

# Determining and Forecasting Financial Inclusion in Northern Ghana Using Discriminant Analysis

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## Abstract

Poverty and income inequality remain a serious challenge in Northern Ghana. Given the causal link between financial inclusion and poverty reduction, this paper aims at estimating a discriminant function model to analyze the determinants of financial inclusion in Northern Ghana. The study is mainly based on primary data elicited through survey questionnaires. Even though the minimum sample size was determined to be 385 households, a total of 400 households were selected systematically, out of which 395 households returned their questionnaires for analysis. The estimated discriminant function model was found to be significant at the 1% level of significance. It was also found that, the most significant determinants of financial inclusion in Northern Ghana (in order of importance) are “Age”, “Cost”, “Capability”, “Literacy”, “Distance”, and “Employment”. Overall, 72.4% of the cases were correctly classified by the estimated model. This paper therefore concludes that there is the need for Government and donors to make coordinated efforts towards addressing these determinants so as to broaden financial inclusion, thereby contributing to poverty reduction and lower income inequalities in the area.

**Keywords:** Financial Inclusion, Discriminant Analysis, Determinants, Northern Ghana  
**JEL Classification:** G21; C25

## **1. Introduction**

The significance of financial inclusion for economic growth cannot be overemphasized and has been extensively documented in the past two or three decades. The World Bank defines financial inclusion as the proportion of individuals and firms that use financial services (World Bank, 2013). Financial inclusion helps individuals cope better with poverty, provide funds for setting up and expanding micro enterprises and for improving risk management, boost economic growth on a macro scale by mobilizing savings, draw more firms into the formal sector, raising tax revenues and making workers eligible for better protection and benefit (Jha, Amerasinghe, & Calverley, 2014). King & Levine (1993) and Rajan & Zingales (1998) argue that financial inclusion and development can predict long-term economic growth, capital accumulation and productivity growth. In addition, Burgess, Pande, & Wong (2005) and Levine (2005) have shown that the relationship between financial development and long-term economic growth holds sway for developing economies as well as advanced ones.

It is argued that as financial services are in the nature of public good, the availability of banking and payment services to the entire population without discrimination is the prime objective of this public policy (Sharma & Kukreja, 2013). Hence getting the important policy decisions right has always been and continue to be one of the central development challenges. Providing financial services to the marginalized groups makes it possible for poor people to have access to otherwise unavailable money to embark on income generating activities (Meyer, 2002). Financial and social inclusion services that are being provided by financial services providers have increasingly proven to be an important liberating force in vulnerable and other pro-poor communities that struggle against repressive and uncertain struggle for survival (Littlefield & Rosenberg, 2004). Globally, financial inclusion has assumed a critical development policy priority. The World Bank Group in October 2013 postulated the global goal of universal access to basic transaction services as an important milestone toward full financial inclusion—a world where everyone has access and can use the financial services he or she needs to capture opportunities and reduce vulnerability (World Bank, 2013). The G20 has established the Global Partnership for Financial Inclusion (GPMI) which includes the World Bank, International Finance Corporation, and Consultative Group as well as the Alliance for Financial Inclusion and the OECD as designated implementing partners to assist the poor.

Greater financial inclusion according to Kama & Adigun (2013) is achieved when every economic activity, geographical region and segments of the society have access to financial information, financial assistance, financial services and financing with ease and at minimum cost. This helps to promote balanced growth through its process of facilitating savings and investment and thus causing efficient resource allocation from surplus sectors (unproductive) of the society to deficit sectors (productive) of the society. The objective of financial inclusion is to extend the scope of activities of the organized financial system to include within its ambit people with low incomes (Rangarajan & others, 2008). The importance of financial inclusion arises from the problem of financial exclusion of almost 3 billion adults from the formal financial services across the world (Swamy & Vijayalakshmi, 2010). For the lowest income quintile, which is the concern of this research, 77% are excluded (Demirgüç-Kunt & Klapper, 2012).

In a cross-country policy research working paper on access to financial services and inclusion around the world in 2011, Ardic, Heimann, & Mylenko (2011) noted that there is yet much to be done in the financial inclusion arena. In the world over, access to finance has been as low as 13% in the rural areas of the poorest households, which in other words mean 87% of these marginal households lack access to credit, which charge as much as 100% interest rates on its lending. Thus, this stratum of population, in midst of financial exclusion, has been pushed to the vicious circle of poverty and, therefore, remain outside the growth parameters always (Sangmi, 2013). Studies also reveal that between 2.1 billion and 2.7 billion adults or 72% of the adult population in developing countries do not even have a basic bank account (Ardic et al., 2011; Hannig & Jansen, 2010).

Although this problem is universal, the financially excluded person is more often than not the average citizen in a developing country as noted by (Chibba, 2009). Financial inclusion also differs in

important ways by individual characteristics such as gender, education level, age, and rural or urban residence (Demirgüç-Kunt & Klapper, 2012). In the remote areas of sub-Saharan Africa, less than 20 percent of the population has access to any type of formal financial institution. The protracted economic challenge of African countries has been explained in some studies as a consequence of the low level of financial services in Africa, despite efforts by countries to reform and develop financial services sectors in the continent.

In Ghana, 14 million adults are without any form of access to any formal financial services (Adu-Asare Idun & QQ Aboagye, 2014). The World Bank's Doing Business Report has thus ranked Ghana at a dismal 115 out of 178 economies in ease of access to credit (Business, 2008). Without access to formal financial services, households in such contexts typically share risk and fill income gaps at the household and business-level by self-insurance (savings), including "at home savings" (i.e., under a mattress), saving with collectors (i.e., susu) or "rotating savings clubs" (Aker & Wilson, 2013). Financial inclusion requires that attention is given to human and institutional issues, such as quality of access, affordability of products, provider sustainability, and outreach to the most excluded populations. KC (2012) opines that, the dearth of access to financial services by billions of adults all over the world poses serious challenges to global economic growth and development. The poor live and work in the informal economy—not by choice, but by necessity. They save and borrow constantly in informal ways. Estimates of the share of the world population living and working in the informal economy vary between 50 percent and 60 percent (Demirgüç-Kunt & Klapper, 2012). The share of informality is considerably higher for poorer countries and poorer income segments and can reach well over 80 percent or even 90 percent in some developing countries (Williams & Lansky, 2013).

As a consequent, building an inclusive financial sector has gained growing global recognition with the aim of drawing the unbanked population especially those with low incomes into the formal financial system so that they have the opportunity to access financial services ranging from savings, payments and transfers to credit and insurance (Hannig & Jansen, 2010). Access to safe, easy and affordable credit and other financial services by the poor and vulnerable groups in disadvantaged areas and lagging sectors is recognized as a pre-condition for accelerating growth and reducing income disparities and poverty. Access to a well-functioning financial system, by creating equal opportunities, enables economically and socially excluded people to integrate better into the economy and actively contribute to development and protects themselves against economic shocks.

In the literature there is no consensus on the determinants of financial inclusion, rather they vary from place to place. In a cross country analysis, Sarma & Pais (2008) showed that income, income inequality, telephone and internet usage and adult literacy are significant factors for financial inclusion in a country. They contend that countries with low GDP per capita have comparatively poorer connectivity and lower rates of literacy and seem to be more financially exclusive. In China, Fungáčová & Weill (2015) showed that better education and higher income are correlated with higher usage of formal accounts and formal credit. In Argentina, Tuesta et al. (2015) found that income and education are all significant factors for financial inclusion. In India, Chithra & Selvam (2013) found that income, population, literacy, deposit and credit penetration are significantly associated with financial inclusion. As well, Kumar (2013) found that the socio-economic and environmental structure is significant in shaping the banking habits of the masses in India. In Peru, Camara et al. (2014) showed that income levels and education are significant variables for the level of financial inclusion. In Africa, Allen et al. (2014) showed that population density is highly more significant for financial inclusion than elsewhere. Besides, they found that mobile banking expands financial access. Factors such as age, literacy, wealth class, distance, lack of documentation, lack of trust for formal financial institutions, poverty and social networks as reflected in family relations are the significant determinants of financial inclusion in Western Africa with insights from Ghana (Akudugu, 2013). However, not much is known about the determinants of financial inclusion in Northern Ghana. This paper therefore focuses on the situation in Northern Ghana which has been described as the most poverty-stricken spot in Ghana.

## 2. Methodology

### 2.1. Study Area

Northern Ghana (Figure 1) comprises the three northernmost administrative regions of Ghana: the Upper West region, Upper East region and Northern region. These lie roughly north of the Lower Black Volta River, which together with its tributaries the White and Red Voltas and the Oti and Daka rivers drain the area that comprises Northern Ghana. Northern Ghana shares international boundaries with Burkina Faso to the North, Togo to the east and Cote d'Ivoire to the lower southwest. To the south, Northern Ghana shares regional boundaries with the Brong Ahafo region and the Volta region (Awedoba, 2006).

According to the 2010 population and housing census (GSS, 2012), even though Northern Region is the largest of the 10 regions of Ghana in terms of landmass, occupying about 70,384 square kilometres and accounting for 29.5 per cent of the total land area of Ghana, the region has a population of about 2,479,461 with 1,229,887 male and 1,249,574 female; the Upper East region has a population of about 1,046,545 with 506,405 male and 540,140 female; and the Upper West region has a population of about 702,110 with 341,182 male and 360,928 female. Northern Ghana therefore has a total population of about 4,228,116 with 2,077,474 male and 2,150,642 female. The main economic activity of the people of Northern Ghana is Agriculture (Quaye, 2008). The area has been described as the most poverty-stricken and hunger spot in Ghana (GSS, 2008).

**Figure 1:** Map of the Study Area (Antwi et al., 2014).



## 2.2. Data

This study is mainly based on primary data elicited through survey questionnaires. The issues raised in the questionnaire focused mainly on the determinants of financial inclusion relating to income, attitude, employment, cost, culture, etc. The target population consists of all adults in Northern Ghana. Households in the study area were the sampling units in this study since the study was a household survey. The observation unit was the head of the household who is responsible for taking financial decisions in the household. Following Krejcie & Morgan (1970), the minimum sample size was determined to be 385 households based on 95% confidence level and 5% margin of error. However, a total of 400 households were selected and administered questionnaires to cater for possible non-respondents. Out of the total of 400 households" sampled based on systematic sampling, 395 households returned their questionnaires for analysis. The returned questionnaires were cleaned and entered into the computer for analysis.

## 2.3. Description of Variables

The variables used in this study were categorized as dependent and independent variables. The dependent variable was status of financial inclusion. However, measuring financial inclusion is not straightforward since there is no standard financial inclusion scale. Financial inclusion has been traditionally approached using supply-side indicators such as banking penetration or financial depth, which however do not take into account how these figures are distributed among the population, and therefore are not an accurate way of measuring the degree of inclusiveness of a financial system (Camara et al., 2014).

As mentioned earlier, full financial inclusion is a state in which all people who can use them have access to a suite of quality financial services, provided at affordable prices, in a convenient manner, and with dignity for the clients (Gardeva & Rhyne, 2011). Based on this definition, this study measures financial inclusion using several indicators. A household is financially included if it has access to at least one of the following financial services: formal bank account, pension fund, mortgage loan, credit/debit card, insurance, microfinance loan, mobile phone payment account, bonds, stocks and shares. Financial inclusion is therefore a binary variable in this study, which assumes a value of 1 if a household fulfils at least one of the above conditions and 0 otherwise.

The independent variables considered in this study relate to gender, age, employment, income, attitude (spending habits), community (place of residence), trust (belief that the financial institution has your best interest at heart), distance (closeness to financial institutions or services), cost (affordability of financial services), culture (cultural and religious beliefs), financial capability (the capacity to manage financial resources effectively based on knowledge, skills, and access), documentation, family, money, and literacy. A detailed description of the main independent variables is presented in Table 1.

**Table 1.** Description of the key independent variables considered

Variable	Description
<b>Gender</b>	Dummy variable that takes the value 1 if the respondent is male and 0 if the respondent is female.
<b>Age</b>	Quantitative variable taking values from 1 to 7 depending on whether the respondent is less than 20 years, between 20 and 29 years, between 30 and 39 years, between 40 and 49 years, between 50 and 59 years, between 60 and 69 years, or 70 years and over.
<b>Employment</b>	Quantitative variable taking values from 1 to 5 depending on whether the respondent is self employed, in paid employment, retired, student, or unemployed.
<b>Income</b>	Quantitative variable taking values from 1 to 3 depending on whether the respondents" income falls in the category of low income, average income, or high income.

<b>Variable</b>	<b>Description</b>
<b>Attitude</b>	Quantitative variable taking values from 1 to 5 depending on whether the respondent completely agreed, agreed, remained neutral, disagreed, or completely disagreed with the statement that, "I find it more satisfying to spend money than to save it for the long term."
<b>Community</b>	Quantitative variable taking values from 1 to 5 depending on whether the respondent lives in a village (fewer than 3 000 people), a small town (3 000 to about 15 000 people), a town (15 000 to about 100 000 people), a city (100 000 to about 1 000 000 people), or a large city (with over 1 000 000 people).
<b>Trust</b>	Dummy variable that takes the value 1 if the respondent believe that financial institutions have the best interest of their clients at heart and 0 otherwise.
<b>Distance</b>	Quantitative variable taking values from 1 to 3 depending on whether the respondent is near to, far away, or very far away from a financial institution.
<b>Cost</b>	Quantitative variable taking values from 1 to 5 depending on whether the respondent completely agreed, agreed, remained neutral, disagreed, or completely disagreed with the statement that, "financial institutions charge very high rates on their products and services."
<b>Culture</b>	Dummy variable that takes the value 1 if the respondent's religion/culture prevent him/her from taking a loan or any other financial product from a financial institution and 0 otherwise.
<b>Capability</b>	Quantitative variable taking values from 1 to 5 depending on whether the respondent completely agreed, agreed, remained neutral, disagreed, or completely disagreed with the statement that, "I have the capacity to keep a close personal watch on my financial affairs."
<b>Documentation</b>	Dummy variable that takes the value 1 if the respondent has personal identification that he/she can use for financial transactions and 0 otherwise.
<b>Family</b>	Quantitative variable taking values from 1 to 5 depending on whether the respondent completely agreed, agreed, remained neutral, disagreed, or completely disagreed with the statement that, "I depend on a relative's bank account for my financial transactions."
<b>Money</b>	Quantitative variable taking values from 1 to 5 depending on whether the respondent completely agreed, agreed, remained neutral, disagreed, or completely disagreed with the statement that, "I don't have enough money to transact with a financial institution."
<b>Literacy</b>	Dummy variable that takes the value 1 if the respondent can read and write and 0 otherwise.

## 2.4. Model

In order to analyze the links between financial inclusion and its determinants, discriminant analysis was used in this study. Discriminant analysis is used to predict group membership from a set of predictors (independent variables). It involves deriving a variate, the linear combination of two or more independent variables that will discriminate best between a priori defined groups (Walde, 2014). Discrimination is achieved by setting the variate's weight for each variable to maximize the between-group variance relative to the within-group variance.

The linear combination for a discriminant analysis, also known as the discriminant function, is derived from an equation that takes the following form:

$$Z_{ik} = \beta_{0i} + \beta_{1i}X_{1k} + \dots + \beta_{ji}X_{jk}, \quad (1)$$

where  $Z_{ik}$  is the discriminant score of discriminant function  $i$  ( $i=1,2,\dots,G-1$ ) for object  $k$ ,  $X_{jk}$  is the independent variable  $j$  ( $j=1,2,\dots,J$ ) for object  $k$ ,  $\beta_{ji}$  is the discriminant weight for independent

variable  $j$  and discriminant function  $i$ , and  $\beta_{0i}$  is the constant of discriminant function  $i$  (Walde, 2014). In a two-group discriminant analysis as we have in this study, only one function is estimated since  $G$  is the number of categories in the dependent variable.

The stepwise method of variable selection was used to select independent variables into the model. It involves entering the independent variables into the discriminant function one at a time on the basis of their discriminating power. The Wilks' lambda (Wilks, 1938) is appropriate for stepwise procedure. It is computed in the original space of the predictor variables. The selection rule is to minimize the Wilks' lambda. The Wilks' procedure performs stepwise discriminant analysis similar to stepwise regression analysis, designed to develop the best one-variable model, followed by the best two-variable model, and so forth. The stepwise discriminant analysis was conducted using IBM SPSS Statistics for windows version 19 (IBM\_Corp, 2010).

The assumptions of discriminant function analysis include independence of the cases, multivariate normality of the predictor variables and equality of within-group variance-covariance matrices across groups. Group membership is also assumed to be mutually exclusive (Bian, 2012).

### 3. Empirical Results and Discussion

#### 3.1. Descriptive Statistics

We observe from the group statistics in Table 2 that only 174 (44.2%) out of the 394 respondents who responded to all the variables considered are financially included while 220 (55.8%) are financially excluded. Also, we see from the group means that those who are financially included recorded slightly lower means in terms of "Community", "Employment", "Money", "Cost", "Capability", "Family", "Attitude", "Culture" and "Distance" while those who are financially excluded recorded slightly lower means in terms of "Gender", "Age", "Income", "Literacy" and "Documentation". The average for "Trust" was however equal for the two groups.

**Table 2.** Group Statistics

Status		Mean	Std. Deviation	Valid N (listwise)	
				Unweighted	Weighted
Financially included	Gender	.79	.410	174	174.000
	Community	2.13	1.158	174	174.000
	Age	4.07	1.352	174	174.000
	Employment	1.47	.851	174	174.000
	Income	1.37	.571	174	174.000
	Money	2.03	.866	174	174.000
	Cost	2.06	1.171	174	174.000
	Capability	1.35	.625	174	174.000
	Family	1.75	.888	174	174.000
	Attitude	2.78	1.334	174	174.000
	Trust	.40	.491	174	174.000
	Culture	.30	.459	174	174.000
	Literacy	.93	.264	174	174.000
	Documentation	.95	.222	174	174.000
Distance	1.71	.825	174	174.000	
Financially excluded	Gender	.63	.485	220	220.000
	Community	2.16	1.220	220	220.000
	Age	3.34	1.150	220	220.000
	Employment	1.69	.751	220	220.000
	Income	1.34	.520	220	220.000
	Money	2.44	1.051	220	220.000
	Cost	2.74	1.304	220	220.000
	Capability	1.73	.793	220	220.000
	Family	2.02	.901	220	220.000

	Attitude	2.85	1.189	220	220.000
	Trust	.40	.490	220	220.000
	Culture	.33	.472	220	220.000
	Literacy	.80	.397	220	220.000
	Documentation	.88	.329	220	220.000
	Distance	2.03	.819	220	220.000

The test of homogeneity of covariance matrices is presented in Table 3. This assumption is tested using Box's M test which is very sensitive to meeting the assumption of multivariate normality (Bian, 2012). The log determinants in the table suggest the covariance matrix for those who are financially included differ more than the covariance matrix for those who are financially excluded. Also, the significance (p-value = 0.000) of the Box's M test confirms that the two groups do differ in terms of their covariance matrices which violates the assumption of homogeneity. However, the discriminant function analysis is still robust even with the violation of the homogeneity of variance assumption since the data do not contain outliers (Bian, 2012).

**Table 3.** Test of equality of covariance matrices

Status	Rank	Log Determinant	Box's M	Approx. F	df1	df2	Sig.
Financially included	6	-3.845	102.400				
Financially excluded	6	-2.661		4.795	21	505656.432	0.000
Pooled within-groups	6	-2.922					

The test of equality of group means is presented in Table 4. Importance of the independent variables is indicated by the Wilks' Lambda. The smaller the Wilks' Lambda, the more important the independent variable is to the discriminant function. We observe from the table that "Age" is the most important independent variable (Wilks' Lambda = 0.920, p-value = 0.000) in the discriminant function whilst "Community" and "Trust" are the least important independent variables in the discriminant function (Wilks' Lambda = 1, p-value = 0.795). "Attitude", "Culture" and "Income" were also not significant (p-values of 0.567, 0.486 and 0.568 respectively).

**Table 4.** Tests of Equality of Group Means

Variables	Wilks' Lambda	F	df1	df2	Sig.
Gender	.970	12.114	1	392	.001
Community	1.000	.068	1	392	.795
Age	.920	33.872	1	392	.000
Employment	.981	7.471	1	392	.007
Income	.999	.326	1	392	.568
Money	.960	16.540	1	392	.000
Cost	.931	29.179	1	392	.000
Capability	.937	26.331	1	392	.000
Family	.979	8.529	1	392	.004
Attitude	.999	.328	1	392	.567
Trust	1.000	.000	1	392	.795
Culture	.999	.486	1	392	.486
Literacy	.971	11.909	1	392	.001
Documentation	.985	5.959	1	392	.015
Distance	.964	14.674	1	392	.000

### 3.2. Stepwise Statistics

The stepwise method was used to automatically select the best independent variables to be included in the discriminant function model. The Wilks' Lambda method was specifically utilized to select



independent variables for entry into the model on the basis of how much they lower Wilks' Lambda. The method starts with a model that does not include any of the independent variables, and at each step, the variable with the largest "F to Enter" value that exceeds the entry criteria (by default, 3.84 in SPSS) is added to the model.

We observe from Table 5 that, the best independent variables that minimizes the overall Wilks' Lambda and were used in the analysis include "Age", "Cost", "Capability", "Literacy", "Distance", and "Employment". However, "Gender", "Community", "Income", "Money", "Family", "Attitude", "Trust", "Culture" and "Documentation" could not meet the entry requirement and were therefore not used in the analysis.

**Table 5.** Variables in the analysis/Variables not in the analysis

Variables in the Analysis				Variables Not in the Analysis				
Variable	Tolerance	F to Remove	Wilks Lambda	Variable	Tolerance	Min. Tolerance	F to Enter	Wilks Lambda
Age	.978	32.272	.840	Gender	.965	.894	3.379	.768
Cost	.894	15.252	.805	Community	.909	.879	.023	.775
Capability	.902	15.703	.806	Income	.981	.887	.059	.775
Literacy	.991	7.463	.790	Money	.760	.760	1.257	.772
Distance	.965	5.626	.786	Family	.718	.718	.012	.775
Employment	.945	4.672	.784	Attitude	.983	.894	.885	.773
				Trust	.974	.891	.173	.775
				Culture	.956	.893	1.975	.771
				Documentation	.965	.887	.646	.774

### 3.3. Summary of Canonical Discriminant Functions

The significance of the estimated discriminant function is presented in Table 6. Wilks' Lambda in the table indicates how well the function separates cases (respondents) into the two groups (Financially included and financially excluded). Smaller values of Wilks' Lambda indicate greater discriminatory ability of the function (Uddin, Meah, & Hossain, 2013). We observe from the table that estimating the discriminant function is significant (Wilks' Lambda = 0.775, p-value = 0.000).

**Table 6.** Significance of the Discriminant Function

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.775	99.199	6	.000

Table 7 shows the correlations of the independent variables with the discriminant function which are known as factor loadings. The variation in the dependent variable which the independent variable can explain is determined by squaring the factor loading. The factor loadings in Table 7 are arranged in descending order, where the most important variable is the variable with the largest loading and the least important is the variable with the smallest loading. Variables with factor loadings that are less than 0.30 may not be very important in the model and may be removed from the model (Bian, 2012). Hence we observe from the table that, the most significant determinants of financial inclusion in Northern Ghana (in order of importance) are "Age", "Cost", "Capability", "Distance" and "Literacy". "Employment" is also important but may be removed from the model since its factor loading is less than 0.30. However, "Family", "Money", "Documentation", "Gender", "Culture", "Income", "Attitude", "Trust" and "Community" are not significant determinants of financial inclusion in Northern Ghana and are therefore not included in the estimated model.

**Table 7.** Structure Matrix

Variables	Function
	1
Age	-.545
Cost	.506
Capability	.481
Distance	.359
Literacy	-.323
Family <sup>a</sup>	.284
Money <sup>a</sup>	.276
Employment	.256
Documentation <sup>a</sup>	-.144
Gender <sup>a</sup>	-.132
Culture <sup>a</sup>	-.082
Income <sup>a</sup>	-.079
Attitude <sup>a</sup>	-.046
Trust <sup>a</sup>	.042
Community <sup>a</sup>	.009

a. This variable is not used in the analysis.

Table 8 contains the unstandardized discriminant function coefficients which are used to construct the actual prediction equation used to classify new cases. Based on the coefficients in the table, the model developed in this study is given in equation (2).

$$Z = -0.390 - 0.476Age + 0.297Employment + 0.348Cost + 0.606Capability - 0.844Literacy + 0.313Distance \quad (2)$$

**Table 8.** Canonical Discriminant Function Coefficients

Variables	Function
	1
Age	-.476
Employment	.297
Cost	.348
Capability	.606
Literacy	-.844
Distance	.313
(Constant)	-.390

Functions at group centroids are presented in Table 9. The centroids are the mean discriminant scores for each group which are used to establish the cut-off point for classifying cases. The centroid for those who are financially included is -0.604 while that of those who are financially excluded is 0.478. What this means is that, if the score for a new case based on equation (2) is negative, such a case will be classified among those who are financially included and if it is positive, it will be classified among those who are financially excluded.

**Table 9.** Functions at Group Centroids

Status	Function
	1
Financially included	-.604
Financially excluded	.478

### 3.4. Classification Statistics

The classification results in Table 10 are used to assess how well the discriminant function model works. We observe from the table that 128 (73.1%) of the 175 original cases who are financially included are correctly classified as financially included by the estimated model whereas 158 (71.8%) of the 220 Original cases who are financially excluded are correctly classified as financially excluded by the model. Overall, 72.4% of the original cases are correctly classified by the model while 71.6% of the cross-validated cases are correctly classified. This indicates that the estimated model is quite good in predicting financial inclusion in Northern Ghana.

**Table 10.** Classification Results<sup>b,c</sup>

		Status	Predicted Group Membership		Total
			Financially included	Financially excluded	
<b>Original</b>	Count	Financially included	128	47	175
		Financially excluded	62	158	220
	%	Financially included	73.1	26.9	100.0
		Financially excluded	28.2	71.8	100.0
<b>Cross-validated<sup>a</sup></b>	Count	Financially included	125	50	175
		Financially excluded	62	158	220
	%	Financially included	71.4	28.6	100.0
		Financially excluded	28.2	71.8	100.0

a. Cross validation is done only for those cases in the analysis. In cross validation, each case is classified by the functions derived from all cases other than that case.

b. 72.4% of original grouped cases correctly classified.

c. 71.6% of cross-validated grouped cases correctly classified.

## 4. Conclusion

This study estimates a two-group discriminant function model in order to analyse the determinants of financial inclusion in Northern Ghana, which will have policy implications towards enhancing financial inclusion in the area, and consequently boost economic growth on a macro scale. The estimated discriminant function model was significant at the 1% level of significance. The structure matrix in Table 7 shows that, the most significant determinants of financial inclusion in Northern Ghana (in order of importance) are “Age”, “Cost”, “Capability”, “Distance” and “Literacy”. “Employment” is also important but may be removed from the model since its factor loading is less than 0.30 (minimum threshold). However, “Family”, “Money”, “Documentation”, “Gender”, “Culture”, “Income”, “Attitude”, “Trust” and “Community” were not significant determinants of financial inclusion in Northern Ghana and were therefore not included in the estimated model. The estimated model was able to classify 72.4% of the original cases and 71.6% of the cross-validated cases correctly. Although the classification accuracy in this study was quite good, future research may explore more potential determinants of financial inclusion so as to increase the classification accuracy of the model.

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