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Mobile Money Use and Entrepreneurs' Access to Trade Credit in the Informal Sector

Godsway Korku Tetteh[1,2] | Micheline Goedhuys[2] | Maty Konte[3] | Pierre Mohnen[2]

[1]Strathclyde Business School, University of Strathclyde, Glasgow, UK | [2]Maastricht University and UNU-MERIT, Maastricht, the Netherlands | [3]International Finance Corporation, World Bank Group, Washington, DC, USA

Correspondence: Godsway Korku Tetteh (tetteh@merit.unu.edu; godsway.tetteh@strath.ac.uk)

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Keywords: entrepreneurship; financial innovation | mobile money | trade credit

ABSTRACT

Using the 2016 FinAccess Household Survey of Kenya, this article investigates the relationship between mobile money use for transactions and trade credit based on a sample of entrepreneurs who operate informal businesses. Our main findings are as follows. Informal firms that use mobile money for business transactions are more likely to receive goods and services on credit from suppliers and offer goods and services on credit to customers. The effect of mobile money use on the probability of regularly receiving goods and services on credit is higher among entrepreneurs with lower income, those without access to informal finance, and those with bank accounts. The effects of mobile money use on the likelihood of offering credit to most or all customers are higher among high-income entrepreneurs, those with bank accounts, and those with access to informal loans. Mobile money use affects entrepreneurs likelihood to offer credit to customers because it enables them to receive credit from their suppliers. Transaction costs matter in the relationship between mobile money use and the likelihood of receiving or offering credit.

JEL Classification: D14, G21, L26, O16, O33

1 | Introduction

This study seeks to understand whether the use of mobile money for business transactions among informal firms influences their propensity to receive or offer goods and services on credit. The informal sector is pervasive in Africa (Cunningham et al. 2024) and a significant proportion of the population operates small and household enterprises outside formal wage employment (World Bank 2016). In Kenya, the informal sector accounts for about 85% of all newly created jobs in 2023 (KNBS 2024) and plays an important role in production and income generation (Kenya National Bureau of Statistics 2020). However, about 50% of businesses in the informal sector are financially constrained due to inadequate collateral, lending ceilings, and high interest rates (FKE and ILO 2021).

Trade credit represents an important source of alternative finance for financially constrained firms (Dak-Adzaklo 2025; Shao 2025) given that it is not dependent on formal collateral but on trust and reputation (Bastos and Pindado 2013; Biais and Gollier 1997; Fafchamps 1997; Petersen and Rajan 1997). However, delays in credit repayments can sever the credit relationship, leading to a cut in credit supply, particularly in the case of microenterprises (Fafchamps 1997), which are predominant in the informal sector. At the same time, credit constraints and limited cash flows can inhibit entrepreneurs' ability to offer trade credit to customers (Shang 2020). In developing countries, the constraints faced by entrepreneurs are further compounded by high financial transaction costs due to the limited availability of banking services (Beck et al. 2009; Demirgüç-Kunt et al. 2018).

The advent of mobile money has revolutionised the payment landscape through the provision of financial services to both the banked and the unbanked segments of society (Aker and Mbiti 2010; Maurer 2012; Suri 2017) with significant implications for firms (Guo et al. 2025; Hassan 2024). Mobile money is a payment account that enables consumers to conduct basic financial transactions using their mobile phones without the need to hold a formal account with financial institutions (Beck et al. 2018; Suri 2017). Mobile money adoption, for example, has increased financial inclusion by 12–14 percentage points (Avom et al. 2023). In Kenya, about 96% of households have at least a mobile money user (Suri and Jack 2016). Aracil et al. (2025) show that mobile money can enhance the transition to deposit and credit-based financial services when there is an alignment between institutional conditions and banks' financial technologies. Mbiti and Weil (2016) document that before mobile money was introduced in Kenya, the most common means of receiving and sending money included friends, transportation companies, and post offices, with friends accounting for about 50% of such transactions. The launch of M-PESA (mobile money) in 2007 brought about a significant change in financial transactions, and by the year 2009, mobile money had become the leading payment instrument of choice in Kenya (Mbiti and Weil 2016). Mobile money has become an alternative to informal channels of money transfer and facilitated transactions at reduced costs (Jack and Suri 2014).

The use of mobile money offers several advantages to firms that can influence the receipt and provision of trade credit. In a financially constrained environment such as the informal sector, mobile money can improve cash flows and the liquidity position of firms through a reduction in transaction costs (Jack and Suri 2014), thereby enabling entrepreneurs to avoid default risks or delays in credit repayment, given that such delays can disrupt trade credit relationships (Fafchamps 1997). Improved cash flows and the liquidity position of firms can equally put entrepreneurs in a better position to offer trade credit to customers and depend less on supplier credits (Shang 2020; Petersen and Rajan 1997).

Despite the potential contribution of mobile money, only a limited number of studies link mobile money to trade credit (Beck et al. 2018; Islam and Muzi 2022). Beck et al. (2018) for example, examine the relationship between mobile money use and access to trade credit from suppliers using a sample that is largely comprised of formal firms. Moreover, this study does not account for the effect of mobile money use on the likelihood of offering trade credit to customers. Islam and Muzi (2022) explore the link between mobile money use and the likelihood of receiving and offering trade credit, but this study is based on formal firms. An exception is a recent study by Abdulai et al. (2024), which finds that the use of digital payment platforms (mobile money) increases the demand for and supply of trade credit among informal firms in Ghana. However, a major question that remains unanswered is whether access to supplier credit[1] can mediate the relationship between mobile money use and the provision of credit to customers, especially in the informal sector. This article fills this gap by estimating both the direct and indirect effects of mobile money use, thereby providing empirical evidence on the channel through which mobile money use affects the provision of credit. We also extend the nascent literature by examining how the effect of mobile money use on trade credit differs among entrepreneurs based on income, bank account ownership, and access to informal finance. This is to understand how internal and external financial resources can condition the effect of mobile money use.

This study relies on the 2016 FinAccess Household Survey of Kenya because it provides detailed information on the frequency at which businesses receive goods and services on credit and the extent to which they offer credit to customers. To address endogeneity concerns, we simultaneously estimate the decision to use mobile money for transactions, the likelihood of receiving goods and services on credit from suppliers, and the choice to offer credit to customers using a system of a binary probit and two ordered probit equations. We conduct mediation analysis to examine whether mobile money can influence entrepreneurs' decision to offer goods and services on credit through its effect on supplier credit. We find that informal firms that use mobile money for transactions are more likely to receive goods and services on credit from suppliers. Similarly, we find that the use of mobile money for transactions significantly influences entrepreneurs' propensity to offer goods and services on credit to customers. We also find that mobile money use enables entrepreneurs to offer credit through its effect on supplier credit. This suggests that access to goods and services on credit from suppliers is a mechanism through which mobile money affects the probability of providing credit to customers. Further, the evidence suggests that the effects of mobile money use on the probability of regularly receiving goods and services on credit are higher among entrepreneurs with lower income, those without access to informal finance, and those with bank accounts. We also find that the effects of mobile money use on the likelihood of offering credit to most or all customers are higher among high-income entrepreneurs, those with bank accounts, and those with access to informal loans. We show that transaction costs also matter in the relationship between mobile money use and the likelihood of receiving or offering credit. The findings support the promotion of mobile money use among entrepreneurs in the informal sector to facilitate access to credit.

This article contributes to the growing body of literature on mobile money by providing evidence on the contribution of mobile money to trade credit. We extend the nascent literature at the intersection of mobile money and trade credit to the informal sector where financial constraints abound. Our study also contributes to the entrepreneurship literature by highlighting how mobile money relates to access to external finance in the form of trade credit, capturing both the direct and indirect effect of mobile money use. We show how financially constrained informal firms benefit from financial innovation in a developing country context where access to finance is a major obstacle to firm growth (Beck and Demirgüç-Kunt 2006; Beck et al. 2005). We also demonstrate how the effect of mobile money use on trade credit is conditioned by both internal and external financial resources at the disposal of the entrepreneur.

The rest of the article is organized as follows. Section 2 outlines the theoretical background of the study. Section 3 describes the data and main variables employed for analysis. Section 4 discusses the methodology. Section 5 presents the results, while

Section 6 concludes by summarizing and discussing the main findings.

2 | Related Literature

This section discusses the literature on trade credit and possible linkages between mobile money use for business transactions and the likelihood of receiving or offering goods and services on credit.

2.1 | Demand and Supply of Trade Credit

The question of why suppliers provide trade credit despite the existence of lending institutions such as banks is an essential puzzle that trade credit theory seeks to unravel. An explanation for this puzzle is that suppliers have a comparative advantage over banks in acquiring information on the creditworthiness of clients and in the enforcement of repayment (Petersen and Rajan 1997). Information on the creditworthiness of clients may be gathered by sales representatives through regular visits, and should the buyer default, the supplier can repossess the goods (Mian and Smith 1992). Also, the supplier can control payment by issuing threats to cut off future supplies if the actions of the buyer reduce the chances of repayment (Petersen and Rajan 1997). Other explanations suggest that suppliers are incentivized to offer trade credit because it enables them to price discriminate (Brennan et al. 1988).

On the demand side, the literature suggests that entrepreneurs with limited access to bank loans depend more on trade credit (Biais and Gollier 1997; te Lin and Chou 2015; Petersen and Rajan 1997). This implies that financially constrained firms are more likely to receive goods and services on credit from suppliers. Carbó-Valverde et al. (2016) show that credit-constrained SMEs rely more on trade credit but not bank finance, especially during financial crises. Shao (2025) demonstrates that during financial crises, entrepreneurs decrease their supply of trade credit, but when a few entrepreneurs experience financial shocks, trade credit enables entrepreneurs in distress to overcome their financial constraints. Fabbri and Menichini (2010) show that trade credit can equally be used by financially unconstrained firms to explore the liquidation advantage of the supplier, which is defined as the ability of the supplier to repossess the goods supplied in case of payment default. Fabbri and Menichini (2010) note that the connection between the use of trade credit and financial constraints is dependent on the characteristics of the inputs. Thus, firms are more likely to depend on trade credit and explore the liquidation advantage of the supplier if the inputs available to the firms are highly liquid or have high collateral value. However, the incentive motive, the use of trade credit to relax financial constraints, is more likely to be dominant among financially constrained firms that use illiquid inputs with low collateral values such as services (Fabbri and Menichini 2010).

Trade credit depends on relational contracts, and this can be efficiency-enhancing especially in developing countries where formal means of contract enforcement take time to develop (Danquah and Sen 2022; Fafchamps 2020). Mcmillan and Woodruff (1999) note that trading relationships are crucial for entrepreneurs' access to trade credit and such relationships are equally important for repayment enforcement. Also, a supplier offers trade credit trusting that the customer will repay because of the incentive to maintain an ongoing relationship. The duration of business relationships enables reputation building with positive implications for trade credit access (Fafchamps 1997; Mcmillan and Woodruff 1999). Quan et al. (2023) show that firms' managerial reputation positively affects the receipt of trade credit given that such firms are associated with lower default and information risks. Xu et al. (2024) find that trust enhances the use of trade credit by firms that face barriers to accessing funds from formal channels. Trade credit is granted with the understanding that payment will be made in full within a stipulated period (Wilson and Summers 2002). However, trade credit relationships are often characterised by late payments. While late payments may not immediately lead to a discontinuity in trade credit, prolonged delay in payment is likely to attract such a sanction, mainly in the case of micro-enterprises (Fafchamps 1997). Also, partial repayment is likely to attract a temporal suspension of trade credit supply where there is an asymmetry of information between entrepreneurs (Troya-Martinez 2017).

On the supply side, the literature demonstrates that the liquidity position of firms influences the likelihood of offering goods and services on credit to customers. Shang (2020) documents that firms with higher stock liquidity are more likely to provide trade credit and are less dependent on trade credit. Garcia-Appendini and Montoriol-Garriga (2013) also reveal that firms with higher liquidity levels before the 2007–2008 financial crisis increased the provision of trade credit and experienced better performance. The results further indicate an increment in the uptake of trade credit by financially constrained firms during this period. te Lin and Chou (2015) find a positive association between the supply of trade credit and access to bank loans. The evidence also suggests that the relationship between the demand for trade credit and bank loans is negative. Cao et al. (2022) demonstrate that firms pursuing an innovation-oriented business strategy provide more trade credit to their customers compared to firms following an efficiency-oriented business strategy.

2.2 | Mobile Money and How It Affects Trade Credit

From the demand perspective, the use of mobile money for transactions can reduce the risk of theft. Beck et al. (2018) consider theft as market friction with the potential to disrupt the settlement of transactions, inhibit credit repayment, and cause discontinuation in trade credit supply. Mobile money serves as an alternative payment instrument that is safer compared to cash. Beck et al. (2018) note that, subject to the risk of theft, users of cash are predisposed to a higher repayment burden compared to mobile money users. Therefore, mobile money is expected to affect the receipt of trade credit by reducing the risk of theft and appropriation, which are likely to increase default risk. Further, the liquidity improvement associated with mobile money use, due to a reduction in transaction costs, can enable credit repayment and reduce default risk, leading to more access

to supplier credit. Brogaard et al. (2017), for example, find that an improvement in stock liquidity decreases the default risk among firms. However, significant improvement in the liquidity position of firms can equally lead to lower demand for trade credit (Shang 2020).

Regarding the supply side, mobile money can affect the likelihood of offering goods and services on credit by improving cash flows and liquidity at the firm level. As a payment instrument, mobile money may improve firm liquidity through a reduction in transaction costs. A study by Jack and Suri (2014) indicates that mobile money reduces the costs associated with financial transactions. McKay and Pickens (2010) indicate that transacting small amounts such as USD23 via branchless banking including mobile money is 38% cheaper compared to using bank channels for the same transaction. In contrast, transactions involving high values are 45% more expensive when such transactions are carried out using branchless banking rather than the use of banks. This suggests that mobile money is more advantageous for small-value transactions compared with high-value transactions. Further, the proliferation of mobile money agents compared with bank branches (Mbiti and Weil 2016; Shaikh et al. 2023) suggests that consumers will incur lower costs in the form of transportation costs to access mobile money services compared with banking services. Conducting financial transactions at reduced costs means that additional finance will become available to the entrepreneurs, thereby improving their liquidity position (Islam et al. 2018). The freeing up of financial resources will put entrepreneurs in a better position to offer credit to customers. This view is consistent with the trade credit literature which highlights the importance of liquidity to credit supply (Garcia-Appendini and Montoriol-Garriga 2013; Shang 2020).

The empirical literature suggests that the use of mobile money is advantageous to firms (Hassan 2024; Konte and Tetteh 2023; Ledi et al. 2023; Schilling and Seuring 2023). Konte and Tetteh (2023), for example, demonstrate that mobile money use for transactions enhances the effect of traditional financial services on labour productivity among Small and Medium-sized Enterprises in Sub-Saharan Africa (SMEs). In a related study, Ledi et al. (2023) found a positive and significant effect of mobile money and QR codes on the performance of SMEs. Similarly, Hassan (2024) shows that the use of mobile money has a significant positive effect on the performance of informal businesses. Beck et al. (2018) find a positive and significant relationship between mobile money and access to trade credit. Islam and Muzi (2022) also find that women-owned firms that use mobile money for transactions with suppliers are more likely to invest. The evidence further suggests that mobile money is associated with the provision of trade credit and the demand for credit among women-owned firms (Islam and Muzi 2022). Similarly, Abdulai et al. (2024) find a significant relationship between mobile money and the provision of trade credit, on the one hand, and the receipt of trade credit, on the other hand, in the informal sector. Djossou et al. (2025) show that access to credit and mobile money significantly affect firms' ability to innovate, leading to improved performance. Zhou and Li (2023) demonstrate how digital transformation could significantly reduce trade credit financing across industries and enterprises.

Most studies on trade credit are largely limited to bilateral supplier-customer relationships, thereby viewing firms as either receivers or providers of trade credit (Ersahin et al. 2024). The nascent literature on mobile money and trade credit (Abdulai et al. 2024; Beck et al. 2018; Islam and Muzi 2022) equally views firms either as receivers or providers of trade credit. However, Ersahin et al. (2024) note that firms are part of a complex network in the real world and simultaneously provide and offer credit. It will therefore be interesting to investigate how the decision to use mobile money simultaneously affects the receipt and provision of trade credit. We anticipate that supplier credit will mediate the relationship between mobile money use and the likelihood of offering credit to customers, but this has not been accounted for in previous studies. Moreover, the link between mobile money and the informal sector has received limited attention. Therefore, this study seeks to focus on the informal sector and investigate how the effect of mobile money is conditioned by income, bank account ownership, and access to informal finance.

3 | Data and Main Variables

The study employs the 2016 FinAccess Household Survey of Kenya to answer the research question. This survey is part of a series of nationally representative household surveys that measure access to and use of financial services among the adult population in Kenya. It was spearheaded by the Financial Sector Deepening (FSD) of Kenya in collaboration with the Kenyan National Bureau of Statistics and the Central Bank. FSD was instituted by the UK Department for International Development in 2005 to promote financial inclusion in Kenya (FSD Kenya 2016). For the 2016 survey, respondents were randomly selected at the household level using the National Sample Survey and Evaluation Programme. The household constitutes the basic sampling unit, and an individual aged 16 years and above was randomly selected from a roster of all eligible members in each household. The 2016 FinAccess survey targeted a total of 10,008 households, out of which 8665 respondents were successfully interviewed. Thus, the survey achieved a response rate of about 87%.

The survey has a section on businesses operated by respondents. We take advantage of this information to address our research objective. We focus on the 2016 survey because it provides essential information on the two dependent variables that are relevant to meeting the research objective. Thus, in addition to information on the use of mobile money for business transactions, the survey provides information on how often entrepreneurial businesses receive goods and services on credit from suppliers and the extent to which they grant credit to customers. For our analysis, we concentrate only on entrepreneurs who operate informal businesses. This is because informal firms are most likely to face financial obstacles to growth, and they account for over 90% of businesses in Kenya (World Bank 2016). To gain insights into how mobile money adoption benefits businesses in the informal sector, we identified a sample of 2031 entrepreneurs who operate unregistered businesses for the analysis. We define entrepreneurs as respondents who reported self-employment or running their own business as a source of income. The main variables of interest are discussed below, while Tables 1 and 2 present the definition of variables and summary statistics, respectively.

TABLE 1 | Definition of variables.

Variable	Description
Receive goods/services on credit	An ordered variable that measures how often the business receives goods/services on credit from suppliers (0 = never, 1 = rarely, 2 = occasionally, 3 = regularly)
Offer goods/services on credit	An ordered variable that measures the extent to which businesses offer goods/services on credit to customers (0 = never, 1 = a few customers, 2 = most/all customers)
Mobile money (mm) use	1 if the entrepreneur's business uses mobile money for transactions regularly or occasionally, 0 otherwise
Make mm payment	1 if the entrepreneur's business makes payment via mobile money regularly or occasionally
Receive mm payment	1 if the entrepreneur's business receives payment via mobile money regularly or occasionally
Urban	1 = Urban, 0 = Rural
Female	1 = Female, 0 = Male
Age	Age of entrepreneur
Income	Monthly income of the entrepreneur
High income	1 if monthly income is above the median income
Educated	1 if the entrepreneur has at least primary education, 0 is no education
Business age	Business age
Household size	The number of people in the household
Bank account	1 if the entrepreneur currently has a bank account for everyday needs, 0 otherwise
Informal loan	1 if the entrepreneur has access to a loan from family/friends, 0 otherwise
Informal group	1 if the entrepreneur belongs to at least 1 informal association, 0 otherwise
Sole owner	1 if the entrepreneur is the sole owner of the business
Proximity to agent (share)	Share of respondents in a local area (sublocation) who can access mobile money agents within 10 min (calculation is based on the full sample)
Receive credit (share)	Share of respondents in a local area (sublocation) who receive goods and services on credit from suppliers.

3.1 | Dependent Variable

Conventionally, the supply of trade credit by entrepreneurial firms is measured using accounts receivable, whereas demand for trade credit is proxied by accounts payable (te Lin and Chou 2015; Petersen and Rajan 1997). While data on accounts receivable and accounts payable may be readily available for formal firms, this is unlikely to be the case for informal firms, especially in developing countries. In developing countries, microenterprises are generally unregistered and are less likely to keep records of trade transactions with customers (Hermes et al. 2015). Given the informal context of the study coupled with the absence of accounting records in the dataset, we rely on survey questions on the provision or access to goods and services on credit among respondents to measure trade credit.

This study uses two main dependent variables as proxies for trade credit. First, we measure how often entrepreneurs receive goods and services on credit from suppliers with an ordered variable where 0 = never, 1 = rarely, 2 = occasionally, and 3 = regularly. Second, we measure whether entrepreneurs offer credit with an ordered variable where 0 = never, 1 = a few customers, and 2 = most/all customers. Table 2 shows that about 63% of informal firms never receive goods and services on credit from suppliers. However, 14%, 15%, and 8% of entrepreneurs indicate that they receive goods and services on credit rarely, occasionally, and regularly, respectively. About 16% of informal firms provide goods and services on credit to most and all customers, while 54% offer credit to a few customers and 30% provide no credit.

3.2 | Main Independent Variable and Controls

The main independent variable of interest is a binary variable that measures whether informal firms use mobile money for transactions. As indicated in Table 2, about 26% of entrepreneurial businesses use mobile money for transactions regularly or occasionally. Further, the study controls for variables that are identified in the literature as determinants of trade credit. The study controls for entrepreneurs' access to informal loans (loans from family/friends) since the extant literature suggests that loans play a significant role in conditioning access to trade credit (Biais and Gollier 1997). Our choice of informal loan as a control variable is guided by the fact that entrepreneurs in the informal sector are more likely to depend on informal sources of finance compared with bank capital (Wu et al. 2016). Nonetheless, we also control for bank account ownership among entrepreneurs. Bank account ownership is relevant because it is a major channel for accessing bank credit, and it facilitates payments as well. Furthermore, the study accounts for the availability of internal finance using entrepreneurs' monthly income. The availability of sufficient internal finance to an entrepreneur may result in lower demand for trade credit (Hermes et al. 2015) and can also affect the decision to offer credit.

Importantly, the creditworthiness of entrepreneurial businesses is considered an important determinant of access to trade credit. We control for firm age as it is often considered a proxy for the creditworthiness of firms (Petersen and Rajan 1997). Firm age, for example, is an essential signal for business survival and reputation (Petersen and Rajan 1997). In our case, firm age is

TABLE 2 | Summary statistics.

Variable	Obs	Mean	Std. dev.	Min	Max
Receive goods/services on credit (ordered)					
Never	2031	0.63	0.48	0	1
Rarely	2031	0.14	0.35	0	1
Occasionally	2031	0.15	0.36	0	1
Regularly	2031	0.08	0.27	0	1
Offer goods/services on credit (ordered)					
Never	2031	0.30	0.46	0	1
A few customers	2031	0.54	0.50	0	1
Most/all customers	2031	0.16	0.37	0	1
Mobile money (mm) use	2031	0.26	0.44	0	1
Make mm payment	2031	0.20	0.40	0	1
Receive mm payment	2031	0.20	0.40	0	1
Urban	2031	0.51	0.50	0	1
Female	2031	0.68	0.47	0	1
Age	2031	35.84	13.02	16	93
Income	2025	19177.18	38814.37	0	1,000,000
High income	2025	0.46	0.50	0	1
Educated	2031	0.88	0.33	0	1
Business age	2031	5.96	8.23	0	55
Household size	2031	4.45	2.38	1	16
Bank account	2031	0.26	0.44	0	1
Informal loan	2031	0.25	0.43	0	1
Informal groups	2031	0.59	0.49	0	1
Sole owner	2031	0.88	0.33	0	1
Proximity to agent (share)	2031	0.51	0.33	0	1
Receive credit (share)	2031	0.381	0.281	0	1

measured by subtracting the year in which the business started operating from 2015, the year in which the survey was carried out. Additionally, we control for membership of informal associations. This includes informal societies such as savings and lending groups, investment clubs, and welfare groups to which the entrepreneur contributes regularly. Such groups, for example, can facilitate information sharing, access to loans, and act as an avenue to enforce trade credit repayment (Hermes et al. 2015; Mcmillan and Woodruff 1999). Finally, other variables such as gender, age, location, education, and ownership status of business among others are accounted for in our estimations.

4 | Estimation Strategy

The first objective of this study is to estimate the direct effect of mobile money use on the likelihood of receiving goods and services on credit and the probability of offering credit to customers. The second objective is to understand the differential effects of mobile money use based on the financial resources available to entrepreneurs. The third objective is to examine whether supplier credit mediates the relationship between mobile money use and the provision of goods and services on credit. For the estimations, we suspect that unobserved factors may simultaneously influence the decision to use mobile money for transactions, the choice to receive goods and services on credit, and the likelihood of offering credit to customers (Beck et al. 2018; Lorenz and Pommet 2020). To correct for endogeneity in our baseline estimation, we follow the approach of Greene (1998) and jointly estimate these 3 decisions using the following specifications:

$$\text{Mobile money}_{ijs} = \alpha_0 + \alpha_1 X1_{ijs} + \alpha_2 z_{ijs} + \delta_j + \delta_s + \varepsilon_{ijs1} \quad (1)$$

$$\text{Receive credit}_{ijs} = \beta_0 + \beta_1 X2_{ijs} + \beta_2 \text{Mobile money}_{ijs} + \delta_j + \delta_s + \varepsilon_{ijs2} \quad (2)$$

$$\text{Offer credit}_{ijs} = \psi_0 + \psi_1 X3_{ijs} + \psi_2 \text{Mobile money}_{ijs} + \delta_j + \delta_s + \varepsilon_{ijs3} \quad (3)$$

$$\begin{pmatrix} \varepsilon_{ijs1} \\ \varepsilon_{ijs2} \\ \varepsilon_{ijs3} \end{pmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & \rho_{12} & \rho_{13} \\ \rho_{12} & 1 & \rho_{23} \\ \rho_{13} & \rho_{23} & 1 \end{bmatrix} \right) \quad (4)$$

where the error terms (ε_{ijs1}, ε_{ijs2} and ε_{ijs3}) are assumed to be normally distributed with unit variances and the correlation coefficients ρ capture the correlation between the error terms. In this specification Mobile money$_{ijs}$ corresponds to mobile money user i located in region j who operates an informal business in sector s. α_0, β_0 and ψ_0 are constants while X1, X2 and X3 are vectors of controls. β_2 and ψ_2 represent the parameters of interest to be estimated. δ_j and δ_s are regional and sector fixed-effect dummies, respectively. Receive credit$_{ijs}$ corresponds to how often entrepreneurs receive goods and services on credit whereas Offer credit$_{ijs}$ represents the extent to which entrepreneurs offer credit to customers. Equation (1) constitutes a probit model, while Equations (2) and (3) are estimated using ordered probit models.

To improve identification, we perform exclusion restriction using variable z_{ijs}, proximity to mobile money agent (measured at sublocation level[2]). The justification for this exclusion restriction variable is that access to mobile money agents is required for the effective use of mobile money services (Coffie and Hongjiang 2023; Iheanachor et al. 2021; Ky et al. 2018; Shaikh et al. 2023). We expect that those who live in localities with easy access to mobile money agents will be more likely to use mobile money for transactions. All estimations are carried out within the Roodman (2011) mixed process estimation framework (CMP). The CMP provides a flexible framework for fitting simultaneous equation models where different models such as probit and ordered probit can be jointly estimated.

To achieve the second objective, we interact the mobile money variable with finance variables as specified below.

$$\text{Mobile money}_{ijs} = \alpha_0 + \alpha_1 X1_{ijs} + \alpha_2 z_{ijs} + \delta_j + \delta_s + \varepsilon_{ijs1} \quad (5)$$

$$\begin{aligned}\text{Receive credit}_{ijs} = {} & \beta_0 + \beta_1 \text{Mobile money}_{ijs} + \beta_2 \text{Finance}_{ijs} \\ & + \beta_3 \left(\text{Mobile money}_{ijs} \times \text{Finance}_{ijs}\right) \\ & + \beta_4 X2_{ijs} + \delta_j + \delta_s + \varepsilon_{ijs2}\end{aligned} \quad (6)$$

$$\begin{aligned}\text{Offer credit}_{ijs} = {} & \psi_0 + \psi_1 \text{Mobile money}_{ijs} + \psi_2 \text{Finance}_{ijs} \\ & + \psi_3 \left(\text{Mobile money}_{ijs} \times \text{Finance}_{ijs}\right) \\ & + \psi_4 X3_{ijs} + \delta_j + \delta_s + \varepsilon_{ijs3}\end{aligned} \quad (7)$$

where Finance$_{ijs}$ is a vector of internal and external finance variables comprising entrepreneurs' monthly income, bank account ownership, and access to informal loans. β_3 and ψ_3 are the parameters of interest capturing the interaction effects of mobile money use and entrepreneurial finance.

4.1 | Mediation Analysis

To achieve the third objective, we carry out a mediation analysis. Figure 1 presents a diagram depicting the direct and indirect effect of mobile money use on the provision of credit. In this case, supplier credit is employed as the mediating variable between mobile money use and the probability of offering goods and services on credit. Baron and Kenny (1986) note that a variable functions as a mediator when it meets the following conditions: first,

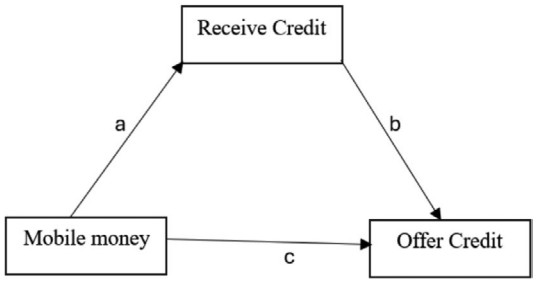

FIGURE 1 | Causal chain depicting the direct and indirect effects of mobile money use on the provision of credit.

the independent variable (mobile money) should have a significant effect on the mediator (causal path a); second, the mediator should have a significant effect on the outcome variable, in this case, offer credit (causal path b); third, a previously significant effect of the independent variable on the outcome is no longer significant when both paths a and b are controlled for, with a strong mediation effect occurring when path c is reduced to zero.

Following Baron and Kenny (1986) we reestimate our baseline model but in this case, we control for paths a and b to test for the mediation effect. Thus, in addition to mobile money, we control for supplier credit in Equation (10) using a binary variable that equals 1 if an entrepreneur has received goods and services on credit and 0 otherwise (we collapse the ordinal variable into a dummy for easy interpretation). To improve identification we perform additional exclusion restriction with variable K_{ijs} that captures the proportion of entrepreneurs with access to supplier credit at the sublocation level (Equation (9)).

$$\text{Mobile money}_{ijs} = \alpha_0 + \alpha_1 X1_{ijs} + \alpha_2 z_{ijs} + \delta_j + \delta_s + \varepsilon_{ijs1} \quad (8)$$

$$\begin{aligned}\text{Receive credit}_{ijs} = {} & \beta_0 + \beta_1 X2_{ijs} + \beta_2 \text{Mobile money}_{ijs} \\ & + \beta_3 K_{ijs} + \delta_j + \delta_s + \varepsilon_{ijs2}\end{aligned} \quad (9)$$

$$\begin{aligned}\text{Offer credit}_{ijs} = {} & \psi_0 + \psi_1 X3_{ijs} + \psi_2 \text{Receive credit}_{ijs} \\ & + \psi_3 \text{Mobile money}_{ijs} + \delta_j + \delta_s + \varepsilon_{ijs3}\end{aligned} \quad (10)$$

5 | Results

5.1 | Mobile Money and the Likelihood to Receive Goods and Services on Credit

This subsection examines the relationship between the use of mobile money for business transactions and entrepreneurs' propensity to receive goods and services on credit from suppliers. In line with our estimation strategy, we first estimate the probability of using mobile money based on a set of covariates identified in the literature to affect financial inclusion (Demirgüç-Kunt et al. 2018; Simpson and Buckland 2009). These variables include proximity to mobile money agent (share), location in an urban area, the gender of the entrepreneur (Female), age of the entrepreneur (in logs), income (in logs), education status, bank account ownership, business age (in logs), and household size (in logs). As shown in column (1) of Table 3, proximity to mobile money agents, the excluded variable, significantly predicts mobile money use at the 5% significance level. This suggests that

TABLE 3 | Relationship between mobile money use and the likelihood of receiving or offering goods and services on credit.

	Mobile money use	Receive credit from suppliers	Offer credit to customers
	(1)	(2)	(3)
Mobile money use		1.211***	0.477**
		(0.243)	(0.194)
Proximity	0.363**		
	(0.143)		
Urban	0.056	−0.048	−0.025
	(0.109)	(0.073)	(0.068)
Female	−0.250***	0.134**	0.178***
	(0.074)	(0.060)	(0.055)
Age (in logs)	−0.088	−0.171*	0.006
	(0.132)	(0.089)	(0.095)
Income (in logs)	0.113***	0.008	0.048**
	(0.037)	(0.026)	(0.019)
Educated	0.617***	−0.015	0.115
	(0.174)	(0.119)	(0.130)
Business age (in logs)	0.055*	0.064**	−0.012
	(0.031)	(0.028)	(0.029)
Household size (in logs)	−0.022	0.127*	0.012
	(0.086)	(0.069)	(0.063)
Bank account	0.248***	0.140**	0.137
	(0.091)	(0.065)	(0.097)
Informal loan		0.042	0.042
		(0.093)	(0.055)
Informal groups		0.044	0.034
		(0.053)	(0.057)
Sole owner of business		0.092	0.030
		(0.076)	(0.078)
Constant	−1.692**		
	(0.784)		
cut_2_1		1.799***	
		(0.530)	
cut_2_2		2.214***	
		(0.541)	
cut_2_3		2.870***	
		(0.546)	
cut_3_1			1.212***
			(0.425)
cut_3_2			2.795***
			(0.432)
rho_12			−0.582***
			(0.134)
rho_13			−0.244**
			(0.110)

(Continues)

TABLE 3 | (Continued)

	Mobile money use	Receive credit from suppliers	Offer credit to customers
	(1)	(2)	(3)
rho_23			0.467***
			(0.043)
Wald $\chi 2$			509472.83
Probability $>\chi 2$			0.000
Regional fixed effects	Yes	Yes	Yes
Sector fixed effect	Yes	Yes	Yes
Number of observations	2025	2025	2025

Note: The table reports the coefficient estimates. The decision to use mobile money, receive goods and services on credit, and offer goods and services on credit is jointly estimated. Robust standard errors in parentheses are clustered at the regional level. All estimations are carried out using the Roodman (2011) mixed processed model.
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

TABLE 4 | Average marginal effects for mobile money use and the likelihood to receive or offer goods and services on credit.

	Mobile money use	Receive credit from suppliers				Offer credit to customers		
		Never	Rarely	Occasionally	Regularly	Never	A few	Most or all
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mobile money use		−0.435***	0.033***	0.136***	0.266***	−0.148***	0.027***	0.122**
		(0.080)	(0.009)	(0.011)	(0.083)	(0.057)	(0.002)	(0.056)
Proximity to agent (share)	0.105***							
	(0.041)							
Urban	0.016	0.015	−0.002	−0.005	−0.008	0.008	−0.002	−0.006
	(0.032)	(0.023)	(0.004)	(0.008)	(0.012)	(0.022)	(0.007)	(0.016)
Female	−0.075***	−0.043**	0.007**	0.014**	0.022**	−0.059***	0.019***	0.040***
	(0.023)	(0.019)	(0.003)	(0.006)	(0.010)	(0.019)	(0.006)	(0.012)
Age (in logs)	−0.025	0.055*	−0.009*	−0.018*	−0.028**	−0.002	0.001	0.001
	(0.038)	(0.029)	(0.005)	(0.011)	(0.014)	(0.031)	(0.009)	(0.022)
Income (in logs)	0.033***	−0.002	0.000	0.001	0.001	−0.016**	0.005**	0.011**
	(0.011)	(0.008)	(0.001)	(0.003)	(0.004)	(0.006)	(0.002)	(0.004)
Educated	0.153***	0.005	−0.001	−0.002	−0.002	−0.038	0.013	0.025
	(0.034)	(0.038)	(0.006)	(0.013)	(0.020)	(0.044)	(0.017)	(0.027)
Business age (in logs)	0.016*	−0.021**	0.003*	0.007**	0.010**	0.004	−0.001	−0.003
	(0.009)	(0.009)	(0.002)	(0.003)	(0.004)	(0.009)	(0.003)	(0.007)
Household size (in logs)	−0.006	−0.041*	0.006*	0.014*	0.021*	−0.004	0.001	0.003
	(0.025)	(0.022)	(0.004)	(0.008)	(0.011)	(0.021)	(0.006)	(0.014)
Bank account	0.075***	−0.046**	0.007**	0.015**	0.024**	−0.044	0.012	0.032
	(0.028)	(0.022)	(0.004)	(0.008)	(0.011)	(0.031)	(0.007)	(0.024)
Informal loan		−0.013	0.002	0.004	0.007	−0.014	0.004	0.010
		(0.030)	(0.005)	(0.010)	(0.015)	(0.018)	(0.005)	(0.013)
Informal groups		−0.014	0.002	0.005	0.007	−0.011	0.003	0.008
		(0.017)	(0.003)	(0.006)	(0.009)	(0.019)	(0.006)	(0.013)
Sole owner		−0.029	0.005	0.010	0.015	−0.010	0.003	0.007
		(0.024)	(0.004)	(0.008)	(0.012)	(0.026)	(0.008)	(0.018)
No. of observations	2025	2025	2025	2025	2025	2025	2025	2025

Note: The decision to use mobile money, receive goods and services on credit, and offer goods and services on credit is jointly estimated. Robust standard errors in parentheses are clustered at the regional level. The estimation controls for both regional and sector fixed effects and is carried out using the Roodman (2011) mixed processed model.
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

TABLE 5 | Differential effects of mobile money use for high and low-income entrepreneurs.

	Receive credit from suppliers				Offer credit to customers		
	Never	Rarely	Occasionally	Regularly	Never	A few	Most or all
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Low income	−0.414***	0.030**	0.131***	0.254**	−0.051	0.016	0.034
	(0.121)	(0.014)	(0.016)	(0.123)	(0.097)	(0.026)	(0.071)
High income	−0.407***	0.042***	0.137***	0.228**	−0.135**	0.022***	0.114*
	(0.102)	(0.007)	(0.019)	(0.092)	(0.064)	(0.006)	(0.061)
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	2025	2025	2025	2025	2025	2025	2025

Note: The table reports average marginal effect estimates capturing the differential effects for the interaction between mobile money use and income. The decision to use mobile money, receive goods and services on credit, and offer goods and services on credit are jointly estimated. Only results for the receive credit and offer credit equations are reported. The estimation includes all baseline control variables and is carried out using the Roodman (2011) mixed-processed model. Robust standard errors in parentheses are clustered at the regional level.
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

TABLE 6 | Differential effects of mobile money use for entrepreneurs with and without bank accounts.

	Receive credit from suppliers				Offer credit to customers		
	Never	Rarely	Occasionally	Regularly	Never	A few	Most or all
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
No bank account	−0.423***	0.039***	0.138***	0.246**	−0.138**	0.032***	0.106*
	(0.104)	(0.010)	(0.016)	(0.101)	(0.062)	(0.005)	(0.058)
Has bank account	−0.441***	0.019	0.127***	0.295***	−0.149**	0.007	0.142**
	(0.077)	(0.013)	(0.013)	(0.088)	(0.059)	(0.014)	(0.062)
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	2025	2025	2025	2025	2025	2025	2025

Note: The table reports average marginal effect estimates capturing the differential effects for the interaction between mobile money use and bank account. The decision to use mobile money, receive goods and services on credit, and offer goods and services on credit are jointly estimated. Only results for the receive credit and offer credit equations are reported. The estimation includes all baseline control variables and is carried out using the Roodman (2011) mixed-processed model. Robust standard errors in parentheses are clustered at the regional level.
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

those who reside in localities with easy access to mobile money agents are more likely to use mobile money. Also, the results indicate that income, education, business age, and bank account ownership have significant and positive effects on mobile money use for business transactions. However, females are less likely to use mobile money. This is consistent with the financial inclusion literature, which suggests that females are more prone to exclusion from formal financial services compared to their male counterparts (Demirgüç-Kunt et al. 2018).

We present the results for our first outcome of interest that measures how often informal firms receive goods and services on credit from suppliers in column (2) of Table 3. In this estimation, the recursive nature of our model allows for the main dependent variable in Equation (1) (mobile money) to also appear as the independent variable in Equation (2). We control for access to informal loans, membership of an informal association, and whether the entrepreneur is the sole owner of the business, in addition to the covariates employed in Equation (1). The results show that mobile money use has a positive and significant association with the likelihood of receiving goods and services on credit. The results are statistically significant at the 1% significance level. The marginal effect estimates, as indicated in Table 4 suggest that on average mobile money use increases the likelihood of receiving credit rarely, occasionally, and regularly by 3, 14, and 27 percentage points, respectively.

The control variables also show interesting results. As expected, business age has a positive and significant effect on the propensity to receive goods and services on credit, probably because it provides an important signal for business survival and reputation (Petersen and Rajan 1997). The variables female, bank account ownership, and household size also show significant

TABLE 7 | Differential effects of mobile money use for entrepreneurs with and without access to informal loans.

	Receive credit from suppliers				Offer credit to customers		
	Never	Rarely	Occasionally	Regularly	Never	A few	Most or all
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
No informal loan	−0.471***	0.033***	0.142***	0.297***	−0.151***	0.029***	0.122**
	(0.070)	(0.011)	(0.011)	(0.080)	(0.055)	(0.003)	(0.054)
Has informal loan	−0.362***	0.030***	0.116***	0.217***	−0.155**	0.020**	0.135*
	(0.086)	(0.008)	(0.017)	(0.077)	(0.069)	(0.009)	(0.072)
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	2025	2025	2025	2025	2025	2025	2025

Note: The table reports average marginal effect estimates capturing the differential effects for the interaction between mobile money use and access to informal loans. The decision to use mobile money, receive goods and services on credit, and offer goods and services on credit are jointly estimated. Only results for the receive credit and offer credit equations are reported. The estimation includes all baseline control variables and is carried out using the Roodman (2011) mixed-processed model. Robust standard errors in parentheses are clustered at the regional level.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

positive effects on the likelihood of receiving goods and services on credit. The coefficient for entrepreneurs' age is significant but negative, reflecting the role of age in an informal setting. We find no significant association between informal loans and access to supplier credit. Also, the marginal effects of monthly income and membership in an informal group are not statistically significant.

5.2 | Mobile Money and the Likelihood to Offer Goods and Services on Credit

This subsection investigates the relationship between mobile money use and entrepreneurs' propensity to offer goods and services on credit to customers. The results are presented in column (3) of Table 3. The coefficient on the mobile money variable in column (3) is positive and statistically significant at the 5% significance level. The evidence suggests that entrepreneurs who use mobile money for business transactions are more likely to offer goods and services on credit to customers. The marginal effect estimates reported in Table 4 show that on average mobile money use increases the probability of offering credit to a few customers and most/all customers by 3 and 12 percentage points, respectively.

The coefficient on the variable Female is positive and statistically significant at the 1% significance level, suggesting that female entrepreneurs are more likely to offer goods and services on credit to their customers compared with their male counterparts. Female entrepreneurs are possibly more likely to supply trade credit because they are better able to monitor the creditworthiness of customers compared with male entrepreneurs (Hermes et al. 2015). Also, income is a significant determinant of the probability of offering goods and services on credit. We observe that the rhos are statistically significant, justifying the choice of our approach to jointly estimate Equations (1–3) simultaneously. In particular, the fact that rho_12 and rho_13 are significantly different from 0 indicates the endogeneity of mobile money in the ordered probit equations. Controlling for these correlations between the error terms corrects for endogeneity.

5.3 | Differential Effects of Mobile Money Use for Entrepreneurs With and Without Access to Financial Resources

The literature suggests that firms with sufficient internal finance depend less on supplier credit (Hermes et al. 2015) while entrepreneurs with higher liquidity levels are less dependent on trade credit from suppliers but more likely to provide trade credit to customers (Shang 2020). In this section, we test whether mobile money use affects entrepreneurs with access to financial resources differently compared with those with limited or no access.

To achieve this objective, we simultaneously estimate our results using Equations (5–7) in line with our estimation strategy and compute the average marginal effects of mobile money use for entrepreneurs with and without finance. Table 5 reports the results when we interact mobile money use with our measure of internal finance (monthly income). In this case, we compute the differential effects of mobile money use for high and low-income entrepreneurs where high income equals 1 if entrepreneurs' monthly income is above the median and 0 otherwise. Columns (1–4) report the results where the outcome variable is receive credit from suppliers, whereas columns (5–7) report the estimates where the outcome variable is offer credit to customers. The evidence in column (3) suggests that on average the use of mobile money increases the likelihood of occasionally receiving goods and services on credit by 13 and 14 percentage points for low-income and high-income entrepreneurs, respectively. The results in column (4) reveal that on average mobile money use increases the probability of regularly receiving goods and services on credit by 25 percentage points for low-income entrepreneurs and 23 percentage points for those with high income. These effects point to the fact that the use of mobile money can result in a relatively lower demand for

TABLE 8 | Average marginal effects for mobile money use and the likelihood to receive or offer goods and services on credit (testing for mediation effect).

	Mobile money use	Receive credit from suppliers				Offer credit to customers		
		Never	Rarely	Occasionally	Regularly	Never	A few	Most/all
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mobile money use		−0.323***	0.044***	0.113***	0.166***	−0.062	0.017	0.045
		(0.080)	(0.003)	(0.022)	(0.059)	(0.071)	(0.016)	(0.056)
Receive credit from suppliers						−0.233***	0.073***	0.159***
						(0.029)	(0.009)	(0.021)
Proximity to agent (share)	0.111***							
	(0.038)							
Receive credit (share)		−0.699***	0.133***	0.247***	0.319***			
		(0.040)	(0.021)	(0.032)	(0.017)			
Urban	0.014	0.030*	−0.006*	−0.011*	−0.014*	0.011	−0.003	−0.007
	(0.031)	(0.017)	(0.003)	(0.006)	(0.008)	(0.022)	(0.007)	(0.015)
Female	−0.078***	−0.033*	0.006*	0.012*	0.015*	−0.048**	0.016**	0.032***
	(0.023)	(0.019)	(0.004)	(0.007)	(0.008)	(0.019)	(0.007)	(0.012)
Age (in logs)	−0.028	0.046*	−0.009*	−0.016	−0.021*	−0.022	0.007	0.015
	(0.037)	(0.026)	(0.005)	(0.010)	(0.011)	(0.029)	(0.009)	(0.020)
Income (in logs)	0.032***	−0.003	0.001	0.001	0.001	−0.015**	0.005**	0.010**
	(0.011)	(0.009)	(0.002)	(0.003)	(0.004)	(0.006)	(0.002)	(0.004)
Educated	0.150***	0.017	−0.003	−0.006	−0.008	−0.044	0.016	0.028
	(0.034)	(0.033)	(0.006)	(0.011)	(0.016)	(0.040)	(0.016)	(0.023)
Business age (in logs)	0.017**	−0.017**	0.003*	0.006*	0.008**	0.013	−0.004	−0.009
	(0.009)	(0.009)	(0.002)	(0.003)	(0.004)	(0.009)	(0.003)	(0.006)
Household size (in logs)	−0.005	−0.035	0.007	0.012	0.016*	0.007	−0.002	−0.005
	(0.025)	(0.022)	(0.004)	(0.008)	(0.010)	(0.018)	(0.006)	(0.013)
Bank account	0.074***	−0.042*	0.008*	0.015*	0.020*	−0.034	0.010	0.024
	(0.028)	(0.022)	(0.004)	(0.008)	(0.010)	(0.028)	(0.008)	(0.021)
Informal loan		−0.022	0.004	0.008	0.010	−0.009	0.003	0.006
		(0.031)	(0.006)	(0.011)	(0.014)	(0.017)	(0.005)	(0.012)
Informal groups		−0.009	0.002	0.003	0.004	−0.007	0.002	0.005
		(0.017)	(0.003)	(0.006)	(0.008)	(0.018)	(0.006)	(0.012)
Sole owner		−0.018	0.003	0.006	0.008	−0.002	0.001	0.001
		(0.025)	(0.005)	(0.009)	(0.011)	(0.026)	(0.008)	(0.018)
Observations	2025	2025	2025	2025	2025	2025	2025	2025

Note: The decision to use mobile money, receive goods and services on credit, and offer goods and services on credit is jointly estimated. Robust standard errors in parentheses are clustered at the regional level. The estimation controls for both regional and sector fixed effects and is carried out using the Roodman (2011) mixed processed model.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

trade credit for high-income entrepreneurs compared with low-income entrepreneurs.

Turning to columns (5–7), we find that the effect of mobile money use on the likelihood of offering goods and services on credit is only significant for high-income entrepreneurs.

Table 6 presents the average marginal effects when we interact mobile money use with bank account ownership. We report the differential effects for entrepreneurs with and without bank accounts. We find that mobile money use enhances the probability of regularly receiving credit from suppliers by 25 percentage points for entrepreneurs with no bank account and 30 percentage points for entrepreneurs with bank accounts, on average (column 4). This evidence points to a potential complementarity between mobile money use and bank account ownership. We also find that, on average, mobile money use increases the probability of offering credit to most or all customers by 11 percentage

TABLE 9 | Causal mediation analysis.

	Offer credit to most/ all customers		
	(1)	(2)	(3)
Average mediation	0.016	0.019	0.016
Average direct effect	0.054	0.046	0.071
Total effect	0.070	0.065	0.087
% of total effect mediated	23%	30%	19%
Regional fixed effect	No	No	No
Sector fixed effect	Yes	Yes	Yes
Baseline controls	Yes	Yes	Yes
Number of observations	2025	2025	2025

Note: The outcome variable equals 1 if an entrepreneur offers goods and services on credit to most or all customers and 0 otherwise. In column 1, the treatment variable equals 1 if the business uses mobile money for transactions regularly or occasionally, and 0 otherwise. In column 2, the treatment variable equals 1 if the business makes payment via mobile money regularly or occasionally, and 0 otherwise. In column 3, the treatment variable equals 1 if the business receives payment via mobile money regularly or occasionally, and 0 otherwise.

points for those without bank accounts and 14 percentage points for those with bank accounts (column 7).

Table 7 presents the differential effects of mobile money use for entrepreneurs with and without access to informal loans. The result in column (3) suggests that on average mobile money use increases the likelihood of occasionally receiving goods and services on credit by 14 percentage points for those without access to informal loans compared with 12 percentage points for those with informal loans. Similarly, mobile money use enhances the probability of regularly receiving credit from suppliers by 30 percentage points for entrepreneurs without informal loans compared with 22 percentage points for those with informal loans as presented in column (4). Turning to columns (5–7) we find a complementarity between mobile money use and informal loans with respect to the provision of credit to most or all customers.

5.4 | Does Receiving Credit From Suppliers Mediate the Relationship Between Mobile Money Use and the Likelihood of Offering Credit?

Table 8 presents the results of the mediation analysis (Equations (8–10)). The main results of interest (Equation (10)) are captured in columns (6–8). We find a significant effect of supplier credit on the probability of offering credit to customers. However, compared with our baseline results, we find that the effect of mobile money use on the likelihood of offering goods and services on credit becomes insignificant once we control for supplier credit. This suggests that mobile money use affects the likelihood of providing credit because it affects the probability of receiving credit from suppliers. We conduct further mediation analysis using the causal framework proposed by Hicks and Tingley (2011) where the outcome variable equals 1 if an entrepreneur offers goods and services on credit to most or all customers and 0 otherwise. The mediator in this case equals 1 if an entrepreneur receives credit from suppliers occasionally or regularly. Table 9 presents the average mediation effect, the average direct effect, the total effect, and the proportion of the total effect mediated. The treatment variable in this case equals 1 if mobile money is used to make or receive payments regularly or occasionally, and 0 otherwise. In column 2, the treatment variable equals 1 if the business makes payment via mobile money regularly or occasionally, and 0 otherwise. In column 3, the treatment variable equals 1 if the business receives payment via mobile money regularly or occasionally, and 0 otherwise. The results reveal that about 23% of the total effect of mobile money use on the probability of offering credit is mediated through supplier credit (column 1). We also find that 30% of the total effect is mediated through supplier credit when entrepreneurs use mobile money to make payments regularly or occasionally (column 2) while about 19% is mediated when mobile money is used to receive payments regularly or occasionally (column 3).

5.5 | Does Transaction Cost Matter?

Accessing banking services in developing countries is associated with high travel costs as well as long waiting time costs owing to underdeveloped banking sectors (Islam and Muzi 2022). Mobile money can reduce travel costs and the time spent on financial transactions given that mobile money services are widespread and more accessible compared with bank branches. In this case, mobile money use enables a faster rate of cash flow at reduced costs thereby improving the liquidity position of firms as lower outstanding liquidity balances will be needed for the same level of business activity with significant implications for trade credit (Islam and Muzi 2022).

To examine the role of costs in the relationship between mobile money use and trade credit, we employ an ordered probit model to provide disaggregated results based on proximity to mobile money agents. Mobile money agents play a central role in enabling consumers to deposit and withdraw cash from mobile money wallets. We expect that those closer to mobile money agents can easily access mobile money services with lower costs, such as transportation costs.

Table 10 presents the results. In columns (1–4), we provide the estimations where the outcome variable is receiving credit from suppliers. Columns (1) and (2) provide the estimated results where proximity to mobile money agents is under 10 min, whereas columns (3) and (4) present the results where proximity to mobile money agents is 10 min and above. We also provide the results based on proximity to mobile money agents where the outcome of interest is offering credit to customers in columns (5) and (6). We find that the effect of mobile money use to make payments on the likelihood of receiving goods and services on credit is more pronounced among entrepreneurs who can access mobile money agents within 10 min compared with those who can access these agents 10 min and above. Similarly, the use of mobile money to receive payments has a significant positive effect where proximity to mobile money agents is under 10 min but is insignificantly different from zero for firms located 10 min or more than 10 min away from mobile money agents. We equally find that the effect of paying or receiving payments via mobile money on the probability of offering goods and services on credit is more pronounced when

TABLE 10 | Ordered probit estimates of the use of mobile money and the probability to receive and offer credit: disaggregation by proximity to mobile money agents.

	Dependent variable: Receive goods and services on credit from suppliers				Dependent variable: Offer goods and services on credit to customers			
	Can access mobile money agents under 10 min		Can access mobile money agents 10 min and above		Can access mobile money agents under 10 min		Can access mobile money agents 10 min and above	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Make mm payment	0.324***		0.257**		0.179*		−0.091	
	(0.099)		(0.130)		(0.099)		(0.136)	
Receive mm payment		0.311***		0.058		0.194**		−0.195
		(0.106)		(0.125)		(0.087)		(0.154)
Urban	−0.053	−0.062	−0.066	−0.064	−0.075	−0.083	−0.063	−0.062
	(0.118)	(0.118)	(0.130)	(0.130)	(0.102)	(0.101)	(0.097)	(0.098)
Female	0.027	0.028	0.076	0.061	0.046	0.047	0.268***	0.263***
	(0.094)	(0.090)	(0.111)	(0.113)	(0.078)	(0.078)	(0.094)	(0.095)
Age (in logs)	−0.216	−0.205	−0.419***	−0.418***	−0.089	−0.079	0.071	0.075
	(0.177)	(0.178)	(0.132)	(0.132)	(0.135)	(0.136)	(0.151)	(0.152)
Income (in logs)	0.015	0.017	0.079***	0.080***	0.012	0.013	0.116***	0.117***
	(0.033)	(0.031)	(0.027)	(0.027)	(0.025)	(0.025)	(0.026)	(0.026)
Educated	−0.143	−0.129	0.115	0.134	0.154	0.164	0.233	0.240
	(0.216)	(0.217)	(0.137)	(0.139)	(0.172)	(0.171)	(0.156)	(0.155)
Business age (in logs)	0.053	0.050	0.188***	0.189***	0.004	0.002	0.002	0.002
	(0.040)	(0.039)	(0.052)	(0.052)	(0.042)	(0.041)	(0.048)	(0.047)
Household size (in logs)	0.230**	0.249**	−0.008	−0.007	0.083	0.096	−0.075	−0.077
	(0.111)	(0.109)	(0.102)	(0.104)	(0.082)	(0.081)	(0.097)	(0.097)
Bank account	0.172**	0.175**	0.391***	0.416***	0.170	0.173	0.236**	0.242**
	(0.088)	(0.088)	(0.099)	(0.097)	(0.121)	(0.120)	(0.097)	(0.096)
Informal loan	0.065	0.050	0.076	0.073	0.026	0.018	0.104	0.101
	(0.139)	(0.141)	(0.107)	(0.109)	(0.063)	(0.063)	(0.092)	(0.093)
Informal groups	0.005	−0.000	0.083	0.090	−0.018	−0.022	0.001	0.005
	(0.067)	(0.069)	(0.113)	(0.110)	(0.079)	(0.077)	(0.091)	(0.091)
Sole owner of business	0.100	0.115	0.147	0.149	0.023	0.033	0.156	0.147
	(0.117)	(0.120)	(0.149)	(0.146)	(0.094)	(0.098)	(0.155)	(0.154)
/cut1	1.030	1.133	5.117***	5.112***	0.047	0.131	3.015***	3.006***
	(0.973)	(0.980)	(0.566)	(0.572)	(0.725)	(0.731)	(0.576)	(0.571)
/cut2	1.480	1.583	5.589***	5.582***	1.706**	1.792**	4.688***	4.680***
	(0.988)	(0.995)	(0.559)	(0.565)	(0.725)	(0.729)	(0.568)	(0.563)
/cut3	2.269**	2.375**	6.311***	6.301***				
	(0.996)	(1.006)	(0.561)	(0.566)				
Observations	1039	1039	931	931	1039	1039	931	931

Note: The table reports coefficient estimates using ordered probit. Make mm payment equals 1 if a business regularly or occasionally makes payments using mobile money. Receive mm payment equals 1 if a business regularly or occasionally receives payments using mobile money. Robust standard errors in parentheses are clustered at the regional level, and the estimations control for both regional and sector fixed effects.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

TABLE 11 | Propensity Score Matching (PSM) estimates of the average treatment effect on the treated (ATT).

	Kernel	Radius	Nearest neighbour	Observations	
Outcome	**ATT**	**ATT**	**ATT**	**Treated**	**Controls**
Receive credit regularly/occasionally	0.095***	0.098***	0.096***	528	1447
	(4.01)	(4.10)	(3.82)		
Offer credit to most/all customers	0.069***	0.070***	0.074***	528	1447
	(3.32)	(3.38)	(3.39)		

Note: *t*-values are in parentheses. The table reports estimations for Kernel matching with bandwidth 0.02, Radius Matching with caliper 0.01, and Nearest Neighbour Matching for 5 neighbours. Treatment equals 1 if the entrepreneur either receives or makes business payments occasionally or regularly using mobile money.
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

proximity to mobile money agents is under 10 min. Together, these results suggest that transaction costs matter in the relationship between mobile money use and trade credit. This implies that entrepreneurs closer to mobile money agents can benefit from significant cost savings, leading to liquidity improvements.

5.6 | Robustness Checks

To test for the robustness of the results, we implement a Propensity Score Matching technique. We consider an informal firm as treated if the business uses mobile money for transactions. We use two binary outcomes that reflect the frequency or the extent to which entrepreneurs receive or offer goods and services on credit. The first outcome of interest is a binary variable equal to 1 if the entrepreneur receives goods and services on credit regularly or occasionally from suppliers. The second outcome variable equals 1 if the entrepreneur offers goods and services on credit to all or most customers, and 0 otherwise.

A potential objective will be to estimate the differences in outcome for the same informal firm with or without mobile money usage. However, in practice, we cannot simultaneously observe both outcomes for the same firm (Caliendo and Kopeinig 2008). Consequently, we use a Propensity Score Matching approach to create a counterfactual group that is similar in many ways to the treated group based on observable characteristics (Rosenbaum and Rubin 1983). In this way, we can attribute the differences in outcome observed between the control group and the treated group to mobile money usage.

We use a probit model to estimate the propensity score, which is defined as the probability of assignment to treatment conditional on a vector of covariates. Table A1 of the Appendix presents the probit estimates for the propensity score using a set of variables that are theoretically assumed to be related to both treatment and outcome but not affected by treatment. The covariates include location in an urban area, gender (Female), age of respondent (in logs), education, membership of an informal group, business age, household size, sole ownership of the business, and proximity to mobile money agents. We estimate the Average Treatment Effect on the Treated (ATT) based on the assumption of conditional independence and common support. Guided by the trade-off between bias, variance, and matching quality, we use three different matching algorithms to estimate the effect of mobile money usage on the outcome variables of interest. With the common support condition imposed, we conduct Kernel matching with bandwidth 0.02, radius matching with caliper 0.01, and Nearest Neighbour Matching for 5 neighbours. Also, the matching quality for all estimations is examined to ensure that there is no significant difference between the treated and the control groups after matching, as indicated in Table A2 of the Appendix.[3] Figure A1 shows the common support in the distribution of the propensity score and Figure A2 provides a Kernel density graph showing the overlap in the distribution of the propensity score.

Table 11 presents the estimates for the Average Treatment Effect on the Treated (ATT). We interpret the results using Kernel matching but present the estimates for the other algorithms for comparison. The treatment effect on the treated is positive and statistically significant at the 1% significance level. Thus, the treatment effects for the outcome Receive Credit and Offer Credit are 0.095 and 0.069, respectively. The evidence suggests that entrepreneurs who use mobile money for business transactions regularly or occasionally are more likely to receive goods and services on credit regularly or occasionally from suppliers. Further, the results imply that the use of mobile money is associated with the probability of offering credit to most, if not all, customers.

Furthermore, we investigate whether the effect of mobile money usage on the propensity to receive or offer credit is likely to change in the face of deviation from the unconfoundedness assumption (Becker and Caliendo 2007). We employ the Mantel–Haenszel bound test proposed by Becker and Caliendo (2007) to examine the sensitivity of the matching estimates to hidden bias. The interest here is to investigate the critical levels of gamma (Γ) at which the estimates will be considered biased[4]. The evidence as presented in Tables A3 and A4 indicates that the propensity score matching estimates will only become sensitive to hidden bias at critical levels of $\Gamma = 1.5$ and 1.4 for the outcomes Receive credit and Offer credit, respectively. This suggests that the estimates are relatively robust to hidden bias.

6 | Conclusion and Discussion

This article investigates the relationship between mobile money use and informal firms' propensity to receive goods and services on credit on the one hand and their likelihood to offer credit to

customers on the other. We focus on the informal sector given that entrepreneurs in this sector are more exposed to financial constraints. Our main results suggest that informal firms that use mobile money for business transactions are more likely to receive goods and services on credit from suppliers and to grant goods and services on credit to customers. This finding is consistent with previous studies on the relationship between the use of mobile money and trade credit (Abdulai et al. 2024; Beck et al. 2018; Islam and Muzi 2022). We extend this literature by examining whether supplier credit mediates the relationship between mobile money use and the probability of offering credit to customers. The evidence suggests that mobile money use enables entrepreneurs to offer credit through its effect on supplier credit. Unlike previous studies, we contribute to the literature by providing complete causal pathways through which mobile money affects trade credit.

We also find that transaction costs matter in the relationship between mobile money and trade credit. We argue that for informal firms, where financial constraints abound, the freeing up of additional financial resources due to a reduction in transaction costs is crucial in credit repayment. This is because mobile money-induced liquidity improvement will enable informal firms to avoid delays in credit repayment to suppliers or default risk, which can adversely affect trade credit relationships (Brogaard et al. 2017; Mcmillan and Woodruff 1999). We expect that mobile money use will enable informal firms to unlock their growth potential through the relaxation of financial constraints (Beck and Demirgüç-Kunt 2006; Beck et al. 2005; Goedhuys and Sleuwaegen 2000).

We show that the effects of mobile money use on the probability of regularly receiving goods and services on credit are higher among entrepreneurs with lower incomes. A possible explanation for this effect is that the use of mobile money can free up additional resources to augment the liquidity position of high-income entrepreneurs, leading to lower demand for trade credit. For low-income entrepreneurs, mobile money-induced liquidity improvement may not be sufficient to avoid reliance on supplier credit, but it can at least enable them to reduce default risks, leading to more regular access to trade credit.

In contrast, the effect of mobile money use on the likelihood of offering credit to customers is significantly higher among high-income entrepreneurs compared with low-income entrepreneurs. A possible explanation is that the liquidity improvement associated with mobile money use can complement the available internal finance, enabling entrepreneurs to offer credit to customers. This effect tends to be more favourable to entrepreneurs who already have relatively high levels of income, suggesting a complementarity between mobile money use and income.

Furthermore, we find that the effect of mobile money use on the likelihood of regularly receiving supplier credit or offering credit to most/all customers is higher among entrepreneurs with bank accounts compared with those without bank accounts. This implies that mobile money can complement bank account ownership given that mobile money transactions are cost-effective for low-value transfers whereas bank transfers are more cost-effective for high-value transactions (McKay and Pickens 2010).

Finally, we find that the effect of mobile money use on the probability of receiving goods and services on credit is higher among entrepreneurs without access to informal finance. This evidence suggests that mobile money use has the potential to enhance the liquidity position of entrepreneurs with informal finance, leading to lower demand for trade credit. We find complementarity between informal finance and mobile money use with respect to the provision of credit to most or all customers.

The findings of the study have important policy implications. We demonstrate that mobile money is relevant for engendering access to external finance in the informal sector. Our contribution to the literature in this regard is interesting given that the informal sector is pervasive in Kenya and entrepreneurs who operate in this sector face multiple challenges, including financial exclusion. The evidence, therefore, supports the promotion of mobile money use in the informal sector to facilitate access to external finance. Also, our findings indicate that mobile money influences the provision of trade credit to customers. This suggests that mobile money has the potential to indirectly improve the welfare of non-business customers through the provision of goods and services on credit. Therefore, the promotion of financial inclusion through mobile money should be encouraged to bring about economic development.

So far, our study suggests that the use of mobile money for transactions affects trade credit through its influence on firm-level outcomes. However, we are unable to test for all possible mechanisms due to data limitations. Future studies can explore other mechanisms such as the risk of theft at the firm level. Also, Fabbri and Menichini (2010) reveal that the relationship between trade credit and financial constraints depends on the characteristics of the inputs. In our case, due to the nature of the variable, we are not able to disaggregate results for goods on the one hand and services on the other. Future studies can examine how the use of mobile money differently affects goods and services.

It is worth noting that this study is limited to entrepreneurs who operate informal businesses in Kenya. Therefore, we do not claim that the results are generalizable across Sub-Saharan Africa. However, given that Kenya is the leader in mobile money adoption, other countries can learn from the Kenyan experience and apply these lessons accordingly to suit their local contexts. Future studies can extend the analysis to other countries to broaden our understanding of how the effect of mobile money on trade credit differs across countries.

While our findings suggest that the use of mobile has a positive implication for firms, we acknowledge that mobile money is not insulated from negative consequences. For example, mobile money use is associated with consumer protection concerns such as data privacy, fraud, and agent exploitation in the form of unapproved fees (Mogaji and Nguyen 2022). We recommend that the promotion of mobile money should go hand in hand with appropriate consumer protection policies to mitigate the negative effects of mobile money use.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data is available upon reasonable request.

Endnotes

[1] Supplier credit refers to the receipt of goods and services on credit from suppliers.

[2] Sublocation is a smaller administrative unit in the dataset.

[3] We present the matching quality for only Kernel matching since this is the primary matching algorithm in this paper. The matching quality for radius matching and nearest neighbour matching are equally checked and there are no significant differences between the treated and the control groups after matching.

[4] Gamma (Γ) is the level at which the results will become sensitive to hidden bias and is estimated using Mantel–Haenszel bound test. Mantel–Haenszel bound test examines the sensitivity of matching results to hidden bias for binary outcome variables.

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Appendix A

TABLE A1 | Probit estimates of propensity score.

Urban	0.079***
	(0.021)
Female	−0.128***
	(0.021)
Age	−0.001
	(0.001)
Educated	0.131***
	(0.038)
Informal groups	0.052**
	(0.021)
Business age	−0.000
	(0.001)
Household size	0.002
	(0.004)
Sole owner	0.012
	(0.029)
Proximity to agent (1 equals 10 min or less)	0.074***
	(0.021)
No. of observations	1975

Note: Treatment equals 1 if the entrepreneur used mobile money for business transactions (regularly or occasionally). The table reports marginal effect estimates. Standard errors in parentheses. *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

TABLE A2 | Covariance balance test for kernel matching comparing differences between the control group and the treated group before and after matching.

	Unmatched	Mean		%reduct		*t*-test	
Variable	**Matched**	**Treated**	**Control**	**%bias**	**Bias**	***t***	***p*>t**
Urban	U	0.631	0.483	30		5.86	0.000
	M	0.630	0.625	1	96.5	0.17	0.864
Female	U	0.574	0.713	−29.4		−5.90	0.000
	M	0.575	0.568	1.4	95.1	0.22	0.824
Age	U	34.765	36.187	−11.5		−2.16	0.031
	M	34.782	34.557	1.8	84.2	0.32	0.749
Educated	U	0.951	0.871	28.3		5.10	0.000
	M	0.951	0.950	0.1	99.8	0.01	0.990
Informal groups	U	0.633	0.585	9.8		1.92	0.055
	M	0.632	0.627	0.9	90.8	0.15	0.882
Business age	U	5.688	6.034	−4.4		−0.82	0.410
	M	5.689	5.444	3.1	29.4	0.55	0.584
Household size	U	4.199	4.517	−13.3		−2.64	0.008
	M	4.184	4.188	−0.2	98.8	−0.03	0.980
Sole owner	U	0.867	0.880	−3.7		−0.74	0.461
	M	0.867	0.861	1.8	51.9	0.28	0.779
Proximity to agent	U	0.640	0.487	31.2		6.08	0.000
	M	0.639	0.634	1.2	96.2	0.19	0.847

Note: U = Unmatched, M = Matched. Proximity to agent (1 equals 10 min or less).

TABLE A3 | Sensitivity analysis using Mantel–Haenszel test for Kernel matching. The outcome is 1 if the entrepreneur receives goods and services on credit regularly or occasionally.

Gamma	Q_mh+	Q_mh−	p_mh+	p_mh−
1	4.697	4.697	0.000	0.000
1.05	4.264	5.133	0.000	0.000
1.1	3.852	5.550	0.000	0.000
1.15	3.459	5.950	0.000	0.000
1.2	3.084	6.334	0.001	0.000
1.25	2.725	6.705	0.003	0.000
1.3	2.381	7.062	0.009	0.000
1.35	2.050	7.408	0.020	0.000
1.4	1.731	7.743	0.042	0.000
1.45	1.424	8.067	0.077	0.000
1.5	1.127	8.382	0.130	0.000
1.55	0.841	8.689	0.200	0.000
1.6	0.563	8.987	0.287	0.000
1.65	0.295	9.277	0.384	0.000
1.7	0.034	9.560	0.486	0.000

Note: Gamma: odds of differential assignment due to unobserved factors. Q_mh+: Mantel–Haenszel statistic (assumption: overestimation of treatment effect). Q_mh−: Mantel–Haenszel statistic (assumption: underestimation of treatment effect). p_mh+: significance level (assumption: overestimation of treatment effect). p_mh−: significance level (assumption: underestimation of treatment effect.

TABLE A4 | Sensitivity analysis using Mantel–Haenszel test for Kernel matching. The outcome is 1 if the entrepreneur offers goods and services on credit to most or all customers.

Gamma	Q_mh+	Q_mh−	p_mh+	p_mh−
1	3.606	3.606	0.000	0.000
1.05	3.229	3.986	0.001	0.000
1.1	2.870	4.349	0.002	0.000
1.15	2.528	4.697	0.006	0.000
1.2	2.202	5.032	0.014	0.000
1.25	1.889	5.355	0.029	0.000
1.3	1.589	5.667	0.056	0.000
1.35	1.301	5.969	0.097	0.000
1.4	1.024	6.261	0.153	0.000
1.45	0.756	6.544	0.225	0.000
1.5	0.498	6.819	0.309	0.000
1.55	0.248	7.087	0.402	0.000
1.6	0.006	7.347	0.497	0.000
1.65	0.097	7.601	0.461	0.000
1.7	0.325	7.849	0.373	0.000

Note: Gamma: odds of differential assignment due to unobserved factors. Q_mh+: Mantel–Haenszel statistic (assumption: overestimation of treatment effect). Q_mh−: Mantel–Haenszel statistic (assumption: underestimation of treatment effect). p_mh+: significance level (assumption: overestimation of treatment effect). p_mh−: significance level (assumption: underestimation of treatment effect.

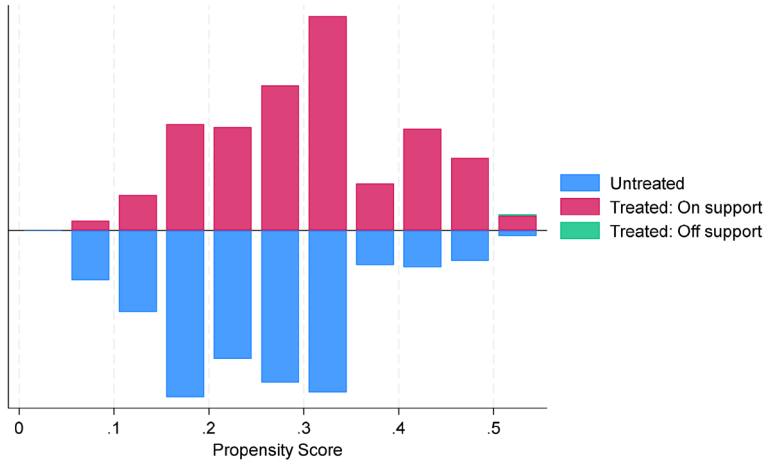

FIGURE A1 | Graph showing common support in the distribution of propensity score. [Colour figure can be viewed at wileyonlinelibrary.com]

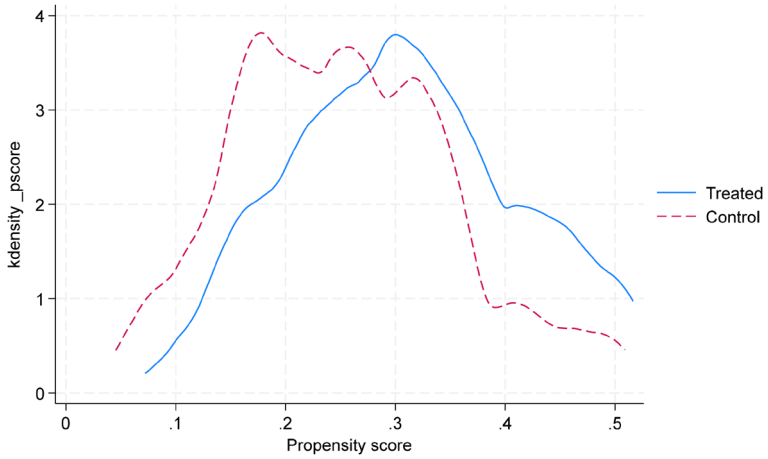

FIGURE A2 | Kernel density graph showing the overlap in the distribution of propensity score. [Colour figure can be viewed at wileyonlinelibrary.com]