Original Research Article

Ordinal logit analysis of financial inclusion in Kenya

Abstract

This study sought to analyze the underlying financial inclusion determinant in Kenya. The study applied ordinal logit regression to examine the effect of residential area, gender, education level, marital status and employment type on financial inclusion. Financial inclusion was measured by developing a financial inclusion score index for ten financial services binary variables. From the index, three financial inclusion level namely low with score zero to three, medium with score 4 to 6 and high level with score seven to ten. The estimates ordinal model is statistically significant with all factors considered except gender being statistically significant. Gender has positive effect on the log odds of financial inclusion though the effect is not significant. Area of residence, age, education type,income and marital status have positive effect on the log-odds of financial inclusion while type of employment linked negatively. Education, employment and marital status have main and interaction effect on financial inclusion. A male living in urban areas, more educated, otherwise not divorced will be favored in financial inclusion as he ages. The study recommended the Kenya government to develop policies that will address challenges in gender parity, rural bank infrastructure development, entrepreneur thriving environment to address employment and income, advocating for secondary school completion, and social problems that affects family leading separation or no marriage at all.

Keywords and phrases

Financial inclusion, ordinal regression, determinants, Kenya

1 Introduction

Financial inclusion is the degree of financial services development aimed at covering excluded population in an economy. This involves deliberate measures to promote access to financial services as well as their utilization (Sinclair, 2013; Raichoudhury, 2020). In most scenarios, the excluded population compose of low income earners and the vulnerable groups. Financial inclusion is thus generalized as the process by which individual, households and firm level have access to financial product and services that help meet social and economic needs (Allen et al., 2016; Demirguc-Kunt et al., 2018). The most common financial product and services include; payment instrument such as debit/credit cards,savings account, credit,insurance products, investment accounts, digital platforms, among others. Financial inclusion has a significant impact on poverty reduction and economic growth. It helps to boost entrepreneurs liquidity resulting to many operational business premises that leads to employment and poverty eradication (Harley et al. 2017; Kim et al. 2018).

Financial inclusion determinant analysis is approached from two side namely; the supply side and the demand side. The supply side approach considers the banking sector infrastructure to analyze financial services provision while demand side approach use household socio-economic characteristics obtained from surveys. There exists several socio-economic factors that contribute to rate of financial inclusion in an economy as proved by quite a number of empirical research. Rural population as a proxy for area of residence has a significant negative effect on financial inclusion (Wokabi and Fatoki, 2019; Bashiru et al., 2023). Gender has a significant effect on financial inclusion. Being a male increases the likelihood of higher financial inclusion (Özşuca, 2019; Workineh, 2022). Income is factor that affect financial inclusion, with better financial inclusion level with increase in income (Altarawneh et al., 2020; Badar et al., 2020). Higher education level is attribute to high chances of financial inclusion (Yangdol and Sarma, 2019; Mhlanaga and Denhere, 2020). Financial inclusion have proved to increase with increase in age (Rashdan and Noura, 2020; Gautier et al., 2020.) Research shows that marital status has a significant influence on financial inclusion. Unmarried

people tend to have low interest for financial products relatively to married people (Martin-Oliver, 2019).

The aim of this article is to use financial inclusion demand-side approach to determine socio-economic factors that determine financial inclusion in Kenya using an ordinal regression model. This will be achieved by assessing the linkage of financial inclusion level and socio-economic factors namely; age, income, gender, marital status, employment type and area of resident. For this study, a financial inclusion level is develop from financial inclusion index which is a sum of ten binary formal financial services factors.

2 Methodology

2.1 Data

2.1.1 Data sampling

This study used financial access survey conducted in the year 2021 by the Kenya national bureau of statistic (KNBS). Financial survey aims at assessing financial inclusion dimensions namely; access, usage, quality and impact. Access and usage dimension considered financial utility in the last 12 months. The survey was conducted from September 2021 during COVID-19 pandemic period. It covered all the 47 counties that form devolved government system unit in Kenya.

2.1.2 Independent variables

This study considered two continuous variables and five categorical variables. The continuous variables include age and monthly income are the continuous variable. The categorical variables are namely; area, gender, education, marital status and employment with their respective level as indicated below

- area (=1 if urban otherwise zero)
- gender (=1 if male otherwise zero)
- education (=1 if none, =2 if primary, =3 if secondary, =4 if post secondary)
- marital status (=1 if divorced, =2 if married, =3 if single, =4 if windowed)
- employment (=1 if formal, =2 if informal, =3 if others)

2.1.3 Financial inclusion level index

The dependent variable in this research is financial inclusion level, that is ordinal with three level.

$$Y = \begin{cases} 1, & \text{low} \\ 2, & \text{medium} \\ 3, & \text{high} \end{cases}$$

The individual financial inclusion index score is obtained by summing the score for ten binary variables. The variables are indicators of financial inclusion, namely; access bank account, credit card, debit card, share or stock investments, bill or bond investment, life insurance, non-life insurance, mobile banking, mobile money and current loan. These variables take the value 1 if yes otherwise zero. Financial inclusion index ranges from zero to 10, and financial inclusion level is obtained as shown in table (1).

Table 1: Dependent variable

Fiancial inclusion score	Financial inclusion level
0- 3	low level
4-6	medium level
7 -10	high

2.1.4 Descriptive statistics

The survey was administered to personnel with 16 years and above, however for analysis process only those above 18 years were considered as per Kenya legal framework. The descriptive statistic results are as shown in table 2. The mean age is 39.84 with standard deviation of 16.61. To control for outlier effect in monthly income and dampen its variance, a log transformation was conduct on it. The monthly mean income is 8.47 with a spread of 1.08. Majority of the people live in towns with a percentage of 65 as compared to 35 for rural areas. Primary school as the highest attained education level has the highest proportion at 40%. Majority of Kenyan also engage in informal sector as a major source of livelihood.

Table 2: Descriptive statistic results

a	Categorical variables frequency distribution				
variable	Category	Total(%)	FIL		
			Low	Medium	High
area	rural	12183 (65.23)	10690(87.75)	1454 (11.93)	39 (0.32)
	urban	6495 (34.77)	4804 (73.96)	1636 (25.1927)	55 (0.85)
gender	female	10770 (57.66)	9300 (86.35)	1432 (13.31)	38 (0.35)
	male	7908 (42.34)	6194 (78.33)	1658 (20.97)	56(0.71)
education	none	3443 (18.43)	3369 (97.85)	73 (2.12)	1 (0.03)
	primary	7564 (40.50)	6827 (90.26)	731 (9.66)	6 (0.08)
	secondary	5371 (28.76)	4187 (77.96)	1159 (21.58)	25 (0.46)
	post secondary	2300 (12.31)	1111 (48.30)	1127 (49.00)	62 (2.70)
status	Divorced	1457 (7.80)	1253 (86.00)	201 (13.79)	3 (0.21)
	Married	10823 (57.95)	8749 (80.84)	2001 (18.49)	73 (0.67)
	Single	4119 (22.05)	3430 (83.27)	679 (16.48)	10 (0.25)
	Windowed	2279 (12.20)	2062 (90.48)	209 (9.17)	8 (0.35)
employment	formal	1945 (10.41)	939 (48.28)	949 (48.49)	57 (2.93)
	informal	12576 (67.33)	10790 (85.80)	1755 (13.75)	31 (0.25)
	others	4157 (22.26)	3765 (90.57)	386 (9.29)	6 (0.14)

b	Continuous variable			
variable	Minimum	mean	maximum	sd
age	18	39.84	116	16.61
log(income)	4.61	8.47	9.21	1.08

2.2 Ordinal regression model

Consider an ordinal response variable y with j level and k set of explanatory variables. On assumption of, only the model intercept depends on response variable levels, then a proportional odd model estimated expressed as;

$$ln(\frac{Pr(y \leq i)}{Pr(y \geq i)}) = \beta_{0i} + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \varepsilon \quad (1)$$

For i= 1,2,3, ..., j-1

There may exist interactions in the explanatory variable set, with the model expressed in equation (1) becomes

$$ln(\frac{Pr(y \leq i)}{Pr(y \geq i)}) = \beta_{0i} + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \beta_{k+1} x_m * x_n + \varepsilon \quad (2)$$

For m and n members of set k
The ordinal model parameters are estimated by mean of maximum likelihood estimators. The odds ratio (OR) of an event for any given responsible variable is expressed as in equation (3. The odd ratio if less than 1 implies that the less likelihood of the odd of an event. The odd of event is more likely if the OR is greater than 1. In cases where the OR is equal to 1, the odd for all event are equal.

$$OR = exp(\beta_k) \tag{3}$$

For k= 1,2,3, . . . , k+1

Suppose the categories of the response variable has probabilities $\phi_j(x)$ for given values of the explanatory variables. The probability function is expressed as follow;

$$\phi_1(x) = \frac{exp(\beta_{01} + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k)}{1 + exp(\beta_{01} + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k)} \tag{4}$$

$$\phi_i(x) = \frac{exp(\beta_{0i} + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k)}{1 + exp(\beta_{0i} + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k)} - \frac{exp(\beta_{0i-1} + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k)}{1 + exp(\beta_{0i-1} + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k)} \tag{5}$$

For i= 2,3, . . . , j-1

$$\phi_j(x) = 1 - \sum_{i=1}^{j-1} p_i \tag{6}$$

To test model performance and significant of the explanatory variable, likelihood ratio test that follows a chi square distribution with k degree of freedom for overall model, w-1 degree of freedom for w level explanatory categorical variable and 1 degree of freedom for continuous explanatory variable.

Model parameter estimates are as shown in table 4.The estimated ordinal model is significant at 5% level with likelihood ratio statistic of 4711.184 with 27 degree of freedom. Independent diagnostic test are shown in table 3, where in overall all are significant at 5% level except gender. The study provide evidence to concluded that education level, age, monthly income, marital status, employment type, education/employment interaction and education/employment interaction are significant determinant of financial inclusion in Kenya.
Controlling for the other five variables and considering location area, an urban

Table 3: Variables likelihood ratio test results

variable	LR statistic	Df	pvalue
area	18.04	1	0.0001
gender	1.54	1	0.2149
age	58.56	1	0.0001
education	36.30	3	0.0001
log(income)	793.69	1	0.0001
status	15.67	3	0.001
employment	19.88	2	0.0001
education:status	62.97	9	0.0001
education:employment	27.62	6	0.0001

resident is 23% more likely to be in the low financial inclusion level as compared to rural resident. It also holds that an urban resident is 23% more likely to be in the low or medium financial inclusion level as compared to a rural resident.

Accounting for the other explanatory variables, then for every unit increase in age a person is 1.5% more likely to be the low financial inclusion level as opposed to medium or high level. Similarly, for every unit increase in age, a person is 1.5% more likely to be low or medium financial inclusion level as opposed to high level.

Considering education level and accounting for the other explanatory variables, then a person with primary education as the highest level is 2.7 times more likely to be the in low financial inclusion level (as opposed to medium or high financial inclusion level) compared to a person with other informal education. It also holds that, a person with primary education is 2.7 times more likely to be in low or medium financial inclusion level (as opposed to high financial inclusion level) compared to a person with other informal education. A person with secondary education as the highest level is 7.7 times more likely to be in low financial inclusion level (as opposed to medium or high financial inclusion level) compared to a person with other informal education. It also holds that, a person with secondary education is 7.7 times more likely to be in low or medium financial inclusion level (as opposed to high financial inclusion level) compared to a person with other informal education. Any person with post secondary education as the highest level is 8.6 times more likely to be in low financial in-

Table 4: Ordinal regression results

a	parameters				
parameter	estimate	odd ratio	parameter	estimate	odd ratio
Intercept (Low|Medium or high)	9.6137		primary/married	0.1598	1.1732
			secondary/married	-0.2772	0.7579
Intercept (low or medium|high)	13.9481		post secondary/married	0.0063	1.0063
			primary/single	-2.1209	0.1199
area(Urban)	0.2086	1.2319	secondary/single	-2.4373	0.0874
gender(Male)	0.0604	1.0622	post secondary/single	-1.4993	0.2233
age	0.0148	1.0149	primary/widowed	-0.2774	0.7578
log(income)	0.7461	2.1088	secondary/widowed	-0.3778	0.6853
education (primary)	0.9951	2.7049	post secondary/widowed	0.0506	1.0519
education (secondary)	2.0492	7.7613	primary/informal	0.9791	2.6620
education (post secondary)	2.1565	8.6408	secondary/informal	1.1629	3.1991
status(married)	0.3018	1.3522	post secondary/informal	1.4699	4.3487
status (single)	1.8166	6.1507	primary/other	0.6694	1.9530
status (widowed)	0.7110	2.0360	secondary/other	1.0178	2.7671
employment (informal)	-2.0394	0.1301	post secondary/other	1.5792	4.8510
employment (other)	-2.1761	0.1135			
b	Overall model				
AIC	13252.04		LR test statistic	4711.184	
Df	17		pvalue	0.0001	
Residual Deviance	13194.04				

clusion level (as opposed to medium or high financial inclusion level) compared to a person with other informal education. It also holds that, a person with post secondary education is 8.6 times more likely to be in the low or medium financial inclusion level (as opposed to high financial inclusion level) compared to a person with other informal education.

Accounting for other explanatory variables, for every unit increase in income, a person is 2 times more likely to be the low financial inclusion level as opposed to medium or high level. Similarly, for every unit increase in income, a person is 2 times more likely to be low or medium financial inclusion level as opposed to high level.

Considering marital status and controlling for other explanatory variables, a married person is 35% more likely to be in the low financial inclusion level (as opposed to medium or high financial inclusion level) compared to a divorced person. It also holds that a married person is 35% more likely to be in low or medium financial inclusion level (as opposed to high financial inclusion level) compared to a divorced person. A person who is single is 6 times more likely to be in low financial inclusion level as compared to a divorced person. It also holds that a person who single is 6 times more likely to be in low or medium financial inclusion level (as opposed to high financial inclusion level) compared to a divorced person. A widowed person is 2 times more likely to be likely to be in the low financial inclusion level (as opposed to medium or high financial inclusion level) compared to a divorced person. Also a widowed person is 2 times more likely to be in the low or medium financial inclusion level (as opposed to high financial inclusion level) compared to a divorced person

Finally, controlling for the other five variables, informal sector person is 87% less likely to be in low financial inclusion level (as opposed to medium or high financial inclusion level) compared to a person in formal sector. Also informal sector person is 87% less likely to be in low or medium financial inclusion level (as opposed to high financial inclusion level) compared to a person with in formal sector. A person who has other form of employment is 89% less likely to be in low financial inclusion level (as opposed to high or medium financial inclusion level) compared to a person in the formal sector. Also a person who has other form of employment is 89% less likely to be in low or medium financial inclusion level (as opposed to high financial inclusion level) compared to a person in the formal sector

The interaction of education level and marital status level except secondary school level interaction with windowed personnel, have odd ratios less than 1 which indicate less likelihood of being in low financial inclusion as compared to medium or high. The interaction of education and employment has the tendency of increasing the likelihood of being in low financial inclusion level.

3 Discussion and conclusion

The objective of the study was to identify determinants of financial inclusion from demand side perspective. The independent variable was financial inclusion level ordinal variable with three levels; low, medium and high. These categories were derived from financial inclusion score index ranging from 0 to 10. The explanatory Socio-economic factors considered were namely; area, gender, education, age, monthly income, marital status and employment. The linkage of the explanatory factors were assessed using ordinal regression model that proved to be statistically significant at 5% level. Except gender, all the other socio-economic factors were significant at 5%. The study also provides evidence of significant education-employment and education-marital status interactions.

In Kenya, area of residence, highest level of education attained, number of years, average monthly income, marital status and the type of employment involved are determinants in accessing and utilization of financial services such having a bank account, credit card, debit card, share or stock investments, bill or bond investment, life insurance, non-life insurance, mobile banking, mobile money and current loan. They all have a positive effect on the log-odd of higher financial inclusion level except type of employment. A male living in urban areas, more educated, otherwise not divorced will be favored in financial inclusion as he ages. The interaction of education and marital status reduces the log-odd of financial inclusion excluding people in the divorced category. Employment type is dependent on education level, which increases the log-odd of financial inclusion.
This study recommends the Kenya government develop policies that will address the challenges in gender parity, rural bank infrastructure development, entrepreneur thriving environment to address employment and income, advocating for secondary school completion, and social problems that affects family leading separation or no marriage at all. These will in the long run reduce the poverty inequality, result to both financial and economic growth.

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