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Article

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FINANCIAL ECONOMICS | RESEARCH ARTICLE

Mobile telephony, social networks and credit access: Evidence from MSMEs in Kenya

Idi Jackson Mdoe^{1*} and George Kariuki Kinyanjui²

Abstract: Access to credit by micro, small and medium enterprises is key for growth and employment. However, it is hindered by information asymmetry. We investigated the effect of mobile telephony and social networks (group networks) on the probability of access to credit by Micro, Small and Medium enterprises in Kenya. Our analysis employed cross-sectional data, the 2016 FinAccess Household Survey infographics sheet. The analysis assumed a limited dependent variable modelling. Our analysis revealed that micro-, small- and medium-sized enterprises with owners who currently have mobile banking, mobile money and group participation, respectively, have 8.8, 6.05 and 1.97 percentage points higher chance of receiving formal credit. In terms of informal credit, the analysis revealed that below five groups participation in an extra group by the MSME owner increases the probability of accessing informal credit by 6.26 percentage points. As policy measures, our analysis implies that owners of MSMEs should participate in groups and take up mobile money and banking to further their MSMEs chances of accessing formal and informal credit. In addition, the findings imply that money lenders should create strategies to tap MSMEs reputation created by groups and mobile telephony.

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Idi Jackson Mdoe is a lecturer of economics and finance at the department of Applied Economics, Kenyatta University Nairobi, Kenya. The author's research fields are competition among banks, role of innovation and information technology in driving competition and access to finance, regulation and public policy. Currently, the author is a member of the next generation of researchers (NGR), a component of the United Nations University Institute for the Advanced Study of Sustainability's (UNU-IAS) Education for Sustainable Development in Africa (ESDA) undertaking.

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PUBLIC INTEREST STATEMENT

MSMEs are important to economies through their job creation and contribution to growth but are credit constrained. We test whether MSMEs owner's participation in either Mpesa, Airtel money, Orange money, mobile banking, merry go rounds, chamas, investment clubs and clans/welfare groups matter in enhancing their MSMEs access to credit? Using survey data on 2,248 MSMEs owners surveyed by FSD-Kenya in 2015 we show that MSMEs owned by participants stand more chances of accessing credit than those owned by non-participants. Our findings imply that economies with credit constrained MSMEs, high mobile penetration and communities organized in groups could use MSMEs owner's participation in mobile telephony and groups to ease the credit constraints.

Subjects: Information & Communication Technology (ICT); Microeconomics; Banking; Credit & Credit Institutions

Keywords: Micro small and medium enterprises; mobile telephony and social networks

AMS subject classifications: L14

1. Introduction

1.1. Background

Micro, Small and Medium enterprises (MSMEs) are vital for growth and employment. MSMEs contribute to 49 and 29 percent of the GDP in high-income and low-income countries, respectively (International Finance Corporation, 2010). In terms of employment, MSMEs contribute to 67 percent of formal employment in high-income countries and 45 percent in low-income countries. Therefore, MSMEs access to credit cannot be overemphasized.

In Kenya, the MSMEs sector is equally important but with an extra level of prominence. The country has prioritized the MSMEs sector for the achievement of her middle-income status envisioned in *the Kenya vision 2030* (Republic of Kenya, 2007). Accordingly, *the Kenya Vision 2030* seeks to deal with the informality, productivity as well as jobs and income generation by MSMEs. The vision identifies the provision of appropriate financial services for MSMEs as an enabler of their role in the attainment of the middle income status.

The importance assigned to MSMEs by Kenya's economic blue print is not unfounded. MSMEs, in Kenya, are the majority establishments in terms of numbers and distribution. The Kenya National Bureau of Statistics (2016) estimates that in 2015, there were 1.56 million licenced and 5.85 million unlicenced MSMEs against 349, 320 registered companies. Therefore, financing MSMEs in Kenya implies financing the majority who are vastly distributed in the country.

The significance assigned to MSMEs in Kenya is further justified by their contribution to the country's growth agenda. In 2015, MSME's output was estimated at 33.8% (KES3,371.7 billion) of national output. This contribution exceeds the average contribution (29 percent of the GDP) of MSMEs to low-income countries. In terms of gross value added, the MSMEs in Kenya are estimated to have contributed KES1,780.0 billion compared to KES5, 668.2 billion for the whole economy. Thus, financing MSMEs in Kenya implies financing part of growth and value addition engine.

The central role of MSMEs in Kenya is further cemented by their contribution to employment. MSMEs are arguably the leading employers in Kenya. In 2015, the sector employed a total of 14.9 million Kenyans (The Kenya National Bureau of Statistics, 2016). The employment was disproportionately in favour of women (The Kenya National Bureau of Statistics, 2016). Thus, MSMEs in Kenya are instruments of promoting equitable distribution of income and gender participation. Therefore, financing MSMEs is synonymous to financing equitable distribution of income and gender mainstreaming.

Other than the economic role played by MSMEs, there is consensus in literature on the need of accessible finance by MSMEs. To begin with, Ayyagari, Beck and Demircuc-Kunt (2007) opine that access to credit is significant in fuelling innovations among MSMEs, sustaining their growth momentum and aiding their transition from their MSMEs status to large firms. This view is also held by Ahiawodzi and Adade (2012) who established that increase in access to credit had a positive effect on the growth of SMEs in the in the Ho-Municipality of Ghana and Cook and Nixon (2000) who observed that notwithstanding the recognition of the role of SMEs in the development process in many developing countries, SMEs development is always constrained by the limited availability of financial resources to meet a variety of operational and investment needs.

The government of Kenya has through various policy documents underscored the importance of MSMEs in the Kenya. The *sessional Paper No. 1 of 1986 on Economic Management for Renewed Growth* recognized and highlighted the importance of MSMEs as a means of strengthening Kenya's economic development. The sessional paper noted that special attention was to be paid to informal sector entrepreneurs in manufacturing, construction, transport, housing and those firms with potential to acquire experience and capital necessary to make transition to large enterprises. This was followed by the *sessional Paper No. 2 of 1992 on Small Enterprises and Jua Kali Development* that recommended creation a robust legal and regulatory framework for the enabling of MSMEs in Kenya. In 2005, the government developed *sessional Paper No. 2 of 2005 on Development of Micro and Small Enterprises for wealth and employment creation for poverty reduction*. This sessional paper spelt out measures to address business registration, licencing and tax regime for the growth of MSMEs. These government aspirations for the growth and development of MSMEs were later included in the *private sector development strategy (PSDS) Kenya and the Kenya Vision 2030*.

Based on their contribution to the growth agenda, consensus in literature on their need for finance and centrality to development policy in Kenya, it would be expected that MSMEs would find it easy to access credit. However, this is not the case. Central Bank of Kenya and Financial Sector Deepening (2016) estimate that only eight percent of MSMEs have access to both formal and informal credit. Formal money lenders—commercial banks, microfinance institutions and Savings and Credit Cooperatives (SACCOs)—refrain from lending to MSMEs on the basis of information asymmetry and lack of collateral (The Kenya National Bureau of Statistics, 2016; Rapsomanikis, 2014). Further for those with access to credit, the interest rates are high making borrowing a costly affair (The Kenya National Bureau of Statistics, 2016). The 2016 national MSMEs establishments survey established that the inaccessibility is more pronounced for commercial banks than small financial institutions. The situation is dire to the extent that 29.6% of MSMEs closed down between 2012 and 2016 due to inadequate financing (The Kenya National Bureau of Statistics, 2016).

To address the impediments to MSMEs financing in Kenya, innovative outreach models have been embraced. The models include the use of social networks (group lending and monitoring) and mobile telephony (mobile banking and mobile money) to tackle the information problems and lack of collateral (Financial Sector Deepening Kenya, 2015). The social networks and mobile telephony have created points of contact with hard to-reach MSMEs and can, therefore, be used as service delivery channels (Financial Sector Deepening Kenya, 2015). From a theoretical standpoint, the money lenders are, therefore, leveraging on technological advances in mobile telephony and social networks to lend to MSMEs. This study therefore seeks to establish the effect of these models on MSMEs access to credit.

From a cursory look, this effect might sound obvious. However, a critical look of the social networks and mobile telephony reveals that they have counter acting effects (Okten & Osili, 2004). Social networks and mobile telephony create communities. While communities provide information and other benefits to those within the community network, certain groups (based on gender, ethnicity, or income) who are less likely to participate in communities may be excluded (Okten & Osili, 2004). Therefore, investigating the effect of the innovative outreach models on MSMEs access to credit is important in evaluating their effectiveness in enhancing access to credit among MSMEs. Further, this study has the implication that the findings may influence the adoption of mobile telephony as a source of MSMEs access to credit in developing countries.

1.2. Mobile telephony, social networks and access to credit

Economic theory posits that technological advancements and social networks can be vital in easing information flow (Fukuyama, 1995). That is technological advancements and social networks have an effect on economic outcomes. This is also true to money lending and in particular lending to MSMEs. According to Fukuyama (1995), economic prosperity or business success is not solely or adequately explained by abundance of natural resources, brilliance of intellect, presence of good laws and institutions, self-interested rationality (the neo-classical argument) in free markets but also by

trust. A culture of trust makes agents spontaneously sociable (Fukuyama, 1995). This capacity enables creation of trust relationships that in turn facilitate business between various agents.

Technology powers new relationships beyond the family (Fukuyama, 1995). In particular, technology eliminates the need for face to face interactions to create trust. Therefore, mobile money and mobile banking in Kenya can be viewed from this perspective. Mobile telephony provides the convenience of interacting with family, financial institutions and members in a group irrespective of place and time. This creates trust and supposedly facilitate exchange between the agents. Our analysis, therefore, seeks to test the hypothesis that participation in mobile money and mobile banking positively influences lending opportunities by banks and access to credit by MSMEs.

Trust emanates from shared values, a shared language of good and evil (Fukuyama, 1995). Therefore, trust emanates from an individual's social networks. Precisely, then, business opportunities and transactions emanate from an individual's networks. It is noteworthy that a majority of the MSMEs are micro and can hardly be distinguished from the owner (Financial Sector Deepening Kenya, 2015). In fact, there is likelihood that most business loans are secured from personal accounts (Financial Sector Deepening Kenya, 2015). This makes the MSMEs owner's social networks important to the MSMEs access to credit. Consequently, our analysis tests the hypothesis that access to credit by MSMEs is a consequence of the owner belonging in a social network (groups).

The information intermediation provided by social networks and technological advancements can enhance or play down trust (Okten & Osili, 2004). Social networks and mobile telephony circulate information on the type of borrowers (MSMEs). The MSME might be high quality or low quality (Okten & Osili, 2004). Therefore, it is expected that social networks and mobile telephony would enhance the chances of high quality MSMEs accessing credit than the low-quality MSMEs.

Although mobile telephony and social networks fight information asymmetry, they may propagate it further by alienating MSMEs who hardly participate in the social networks but are potential borrowers (Okten & Osili, 2004). Therefore, social networks may promote or hinder uptake of credit depending on the offsetting effects it creates in a community. Therefore, in testing our suppositions, we largely agree with past literature that social networks and mobile telephony are not the silver bullets in disseminating quality information about lenders and borrowers.

The setting in Kenya provides a rich environment for testing the effect of mobile telephony and social networks on MSMEs access to credit. Kenya has a 90% (39.78 million mobile subscribers) mobile penetration rate which is way above the African continent average of 76.2% (Communications Authority of Kenya, 2016). Mobile money transfer in Kenya is a global pacesetter with a penetration rate of 66.1% (26.3 million of the 39.78 million mobile subscribers) and has a vast agent network of 158,777 (Communications Authority of Kenya, 2016). These subscription rates led to the transfer of KES3, 355.1 trillions in 2016 (Communications Authority of Kenya, 2016). Therefore, MSMEs have an incentive to join mobile money. The MSMEs survey of 2016 reveals that 49.3% of the MSMEs use mobile money with 29% having paybill numbers (The Kenya National Bureau of Statistics, 2016). The survey further shows that at least one percent of the MSMEs use mobile banking. In terms of social networks most if not all of the MSMEs belonged to more than one support group (The Kenya National Bureau of Statistics, 2016). The proportion of licenced MSMEs participating in men and women associations were 64.2% while the unlicenced had 4.2%. The participation of MSMEs in mobile telephony and social networks allows us explore the role of mobile telephony and social networks in MSMEs access to credit in Kenya.

Previous studies on the effect of networks in general on the access to credit include: Okten and Osili (2004) who investigated how family and community networks affect an individual's access to credit institutions in Indonesia. The study established that community and family networks are important in knowing a place to borrow, as well as for loan approval and that women benefit from participating in community networks more than men; Wydick, Hayes and Kempf (2011) measured

the extent to which social networks determine sources of credit from a survey of 465 households in western Guatemala. The study established that church networks displayed endogenous effects in credit access; if the number of people accessing microfinance in a church network doubles, the probability of an individual household accessing microfinance increases by 14.1%; Biggs, Raturi, and Srivastava (2002) who analysed the impact of ethnic networks on access to finance of Kenyan firms. The study established that ethnicity does not affect access to formal sources of finance, but being a member of an ethnic group is significant in explaining access to informal sources of finance like supplier credit; Kinyanjui and Mdoe (2017) who sought to unravel the effects of family networks in increasing the probabilities of members accessing microcredit. The study established that family networks are vital in reducing search and information costs and active networks increase the probability of accessing credit compared to non-active networks. None of these studies attempted to estimate the effect of mobile telephony or social networks on MSMEs access to credit. Biggs et al. (2002) focuses on ethnic networks while we focus on mobile telephony and social networks. Kinyanjui and Mdoe (2017) focus on the household side while we focus on the firm side. Okten and Osili (2004) and Wydick et al. (2011) focus on other developing countries in central America and South East Asia. Therefore, we seek to fill the gap of testing the effect of social networks on firms access to credit in Kenya as well as that of the “new” concept of mobile telephony.

2. Data and methodology

2.1. The methodology

There are two outcomes in MSMEs access to credit. Our analysis is, therefore, modelled using a binary choice model. The dependent variable, access to credit, is defined as:

$$\text{Access} = \begin{cases} 1, & \text{MSME has a credit facility} \\ 0, & \text{MSME has no credit facility} \end{cases} \quad (1)$$

The limited dependent variable regression is specified as:

$$y_i = X_i' \beta + Z_i' \phi + W_i' \alpha + \epsilon_i \quad (2)$$

where: y_i is the observable credit access outcome, X_i is the owner’s social networks and mobile telephony variables, Z_i is a vector of the firm characteristics, W_i is a vector of the owner’s characteristics, β , ϕ and α are vectors of coefficients and ϵ is the error term.

Assuming a probit model, β , ϕ and α in model (2) are parameters of the latent regression. However, this is not the concern of this study. The study is interested with the effect of changes in X_i , Z_i and W_i on the access outcome y_i . This is achieved using marginal effects. Since we assume a probit regression the marginal effects are given by (3):

$$\frac{\partial [y_i | G]}{\partial g_i k} = \frac{\partial \Phi(G_i \gamma)}{\partial g_i k} = \phi(G_i \gamma) \cdot \gamma_i k \quad (3)$$

where: $G = [X_i \ Z_i \ W_i']$ and $\gamma = [\beta \ \phi \ \alpha]$. Equation (3) shows that the marginal effects vary with the values of the independent variable and their signage corresponds to that of the coefficients. For the purposes of this study, average marginal effects (partial effects) are used.

2.2. The data

The study used cross-sectional data from the Kenya FinAccess household survey of 2016 that measured access to and demand for financial services among adults in Kenya. The study had 8,665 respondents of whom 2,248 had businesses falling under the MSMEs category. For empirical purposes, the variables employed in estimating (2) are defined as follows.

2.2.1. Social networks and mobile telephony covariates

In our empirical analysis, we define social networks using participation in the groups. As pointed out earlier, economic outcomes are not only a function of market, intellect and the neoclassical arguments of the free market but also trust that emanates from social networks and mobile telephony. A majority of the MSMEs can hardly be distinguished from the owner (Financial Sector Deepening Kenya, 2015). As such, the owner's social networks and participation in mobile telephony become important in determining the outcomes of the lending process.

We define social networks with a dummy variable that sets to one if the owner belongs to a group and zero otherwise. As per the Kenya FinAccess household survey of 2016, the groups constitute merry go rounds, savings and lending groups, chamas, investment clubs and clan/welfare groups. Therefore, our network covariate, group, sets to one if the owner of the MSME belongs to either of these groups. To address endogeneity that may arise between access to informal credit and belonging to a group, we instrument this belonging with the number of groups that the owner belongs to. Considering that the group plays an information intermediation role, then the number provides the quantity of information that the owner has at his disposal. However, we hold that the number of groups that the owner belongs to has non-linear effects on access. Therefore, in capturing participation in the groups, we introduce the number of groups that the individual belongs to and its square.

Mobile telephony has two aspects: mobile money transfers and mobile banking. Mobile money involves participation in the sending and receiving of money via mobile money platforms such as M-PESA, Airtel Money and Orange Money (Odhiambo, 2013). The mobile money variable is binary. The variable captures those who currently have and those without mobile money. Therefore, mobile money sets to one if a respondent currently has mobile money. On the other hand, mobile banking refers to the use of mobile phones to access banking services (Odhiambo, 2013). The variable is likewise binary. It sets to one if a respondent currently has mobile banking and zero otherwise.

2.2.2. Firm characteristics

In our analysis, we control for MSME characteristics. Previous studies have shown that MSME characteristics are important in determining whether it accesses credit or not. Biggs et al. (2002), Ayyagari et al. (2007) and Kebede and Abera (2014) use MSME size, stage in business cycle, length of relationship with suppliers, ethnic networks, age of the firm and the sectors where the firm operates.

These covariates will be included in our estimation with the exception of the stage in business life cycle and length of relationship with suppliers. Biggs et al. (2002), Ayyagari et al. (2007) and Kebede and Abera (2014) use the number of employees to measure the size of the MSME. In Kenya, the Micro and Small Enterprises Act of 2013 provide two proxies of measuring MSME size: the number of employees and annual sales turnover (Financial Sector Deepening Kenya, 2015; Republic of Kenya, 2013). However, it is noteworthy that the Act does not define medium enterprises. The study, therefore, uses the Republic of Kenya's definition of micro and small enterprises and adopts the medium enterprise definition by FSD Kenya.

In terms of the number of the employees¹, an MSME is considered medium if it has more than 50 employees, small if it has eleven to 50 employees and micro if it has one² to ten employees. With regard to sales turnover, a MSME is considered medium if it has a sales turnover greater than five million Kenya shillings, small if it has a turnover of between half a million and five million Kenya shillings and micro if the annual³ sales turnover is less than half a million Kenya shillings. Since the reported sales turnover is annual this study employed sales turnover to define size of the firm. Owing to the categories size is defined as in equation four

$$\text{Access} = \begin{cases} 0, & \text{Micro} \\ 1, & \text{Small} \\ 2, & \text{Medium} \end{cases} \quad (4)$$

The Kenya FinAccess household survey of 2016 divided the sectors where MSME operate into 18 categories. Thus, the sector variable could not enter the regression without recoding.⁴ The variable is recoded to reflect the ability of a sector to have collateral. Therefore, the sector of a MSME sets to one if it operates in electronics, general retail and whole sale shop, motor vehicle trade and repair, waste management and recycling, food and beverages, machinery and equipment, land transport as well as bar and restaurant and zero otherwise. The common characteristic of these sectors is their endowment with assets that act as collateral unlike those in professional services, financial services among others.

With respect to age of the firm, the survey required the owner to ascertain the year in which the business started operations. The age of the firm is, therefore, assumed to be the difference between 2016 and the year the business began operations.

Other than firm level covariates used by previous studies, our analysis employs the registration status of the MSME. The MSME is considered registered if it is registered with the registrar of companies or has a single business permit. Therefore, registration is a dummy variable that sets to one if the MSME is registered with the registrar of companies or has single business permit.

2.2.3. Owner characteristics

As pointed out in Equation (2), access to credit is not only a function of social networks, mobile telephony and firm characteristics but also owner’s characteristics. This view is also held by previous studies. We control for the owner’s highest level of education and religion. The highest level of education is a multilevel dummy variable that sets to zero if the owner has no education, one if the highest level is primary education, two if the highest level is secondary education and three for post-secondary education. Religion sets to one if the owner is Muslim and zero otherwise.

2.2.4. Access to credit

Access to credit is dichotomous. It takes a value of one if the MSME has a credit facility and zero otherwise. In addition, the Kenya FinAccess household survey of 2016 categorizes the sources of credit into two: formal and informal sources. Therefore, two flavours of Equation (2) are estimated, one for formal credit⁵ and the other for informal credit.⁶ This division follows that of Biggs et al. (2002)⁷ who divided credit into bank overdrafts and supplier credit to capture the dual nature of credit markets in Kenya.

3. Results

3.1. Descriptive statistics

This section provides the summary statistics and frequencies of variables used in the analysis. The summary statistics for the access to credit are shown in Table 1.

The frequencies in Table 1 confirm that only eight percent of the MSMEs have accessed credit whether informal or formal. However, in terms of size, access to credit from formal lenders stands at 33 percent for small firms. This implies that access varies across the sizes.⁸ Only six percent of small firms accessed credit from informal sources compared to 33 percent that accessed credit from formal sources. This means that size might be having differential effects on the access to formal and informal credit. The proportion of micro firms is equal at eight percent for informal and formal sources. No medium firm accessed credit from formal or informal sources. This could be explained by lack of enough observations on medium firms in the data set.⁹

Table 1. Access to formal and informal credit

	Micro (%)	Small (%)	Medium (%)	Total (%)
Formal credit	8.2	33.3	0	8.41
Informal credit	8	6	0	8

Table 2. Frequencies of factor variables

Variable	Mean
Mobile banking	0.228
Mobile money	0.81
Group participation	0.588
Registration	0.236
Micro enterprises	0.992
Age of the firm	8
Sector	0.24
Muslim	0.13

Table 2 shows that a majority, 58.8 percent, of the owners are in groups for business purposes and almost all of them, 81 percent, currently have mobile money. However, only a minority, 22.8 percent, currently have mobile banking. In terms of size, Table 2 shows that the sample is highly biased in favour of micro enterprises that stand at 99.20 percent.¹⁰ A majority of these firms, 76.4 percent, are yet to be registered with the registrar of companies or are yet to acquire the single business permit. This means that a majority of MSMEs are still informal in terms of registration, recognition by the government. Cumulatively, more than half of the owners have some education, are non-Muslim and on average run enterprises that are eight years old.

3.2. Effect of mobile telephony and social networks on MSMEs access to credit

This section presents the empirical findings. The estimation of model (2) for the formal and informal sources of credit is presented in Table 3. The McFadden pseudo R^2 shows that the models do well in predicting the probabilities than the restricted model.¹¹ The likelihood ratio test shows that all the variables are jointly significant in predicting the probabilities.

3.2.1. Effect on access to formal credit

Table 3 shows that both mobile telephony and group networks are important in explaining MSMEs access to formal credit. The quantity of group networks, mobile banking and mobile money have positive effect. However, the number of groups has no non-linear effects since its square is not significant. With respect to the control variables size, registration status, sector, owners highest level of education and age of the firm have positive effect on access to formal credit.

To establish the magnitude of the effects of mobile telephony and group networks on access to formal credit average partial effects were used. The partial effects are reported in Table 3. The margins column in Table 3 shows that a unit increase in the number of groups that the owner participates in increases the probability of accessing credit from formal sources (Bank, SACCO, MFI, Mshwari, KCB M-PESA, government institution, hire purchase, bank overdraft and credit card) by 1.97 percentage points holding other factors constant. This implies that the more the number of groups the owner of an enterprise subscribes to, the higher the probability of accessing formal credit. Since the square of the number of groups is not significant this number is not bounded.

As noted, owner’s participation in mobile banking increases the probability of the MSME access to formal credit. Specifically, the marginal effects column in Table 3 shows that MSMEs with owners who currently have mobile banking have 8.8 percent points higher chance of receiving formal credit compared to those not having mobile banking holding other factors constant. This means that MSMEs with owners who participate in mobile banking have much access to formal credit than those non-participating owners.

In terms of the MSME owner’s participation in mobile money, mobile money has a positive effect. In particular, the marginal effects show that MSMEs with owners who currently have mobile money

Table 3. Effect of mobile telephony and social networks on MSMEs access to credit

Variables	Formal		Informal	
	Base model	Margins	Base model	Margins
Number of groups	0.151*** (0.0545)	0.0197*** (0.00710)	0.461*** (0.0571)	0.0626*** (0.00790)
Number of Groups squared	-0.00983 (0.00692)	-0.00128 (0.000902)	-0.0424*** (0.00760)	-0.00575*** (0.00104)
Owner has mobile banking	0.582*** (0.0892)	0.0881*** (0.0154)	0.0703 (0.100)	0.00977 (0.0142)
Owner has mobile money	0.642*** (0.213)	0.0605*** (0.0133)	0.185 (0.127)	0.0233 (0.0147)
Small enterprise	0.170 (0.149)	0.0240 (0.0227)	0.338** (0.166)	0.0551* (0.0319)
Medium enterprise	1.216*** (0.390)	0.275** (0.121)	0.228 (0.559)	0.0348 (0.0973)
MSME registered	0.320*** (0.0923)	0.0453*** (0.0141)	-0.0873 (0.103)	-0.0115 (0.0132)
Sector with collateral	0.355*** (0.0910)	0.0510*** (0.0142)	0.457*** (0.0883)	0.0716*** (0.0157)
Muslim	-0.168 (0.171)	-0.0201 (0.0188)	0.153 (0.128)	0.0224 (0.0200)
Primary education	0.843** (0.423)	0.0614*** (0.0163)	-0.265* (0.154)	-0.0423 (0.0273)
Secondary education	0.930** (0.427)	0.0729*** (0.0172)	-0.300* (0.168)	-0.0470 (0.0289)
Post secondary education	1.062** (0.435)	0.0928*** (0.0226)	-0.406** (0.206)	-0.0598* (0.0316)
Age of the firm	0.0131** (0.00556)	0.00171** (0.000725)	-0.00757 (0.00574)	-0.00103 (0.000780)
Constant	-3.519*** (0.462)		-1.861*** (0.162)	
Observations	2,248	2,248	2,248	2,248

Note: Standard errors in parentheses.

* $p < 0.1$.

** $p < 0.05$,

*** $p < 0.01$,

have 6.05 percent points higher chance of receiving formal credit compared to those not having mobile money holding other factors constant. This indicates that MSMEs with owners who participate in mobile money have much access to formal credit than those non-participating owners.

Overall, therefore, both mobile telephony and group networks have a positive effect on MSMEs access to formal credit. The MSMEs owned by owners who participate in group networks and mobile telephony have a much higher chance of accessing formal credit.

3.2.2. Effect on access to informal credit

Unlike in the case of formal credit, Table 3 shows that only group networks are important in accessing informal credit. The number of groups squared is significant implying that the number of groups

that the owner participates in have nonlinear effects on access to informal credit. Unlike in the case of formal credit with respect to control variables only size, sector and education are important in explaining access to informal credit. As is expected, education has a negative effect but being a small enterprise and belonging to a sector that can easily raise collateral has a positive effect on access to informal credit.

To interpret the average partial effect of group networks, the non-linear effect of the number of groups should be considered. The inverted U effect shows that there is an optimal number of groups beyond which access to informal credit diminishes. Further, it implies that owners participation in groups increase the probability of accessing informal credit but up to some point.¹² Calculation of this of point yielded five groups. Therefore, the average partial effects in Table 3 show that additional participation in groups by the owner of the MSME increases the probability of accessing informal credit by 6.26 percentage points up to five groups beyond which the probability of accessing informal credit begins to fall holding other factors constant.¹³ This means that participation by the owners of MSMEs in five or less than five groups increases the chance of the MSME accessing informal credit.

Overall, therefore, only group networks have a positive effect on MSMEs access to formal credit. Below five groups, MSMEs owned by owners who participate in group networks and mobile telephony have a much higher chance of accessing informal credit. This finding is in line with expectations. Informal lending hardly considers information available in the formal structures while lending. Mobile telephony is a formal structure and, therefore, it is expected that it will hardly influence informal lending to MSMEs.

4. Conclusion

Our analysis sought to test the hypotheses that access to credit by MSMEs is a consequence of the owner belonging in a social network (groups) and participating in mobile money and mobile banking (mobile telephony).

We establish indeed that group networks and mobile telephony affect lending outcomes to MSMEs. In particular, we establish that both mobile telephony and group networks have a positive effect on MSMEs access to formal credit. The MSMEs owned by owners who participate in group networks and mobile telephony have a much higher chance of accessing formal credit. However, only group networks have an effect on access to informal credit. We establish that below five groups additional participation of MSMEs owners in groups increases MSMEs access to informal credit.

Therefore, as policy measures, owners of MSMEs should participate in groups and take up mobile money and banking to further their MSMEs chances of accessing formal and informal credit. The MSME owners should join groups and mobile telephony to leverage on the information gains from groups and mobile telephony. The information gains are substantial considering that the national payment systems (NPS) regulations of 2014. The NPS regulations of 2014 provide for free disclosure of mobile money transactions on a regular basis using statements. The provision of statements to mobile money participants is important in creating a financial history that may not exist for some MSMEs. Money lenders as well should create strategies to tap MSMEs reputation created by groups and mobile telephony. For instance, money lenders could use information on payments of bills and other utilities using mobile money and mobile banking to gauge the credit worthiness of MSMEs. In the long term, the lenders should lobby with credit bureaus to include mobile money transactions and group participation in credit information sharing.

Further, the study has implications for countries that have problems financing MSMEs but have a high mobile telephony penetration and group participation. Such countries should first appreciate that the 'new' concept of mobile telephony and the long standing use of social networks are innovative outreach models in enhancing MSMEs access to both formal and informal credit. These innovative technologies work to create information where there was none and tackle lack of collateral. As such, these countries could mainstream these innovations to ease lending to MSMEs in their countries.

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Note

1. Both permanent and casual.
2. Excluding the owner.
3. Does away with macroeconomic cycles.
4. Necessary to deal with categories that do not occur. Also, too many levels in a dummy variable pull down the performance of the model.
5. Bank, SACCO, MFI, Mshwari, KCB M-PESA, government institution, hire purchase, bank overdraft and credit card.
6. Employer, ASCA, Chama, friends, family, neighbours, shopkeeper, shylocks, local shop/supplier and buyer of harvest.
7. The decision of formal sources to extend credit is assumed to be separate to that of informal sources.
8. This is consistent with the FSD bank financing of SMEs in Kenya 2015 report that showed that proportion of access to formal finance increases with the size of SMEs.
9. It also confirms the problem of the missing middle in terms of size and financing.
10. This is important since the study assumes that most enterprises if not all cannot be differentiated from the owners.
11. McFadden's Pseudo R^2 estimates need not be high. Lee (2013) considers Pseudo R^2 between 20 and 40 percent perfect fit.
12. The point is calculated using $\frac{-(\text{coefficient of the linear term})}{(2 \times \text{coefficient of the squared term})}$ the solution is the same whether marginal effects or the coefficients in the Probit regression are used. see <https://www3.nd.edu/~rwilliam/stats2/l61.pdf>.
13. Number of groups have a non-linear relationship with access to informal credit. The linear component shows the relationship between access to credit and number of groups while the non-linear component is helpful in calculating the turning point. see <https://www3.nd.edu/~rwilliam/stats2/l61.pdf>.

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