics of the supply of financial services in rural areas. ε_i is the error term of the equation. In Equation 1, Y_i^* is a latent (unobserved) variable, its dichotomous realization noted Y_i is observed as: $Y_i = 1$ if $Y_i^* > 0$ (the individual has access to the rural financial service, notably access to credit) and 0 otherwise.

Given the normality of the error term in Equation 1, a probit-type specification is suggested as relevant for estimating the determinants of rural finance, conditional on the characteristics of the demand for and supply of financial services. The probability of an individual accessing credit in rural areas can be rewritten as:

$$P[Y_i = 1] = P[\beta' X_i + \delta Z_i + \varepsilon_i > 0] = \Phi[\beta' X_i + \delta Z_i] \quad (2)$$

Where Φ is the distribution function of the normal distribution.

In this study, individuals with access to rural finance are considered to be either in formal or informal finance. If access to one of these types of finance is influenced by unobservable characteristics that also affect the probability of accessing rural finance, then a univariate probit model alone would not provide consistent estimates. The study uses Heckman's two-stage estimation approach to control this problem. Heckman's two-stage estimation approach is used to correct for selection bias. Selection bias occurs when certain unobservable characteristics influence both the probability of accessing rural finance in general and the probability of accessing a particular type of rural finance (formal or informal). This study first estimates a selection equation to correct for this bias. The sample selection indicator for access to rural finance is defined as 1, if the individual has declared having benefited from a credit and 0

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otherwise. The identification strategy is based on the assumption that the proportion of individuals accessing rural finance only affects an individual's access to rural finance in general but does not influence the probability of the specific type of rural finance accessed. Consequently, the selection equation is estimated using the entire sample of individuals who have benefited from rural financial services (credit) and those who have never benefited. In a nutshell, this two-stage approach takes into account the selection bias potentially present in the data when studying access to rural finance. Thus, it makes it possible to obtain consistent estimates of the determinants of rural finance while controlling for the selection problem. The probability-based model of rural finance can be written as follows:

$$S = 1\left[\beta_0 + w_g\beta_g + \varepsilon_g > 0\right] \quad (3)$$

Where S is a dichotomous indicator of selection, it takes the value 1 if the individual has declared that he has benefited from a credit and the value zero otherwise.β_0 is the constant term;β_g is a vector of unknown parameters to be estimated;ε_g is the error term whilew_g is a vector of exogenous variables that explain rural finance. Assuming the error term in Equation 3 is normally distributed, Equation 2 can be rewritten as:

$$P[Y_i = 1] = P[\beta' X_i + \alpha Z_i + \varepsilon_i > 0] = \Phi\left[\beta' X_i + \alpha Z_i + \lambda_g IRM_g\right] \quad (4)$$

Whereλ_g is a vector of unbiased and consistent parameters to be estimated and IRM_g is the inverse mills ratio derived from Equation 3. In this study, the dependent variable is rural finance encompassing both formal and informal aspects. The independent variables are divided into two categories: demand characteristics (such as gender, education level, age, marital status, household size, employment, household income, sector of activity, and employment income) and supply characteristics (such as membership in a financial solidarity group as well as knowledge of the Keystone Symbiotic Group (KSG), a key entity facilitating the provision of financial services in rural areas, and the Protection Mutuelle Agricole (PMA), a mutual protection system offering insurance to farmers against agricultural risks).

According to Traoré, Bocoum, and Tamini (2020), rural finance refers to financial services such as savings, credit, insurance, and money transfers provided by various actors. In a nutshell, rural finance includes these services offered by friends, relatives, traders, merchants, pledge agreements, traditional savings and credit organizations, microfinance programs, or banks. The determining factors are detailed in Table 4.

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Table 4. Dependent variables.

Variables	Definition
Dependent variables	
Rural finance	Binary variable coded 1 if the individual has access to rural credit and 0 otherwise.
Formal rural finance	Binary variable coded 1 if the individual has access to formal rural credit and 0 otherwise.
Informal rural finance	Binary variable coded 1 if the individual has access to informal rural credit and 0 otherwise.

The dependent variables include supply (see Table 5) and demand characteristics.

Table 5. Independent variables.

Independent variables	
Application features	
Woman	Binary variable capturing gender, coded 1 if female and 0 if male.
Education	Highest level of education achieved, 0=None, 1=Primary, 2=Secondary, 3=Higher education and university.
Age	Age group 0=Between 19 and 40, 1=Between 41 and 60 and 2=Over 60.
In couple	Marital status coded 1 if living with a partner and 0 if living alone.
Household size	Number of individuals in a household, 0=Less than 5 individuals, 1= Between 5 and 10 individuals and 2=More than 10 individuals.
People in employment	Number of active individuals in a household, 0=Less than 2 individuals, 1=Between 2 and 4 individuals, 2=Between 5 and 6 individuals and 3=More than 7 individuals.

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Independent variables	
Application features	
Household income	Sum of household income, 0=10.000 and 50.000 FC, 1=51.000 and 100.000 FC, 2=101.000 and 200.000 FC and 3=More than 200.000 FC.
Sector of activity	Professional activity of head of household 1=Agricultural, 2=Trade, 3=Public servant and 0=Other activity.
Income from business activity	Income from main activity, 0=Less than 80,000 FC, 1=80,000 and 170,000 FC , 2=170,001 and 340,000 FC and 3=340,001 FC and more.
Offer features	
GSF membership	A binary variable is coded 1 if the individual is a member of a GSF and 0 if he or she is not.
CARG knowledge	Binary variable coded 1 if the individual recognizes the existence of CARG and 0 otherwise.
Knowledge of CLD	Binary variable coded 1 if the individual recognizes the existence of a CLD and 0 otherwise.

3. RESULTS AND DISCUSSION

The results are presented in a sequence that begins with an analysis of rural finance as a whole, then focuses more specifically on the determinants of formal and informal rural finance. Overall, the results largely confirm the theoretical predictions concerning the explanatory factors of access to rural finance whether we distinguish formal rural finance from informal rural finance. In addition, the ROC curves (of the model predictions show a good specification which reinforces the reliability of the results.

Firstly, it is interesting to note that gender plays a significant role in access to rural finance. Women are more likely to access credit in rural areas in the case of Kongo Central. This result is in line with what has been observed in the literature on developing countries, notably studies by Nsengiyumva (2023) and Kacem, Zahonogo, and Kimseyinga (2013). There appears to be a positive effect of gender on access to rural finance in this region.

In terms of age, the results show that people over 60 have more difficulty accessing rural finance. Specifically, being over 60 reduces the probability of obtaining credit by 14.5%. This observation is in line with that of Adaskou and Hssoune (2023) who noted a marked shift in access to credit in favor of young people (18-39). It would therefore seem that youth is a favorable factor for access to rural finance.

Marital status also has a significant impact. Couples are more likely to access rural finance than single. This finding is consistent with research conducted in African countries (Ololade & Olagunju, 2013).

With regard to education, the study highlights the importance of higher and university education for access to credit in rural areas. Indeed, having a higher education diploma increases the probability of accessing credit by 24.4%. This finding is in line with the idea that education improves the ability of individuals to make informed decisions as suggested by Dagbeto, Adekambi, Elegbe, Yabi, and Elegbe (2023).

As for household size, it is interesting to note that unlike the study by Soro and Ifecro (2023) which found a reduction in the probability of obtaining credit as household size increased, this research indicates that the larger the household size, the higher the probability of accessing rural finance. However, it is important to note that these results do not allow definitive conclusions to be drawn on the effect of active household members on the probability of accessing rural finance.

Finally, employment in the agricultural sector and in the civil service is associated with an increased probability of access to rural finance. The effect of the sector of activity variable is significant for both sectors but is more marked for civil servants with an increase of 20%, than for farmers with an increase of 18.6%.

These results provide valuable information on the factors influencing access to rural finance in the case of Kongo Central. They may be useful in guiding policies aimed at promoting financial inclusion in rural areas and addressing the specific needs of different population groups. In this analysis of the determinants of rural finance, it is essential to note that the study examined rural finance from a perspective that distinguishes between formal and informal rural

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finance. This distinction is crucial for assessing the variability of factors influencing access to finance in rural areas. Several significant findings can be made when examining the model results without considering selection.

Firstly, it is interesting to note that gender no longer has a significant effect with regard to the impact of gender on access to formal and informal rural finance. The analysis of Kacem et al. (2013) show no significant difference between men and women in access to formal and informal rural finance in the case of Kongo Central contrary to some previous studies that highlighted a significant impact of gender on the probability of access to credit. This contrasts with earlier work but it is important to note that there are similarities with a recent study carried out in Mali by Tangara et al. (2023) and Adaskou and Hssoune (2023) which also found no significant effect of gender on access to credit in rural areas. These results suggest that there may be no gender discrimination in access to formal and informal rural finance in this region.

Secondly, marital status and level of higher education prove to be important determinants of access to formal and informal rural finance. According to Nya, Ousmaila, and Bitomo (2022) being in a couple increases the probability of access to formal and informal rural finance by 27.6% while holding a higher education degree increases this probability by 66.6%. On the other hand, having a secondary education reduces the probability of access to rural finance by 18.7%. Thirdly, the household size variable also deserves particular attention. The findings show that the likelihood of receiving credit for agricultural labour decreases with household size which is consistent with the study conducted by Nya et al. (2022). This observation raises important questions about how financial institutions perceive and assess the risks associated with large households.

In a nutshell, this analysis of the determinants of formal rural finance in the case of Kongo Central region has revealed some interesting results. It shows the absence of a significant difference between men and women in access to formal rural finance suggesting the absence of gender-based discrimination. In addition, marital status, higher education level and household size were all identified as significant factors influencing access to formal rural finance. These results provide valuable information for policymakers and financial sector players seeking to promote financial inclusion in rural areas.

Table 6 study suggests that characteristics connected to formal rural financing availability and earnings from the household head's activities are particularly important when it relates to employment. These results highlight important trends that need to be considered in the context of Kongo Central.

First of all, access to formal rural finance does not appear to be favored by being a farmer despite expectations. On the other hand, employment in the civil service is associated with a significant increase in the probability of access to formal rural finance. This observation may be explained by the stability of employment in the public sector which can reinforce borrowers' creditworthiness.

In addition, a household's total income, i.e. the sum of all incomes combined to form the household budget relatively increases the probability of access to formal finance. Individuals whose total income exceeds 100,000 CF have a high propensity to access formal finance. This correlation suggests that financial capacity to repay loans is a key factor in obtaining financing. This is in line with existing literature notably the work of Honohan (2005) and Mbaye (2023).

Results show that participation in Financial Solidarity Groups (FSGs) positively impacts access to formal rural financing. Membership in FSG increases the probability of accessing formal rural finance by 53%. These results confirm the findings of previous studies carried out in Togo, notably those by Abalo (2007) as well as more recent research by Goudjo (2023) and Tangara et al. (2023) which have shown that membership in a financial solidarity association is a determining factor in accessing credit. In addition, this result also highlights the importance of the presence of a Local Development Fund (LDF) in improving access to formal rural finance in the case of Kongo Central. LDFs play a crucial role in facilitating people's access to rural finance.

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Table 6. Probit estimation of rural finance determinants in the case of Kongo Central.

Variables	Set	Formal finance		Informal finance	
	(1)	(2)	(3)	(4)	(5)
Hoh features (Head of household)					
Woman	0.137**	0.818**	0.301	0.381**	0.218***
	(0.065)	(0.337)	(0.216)	(0.182)	(0.066)
Between 41 and 60 years old	0.001	-0.0926	-0.065	-0.007	0.003
	(0.055)	(0.125)	(0.115)	(0.066)	(0.064)
Over 60 years old	-0.145*	-0.415**	-0.314***	-0.510	-0.169*
	(0.079)	(0.176)	(0.0605)	(0.466)	(0.102)
In couple	0.154*	0.410**	0.276***	0.549	0.226**
	(0.086)	(0.200)	(0.062)	(0.44)	(0.10)
Primary education	-0.018	-0.206	-0.120	-0.091	0.001
	(0.068)	(0.126)	(0.0968)	(0.171)	(0.077)
Secondary education	-0.085*	-0.482	-0.187*	-0.275	-0.090
	(0.051)	(0.455)	(0.101)	(0.294)	(0.059)
University education	0.244***	0.857***	0.660***	0.192	0.344***
	(0.055)	(0.083)	(0.237)	(0.137)	(0.053)
Household characteristics					
Between 5 and 10 individuals in the household	-0.025	-0.393	-0.117	-0.182	-0.032
	(0.052)	(0.454)	(0.010)	(0.240)	(0.062)
More than 10 individuals in the household	0.190***	0.546	-0.212***	0.372***	0.240***
	(0.061)	(1.48)	(0.072)	(0.109)	(0.067)
Between 2 and 4 active individuals in the household	0.027	0.350	0.046	0.207	0.061
	(0.052)	(0.523)	(0.103)	(0.226)	(0.062)
Between 5 and 6 active individuals in the household	-0.047	0.369	0.242	0.022	-0.039
	(0.074)	(0.274)	(0.177)	(0.128)	(0.089)
More than 7 active individuals in the household	-0.203**	-0.211	-0.107	0.313	0.194*
	(0.098)	(0.139)	(0.138)	(0.217)	(0.115)
Activity and income					
Agricultural sector	0.186**	0.301	-0.166	0.606	0.324***
	(0.084)	(0.578)	(0.154)	(0.380)	(0.102)
Trade	0.054	0.212	-0.109	0.214	0.0752
	(0.085)	(0.656)	(0.122)	(0.198)	(0.104)
Civil servant	0.200**	0.854***	0.704***	0.0320	0.311***
	(0.083)	(0.075)	(0.201)	(0.293)	(0.098)
51,000 - 100,000 FC (Household income)	-0.067	-0.068	0.077	-0.174	-0.085
	(0.055)	(0.234)	(0.117)	(0.158)	(0.063)
101,000 - 200,000 FC (Household income)	-0.082	-0.098	0.297**	-0.405	-0.168*
	(0.069)	(0.510)	(0.148)	(0.365)	(0.088)
More than 200,000 FC (Household income)	0.082	0.818***	0.473**	0.339**	0.193***
	(0.073)	(0.220)	(0.192)	(0.209)	(0.089)
80,000 - 170,000 FC (Business income)	-	-0.110	-0.108	0.0553	0.0569
		(0.090)	(0.091)	(0.057)	(0.057)
170,001 - 340,000 FC (Business income)	-	0.039	0.045	0.202**	0.199**
		(0.276)	(0.281)	(0.091)	(0.091)
340,001 Fc and over (Income from activity)	-	0.014	0.013	-0.107	-0.109
		(0.126)	(0.127)	(0.101)	(0.101)
FSG member (Financial solidarity group)	-	0.516***	0.532***	-0.015	-0.001
		(0.088)	(0.083)	(0.060)	(0.059)
CARG knowledge	-	0.036	0.019	-0.199	-0.202
		(0.163)	(0.155)	(0.178)	(0.177)
CLD knowledge	-	0.759***	0.755***	0.315***	0.310***
		(0.106)	(0.106)	(0.049)	(0.045)
Constant	0.122	2.363	-2.350***	1.647	-0.634
	(0.377)	(7.665)	(0.812)	(3.646)	(0.437)
Comments	500	219	219	433	433
Mills ratio	-	-1.758	-	-1.031	
		(2.84)		(1.64)	-
LR chi2(26)	72.95	128.12	127.73	103.65	103.25
Prob > chi2	0.000	0.000	0.000	0.000	0.000
R2 username	0.12	0.48	0.47	0.18	0.18

Note: *** p<0.01; **p<0.05; *p<0.1. Standard deviations in brackets. LR : Likelihood ratio , ROC : Receiver Operating Characteristic , RAMC: Rural agricultural management council (CARG) Hoh : Head of household CF : Congolese francs.

Source: Results obtained from our survey.

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Table 7 capitalizes a robustness analysis that was carried out using logit models to reinforce the validity of the results.

Table 7. Logit estimation of rural finance determinants in the case of Kongo Central: Robustness analysis.

Variables	Set	Formal finance	Informal finance
CM features			
Woman	0.796* (0.419)	1.920* (1.041)	1.221*** (0.466)
Between 41 and 60 years old	0.0383 (0.278)	-0.286 (0.674)	0.0404 (0.303)
Over 60 years old	-0.672* (0.402)	-3.939*** (1.477)	-0.721* (0.437)
In couple	0.715* (0.380)	3.059*** (1.091)	0.984** (0.435)
Primary education	-0.139 (0.342)	-0.895 (0.818)	-0.0379 (0.367)
Secondary education	-0.455* (0.258)	-1.285** (0.644)	-0.422 (0.287)
University education	2.045* (1.103)	3.150* (1.817)	1.088 (1.149)
Household characteristics			
Between 5 and 10 individuals in the household	-0.131 (0.269)	-0.808 (0.583)	-0.156 (0.298)
More than 10 individuals in the household	1.331** (0.570)	-2.471 (1.867)	1.549** (0.616)
Between 2 and 4 active individuals in the household	0.109 (0.267)	0.248 (0.619)	0.294 (0.306)
Between 5 and 6 active individuals in the household	-0.264 (0.358)	1.389 (0.896)	-0.210 (0.410)
More than 7 active individuals in the household	-0.974** (0.428)	-0.574 (1.182)	-0.865* (0.498)
Activity and income			
Agricultural sector	0.892** (0.371)	-1.035 (0.837)	1.510*** (0.468)
Trade	0.322 (0.457)	-0.983 (0.975)	0.397 (0.551)
Civil servant	1.656* (0.998)	3.760* (2.028)	-0.234 (1.351)
51,000 - 100,000 CF (Household income)	-0.352 (0.265)	0.460 (0.671)	-0.411 (0.288)
101,000 - 200,000 CF (Household income)	-0.413 (0.320)	1.722** (0.769)	-0.770** (0.383)
More than 200,000 CF (Household income)	0.456 (0.436)	2.385** (0.985)	0.469 (0.503)
80,000 - 170,000 CF (Business income)	-	-0.544 (0.625)	0.272 (0.278)
170,001 - 340,000 CF (Business income)	-	0.212 (1.552)	1.184 (0.761)
340,001 CF and more (Income from activity)	-	0.214 (0.741)	-0.492 (0.445)
FSG member (Financial solidarity group)	-	3.202*** (0.616)	-0.120 (0.283)
CARG knowledge (Rural agricultural management council (RAMC))	-	0.124 (0.879)	-0.944 (0.755)
CLD knowledge	-	4.188*** (1.005)	2.324*** (0.721)
Constant	0.172 (0.623)	-4.540*** (1.548)	-1.115 (0.745)
Comments	500	219	433
LR chi2(26)	74.11	127.81	104.39
Prob > chi2	0.000	0.000	0.000
R2 username	0.121	0.474	0.186

Note: *** p<0.01; **p<0.05; *p<0.1. Standard deviations in brackets. We have kept only the coefficients here.
Source: Results obtained from our survey.

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The overall findings remain significantly robust reinforcing the credibility of the results previously presented. These results are essential for policymakers and financial sector players seeking to promote financial inclusion in rural areas. They highlight specific factors that can be targeted to improve rural populations' access to formal financial services.

4. CONCLUSION

The conclusion of this study provides an in-depth look at the determinants of access to rural finance in the province of Kongo Central. The main objective of this research was to analyze the factors that could contribute to improve access to rural finance whether formal or informal in a region little explored until now. This study is distinguished by its focus on both formal and informal rural finance and on the combination and separation of these two facets. Agriculture plays a fundamental role in the fight against extreme poverty and hunger in the case of Kongo Central mobilizing around 75% of the population. However, it is imperative to adopt technological innovations and ensure the availability of financing adapted to farmers' needs to increase the efficiency of this sector. This study sought to understand the determinants of access to such financing. The results revealed that in Kongo Central, the rate of access to rural finance is 69.6%, divided into 56.2% for informal finance and 13.4% for formal finance. Women have a slightly higher access rate than men. Level of education particularly at the university level is a determining factor in access to rural finance. On the other hand, access decreases with age. Econometric results confirmed these findings and highlighted the positive impact of various factors such as being in a couple with a higher level of education, belonging to the agricultural sector, being a member of a financial solidarity group and having a high household income. On the other hand, age and level of secondary education seem to have a negative impact. It is necessary to develop financial products tailored to the needs of rural populations to improve access to formal rural finance. In addition, raising awareness of the benefits of joining farmers' organizations and financial solidarity groups is crucial.

It would be desirable for several solutions to be considered to promote more equitable financial inclusion in rural areas in the context of the absence of any significant difference between men and women in terms of access to formal rural finance and the factors such as marital status, higher education and household size that influence this access. These solutions include awareness-raising and financial education, the reduction of educational barriers, the promotion and consolidation of rural microfinance on a territorial basis, measures to empower women, the development of bancarization, the monitoring and evaluation of initiatives, appropriate regulation and finally, the encouragement of partnerships between governments, the private sector (financial institutions, NGOs and development aid) and producers with a focus on value chain financing. These efforts are in line with the United Nations' Sustainable Development Goals (SDGs) notably SDG 1 (no poverty), SDG 5 (gender equality), SDG 4 (quality education), SDG 8 (decent work and economic growth) and other SDGs related to reducing inequalities and promoting partnerships for sustainable development. In a nutshell, these solutions offer a solid framework for improving access to formal rural finance, thus contributing to the achievement of the SDGs and the reduction of rural poverty. Finally, this paper suggests avenues of reflection for the establishment of value chain-based financing, the implementation of producer public-private partnerships (4Ps) and the creation of various mechanisms to improve MFI performance and reduce risk in the agricultural sector.

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