



Impact of Mobile Money on Financial Inclusion: A Comparative Analysis based on Gender and Place of Residence of Households in Cameroon

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Abstract: This article uses propensity score matching to assess the impact of mobile money on women's financial inclusion compared to men's in Cameroon. The results, based on 2021 World Bank Findex data, show that overall, regardless of place of residence, there is a reduction in financial inclusion inequalities in favor of women. Indeed, the adoption of mobile money increases women's financial inclusion by approximately 5 percentage points, from 64% to 69%, depending on the algorithm used, while it increases men's by only about 3 percentage points, from 63% to 66%. Furthermore, women who use mobile money are more financially included than male users, and more so than their counterparts who do not use it. In rural areas, however, mobile money has a greater impact on men's financial inclusion than on women's. Finally, financial inclusion via mobile money takes precedence over inclusion through bank accounts. In this regard, providers of this product would benefit from strengthening women's financial literacy and skills, particularly in rural areas, in order to reduce inequalities in access to financial services.

Keywords: Financial inclusion, mobile money, PSM.

JEL: E51, G21, G29

INTRODUCTION

Studies unanimously agree that financial inclusion plays a crucial role in economic development by increasing savings available for long-term investments, diversifying loan portfolios, and guaranteeing access to formal financial services for economic

actors in the informal sector (Chen, Ali, Lateef, Khan, & Anser, 2023; Cama, Emara, & Trabelsi, 2024; Kelikume, 2021). At the microeconomic level, studies show that financial inclusion is essential for improving the well-being of individuals and households by enabling investment in education, empowering women, encouraging entrepreneurship, and building resilience to socioeconomic shocks (Mvogo & Awounang, 2022). The development of mobile money in sub-Saharan Africa has strengthened financial inclusion capacities, particularly by reducing gender inequalities and increasing women's participation in their families' well-being.

Recent literature argues that the rapid expansion of mobile money has improved women's financial inclusion in sub-Saharan Africa (World Bank, 2021; Suri & Jack, 2016; Dorfeitner & Nguyen, 2022) by providing them with confidential financial services independent of their husbands (Showkat & Shah, 2024), enabling them to invest more in essential family activities with greater autonomy, and to transition from subsistence activities to viable income-generating activities. In this literature, mobile money is a driver of female entrepreneurship, allowing women to manage all their expenses and, consequently, reduce their vulnerability through its impact on improving their income. (Swamy, 2014) Finally, mobile money helps to increase women's participation in decision-making, both within the community and within the family.

While these studies offer a good overview of the impact of mobile money on women's lives, they highlight the lack of empirical evidence on its effect on women's financial inclusion, as women are a vulnerable group compared to men. Before the advent of mobile money, women faced enormous difficulties accessing financial services, as their financial inclusion needs were sometimes ignored. Today, thanks to mobile money, the proportion of women (68%) with access to financial services has grown faster than that of men in sub-Saharan Africa (World Bank, 2021). In Cameroon, the same trend is observed: more than 40% of women have a mobile money account, with some differences between the cities of Douala and Yaoundé (Avom *et al.*, 2021). While financial inclusion is identified as a means of achieving seven Sustainable Development Goals (SDGs), there is a lack of studies evaluating the capacity of financial inclusion, via mobile money, to reduce gender inequality (SDG 5) in sub-Saharan Africa. This study aims to fill this gap in the literature.

For several reasons, Cameroon provides an interesting case study on this topic. First, Cameroon accounts for over 71% of mobile money activity in Central

Africa. In 2022, the mobile financial services access rate was 73.13% (BEAC, 2023), a figure supported by the World Bank (2021), which reports that mobile phones have increased financial inclusion by 48.6%. Second, in Cameroon, given that, according to the National Institute of Statistics (INS), the demographic composition is dominated by women (52% compared to 48% men), improvements in financial inclusion have reduced the gap in access to financial services. There is near gender parity in access to financial services between Cameroonian women (60.4%) and men (66.2%) (INS, 2023). Therefore, given these very telling indicators, the question is: what is the impact of mobile money on this financial inclusion?

Research on the impact of mobile money on household financial inclusion by gender is very recent. Kim's study (2022). This study assesses the channels through which mobile money promotes women's financial inclusion in Nairobi. Adeleke (2024) also examines the determinants of differences in mobile money use between urban and rural women. Asante *et al.* (2024) investigated the impact of mobile money on fertilizer expenditures and found that men spend between 6.5% and 13.9% more on fertilizer than women, who spend only 4.3%. Furthermore, Sakyi-Nyarko *et al.* (2022) analyze the effects of gender differences on financial inclusion and household resilience, showing that, overall, mobile money increases men's resilience more than women's. While these studies have introduced gender into the study of financial inclusion, they remain limited because a comparative, gender-based analysis of the impact of mobile money on household financial inclusion is not explicitly presented. Our study will fill this gap in the literature.

The objective of this paper is to assess the impact of mobile money on household financial inclusion in Cameroon, while accounting for gender differences within households. Using World Bank (2021) data, propensity score matching (PSM) is applied. This quasi-experimental method estimates the treatment effect while accounting for confounding factors. PSM aims to balance two non-equivalent groups (in our case, households that have adopted mobile money and those that have not) with respect to observed characteristics in order to obtain less biased estimates of treatment effects. The remainder of the document is structured as follows: Section 2 presents a literature review. Section 3 describes the methodology and data used. The results are examined in Section 4. The conclusion summarizes and highlights the policy implications for decision-makers.

1. LITERATURE REVIEW

The rapid spread of mobile money in developing countries has become a subject of research, given its potential to increase financial inclusion and promote economic and social development. Several seminal studies have shown that mobile money reduces the exclusion of disadvantaged populations from financial services, combats poverty, and makes users more resilient to socioeconomic shocks (Koomson & Hadley, 2020; Churchill & Marisetty, 2019; Lal, 2018).

More recent impact assessment studies have highlighted the effects of mobile money on financial inclusion. Riley (2018) showed that mobile money improves risk sharing and smooths consumption during economic shocks in Tanzania, with greater benefits for women. De Mel et al (2022) and Cole et al. (2024) show that linking mobile money to savings accounts significantly improves saving behavior and entrepreneurial outcomes.

Recent gender studies indicate that mobile money helps reduce the financial inclusion gap between men and women, although controversy remains regarding which gender is most affected by access to financial services via mobile money. Kim's (2022) study shows that mobile money promotes women's financial inclusion in Nairobi through various ease-of-use features. Furthermore, Sakyi-Nyarko et al. (2022) analyze the effects of gender differences in financial inclusion on household resilience and show that, through the remittance mechanism, mobile money contributes more to improving men's resilience than women's, with a greater impact on those living in rural areas. The work of Suri & Jack (2016) and Dorfleitner & Nguyen (2024) shows that women's access to mobile financial services enables them to become entrepreneurs, increases their chances of becoming financially independent, and enhances their participation in decision-making within their families and communities. Kim's (2022) study assesses the channels through which mobile money promotes women's financial inclusion in Nairobi. Adeleke (2024), meanwhile, investigates the determinants of differences in mobile money use between urban and rural women. Asante et al. (2024) studied the impact of mobile money on fertilizer expenditures and found that men spend between 6.5% and 13.9% more on fertilizer than women, who spend only 4.3%. Furthermore, al. (2022) analyze the effects of gender differences on financial inclusion and household resilience and show that mobile money improves men's resilience more than women's. However, there is a lack of research examining the gendered impact of mobile money on

financial inclusion in Central Africa, particularly in Cameroon, where the mobile money market is most concentrated. This study seeks to fill this gap by providing a gender-based analysis of the impacts of mobile money on financial inclusion in Cameroon, using World Bank (2021) data.

2. METHODOLOGY AND DATA OF THE STUDY

The Global Findex Survey (2021), conducted globally using a random sampling method, included 1,000 respondents aged 15 and over in Cameroon. This nationally and regionally representative study examines how people earn a living and manage their finances. Access to financial services is measured by two variables: having an account with a formal financial institution and having a mobile money account. These variables are categorical: 1 if the individual has an account, and 0 otherwise. Use of financial services is measured by three variables: saving, borrowing, and using mobile money services. These take the value 1 if the individual uses a financial service and 0 otherwise. Finally, a series of demographic variables was also selected from the survey.

To understand the evolution of financial inclusion in Cameroon, we also considered all Findex surveys conducted to date, namely those of 2011, 2014, and 2017.

2.1. Financial inclusion: Sociodemographic characteristics

Table 1 presents the sociodemographic characteristics of respondents in the reference survey sample (2021) and previous surveys, highlighting changes in proportions. Of the 1,000 respondents interviewed in each period of the 2011-2021 survey, men are predominant on average (50.33%), while women represent 49.68% of respondents. The age composition of respondents indicates that the majority belong to the 15-25 age group, with an average of 38.41%; followed by the 26-35 age group, with an average of 29.17%; then the 36-45 age group, with an average of 11.74%; and finally the 46-55 age group, with an average of 11.50%. These results show that the Cameroonian population is very young, with the elderly being the least represented (9.17%).

Analysis of the respondents' education levels indicates that Cameroon has an educated population; the majority have attended secondary school (55.05%), followed by those with primary education or less (42.28%), and finally those with higher education (2.05%).

Table 1: Sociodemographic characteristics of the sample (% of 1000 households)

<i>Variables</i>	<i>2011</i>	<i>2014</i>	<i>2017</i>	<i>2021</i>	<i>Average</i>
Women	49.5	48.9	45.7	54.6	49.7
Men	50.5	51.1	54.3	45.4	50.3
Age 15-25	42.7	36.7	35.7	38.5	38.4
Age 26-35	27.6	28.4	30.1	30.5	29.2
Age 36-45	12.5	14.4	15.9	4.1	11.7
Age 46-55	8.8	9.8	8.4	19.0	11.5
Age over 56	8.4	10.6	9.9	7.8	9.2
Primary school completed or less	37.6	50.1	45.0	36.4	42.3
Secondary	60.6	47.1	52.1	60.4	55.1
Graduate of higher education or higher	1.8	1.8	2.1	2.5	2.1
Quintile 1	11.7	17.6	15.1	16.4	15.2
Quintile 2	14.4	16.1	18.0	17.1	16.4
Quintile 3	20.3	17.3	19.5	19.1	19.1
Quintile 4	24.2	21.8	21.7	20.9	22.2
Quintile 5	29.4	27.2	27.7	26.5	27.7
The respondent is in the labor market				71.6	
Rural population				46.0	
urban population				54.0	

Source: Authors based on Global Findex

The distribution of respondents by income quartile indicates that, on average, 27.7% belong to the wealthiest 20% and constitute the majority, while the remaining 15.2% belong to the poorest 20%. In 2021, approximately 71.6% of respondents reported being employed, while 54% reported living in an urban area.

The survey data from Cameroon, presented in Table 2, show that for the four measures of financial inclusion, women are, on average, less included (20.90) than men (24.93) over the entire 2011-2021 period. This is consistent with the findings of [reference missing] (Ndoya & Tsala, 2021) which highlighted the main reasons for this financial inclusion gap in Cameroon. Furthermore, respondents living in rural areas are less included (35.65) than respondents living in urban areas (55.37), confirming the findings of [reference missing] (Allen, A. Demirguc-Kunt, Klapper, & Peria, 2016). This inclusion gap can be explained by the level of poverty in rural areas and by high transaction costs, which limit access to financial products and services.

The results in Table 2 below, concerning household characteristics according to the four measures of financial inclusion, show that high-income individuals

Table 2: Household characteristics according to financial inclusion measures

Variable	Account in a formal institution (%)					Savings					Credit					Mobile money				
	2011	2014	2017	2021	Average	2011	2014	2017	2021	Average	2011	2014	2017	2021	Average	2014	2017	2021	Average	
Women	13.54	10.96	25.41	21.98	17.98	50.3	66.73	56.91	57.33	57.82	3.84	54.01	53.22	56.23	41.83	2.54	17.13	43.04	20.90	
Hommes	18.81	17.79	35.01	35.24	26.71	56.44	67.28	60.61	64.1	62.11	5.74	59.1	51.86	63.66	45.09	2.25	22.32	50.22	24.93	
Age 15-25	6.84	5.46	16.45	19.22	11.99	40.8	56.83	55.11	60.26	53.25	1.89	51.91	49.44	52.47	38.93	1.91	19.49	43.9	21.77	
Age 26-35	20.8	18.02	37.12	28.2	26.04	66.06	74.2	37.12	62.95	60.08	4.74	56.89	61.2	68.85	47.92	5.3	24.41	51.8	27.17	
Age 36-45	27.42	20.83	40.51	40.88	32.41	60.48	78.47	40.51	64.78	61.06	8.06	65.28	53.16	64.15	47.66	1.39	17.72	52.2	23.77	
Age 46-55	25.26	22.45	33.73	40.28	30.43	67.82	67.35	33.73	52.78	55.42	8.05	58.16	50.6	55.56	43.09		16.87	33.33	25.1	
Age over 56	21.11	18.35	31.63	33.33	26.11	50	66.97	31.63	50	49.65	11.11	57.8	38.78	53.85	40.39		9.18	35.9	22.54	
Primary school completed or less	10.37	5.48	18.89	12.64	11.85	50	61.84	47.56	46.15	51.39	5.05	56.75	50.89	56.04	42.18	0.39	9.56	26.1	12.02	
Secondary	17.99	22.08	37.24	35.26	28.14	55.12	71.76	67.18	67.88	65.49	4.62	56.48	53.93	61.42	44.11	4.03	26.3	56.79	29.04	
Graduate of higher education or higher	77.78	61.11	76.19	72	71.77	66.67	88.89	80.95	84	80.13	5.56	50	66.67	64	46.56	16.67	66.67	84	55.78	
Quintile 1	5.98	2.84	18.54	10.37	9.4325	50.43	44.32	50.99	40.85	46.65	2.56	50	47.02	5.93	26.38		6.62	29.27	17.95	
Quintile 2	9.72	1.86	20	22.22	13.45	43.06	62.73	52.22	56.73	53.69	3.47	58.39	55	57.31	43.54	1.24	8.89	30.99	13.71	
Quintile 3	7.88	6.94	28.72	26.18	17.43	46.31	69.36	48.72	58.64	55.76	1.48	55.49	52.82	59.69	42.37	1.16	16.41	44.5	20.69	
Quintile 4	14.46	16.06	28.11	24.88	20.8775	52.89	69.72	63.59	63.64	62.46	4.55	56.42	55.3	63.64	44.98	2.75	22.58	55.5	26.94	
Quintile 5	30.61	32.35	45.53	46.42	38.7275	64.97	80.51	70.82	73.58	72.47	8.84	60.29	51.75	58.87	44.9375	5.15	34.24	60.75	33.38	
Having a mobile phone			35.53	32.73	34.13			64.6	65.98	65.29			54.91	61.75	58.33		24.03	55.07	39.55	
No mobile phone			9.82	11.42	10.62			37.95	41.1	39.53			45.09	52.51	48.8		3.57	15.07	9.32	
Employee			33.85	31.56	32.705			66.85	67.74	67.29			56.74	63.55	60.15		22.47	51.54	37.01	
No job			19.79	19.01	19.4			38.19	41.9	40.05			42.36	49.65	46.01		12.15	33.1	22.63	
Rural				20.22					52.61					58.26				35.65		
Urban				34.63					67.04					60.74				55.37		

Index data

are, on average, more financially included than low-income individuals, due to the significant financial demands associated with certain financial products and services. The analysis also shows that individuals with a mobile phone are, on average, more financially included. The mobile phone has thus emerged as a catalyst for financial inclusion.

Analysis by age of respondents shows that the 36-45 age group reports the highest rate of formal account ownership (32.41%), followed by the 46-55 age group (30.43%). Only 11.99% of young people aged 15 to 25 have a formal account with a financial institution. This can be explained by the need for several documents to open a formal account, which younger people very often do not possess.

2.2. Methodology

Our objective in this paper is to assess the impact of mobile money adoption on the financial inclusion of women (treatment group) compared to those who have not adopted mobile money (control group). The impact of mobile money on women's financial inclusion will then be compared, first, with that observed among men by place of residence, and second, with the use of bank accounts.

Let be the level of financial inclusion of an individual i if they adopt mobile money, and let be the potential level of financial inclusion of individual i if they do not adopt mobile money. Let be the treatment variable taking the value 1 if the individual has adopted mobile money and 0 otherwise. Furthermore, the adoption of mobile money is conditioned by a set of other observed variables (Bidiasse & Mvogo, 2019). Thus, for each individual, we observe (MM_i, FI_i, X) where FI_i is the actual result.

$$FI_i = FI_{0,i} \text{ si } MM_i = 0 \text{ et } FI_i = FI_{1,i} \text{ si } MM_i = 1 \quad (1)$$

Since it is not possible to observe the treatment outcome for two individuals simultaneously, we construct a counterfactual by asking: for an individual i with access to mobile money, what would their level of financial inclusion have been in the absence of mobile money? Therefore, the effect of mobile money for individual i is given by:

$$\theta_i = FI_{1,i} - FI_{0,i} \quad (2)$$

Subsequently, the average treatment-on-treatment (ATT) effect, defined as the average difference in outcome (level of financial inclusion) between the two groups (treatment group and control group), is calculated as follows:

$$ATT = E [FI_{1,i} / MM_i = 1] - E[FI_{0,i} / MM_i = 0] \quad (3)$$

ATT rests on two assumptions: the assumption of no confounding, or presumption of conditional independence, and the assumption of common support. The first assumption implies that selection in the treatment group is conditional only on observed covariates. In other words, after controlling for these covariates, the treatment is independent of the potential outcome. (Rosenbaum & Rubin, 1985) define the propensity score (or probability of adopting mobile money) under this assumption of conditional independence as:

$$P(X) = pr(MM = 1/X)$$

Where X is the preprocessing feature vector

The common support assumption requires sufficient overlap in the characteristics of treated and control individuals so that, for each country, the probability of receiving intermediated financing is comparable to the probability of not receiving it. The common support assumption is expressed as:

$$0 < pr(MM = 1/X) < 1 \quad (5)$$

When both assumptions hold, the propensity score estimator for ATT is unbiased.

3.3. Data Description

The treatment group consists of women (and men) who have adopted mobile money for financial transactions. The control group, therefore, is composed of women (and men) who have not adopted mobile money in Cameroon. In total, the sample consists of 235 women in the treatment group (228 men) and 311 women in the control group (226 men). The variables used in the analysis are defined below:

Financial inclusion: the definition used here is that of Findex 2021, which defines it as the proportion of the population with an account (in a bank or microfinance institution, or via mobile money). In this study, financial inclusion is a dichotomous variable taking the value 1 if the individual has an account and 0 otherwise.

Mobile money refers to the use of a mobile phone, connected or not, to access various financial services. By following the instructions on the dedicated platform, individuals can carry out all financial transactions independently, from anywhere, and at a lower cost. In this study, mobile money is a dichotomous variable: 1 if the individual has adopted it, and 0 if not.

Other control variables identified in the literature, which we take into account, are:

Age

The level of education

Income

The socio-professional category

The place of residence

Possession of a mobile phone

(Bidiassé & Mvogo, 2019); (Avom, Bidiassé & Mvogo, 2021); (Ndoya and Tsala, 2021).

3. RESULTS AND INTERPRETATIONS

This section presents results on the impact of mobile money on the financial inclusion of women and men in Cameroon, using propensity-score estimation. The resulting comparative analysis allows us to identify the gender most affected by mobile money.

4. BASIC RESULT

First, we estimate propensity scores using a logit model, with mobile money adoption as the dependent variable. For this estimation, we draw on the literature to identify variables likely to influence both the decision to adopt mobile money and financial inclusion. (Bidiassé & Mvogo, 2019); (Avom, Bidiassé & Mvogo, 2021); (Ndoya and Tsala, 2021).

Table 3: Estimation of the propensity score using the logit

<i>Variables</i>	<i>Sample entire</i>	<i>Men</i>	<i>Women</i>
Gender	0.277*		
	(0.159)		
Secondary level	0.594***	0.915***	0.613**
	(0.182)	(0.232)	(0.251)
Advanced level and above	1.692**	0.751	0.447
	(0.824)	(0.794)	(0.899)
Quintile 2	-0.426	-0.147	-0.418
	(0.283)	(0.352)	(0.395)
Quintile 3	-0.0451	0.348	-0.115
	(0.267)	(0.315)	(0.357)
Quintile 4	0.267	0.814**	0.395
	0.261	0.322	0.355

<i>Variables</i>	<i>Sample entire</i>	<i>Men</i>	<i>Women</i>
Quintile 5	0.132 (0.269)	0.579*** (0.332)	0.0738 (0.371)
Employee	-0.544*** (0.181)	-0.849*** (0.332)	-0.664 (0.254)
Urban	0.272 (0.165)	0.1277 (0.212)	0.0746 (0.232)
Mobile phone	-1.147*** (0.228)	-1.693*** (0.282)	-1.314*** (0.309)
Cash transfer	-0.527*** (0.0489)	-0.511*** (0.065)	-0.504*** (0.671)
Constant	2.547*** (0.55)	2.162*** (0.756)	2.976*** (0.663)
Observations	999	540	452
Pseudo R2	0.2603	0.1681	0.2864

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 3 presents the estimated results of the logit propensity score model. These results highlight the main variables significant at the 1% level and, therefore, key determinants of the financial inclusion of women and men in Cameroon.

The positive relationship between the probability of inclusion and higher levels of education confirms that education is a prerequisite for accessing financial services. This result is consistent with that of Pahlevan Sharif and Ehigiamusoe (2023) (Nyoka, 2019). Income and gender positively influence the probability of financial inclusion for Cameroonian households. Indeed, income is crucial for conducting financial transactions and enables the financial inclusion of all genders in society (Shabir & Ali, 2022). Finally, the negative correlation between formal employment and mobile phone ownership is justified by the fact that financial inclusion instruments are not intended solely for these households. In fact, households in the informal sector and those without mobile phones also have access to financial services, confirming the inclusive nature of these new financial services, such as mobile money (Amoah & Asiama, 2020). (Shaikh, Glavee-Geo, Karjaluoto, & Hinson, 2023)

Based on propensity score estimates, we matched households that had adopted mobile money with those that had not, using several matching algorithms. First, we performed nearest-neighbor matching, where household *i* in the treatment group was matched with household *j* in the control group whose propensity score was similar. (Jacolin, Massil, & Noah, 2021) We considered the nearest match (N=1),

the two nearest ($N=2$), and the three nearest ($N=3$). The second method was radius matching, which involved associating each household i in the treatment group with a household j in the control group located within radius r . We defined this radius as the lower radius ($r=0.045$), the middle radius ($r=0.09$), and the upper radius ($r=0.18$). The third algorithm used is kernel matching, which associates household i in the treatment group with household j in the control group by assigning weights inversely proportional to the distance between the two groups. The fourth algorithm, local linear matching, is almost identical to the previous one, except that it includes a linear term in the weighting function.

Overall, the results obtained using standard analytical tools (Caliendo & Kopeinig, 2008) show (Li, 2013) that the quality of the matching is quite satisfactory. For example, Figure 1 presents the distribution of propensity score estimates for the two groups and the common support region. Figure 1 clearly shows that the common support hypothesis is verified and that all treated and untreated observations fall within the common support region.

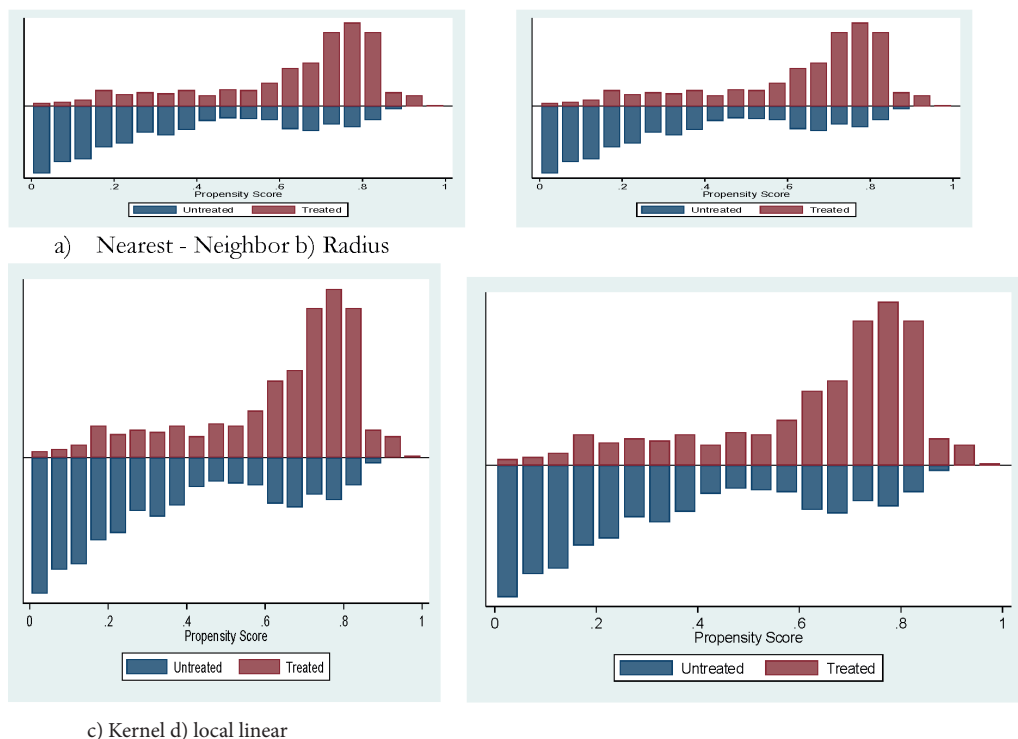


Figure 1: Propensity score distribution and common support region

Table 4 presents the results concerning the balancing properties of the variables used for matching. The results show that the normalized mean bias across all propensity-score-matching variables decreased from 56.6% before matching to 7.2%- 13% after matching. The total bias also decreased from approximately 77.15% to 87.35% across the matching algorithms. These values exceed the 20% critical value suggested by Rosenbaum and Rubin (1985).

Table 4: Quality of indicators before and after matching in women

Algorithm matching		Pseudo R^2		LR X^2		$P > X^2$		Standardized average bias		Reduction of total bias
		Before	After	Before	After	Before	After	Before	After	
Nearest-Neighbor	N=1	0,275	0,028	173,33	17,29	0,000	0,016	56,9	9,5	83,30%
	N=2	0,275	0,017	173,33	10,47	0,000	0,164	56,9	8,8	84,53%
	N=3	0,275	0,014	173,33	8,33	0,000	0,304	56,9	7,5	86,82%
Kernel	BW=0,06	0,275	0,014	173,33	8,40	0,000	0,299	56,9	7,2	87,35%
Radius	r=0,005	0,275	0,016	173,33	10,36	0,000	0,169	56,9	7,8	86,30%
	r=0,009	0,275	0,017	173,33	10,90	0,000	0,143	56,9	8,1	85,76%
	r=0,01	0,275	0,030	173,33	18,90	0,000	0,010	56,9	13	77,15%
Local Linear	BW=0,06	0,275	0,028	173,33	17,29	0,000	0,016	56,9	9,5	83,31%

Source: Auteurs

The second diagnostic test, performed to verify the balance of variables and assess the quality of the matching, is the Pseudo- R^2 . The results show that the Pseudo- R^2 is close to zero after matching, regardless of the algorithm used, indicating that the distributions of variables between mobile money adopters and non-adopters are not systematically different after matching. Furthermore, the likelihood-ratio test p-values assess the overall significance of all variables in the logit model after matching, but not before.

Overall, the low Pseudo- R^2 , low mean standardized bias, high bias reductions, and lack of significance in the likelihood ratio tests confirm the good quality of the matching.

4.2. Impact Analysis Results

Impact of mobile money on the financial inclusion of women and men

Tables 5 and 6 present the propensity score estimates for women and men, respectively. Overall, the results show a positive and significant impact of 1%

Table 5: Estimation of propensity scores for the impact of mobile money on women's financial inclusion

	Nearest-Neighbor			Radius			Kernel	Local Linear
	N=1	N=2	N=3	R=0,045	R=0,090	R=0,18	BW=0,06	BW=0,06
Mobile money (ATT)	0.6434783***	0.6694652***	0, 6695652***	0.6811143***	0.6738092***	0.6852924***	0.6815371***	0.6769478***
	(0.0605706)	(0.0570806)	(0.0625519)	(0.0433307)	(0.0454938)	(0.0447861)	(0.0468482)	(0.0473557)
Number of treaties	235	235	235	235	235	235	235	235
Number of checks	311	311	311	311	311	311	311	311
Observations	546	546	546	546	546	546	546	546
Replications Bootstrap	500	500	500	500	500	500	500	500

Note: Robust standard errors (after bootstrap) are reported in parentheses. (**, *, *) show statistical significance at the 1 %, 5 %, and 10 % levels, respectively.

Tableau 6 : Estimation des scores de propension de l'impact du mobile money sur l'inclusion financière des hommes

	Nearest-Neighbor			Radius			Kernel	Local Linear
	N=1	N=2	N=3	R=0,045	R=0,090	R=0,18	BW=0,06	BW=0,06
Mobile money (ATT)	0.652968115***	0.6621005 ***	0.652968***	0.6392879**	0.6348266***	0.6749699***	0,63707115***	0, 6390315 ***
	(0,0754072)	(0,0724766)	(0,0695151)	(0,0599535)	(0,0539862)	(0,0492306)	(0,0558765)	(0, 060165)
Number of treaties	228	228	228	228	228	228	228	228
Number of checks	226	226	226	226	226	226	226	226
Observations	454	454	454	454	454	454	454	45
Bootstrap Replications	500	500	500	500	500	500	500	500

Note: Robust standard errors (after bootstrap) are reported in parentheses. (**, *, *) show statistical significance at the 1 %, 5 %, and 10 % levels, respectively.

mobile money on financial inclusion for both women and men, regardless of the algorithm used. Thus, the adoption of mobile money increases women's financial inclusion in Cameroon by approximately 64% to 69%, depending on the algorithm used. For men, mobile money adoption increases their financial inclusion by about 3 percentage points. This strong contribution to access to formal financial services stems from mobile money's ability to reduce several barriers to financial inclusion, such as lower transaction costs, adaptability to low-income populations, protection against minor theft, and minimal documentation requirements. However, these results reveal that mobile money plays a more significant role in women's financial inclusion than in men's. This result can be explained by the fact that mobile money is giving women greater financial autonomy from their husbands or partners.

Furthermore, this result is explained by the fact that women, being more vulnerable, participate more actively in digital savings groups than men and routinely receive social and family support from their husbands or other family members. They use this support to purchase household equipment, address social problems faced by their families, and develop micro-enterprises. This finding is consistent with those of Fanta and Mutsonziwa (2016), Reichel (2020), Yang, Huang, and Gao (2022), and Kim (2022), who found that women are more financially included than men, particularly in terms of access to financial services.

Impact of mobile phone gender on financial inclusion, taking into account the place of residence

Tables 7 and 8 present, by place of residence, the results on the impact of mobile money on financial inclusion for women and men, respectively. The findings show that, for women, the adoption of mobile money contributes to their financial inclusion by approximately 56% to 65% in rural areas and approximately 60% to 70% in urban areas, depending on the algorithm used. This result can be explained by the availability of technological and financial resources in cities, as well as by a higher level of education, suggesting that urban women have a better understanding of financial literacy than those in rural areas. This result is consistent with that of Adeleke (2024), who demonstrated that place of residence is a determining factor in mobile money adoption, highlighting that women living in urban areas are more familiar with it than those in rural areas. Furthermore, women living in urban areas

Table 7: Estimation of propensity scores for the impact of mobile money on women's financial inclusion versus place of residence

	Nearest-Neighbor			Radius			Kernel	Local Linear
<i>Rural area</i>								
	N=1	N=2	N=3	R=0.045	R=0.090	R=0.18	BW=0.06	BW=0.06
Mobile money (ATT)	0.555556 *** (0.1079447)	0.555556 *** (0.1051743)	0.5833333 *** (0.1035052)	0.591369 *** (0.0940228)	0.6307047 *** (0.0861948)	0.649068 *** (0.0834345)	0.5980462 *** (0.0883613)	0.5811066 *** (0.0907516)
Number of treaties	235	235	235	235	235	235	235	235
Number of checks	221	221	221	221	221	221	221	221le
Observations	454	454	454	454	454	454	454	454
Replications Bootstrap	500	500	500	500	500	500	500	500

Zone urbaine

Mobile money (ATT)	0.5986842 *** (0.0744992)	0.6644737 *** (0.0736508)	0.6644737 *** (0.0713569)	0.7012118 *** (0.0543791)	0.6941434 *** (0.0547062)	0.7007973 *** (0.0507554)	0.7007593 ** (0.0565866)	0.6921758 *** (0.0586235)
Number of treaties	235	235	235	235	235	235	235	235
Number of checks	221	221	221	221	221	221	221	221
Observations	454	454	454	454	454	454	454	454
Replications Bootstrap	500	500	500	500	500	500	500	500

Note: Robust standard errors (after bootstrap) are reported in parentheses. (***, **, *) show statistical significance at the 1 %, 5 %, and 10 % levels, respectively.

Table 8: Estimation of propensity scores for the impact of mobile money on men's financial inclusion versus place of residence

	Nearest-Neighbor			Radius		Kernel	Local Linear
Zone rurale							
Mobile money (ATT)	N=1	N=2	N=3	R=0,045	R=0,090	R=0,18	BW=0,06
	0,6547619 *** (0,0845793)	0,6964286 *** (0,0840346)	0,6785714*** (0,082792)	0,691689 *** (0,0704734)	0,7010874 *** (0,0675951)	0,7292937*** (0,0600448)	0,6928592*** (0,0715193)
Number of treaties	235	235	235	235	235	235	235
Number of checks	221	221	221	221	221	221	221
Observations	454	454	454	454	454	454	454
Replications Bootstrap	500	500	500	500	500	500	500

Zone urbaine

Financement intermedié (ATT)	0,6716418 *** (0,1101563)	0,6044776 *** (0,1024491)	0,5845771*** (0,0983066)	0,6026689 *** (0,0864805)	0,6032087 *** (0,0818091)	0,6397023 *** (0,0798933)	0,5978175 *** (0,0887419)	0,6062952 *** (0,086937)
	235	235	235	235	235	235	235	235
Number of treaties	221	221	221	221	221	221	221	221
Number of checks	454	454	454	454	454	454	454	454
Observations	500	500	500	500	500	500	500	500
Replications Bootstrap								

Note: Robust standard errors (after bootstrap) are reported in parentheses. (***, **, *) show statistical significance at the 1 %, 5 %, and 10 % levels, respectively.

are closer to mobile money distribution networks, which facilitates their financial inclusion, whereas women living in rural areas, where the density of the mobile money network remains low, are less close to these networks (Naito & Yamamoto, 2022).

Regarding men, the impact of mobile money on their financial inclusion ranges from 65% to 73% in rural areas and from 58% to 67% in urban areas, depending on the algorithm used. This result, which highlights the greater impact of mobile money on financial inclusion in rural areas, is explained by the fact that mobile money addresses the problem of easier access to bank accounts in urban areas. This finding aligns with that of [reference missing (Gosavi, 2018)], (Asongu & Odhiambo, 2022), which demonstrates that mobile money facilitates access to formal bank accounts and savings accounts for households and businesses.

Overall, it appears that mobile money has a greater impact on men's financial inclusion in rural areas than on women's. Indeed, women in rural areas have lower incomes than men and are particularly dependent on their husbands, which may explain the disparities in mobile money adoption and, consequently, a higher rate of financial inclusion among men. Furthermore, for economic reasons, men are more active than women in rural areas and generally organize themselves around common initiative groups (CIGs) to better carry out small income-generating activities and obtain financing from community mutuals. This finding corroborates that of Reynolds, Biscaye, Leigh, O'Brien, and Keel (2023), which shows that in rural areas, the financial inclusion gap remains in favor of men in low- and middle-income countries.

Impact of mobile money compared to bank accounts, according to gender

Comparing the impact of mobile money on financial inclusion with that of having a bank account allowed us to situate the contribution of this innovation. Table 9 shows that the impact of a bank account on women's financial inclusion is between 40% and 42%, and on men's between 37% and 42%. These results demonstrate that financial inclusion is achieved more through mobile money than through bank accounts, as shown in Tables 4 and 5. This finding is consistent with that of Avom et al. (2023), who argue that mobile money represents a true revolution in financial inclusion in Africa.

Table 9: Estimation of propensity scores for the impact of formal bank accounts on financial inclusion

WOMEN

	Nearest-Neighbor			Radius			Kernel	Local Linear
	N=1	N=2	N=3	R=0.045	R=0.090	R=0.18		
	Women							
Bank account (ATT)	0.4152542 ***	0.4152542 ***	0.4039548***	0.401027***	0.400218***	0.4144677***	0.3998595***	0.4003119 ***
	(0.0593058)	(0.0538307)	0.0498583	(0.0351169)	(0.0347676)	(0.0345539)	(0.0337628)	(0.0358604)
Number of treaties	235	235	235	235	235	235	235	235
Number of checks	311	311	311	311	311	311	311	311
Observations	546	546	546	546	546	546	546	546
Replications Bootstrap	500	500	500	500	500	500	500	500

MENS

Compte bancaire (ATT)	0,36875 ***	0, 4125 ***	0,3770833 ***	0,3805526 ***	0,3950054 ***	0,4218534 ***	0,3861936 ***	0,3963092 ***
	(0.0553076)	(0.0527479)	(0.0507953)	(0.0402333)	(0.0395705)	(0.0396242)	(0.039704)	(0.0428003)
Number of treaties	235	235	235	235	235	235	235	235
Number of checks	221	221	221	221	221	221	221	221
Observations	454	454	454	454	454	454	454	454
Replications bootstrap	500	500	500	500	500	500	500	500

Note: Robust standard errors (after bootstrap) are reported in parentheses. (**, **, *) show statistical significance at the 1 %, 5 %, and 10 % levels, respectively.

The significant impact of mobile money on financial inclusion, particularly for women, contributes to strengthening household resilience, especially for female-headed households (Swamy, 2014). Indeed, compared to men, women experience an unequal distribution of labor, as well as unequal access to and control over resources, and are therefore more inclined to rely on savings, which they use, according to Karlan et al. (2014), as a buffer against the shocks to which they are frequently exposed. These findings are supported by Nanziri's (2016) work, which shows that when women manage family income, they increase savings and family well-being more than men do.

5. CONCLUSION

The aim of this article was to assess the gendered impact of mobile money on household financial inclusion in Cameroon. To achieve this, we used propensity score matching (PSM) on the World Bank's Findex (2021) data. This quasi-experimental method allowed us to test the treatment effect (mobile money adoption) between two distinct groups: households that had adopted mobile money and those that had not. Based on this, we examined the impact of mobile money on women's financial inclusion relative to men. We then measured the differential impact of mobile money and formal bank accounts on the financial inclusion of women and men, and finally examined the gendered impact of mobile money across urban and rural households.

Overall, the results show that mobile money promotes financial inclusion for both men and women who use it, regardless of where they live. First, women are more financially included than men. Not only do they receive family support and are better at directing family income towards savings for future consumption than men, but they are also heavily involved in rotating savings and credit associations (ROSCAs). Similarly, women in Cameroon who have embraced and used mobile money are financially included, while their counterparts who have not adopted it are not. As a result, mobile money improves the financial inclusion of female users compared to non-users. Second, financial inclusion through mobile money is stronger than that provided by bank accounts. Indeed, the use of mobile phones has fueled the explosive growth of mobile money, which is gradually positioning itself above traditional banking services. Third, in urban areas, women are more financially included than men, just as they are compared to their counterparts living

in rural areas. In rural areas, however, mobile money has a stronger impact on men's financial inclusion, due to the greater availability of other payment methods in urban areas.

It is important for policymakers to consider the dual geographical and gender dimensions of populations in order to implement targeted economic policies that improve their well-being and enable them to fully benefit from the socio-economic advantages of mobile money. Further integrating a gender perspective across key social sectors, such as employment and education, could strengthen women's financial literacy and skills, thereby reducing inequalities in access to financial services.

DECLARATIONS

- **Ethics, consent to participate and consent to publish declarations:** Not applicable.
- **Availability of data and materials:** the datasets generated and analysed during the current study are available from the corresponding author on reasonable request.
- **Competing interests:** The author declares that there are no conflicts of interest that could influence the results or conclusions of this study.
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