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Tesfaye T. Lemma
and
Mthokozisi Mlilo

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Bringing Rigour and Evidence to Economic Policy Making in Africa

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By

Tesfaye T. Lemma
Towson University,
College of Business and Economics,
U.S.A.

and

Mthokozisi Mlilo
University of the Witwatersrand,
School of Economics and Finance,
South Africa

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Contents

List of tables

Abstract

The meteoric rise of digital financial services (DFS) in recent years has sparked the debate on whether they help financially constrained businesses to overcome their performance disadvantages. This study sought to examine whether female-owned enterprises, which tend to be more financially constrained than those owned by men, could curb their performance disadvantage attributable to financial constraints by using mobile money—a form of digital financial technology. Analysing data drawn from 317 firms subsumed in the 2018 World Bank Enterprise Survey on Kenya, we found that the use of mobile money for financial transactions reduces the performance disadvantage of female-owned firms. Using the Oaxaca–Blinder decomposition analysis, we further found that female-owned enterprises which use mobile money for financial transactions were able to cut circa 42.5% of their performance disadvantage induced by financial constraints. In additional analyses, we demonstrated that the influence of access to traditional financial services on the association between a firm's use of mobile money and its performance outcomes is statistically insignificant. Overall, the findings highlight that women-owned firms could exploit mobile money technology to mitigate the gender gap in performance outcomes.

Keywords: *digital finance, mobile money, financial constraints, access to finance, female-owned businesses, female entrepreneurship, business performance.*

1. Introduction

Recent years have witnessed increased academic and policy interest in women entrepreneurship as the economic success of women entrepreneurs is arguably critical for progress toward gender equality, poverty alleviation and human development through economic growth (Brixiová et al., 2020). Although the participation rate of women in entrepreneurship in Africa is ranked amongst the top in the world (Aterido and Hallward-Driemeier, 2011; Boateng, 2018), systemic obstacles and social structures continue to handicap the performance of female-owned businesses in Africa (Lemma et al., 2023). Previous studies highlight systemic obstacles in accessing finance as one of the prime causes of the underperformance of female-owned enterprises (see, for example, Sauer and Wiesemeyer, 2018; Brixiová et al., 2020; Lemma et al., 2023). Financial constraints deprive female-owned enterprises of the resources they need to tap into emerging business opportunities or to withstand shocks to their businesses (Kairiza et al., 2017). Literature advocates for financial inclusion and equity in accessing finance as a panacea for reducing the ubiquitous gender gap in business performance outcomes (Kairiza et al., 2017).

The advent and prominence of digital financial services (DFS)[1] in Africa in recent years made it possible that both "banked and unbanked segments of the society could conduct financial transactions via mobile phones" (Konte and Tetteh, 2023: 2). As a low-cost financial innovation that leverages the telecommunication infrastructure, mobile money is likely to transform and/or fundamentally change how financial services could reach previously excluded groups (Gosavi, 2018; Siddik and Kabiraj, 2020; Kofman and Payne, 2021). This transformative promise of mobile money has elicited a gamut of policy, programme and regulatory responses from governments, financial institutions and multilateral agencies (Gibson et al., 2015; Villasenor et al., 2015; Siddik and Kabiraj, 2020). Several financial agencies are modifying policy frameworks and are offering guidance on the implications of emerging digital technologies to financial institutions and markets (Ehrentraud et al., 2020). Likewise, the G-20 countries have issued principles aimed at galvanizing government policies and actions for promoting financial inclusion through digital technologies (GPFI, 2016).

Transaction cost theory posits that firms whose transactions are governed "appropriately" will experience economic benefits (Cuypers et al., 2021). The use of mobile money by a firm, through its impact on transaction costs (Jack and Suri, 2014) and access to finance (Beck et al., 2015), would foster investment at the firm level (Islam et al., 2018), which in turn is directly associated with firm performance

(Syverson, 2011). Nonetheless, available evidence on the interaction between the two variables is inconclusive. For example, Gosavi (2018), based on examination of data drawn from four African countries, reported a marginally significant positive association between a firm's use of mobile money and performance outcomes. However, using data from 14 countries in Africa, Konte and Tetteh (2023) found no support for a direct association between a firm's use of mobile money and firm performance. These inconclusive findings based on cross-country studies suggest that the association between the two variables is complex and that we need to adopt a more nuanced approach to examine the relationship.

Although firm-level investment as a key channel through which the effect of a firm's use of mobile money is transmitted to business performance, Islam and Muzi (2022) demonstrated that the association between a firm's use of mobile money and investment at the firm-level is significant only for women-owned businesses. Moreover, Kabengele and Roessling (2022) provided evidence that the positive effects of DFS on business performance are more pronounced in firms that face higher transaction costs in accessing finance. The literature provides further support to the conjecture that women-owned firms in sub-Saharan Africa underperform, partly due to more severe financial constraints, compared with firms owned by men (Lemma et al., 2023). The foregoing discussion suggests that female-owned businesses are likely to experience more pronounced performance effects from the use of mobile money. Nevertheless, we know little about the gendered nature of this relationship. Thus, it is imperative that we ask: Does the use of mobile money curb the performance disadvantage of women-owned businesses? Addressing this question has enormous policy implications as women-owned businesses in sub-Saharan Africa are less likely to use mobile money services (Gosavi, 2022) although their firms tend to be more financially constrained than those owned by men (Asiedu et al., 2013).

The objective of our study was to investigate whether the use of mobile money helps female-owned firms mitigate their performance disadvantages, using the Kenyan setting. It also aimed to quantify the contribution of female-owned firms using mobile money to narrow the gender gap in performance outcomes arising from financial constraints. Our motivation to situate the study in Kenya is underpinned by three important considerations. First, there is ongoing debate on the necessity to set standards to oversee DFS practices to foster consistent and comparable practices and enhance regulation of these practices (Ozili, 2021). Kenya has the most developed digital finance footprint in Africa (Demirguc_Kunt et al., 2018) and a study on the impact of DFS in closing the ubiquitous gendered differential in firm performance in a pioneering country like Kenya (Jack and Suri, 2011) would have enormous policy and regulatory implications.

Second, even though Kenya's entrepreneurial ecosystem is rated highly, hurdles related to accessing finance contribute to a substantial share of the gendered differential in performance outcomes in the country (Lemma et al., 2023). Understanding the extent to which the use of mobile money ameliorates the underperformance of female-owned businesses associated with obstacles in accessing finance would enable the formulation of policies and practices that promote gender equality. Policies targeted at

gender equality hold an enormous promise to spur economic and human development (Brixiová et al., 2020). Third, previous studies on the association between firms' use of mobile money for financial transactions and performance outcomes are cross-country studies and report mixed results. As the inconclusive result could be due heterogeneity of institutions across countries, our study focused on a single country, Kenya, to be able to examine the data within the context of a homogeneous set of institutions.

Analysing data drawn from 317 firms subsumed in the 2018 World Bank Enterprise Survey (WBES) on Kenya[2], we first investigated whether the use of mobile money by a firm was associated with its performance outcomes and how a business owner's gender would shape that relationship. Consistent with Konte and Tetteh (2023), we found that the use of mobile money by a firm had no significant direct effect on its performance. Nonetheless, we found that the use of mobile money moderates (i.e., indirect effect) the inverse association between female-owned businesses and performance outcomes. Furthermore, using the Oaxaca–Blinder decomposition (OBD) technique, we quantified the indirect effect of a firm's use of DFS and showed that female-owned enterprises that use DFS can curb about 42.5% of the gendered performance disadvantage induced by obstacles pertaining to access to finance. In additional analyses, in contrast with Konte and Tetteh (2023), we found that the influence of access to traditional financial services on the association between a firm's use of DFS and its performance outcome was not statistically significant.

Taken together, our findings are consistent with the position of Kabengele and Roessling (2022) that mobile money would have a more pronounced beneficial effect on firms with higher transaction costs. Women-owned businesses in Kenya are among the financially constrained enterprises that face higher transaction costs. Such businesses can use mobile money to cut the performance disadvantage associated with financial constraints. On the contrary our evidence differs with Konte and Tetteh (2023), we find that access to traditional financial services has a statistically insignificant role on the relationship between a firm's use of mobile money and its performance outcomes. Thus, we submit that policies targeted at promoting the adoption and extensive use of mobile money by women-owned firms would be effective in abating the underperformance of such firms.

Our study adds to the established literature on gender differences in business performance and the emerging field of DFS by examining the role of DFS in curbing the performance gap between female and male-owned businesses. It sheds light on whether the proliferation of DFS around the world would be just another wave of emerging technologies that favour financially unconstrained businesses or a force to reckon with in curbing performance disadvantage of financially constrained firms, including establishments owned by women. Furthermore, unlike previous studies, our study ascertained the contribution of DFS in ameliorating performance disadvantage of female-owned businesses arising from obstacles in accessing finance.

The rest of this paper is organized as follows. The next section provides a synthesis of key previous studies followed by a third section outlining the empirical strategy of the study. Section 4 reports the findings and discussions and Section 5 concludes.

2. Key previous studies

Although the participation rate of women in entrepreneurship in Africa is among the highest in the world (Aterido and Hallward-Driemeier, 2011; Boateng, 2018), the literature is replete with evidence corroborating the notion that women-owned enterprises in the continent underperform, compared to those owned by men (Bardasi et al., 2007; Lemma et al., 2023). Available evidence also shows that the lion's share of the gendered differential in performance outcomes is attributable to the systemic and structural barriers that women-owned businesses face in accessing finance (Bardasi and Getahun, 2009; Lemma et al., 2023). These observations have triggered considerable academic and policy interest in financial inclusion initiatives and their role in improving business performance outcomes of female entrepreneurs (e.g., Kairiza et al., 2017). Nonetheless, empirical findings on the role of financial inclusion in enhancing performance outcomes of female-owned businesses are mixed. While some studies have demonstrated that female-owned businesses, compared to those owned by men, have higher returns to financial inclusion or access to finance (e.g., Kairiza et al., 2017; Sauer and Wuesemeyer, 2018). On the contrary, others have documented that female-owned businesses are associated with lower returns to access to finance (e.g., Bardasi et al., 2011).

The emergence and popularity of mobile money—the latest wave of digital financial services—in sub-Saharan African countries has revolutionized how firms in those countries transact. As a low-cost technology that permits real-time transfers of money without the need for a bank account, mobile money cuts the time that businesses spend on financial transactions, fulfil suppliers' and clients' preference to transact using mobile money, reduces transaction friction between firms and their suppliers and lessens the costs of financial transactions (Aker et al., 2011; World Bank, 2013;; Gosavi, 2018; Beck et al., 2018; Jack and Suri, 2014; Horne et al., 2015). The use of mobile money enables businesses to build a reliable database of information on repayment behaviour, reducing the information asymmetry between businesses and lenders, which in turn may facilitate access to trade and bank credit (Gosavi, 2018; Islam et al., 2018; Dalton et al., 2019).

Consistent with the arguments already mentioned, emerging studies have demonstrated that mobile money improves access to finance by businesses. For example, using data obtained from four sub-Saharan African economies, Gosavi (2018) showed that firms which use mobile money for their financial transactions are more likely to have bank loans and/or lines of credit than other firms. Similarly, based on examination of survey

data from Kenya, Beck et al. (2015) reported that businesses which use mobile money to pay suppliers are positively associated with trade credit. In an experimental study on a sample of Kenyan merchants, Dalton et al. (2019) demonstrated that firms which adopted mobile money are positively associated with access to finance in the form of mobile loans. These findings have enormous research and policy implications, especially to sub-Saharan Africa where traditional financial services are not necessarily readily accessible.

The literature highlights that one of the channels through which the reductions in transaction costs and financial constraints arising from the use of mobile money will impact performance outcomes of businesses is through investment at the firm-evel. First, firms may reallocate the funds saved due to reduced transaction costs to increase investments in productive fixed assets (Islam et al., 2018). Second, the ease with which funds could be transferred using mobile money technologies could lead to higher cash flow rates and better firm-level liquidity (Bångens and Söderberg, 2011) both of which are positively associated with firm-level investments (Kadapakkam et al., 1998). Finally, the increased access to finance associated with the use of mobile money by a firm (Beck et al., 2015; Gosavi, 2018) may encourage the firm to exploit new investment opportunities or expand existing ones (Hovakimian and Titman, 2006).

Available evidence on the association between a firm's use of mobile money and its performance outcomes is inconclusive. Based on examination of data sourced from four sub-Saharan African countries, Gosavi (2018) provided evidence that corroborates positive association between firms that use mobile money and performance outcomes. In a similar vein, using data obtained from firms operating in Ghana, Asamoah et al. (2020) showed that a microenterprise's mobile money transfer capabilities have a positively significant impact on firm growth. Likewise, based on data drawn from firms in Cameroon, Talom and Tengeh (2020) reported that adoption of mobile money by a firm is positively associated with its performance. Moreover, Kabengele and Roessling (2022) provided evidence that the positive effects of the use of mobile money on business performance are more pronounced in firms that face higher transaction costs in accessing finance. Nonetheless, using data drawn from 14 countries in Africa, Konte and Tetteh (2023) demonstrated that the use of mobile money by a firm has an insignificant association with performance outcomes.

Islam and Muzi (2022) demonstrated that the association between firms using DFS and firm performance is significant only for women-owned and small and medium-sized (SME) businesses. Although findings from Islam and Muzi (2022) and Kabengele and Roessling (2022) suggest that female-owned businesses are likely to experience a more pronounced performance effect from the use of mobile money, we have limited knowledge about the gendered nature of this relationship. Therefore, we must investigate whether the use of mobile money by a firm differentially benefits the performance of women-owned businesses. Findings from such a study would have valuable policy implications, especially given that female-owned-enterprises in sub-Saharan Africa are less likely to use mobile money services (Gosavi, 2022) while they tend to be more financially constrained than their male-owned-enterprises counterparts (Asiedu et al., 2013). Thus, we examined whether the use of mobile money by a firm influences the performance gap between firms owned by women and those owned by men.

3. Research design

Data and sources

The data for the study were sourced from the WBES database, which provides firm-level information on circa 200,000 enterprises operating in 148 countries. The survey utilizes a stratified random sampling procedure based on consideration of firm size, business sector and geographical location to draw the sampled firms. These surveys are carried out using uniform procedures and questions encompassing a gamut of issues, comprising enterprise attributes and challenges faced by an enterprise, among many others.[3] The Kenya survey was carried out in 2018 and covered about 1,001 enterprises. We based our analyses on a final data set of 317 businesses after eliminating enterprises with missing values. Table 1 presents a summary of the composition of our final sample for each stratum.

Table 1: Sample composition: The table presents a summary of the composition of our final sample by strata.

Firm size	Number of enterprises
Small (5–19)	148
Medium (20–99)	126
Large (100+	43
Total	317
Sector	
Manufacturing	228
Non-manufacturing	89
Total	317
Location	
Inside the capital city	86
Outside the capital city	231
Total	317
Ownership	
Firms with female participation in ownership (%)	100
Firms with majority female ownership (%)	25.6

Model specifications–main analyses

To examine whether a firm's use of mobile money technology to conduct its financial transactions (*DFS*) is associated with its performance outcomes (*PERFORM*), we first developed an ordinary least squares (*OLS*) model that linked *DFS* with *PERFORM* as follows:

$$PERFORM_i = \beta_0 + \beta_1 DFS_i + \sum_{i=1}^{k} \beta_i X_i + \varepsilon_i, \quad (1)$$

where *PERFORM* is a proxy for firm performance outcomes obtained by taking the natural logarithm of the ratio of total annual sales to the number of full-time employees of an enterprise (Ali and Shabir, 2017; Lemma et al., 2023); *DFS* refers to an ordinal variable, ranging from zero to three, constructed based on whether the firm uses mobile money for obtaining loans, payments to suppliers or receipts from customers; and X is a vector of control variables identified based on prior studies; and ε_i is the error term.

Businesses headquartered in urban areas, due to the relative ease with which such businesses can access a host of resources, are expected to achieve higher performance outcomes relative to those established in non-urban areas (Masakure et al., 2008; Deshpande and Sharma, 2016). Thus, we controlled for business location in our model by including an indicator variable (*LOCAT*), which was assigned a value of one if a business is based in the capital city, and zero otherwise. By using a dummy variable (*MANUFACT*), which was set to equal one if a business operates in fabricated metal products, food processing, motor parts and vehicles, textile and garments, and other manufacturing industries, and zero otherwise, we accounted for the impact of the industry in which a business operates on the performance outcome of the business (Masakure et al., 2008). Businesses whose stocks are listed on stock exchanges tend to have easier access to finance, more robust share-based compensation schemes, stronger stakeholders' oversight and greater firm visibility, while those whose stocks are held privately are likely to have lower agency costs, more flexible management and longer investment time horizon, all of which have a bearing on the performance outcomes (Chemmanur and He, 2011; Badertscheret al., 2013; Allee et al., 2020). To control for the effect of a business's listing status (*LISTED*) on its performance outcomes, we subsumed an indicator variable set to one if the business was traded on a bourse, and 0 otherwise.

As foreign owners can have a considerable oversight role, and hence are able to curb agency costs, we expected that foreign ownership was likely to be positively associated with the performance outcome of a business (Douma et al., 2006). Nevertheless, foreign-owned businesses may also incur a liability of foreignness linked with operating in a foreign country (Carney et al., 2019), especially in developing countries, and therefore are prone to be associated with underperformance (Khanna

and Palepu, 2010). We employed an indicator variable (*FOREIGN*) set to one if local individuals and businesses owned less than 50% of the firm, as a reverse measure of foreign ownership of the firm (Lemma et al., 2023). As larger businesses are likely to incur a lower average cost of production, firm size is expected to have a positive association with the performance outcomes of the firm (Hsieh and Olken, 2014; La Porta and Shleifer, 2014). We divided firm size into three categories and generated three separate indicator variables: *SMALL*, *MEDIUM* and *LARGE*. These indicator variables were respectively assigned a value of one if the number of employees was 5–19 (*SMALL*), 20–99 (*MEDIUM*) and more than 100 (*LARGE*), and zero otherwise. Older businesses are likely to possess a broader and deeper repertoire of knowledge and experience, and therefore, tend to post better performance outcomes than is the case with younger businesses (Qian and Li, 2003; Lee and Marvel, 2014;). Following Masakure et al. (2008), we incorporated firm age (*F_AGE*)—the number of years since the establishment of the business in natural logarithms—in our model.

The extant literature suggests that exporting firms tend to outperform their peers whose sales are limited to the domestic market (Bernard and Jensen, 1999; Wagner, 2002, 2007). We accounted for the effect of the internationalisation of a business on its performance outcomes by subsuming two variables in our model: a dummy variable (*EXPRT*) which captures a firm's participation in the export market and a continuous variable which measures the intensity of a firm's export activity (*EXPRT_INT*). The experience of the chief executive of a business in a similar industry is posited to be a crucial driver of the business's performance outcomes since it is viewed as an important intangible asset that underpins decision making in the business (Shrader and Siegel, 2007). A chief executive who has acquired substantial experience in a similar industry is positively related with business performance outcomes (Shane, 2000; Bosma et al., 2004; La Porta and Shleifer, 2014). We included the years of experience of the chief executive of a business in a similar industry (*MNG_EXP*) in the model, to control for managerial experience. Islam et al. (2020) demonstrated that formally registered enterprises are positively related with performance outcomes and thus, we incorporated an indicator variable (*FORMAL*) set to one if an enterprise had formal registration, and zero otherwise, to control for the effect of formal registration on firm performance.

Available evidence also suggests that obstacles to doing business—including power infrastructure, access to finance and access to land—hamper firm performance (Aghion et al., 2007; Shiferaw et al., 2015; Fowowe, 2017; Cole et al., 2018; Ede, 2021;). In this vein, Cole et al. (2018) demonstrated that power outages have a negative impact on firm performance. Thus, we included the total power outage hours experienced by a firm in a typical month (*PWR_CUT*) and an indicator variable that captures whether a firm has its own generator (*OWN_ELEC*) in our model, to control for the effect of power infrastructure on firm performance (Islam et al., 2020). Both access to land (*LAND_OBST*) and finance (*FIN_OBST*) have been identified as antecedents of performance outcomes of a firm (Fowowe, 2017; Brixiová et al., 2020); thus, we controlled for the two variables in our models. More detailed definition of variables is provided in Appendix A.

As noted earlier, Kabengele and Roessling (2022) contend that the performance enhancing benefit of the use of DFS by a firm are more pronounced in firms that experience the most severe financial constraints. The extant literature documents that female-owned businesses not only face more severe financial constraints than those owned by men (Asiedu et al., 2013) but also achieve lower performance outcomes (Lemma et al., 2023). Thus, once we established the direct effect of the *DFS*, as modelled in Equation 1, we examined whether a firm's use of mobile money technologies to conduct financial transactions (*DFS*) reinforces or mitigates the documented negative association between female-owned businesses and performance outcomes (*PERFORM*). To this end, we augmented Equation 1 with a gender variable (*GENDER*) and its interaction with a firm's use of *DFS* (*DFS*), *DFS* * *GENDER*. The model is expressed as follows:

$$PERFORM_i = \beta_0 + \beta_1 DFS_i + \beta_2 GENDER_i + \beta_3 DFS_i * GENDER_i + \sum_{i=1}^{k} \beta_i X_i + \varepsilon_i, \; E(\varepsilon_i) = 0 \quad (2)$$

where *GENDER* denotes female-owned enterprises represented by an indicator variable set to one if a female (s) entrepreneur owns more than 50% of the business, and zero otherwise (Aterido and Hallward-Driemeier, 2011); and *DFS* * *GENDER* is the interaction term between the *DFS* and *GENDER* variables. All other variables are as defined in Equation 1.

As our argument is fundamentally based on prior empirical observation that female-owned businesses experience more severe financial constraints (Asiedu et al., 2013), we probed the data to directly assess whether the use of DFSs by a firm (*DFS*) reinforces or mitigates the performance impeding role of obstacles in accessing finance (*FIN_OBST*). Thus, we augmented the model in Equation 2 with an interaction term between the *DFS* and *FIN_OBST* variables. The augmented model is expressed as follows:

$$PERFORM_i = \beta_0 + \beta_1 DFS_i + \beta_2 GENDER_i + \beta_3 DFS_i * GENDER_i + \beta_4 DFS_i * FIN\_OBST_i + \sum_{i=1}^{k} \beta_i X_i + \varepsilon_i, \; E(\varepsilon_i) = 0 \; 1 \quad (3)$$

where *DFS* * *FIN_OBST* represents the interaction term between the performance and gender variables. The definition of other variables is as defined in (1) and (2).

Once we established the interplay among a firm's use of mobile money for financial transactions (*DFS*), the gender variable (*GENDER*), the severity of obstacles to access finance (*FIN_OBST*) and the firm's performance outcomes (*PERFORM*), we estimated and quantified the contribution of each predictor in the model toward the performance differential between female and male-owned businesses, using the two-fold Oaxaca–Blinder decomposition technique (Blinder, 1973; Oaxaca, 1973). We considered a business establishment as female-owned if more than 50% of its ownership belonged

to a female(s) entrepreneur(s) (Aterido and Hallward-Driemeier, 2011). To ascertain the gendered performance gap, we estimated Equation 4, separately for female and male-owned enterprises:

$$PERFORM_i = \beta_0 + \beta_1 DFS_i + \beta_4 DFS_i * FIN\_OBST_i + \sum_{i=1}^{k} \beta_i X_i + \varepsilon_i, \; E(\varepsilon_i) = 0 \quad (4)$$

After the expected values of performance outcomes for male-owned businesses ($\overline{PERFORM}^m$) and female-owned firms ($\overline{PERFORM}^f$) were computed based on Equation 4, we disaggregated the gap between the expected values ($\overline{PERFORM}^m - \overline{PERFORM}^f$) into two additive components (see Equation 5): the first component is explained based on differences in predictor variables by gender (i.e., *the explained component*) and the second is explained using differences in coefficients (i.e., *the unexplained component*), as follows:

$$\overline{PERFORM}^m - \overline{PERFORM}^f = \underbrace{[(\bar{X}_m - \bar{X}_f)\beta^*}_{\textbf{Explained}} + \underbrace{\bar{X}_m(\hat{\beta}_m - \beta^*) + (\bar{X}_f)(\beta^* - \hat{\beta}_f)}_{\textbf{Unexplained}} \quad (5)$$

where $\bar{X}_f$ are the means of covariates for female-owned enterprises; and $\bar{X}_m$ are those of male-owned enterprises. Based on the decomposition estimates, we interpreted the contributions of each predictor variable, including a firm's use of mobile money (*DFS*) and its interaction with obstacle to access finance (*DFS * FIN_OBST*), to the gendered gap in performance outcomes among firms in Kenya.

4. Results and discussions

Preliminary results

We present descriptive statistics and tests of differences in the means in Table 2. The table indicates that the mean value of the PERFORM variable was about 14.42. Nonetheless, the mean value of the PERFORM variable for female-owned enterprises (13.82) was lower (significant at the 1% level) than that of enterprises owned by their male counterparts (14.62). These results agree with those reported in Lemma et al. (2023). In concurrence with observations in Islam and Muzi (2022), our results showed that female-owned enterprises' use of mobile money is significantly more extensive (at the 1% level) than that of male-owned enterprises. Consistent with prior observations that female-owned enterprises in sub-Saharan African countries are more prone to be financially constrained than their male-owned enterprises (Asiedu et al., 2013), our results indicated that female-owned enterprises tend to face more severe challenges in accessing finance than their male-owned peers.

In agreement with results in the extant literature, the descriptive statistics also indicated that female-owned establishments, compared to those owned by males, tend to be younger and smaller, privately owned and experience longer hours of electricity outage (Arráiz, 2018; Islam et al., 2018). In contrast, the results also showed that female-owned enterprises are less likely to internationalize or be active in the international market, be led by more seasoned chief executives and generate their own electricity (Islam et al., 2018). These dissimilarities between female and male-owned firms might be systematic and could possibly lead to gaps in performance results.

Table 2: Descriptive statistics–the table reports a summary of means of all variables and results of t-tests of differences of means between male- and female-owned enterprises. *, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively.**

	All firms	Male-owned enterprises	Female-owned enterprises	p-value
PERFORM	14.421	14.627	13.821	***
DFS	0.877	0.801	1.099	***
FIN_OBST	0.539	0.496	0.667	***
LOCAT	0.271	0.284	0.235	
MANUFACT	0.719	0.716	0.728	
LISTED	0.025	0.034	0.000	*
FOREIGN	0.931	0.928	0.938	
MEDIUM	0.397	0.415	0.346	
LARGE	0.136	0.161	0.062	**
F_AGE	2.790	2.936	2.366	***
EXPRT	0.205	0.229	0.136	*
EXPRT_INT	22.123	27.169	7.420	***
PWR_OUT	9.265	8.343	11.951	*
OWN_ELEC	0.697	0.758	0.519	***
MNG_EXP	16.536	17.547	13.593	***
FORMAL	0.896	0.903	0.877	
LAND_OBST	0.325	0.309	0.370	

Regression results

The primary objective of the study was to investigate whether a firm's use of mobile money technologies to carry out financial transactions curbs the gendered differential in performance outcomes associated with financial constraints. Table 3 reports results obtained by regressing the performance outcome of an enterprise (*PERFORM*) on a firm's use of mobile money (*DFS*), female-owned businesses (*GENDER*), access to finance obstacles (*FIN_OBST*) and other control variables, using the OLS estimation procedure. Columns I, II and II of Table 3 respectively present the unconditional effects of the *DFS*, *GENDER* and *FIN_OBST* variables on the *PERFORM* variable. Column IV reports the conditional effect of *DFS* on the *PERFORM* variable obtained by regressing the *PERFORM* variable on the DFS, *GENDER*, *FIN_OBST* and the control variables described in section 3.1. In columns V and VI, we re-specify the model in column IV by respectively including interaction terms between the *DFS* variable with *GENDER* and with *FIN_OBST* variables. Finally, this section report results obtained by estimating a regression model that subsumes each of the two interaction terms. We obtained R-squared statistics spanning from 1.4% to 30.1% and F-statistics that were significant at the 1% level, suggesting that the models are well specified.

The results in Table 3 indicate that the unconditional effect of a firm's use of mobile money for carrying out financial transactions (DFS) is to decrease the firm's performance outcomes (PERFORM). Nevertheless, when we condition our models for the effect of control and other variables, we observed that the association between a firm's use of mobile money (DFS) and its performance outcomes (PERFORM) was statistically insignificant. Although this finding contradicts that found by Gosavi (2018) who demonstrated that a firm's use of mobile money is positively associated with its performance outcomes, it is consistent with that of Konte and Tetteh (2023) who demonstrated that the use of mobile money by a firm has no significant direct effect on its labour productivity. This finding is also in line with that of Kabengele and Roessling (2022) who contended that the influence of a firm's use of mobile money on business performance outcomes is rather nuanced and requires granulated investigation.

In concurrence with the "female underperformance hypothesis", the results in Table 3 across all models show that female-owned enterprises, compared to their male-owned enterprises, were correlated with lower performance outcomes (see Column II). The consistently inverse association between the GENDER and PERFORM variables corroborate findings in previous studies (see, for example, Fairlie and Robb, 2009; Bardasi et al., 2011; Arráiz, 2018; Lemma et al., 2023). We also observed a consistently negative association between the obstacles in accessing finance (FIN_OBST) and firm performance (PERFORM) variables, confirming the conjecture that financial constraints, through their negative effect on firm-level investment, innovation and operations, would impede a firm's performance outcomes (Fowowe, 2017; Brixiová et al., 2020; Kabengele and Roessling, 2022).

Table 3: OLS regression results–the table reports cluster robust OLS regression estimates of regression firm performance on the research and control variables. Cluster robust standard errors are provided in parentheses. *, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively.**

VARIABLES	I	II	II	IV	V	VI	VII
GENDER		-0.805***		-0.267**	-0.402**	-0.259*	-0.373**
		(0.1969)		(0.0150)	(0.0139)	(0.0207)	(0.0181)
FIN_OBST			-0.471***	-0.367**	-0.363**	-0.467***	-0.450***
			(0.1748)	(0.0206)	(0.0174)	(0.00620)	(0.00198)
DFS	-0.215**			-0.156	-0.198	-0.229	-0.253
	(0.1014)			(0.121)	(0.124)	(0.108)	(0.110)
*DFS*GENDER*					0.126**		0.105**
					(0.00911)		(0.00819)
*DFS*FIN_OBST*						0.122*	0.105*
						(0.0121)	(0.0147)
LOCAT				0.249	0.257	0.244	0.251
				(0.0707)	(0.0746)	(0.0701)	(0.0738)

continued next page

Table 3 Continued

VARIABLES	I	II	II	IV	V	VI	VII
MANUFACT				-0.742*	-0.739*	-0.742*	-0.739*
				(0.106)	(0.103)	(0.106)	(0.104)
LISTED				-0.604	-0.624	-0.603	-0.620
				(0.194)	(0.203)	(0.196)	(0.203)
FOREIGN				0.0788	0.0773	0.0465	0.0499
				(0.0800)	(0.0725)	(0.0650)	(0.0598)
MEDIUM				0.112	0.114	0.114	0.116
				(0.294)	(0.294)	(0.301)	(0.300)
LARGE				-0.275	-0.274	-0.279	-0.277
				(0.542)	(0.543)	(0.545)	(0.545)
F_AGE				0.293***	0.285***	0.290***	0.284***
				(0.00191)	(0.00328)	(0.00225)	(0.00329)
EXPRT				0.408	0.422	0.411	0.423
				(0.219)	(0.223)	(0.222)	(0.225)
EXPRT_INT				0.00351	0.00329	0.00342	0.00325
				(0.00227)	(0.00223)	(0.00222)	(0.00219)
PWR_OUT				-0.0123*	-0.0124	-0.0125*	-0.0125*
				(0.00186)	(0.00198)	(0.00170)	(0.00182)
OWN_ELEC				0.152	0.149	0.161	0.157
				(0.125)	(0.116)	(0.128)	(0.120)
MNG_EXP				0.0233**	0.0232**	0.0239**	0.0237**
				(0.00119)	(0.00129)	(0.00133)	(0.00142)
FORMAL				0.764*	0.767*	0.779*	0.780*
				(0.0815)	(0.0817)	(0.0816)	(0.0823)
LAND_OBST				0.303	0.304	0.295	0.297
				(0.154)	(0.159)	(0.150)	(0.154)
Constant	14.61***	14.63***	14.68***	13.09**	13.14**	13.15**	13.19**
	(0.1248)	(0.0995)	(0.128)	(0.479)	(0.478)	(0.454)	(0.455)
Observations	317	317	317	317	317	317	317
F-test	4.51**	16.71***	7.27***	7.50***	7.09***	7.09***	6.72***
R-squared	0.014	0.05	0.019	0.299	0.300	0.300	0.301

The results in both columns V and VII (Table 3) indicate that the interaction term between the *DFS* and *GENDER* variables (*DFS * GENDER*) is positively significantly (at the 5% level) associated with firm performance (*PERFORM*). That is, the negative association between female-owned businesses and performance was lower for those firms which used mobile money for their financial transactions. This result highlights that female-owned firms that use money were able to cut their performance disadvantage relative to their male-owned enterprises. In addition, the finding is in

line with the notion that a performance enhancing effect of using mobile money is likely to be stronger in female-owned firms, as these are the firms that are likely to invest funds obtained through mobile money to productive assets (Islam and Muzi, 2022). The finding is also in agreement with that of Kabengele and Roessling (2022) who contended that firms with higher transaction costs or more severe financial constraints are more likely to have higher returns on use of mobile money.

We further probed the data to examine whether the use of mobile money by a firm (*DFS*) influences the interaction between the firm's financial constraints (*FIN_OBST*) and performance outcomes (*PERFORM*). In this regard, we found that the interaction term between the *DFS* and *FIN_OBST* variables (*DFS * FIN_OBST*) was positively significantly (at the 5% level) associated with firm performance (*PERFORM*). That is, the inverse relationship between a firm's financial constraints (*FIN_OBST*) and performance outcomes (*PERFORM*) was less pronounced in firms which used mobile money for their financial transactions. This result suggests that the use of mobile money by a business attenuates the negative effect of obstacles in accessing finance on the business's performance outcomes. It also provides a further support to the proposition by Kabengele and Roessling (2022) that the performance accentuating effects of the use of mobile money by a firm are likely to be more pronounced in financially constrained firms.

The results in Table 3 revealed that several of the explanatory variables have statistically significant associations with a firm's performance outcomes. In tandem with the observation that the uncompetitiveness of the manufacturing industry in Africa is linked to poor infrastructure (Eifert et al., 2008), the results showed that manufacturing establishments in Kenya (*MANUFACT*) were linked with lower performance compared to those in the non-manufacturing industries. Also, corroborating the view that older businesses are likely to have a richer repertoire of knowledge and executive know-how (Qian and Li, 2003; Lee and Marvel, 2014), our results suggest that older firms (*F_AGE*) were associated with higher performance outcomes (*PERFORM*). Several previous studies (e.g., Bardasi et al., 2011; Brixiová et al., 2020) reported similar relationship between firm age and a firm's performance outcomes.

In agreement with results documented in Islam et al. (2018) and Konte and Tetteh (2023), we found that total duration of power outage (*PWR_OUT*) had a decreasing effect on an enterprise's performance outcomes (*PERFORM*). In concurrence with the view that the experience of the chief executive of an enterprise matters in shaping the enterprise's performance outcomes (Shane, 2000; Shrader and Siegel, 2007) and the available empirical evidence in previous studies (Bosma et al., 2004; La Porta and Shleifer, 2014), our results showed that the chief executive's experience in a similar industry (*MGM_EXP*) yields higher firm performance outcomes (PERFORM). In line with results reported in Agyire-Tettey et al. (2018) and Islam et al. (2018), our results revealed that enterprises that had formal registration at inception (*FORMAL*) were associated with higher performance outcomes (*PERFORM*), suggesting that there is benefit in registering a firm at inception.

Decomposition (OBD) results

Results in Table 2 indicate that more female-owned businesses tend to perceive severe obstacles in accessing finance and that they tend to use mobile money more extensively, relative to men-owned enterprises. Considering that obstacles in accessing finance happen to be significant drivers of a firm's performance outcomes (see also Table 3), we asked: how much of female-owned enterprises' underperformance attributable to financial constraints could be mitigated by using mobile money? We quantified the reduction in performance disadvantage of female-owned enterprises associated with the use of mobile money, utilizing the Oaxaca–Blinder decomposition (OBD) procedure. Table 4 presents results based on two-fold decomposition of the performance gap between female and male-owned enterprises. Consistent with the results reported in Table 3, Table 4 (Column I) shows that there is a significant (at the 1% level) aggregate performance gap between female and male-owned businesses. Specifically, female-owned businesses generate performance outcomes that are about 55.3% below that of male-owned businesses, which corroborates the "female underperformance hypothesis".[4] Once again, this finding is consistent with available empirical evidence from previous studies (see, for example, Fairlie and Robb, 2009; Aterido and Hallward-Driemeier, 2011; Arráiz, 2018).

Columns II and III of Table 4 report a breakdown of the unconditional effect of the *GENDER* variable on the *PERFORM* variable into endowment (i.e., explained) and coefficient (i.e., unexplained) effects. The OBD results summarized in Column II show that differences in endowments contribute *circa* 67.8% (i.e., 0.546/-0.805) of the raw performance differential between male and female-owned enterprises; that is, female-owned enterprises in Kenya achieve performance outcomes that are about 37.50% (i.e., 55.3%*67.83%) lower than those of male-owned enterprises due to gendered differences in endowments.

Table 4: Oaxaca-Blinder decomposition (OBD) results–the table provides results based on OBD of firm performance by an entrepreneur's gender. *, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively.**

	Differential	Endowments	Coefficients
FOEs	13.821***		
	(0.200)		
MOEs	14.627***		
	(0.165)		
Difference	-0.805***		
	(0.035)		
FIN_OBST		-0.080***	0.148
		(0.029)	(0.250)

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Table 4 Continued

	Differential	Endowments	Coefficients
DFS		-0.068**	0.427**
		(0.033)	(0.181)
*DFS*FIN_OBST*		0.034*	-0.339***
		(0.019)	(0.125)
LOCAT		-0.012***	0.219***
		(0.005)	(0.028)
MANUFACT		-0.009	0.056
		(0.009)	(0.320)
LISTED		0.020***	-0.002***
		(0.007)	(0.001)
FOREIGN		0.000	-0.655***
		(0.001)	(0.189)
MEDIUM		-0.008	-0.199***
		(0.020)	(0.060)
LARGE		0.028	-0.069*
		(0.053)	(0.036)
F_AGE		-0.165***	0.369***
		(0.004)	(0.060)
EXPRT		-0.038*	0.093***
		(0.022)	(0.032)
EXPRT_INT		-0.068	-0.101***
		(0.044)	(0.036)
PWR_OUT		-0.045***	0.212***
		(0.008)	(0.031)
OWN_ELEC		-0.039	-0.190***
		(0.030)	(0.025)
MNG_EXP		-0.094***	0.276***
		(0.009)	(0.048)
FORMAL		0.020	-0.112***
		(0.032)	(0.030)
LAND_OBST		0.018	-0.288***
		(0.015)	(0.064)
Constant			-0.233
			(0.220)
Total		-0.546***	0.259***
		(0.025)	(0.049)
Observations	317	317	317

Column II further shows the separate contributions arising from gendered differences in each covariate. We observed from the results that severity of obstacles in accessing finance (*FIN_OBST*) adds to the endowment advantage of male-owned enterprises by about 9.94% (i.e., -0.080/-0.805). This result is in sync with findings in previous research which document gendered difference in access to finance (e.g., Asiedu et al., 2013) and suggests that challenges in accessing finance do not favour female-owned businesses. Contrary to our expectation, the OBD results also showed that the use of mobile money by a firm contributed to an 8.45% (i.e., -0.068/-0.805) widening of the unconditional gendered performance differential between male and female-owned enterprises. Nonetheless, the OBD results further indicated that the use of mobile money by firms that view the finance-access obstacle as a severe impediment could reduce the unconditional gendered performance by about 4.22% (i.e., 0.034/-0.805). Thus, considering these results in tandem, we surmised that female-owned enterprises which perceive access to finance as a severe obstacle to doing business could cut the aggregate gendered gap in performance outcomes by about 42.5% (i.e., -0.034/-0.080).

We further noted from the OBD results presented in Column II that gendered differences in the location of an establishment widens the performance differential between male and female-owned establishments by about 1.49% (i.e., -0.012/-0.805). This observation is consistent with the available evidence that male business owners, relative to their female peers, tend to establish their businesses in urban areas, which in turn is positively associated with performance outcomes (Lee and Marvel, 2014). Similarly, in sync with findings in previous studies that older enterprises are linked with higher performance outcomes and the observation that female-owned businesses tend to be younger (e.g., Arráiz, 2018; Islam et al., 2018), differences in firm age between female and male-owned enterprises widen the unconditional gendered performance differential by about 20.5% (i.e., -0.165/-0.805). Previous studies have demonstrated that the outward orientation of an enterprise, measured by its exporting status, is positively associated with its performance outcomes (e.g., Bernard and Jensen, 1999; Wagner, 2002, 2007) and that female-owned enterprises tend to have a lower propensity to enter foreign markets (Orser et al., 2010). Corroborating these observations, our results indicated that gendered differences in exporting status explained about 4.72% (i.e., -0.038/-0.805) of the unconditional performance disadvantage of female-owned businesses.

In sync with results from previous studies which demonstrated that power outages are inversely associated with performance outcomes (Cole et al., 2018; Konte and Tetteh, 2023) and our earlier observation that female-owned businesses tend to experience more frequent power outages, our OBD results indicated that gendered differences in duration of power outage worsen the performance disadvantage of female-owned enterprises by about 5.59% (i.e., -0.045/-0.805). Consistent with the available evidence that the know-how of the chief executive of an enterprise in a

similar sector is positively related with the enterprise's performance outcomes (see, for example, Shane, 2000; Bosma et al., 2004; La Porta and Shleifer, 2014) and the tendency that female-owned firms are likely to be led by executives with less experience in a similar industry (e.g., Arráiz, 2018), gendered differences in managerial experience between female and male-owned businesses widen the performance disadvantage of the female-owned enterprises by *circa* 11.68% (i.e., -0.094/-0.805). In contradistinction, our results demonstrated that gendered differences in listing status between female and male-owned businesses curb the performance disadvantage of female-owned enterprises by about 2.48% (i.e., 0.020/-0.805).

The OBD results also revealed that about 32.17% (i.e., 0.259/-0.805) of the unconditional gendered differential in performance outcomes was due to differences in coefficients and/or differences in unobservable or unmeasurable characteristics—the econometric literature refers to these as the *unexplained differential*. The OBD results specifically showed that the listing status of a firm (0.77%) (i.e., -0.002/0.259), being domestically owned (252.9%), being medium-sized establishment (76.8%), being a large-sized firm (26.6%), export intensity of the business (39.0%), generating own electricity (73.4%), being formally registered (43.2%), severity of obstacle in accessing land (111.2%) and using mobile money while facing severe obstacle in accessing finance (130.9%) contribute to the widening of the unexplained component of the gendered gap in performance outcomes. However, the location of a business (84.6%), the age of a firm (142.5%), participation in the export market (35.9%), duration of power outage (81.9%), experience of top executives in a similar sector (106.6%), and the use of DFS by a firm (164.9%) reduced the unexplained component of the gendered gap in performance outcomes.

Robustness check

Addressing omitted variable concerns

Konte and Tetteh (2023) highlighted that the firm performance model should subsume a measure of lagged firm performance as the past performance is likely to have an impact on both the current performance of a firm and the decision to use mobile money. Thus, we re-estimated our baseline model after augmenting it with a lagged term of firm performance. A summary of the re-estimated results is presented in Table 5. The cross-sectional nature of our data did not permit the use of more superior methods of controlling for endogeneity such as the Generalised Methods of Moments.[5]

Table 5: OLS regression results–the table reports cluster robust OLS regression estimates of regression firm performance on independent variables including one year lagged firm performance. Cluster robust standard errors are provided in parentheses *, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively.**

VARIABLES	I	II	II	IV	V	VI	VII
GENDER		-0.761**		-0.250*	-0.362**	-0.244*	-0.338*
		(0.0357)		(0.027)	(0.027)	(0.031)	(0.028)
FIN_OBST			-0.461	-0.377**	-0.374**	-0.460**	-0.446***
			(0.077)	(0.028)	(0.025)	(0.009)	(0.005)
DFS	-0.202***			-0.141	-0.176	-0.201	-0.222
	(0.00232)			(0.119)	(0.122)	(0.104)	(0.106)
*DFS*GENDER*					0.104**		0.087*
					(0.007)		(0.008)
*D F S * F I N _ OBST*						0.101	0.086
						(0.019)	(0.022)
LOCAT				0.224	0.231	0.220	0.226
				(0.071)	(0.074)	(0.071)	(0.074)
MANUFACT				-0.721*	-0.718*	-0.720*	-0.718*
				(0.104)	(0.101)	(0.104)	(0.102)
LISTED				-0.716	-0.731	-0.715	-0.727
				(0.184)	(0.191)	(0.185)	(0.191)
FOREIGN				0.001	0.001	-0.025	-0.022
				(0.098)	(0.092)	(0.083)	(0.079)
MEDIUM				0.109	0.111	0.111	0.113
				(0.294)	(0.294)	(0.300)	(0.300)
LARGE				-0.481	-0.479	-0.482	-0.480
				(0.603)	(0.604)	(0.604)	(0.605)
F_AGE				0.278***	0.272***	0.276***	0.271***
				(0.001)	(0.000)	(0.001)	(0.000)
EXPRT				0.365	0.377	0.368	0.378
				(0.212)	(0.215)	(0.214)	(0.217)
EXPRT_INT				0.004	0.004	0.004	0.004
				(0.002)	(0.002)	(0.002)	(0.002)
PWR_OUT				-0.012	-0.012	-0.012	-0.012
				(0.002)	(0.002)	(0.002)	(0.002)
OWN_ELEC				0.139	0.137	0.147	0.143
				(0.122)	(0.115)	(0.124)	(0.117)
MNG_EXP				0.025**	0.025**	0.026**	0.025**
				(0.001)	(0.001)	(0.001)	(0.001)

continued next page

Table 5 Continued

VARIABLES	I	II	II	IV	V	VI	VII
FORMAL				0.735*	0.738*	0.748*	0.749*
				(0.084)	(0.084)	(0.085)	(0.086)
LAND_OBST				0.281	0.282	0.275	0.277
				(0.154)	(0.158)	(0.150)	(0.154)
PRFRM_LAG	9.12e-11*	8.30e-11*	9.28e-11*	8.54e-11*	8.47e-11*	8.46e-11*	8.42e-11*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	14.56***	14.58***	14.63***	13.17**	13.22**	13.23**	13.26**
	(0.165)	(0.165)	(0.133)	(0.480)	(0.479)	(0.455)	(0.456)
Observations	317	317	317	317	317	317	317
R-squared	0.037	0.069	0.046	0.316	0.316	0.316	0.317

After including one-year lagged firm performance into the model, we noted in the re-estimated results that the impact of total duration of power outage (*PWR_OUT*) and the interaction term between the *DFS* and *FIN_OBST* (*DFS*FIN_OBST*) on firm performance wanes into statistical insignificance. As expected, the one-year lagged performance of a business was positively associated with its current performance (significant at the 10% level). Except for these, the overall tenor of the results in the re-estimated model were comparable with those reported in the main analyses.

Alternative measure of business performance

We noted that Konte and Tetteh (2023) used value-added per worker as a measure of firm performance. Thus, we re-estimated our baseline model using the excess of sales revenue over cost of goods sold deflated by the number of permanent fulltime employees of a firm, as our dependent variable. A summary of the estimation results is reported in Table 6.

Table 6 shows that the effect of managerial experience in a similar industry (*MNG_EXP*), firm age (*F_AGE*), the firm being in a manufacturing industry (*MANUFACT*) and the interaction term between the *DFS* and *FIN_OBST* (*DFS*FIN_OBST*) on firm performance become statistically insignificant when we use value-added per worker as a proxy for firm performance. However, the influence of two variables—*LOCATE* and *FOREIGN*—which were not significant in the main analyses turned statistically significant. More importantly, we observed that associated between the key variables of interest—that is, *GENDER*, *DFS* and *DFS*GENDER*—and firm performance remained qualitatively the same, even if we used value-added per worker as our alternative dependent variable.

Table 6: OLS regression results–the table reports cluster robust OLS regression estimates of regression of firm performance (measured by value-added per worker) on the research and control variables. Cluster robust standard errors are provided in parentheses. *, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively.**

VARIABLES	I	II	III	IV	V	VI	VII
GENDER		-2.244***	-0.581*	-3.561**	-0.504**	-3.355**	
		(0.000)		(0.059)	(0.219)	(0.027)	(0.071)
FIN_OBST			-2.609**	-1.654**	-1.577*	-2.630*	-2.221**
			(0.169)	(0.063)	(0.146)	(0.216)	(0.100)
DFS	-0.920**		-0.402	-1.365*	-1.130	-1.791	
	(0.060)			(0.101)	(0.212)	(0.296)	(0.351)
*DFS*GENDER*					2.793*	2.647**	
					(0.291)		(0.202)
*DFS*FIN_OBST*						1.211	0.794
						(0.406)	(0.337)
LOCAT				-1.888*	-1.705**	-1.970*	-1.768*
				(0.159)	(0.124)	(0.204)	(0.166)
MANUFACT				-1.403	-1.350	-1.410	-1.360
				(0.463)	(0.326)	(465,863)	(0.336)
LISTED				-0.384	-0.770	-0.340	-0.721
				(0.469)	(0.306)	(0.439)	(0.282)
FOREIGN				1.780*	1.874***	1.507*	1.690***
				(0.194)	(0.017)	(0.153)	(0.018)
MEDIUM				-1.192	-1.130	-1.160	-1.110
				(0.805)	(0.769)	(0.852)	(0.803)
LARGE			-0.408	-0.364	-0.487	-0.418	
				(0.596)	(0.585)	(0.649)	(0.627)
F_AGE				1.010	0.829	0.096	0.832
				(0.192)	(0.153)	(0.189)	(0.157)
EXPRT				2.330	2.730	2.360	2.720
				(0.504)	(0.530)	(0.547)	(0.548)
EXPRT_INT				0.002	-0.003	0.000	-0.003
				(0.005)	(0.000)	(0.000)	(0.005)
PWR_OUT				-0.049**	-0.051*	-0.051***	-0.052**
				(0.000)	(0.000)	(0.000)	(0.003)
OWN_ELEC				1.080	1.030	1.180	1.090
				(0.399)	(0.209)	(0.473)	(0.274)
MNG_EXP				0.086	0.085	0.092*	0.089
				(0.014)	(0.016)	(0.013)	(0.015)

continued next page

Table 6 Continued

VARIABLES	I	II	III	IV	V	VI	VII
FORMAL				1.860**	1.822**	2.007**	1.920**
				(0.122)	(0.121)	(0.060)	(0.071)
LAND_OBST				0.790	0.855	0.709	0.798
				(0.268)	(0.389)	(0.259)	(0.383)
PRFRM_LAG	4.949**	4.728*	5.532**	-1.020	0.149	-0.453	0.459
	(0.360)	(0.464)	(0.350)	(0.660)	(0.641)	(0.638)	(0.629)
Observations	301	301	301	301	301	301	301
R-squared	0.008	0.013	0.023	0.098	0.113	0.102	0.114

Additional analysis

Consistent with arguments outlined in Kabengele and Roessling (2022), our findings suggest the performance-enhancing benefits of the use of mobile money by a firm are more likely to accrue to female-owned firms, which tend to have limited access to traditional financial services. Nevertheless, in a recent study, Konte and Tetteh (2023) demonstrated that the use of money improves performance outcomes of only those enterprises with access to traditional financial services. To examine if, indeed, the impact of a firm's use of mobile money for financial transaction (DFS) is conditional upon the firm already having access to traditional financial services, we explored the impact of firms with bank capital (B_CAPITAL) and/or savings (or checking) account in a bank (SAVINGS) on the association between a firm's use of mobile money (DFS) and its performance outcomes (PERFORM) (Konte and Tetteh, 2023). Table 7 reports estimation results of Equation 1, Equation 2 and Equation 3 augmented with two interaction terms: DFS*B_CAPITAL and DFS*SAVINGS.

Table 7 shows a positive significant (at the 5% level) unconditional association between a firm with a savings (or checking) account in a bank (SAVINGS) and its performance outcomes (PERFORM); the association wanes into statistical insignificance once we account for the control variables. Likewise, the results in the table also indicate a positive and marginally significant (at the 10% level) unconditional association between access to capital financed by banks (B_CAPITAL) and firm performance (PERFORM); the statistical significance of the association disappears once we introduced the control variables into the model. Taken together, the findings suggest that the performance boosting role of the use of mobile money by a firm is not necessarily driven by firms which already have access to traditional financial services.

Table 7: OLS regression results–the table reports cluster robust OLS regression estimates of regression of firm performance (measured by value-added per worker) on the research and control variables. Cluster robust standard errors are provided in parentheses. *, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively.**

VARIABLES	I	II	III	IV	V	VI	VII
GENDER		-2.244***	-0.581*	-3.561**	-0.504**	-3.355**	
		(0.000)		(0.059)	(0.219)	(0.027)	(0.071)
FIN_OBST			-2.609**	-1.654**	-1.577*	-2.630*	-2.221**
			(0.169)	(0.063)	(0.146)	(0.216)	(0.100)
DFS	-0.920**		-0.402	-1.365*	-1.130	-1.791	
	(0.060)			(0.101)	(0.212)	(0.296)	(0.351)
*DFS*GENDER*					2.793*	2.647**	
					(0.291)		(0.202)
*DFS*FIN_OBST*						1.211	0.794
						(0.406)	(0.337)
LOCAT				-1.888*	-1.705**	-1.970*	-1.768*
				(0.159)	(0.124)	(0.204)	(0.166)
MANUFACT				-1.403	-1.350	-1.410	-1.360
				(0.463)	(0.326)	(465,863)	(0.336)
LISTED				-0.384	-0.770	-0.340	-0.721
				(0.469)	(0.306)	(0.439)	(0.282)
FOREIGN				1.780*	1.874***	1.507*	1.690***
				(0.194)	(0.017)	(0.153)	(0.018)
MEDIUM				-1.192	-1.130	-1.160	-1.110
				(0.805)	(0.769)	(0.852)	(0.803)
LARGE			-0.408	-0.364	-0.487	-0.418	
				(0.596)	(0.585)	(0.649)	(0.627)
F_AGE				1.010	0.829	0.096	0.832
				(0.192)	(0.153)	(0.189)	(0.157)
EXPRT				2.330	2.730	2.360	2.720
				(0.504)	(0.530)	(0.547)	(0.548)
EXPRT_INT				0.002	-0.003	0.000	-0.003
				(0.005)	(0.000)	(0.000)	(0.005)
PWR_OUT				-0.049**	-0.051*	-0.051***	-0.052**
				(0.000)	(0.000)	(0.000)	(0.003)
OWN_ELEC				1.080	1.030	1.180	1.090
				(0.399)	(0.209)	(0.473)	(0.274)
MNG_EXP				0.086	0.085	0.092*	0.089
				(0.014)	(0.016)	(0.013)	(0.015)

continued next page

Table 7 Continued

VARIABLES	I	II	III	IV	V	VI	VII
FORMAL				1.860**	1.822**	2.007**	1.920**
				(0.122)	(0.121)	(0.060)	(0.071)
LAND_OBST				0.790	0.855	0.709	0.798
				(0.268)	(0.389)	(0.259)	(0.383)
PRFRM_LAG	4.949**	4.728*	5.532**	-1.020	0.149	-0.453	0.459
	(0.360)	(0.464)	(0.350)	(0.660)	(0.641)	(0.638)	(0.629)
Observations	301	301	301	301	301	301	301
R-squared	0.008	0.013	0.023	0.098	0.113	0.102	0.114

5. Conclusions

The rapid growth of digital financial services in recent years, especially in sub-Saharan African countries, has ignited the debate on whether these services actually help financially constrained firms to overcome their performance disadvantages. Inspired by recent studies that present contrasting findings on how a firm's use of mobile money would shape firm performance, we examined whether female entrepreneurs could overcome their "underperformance" associated with financial constraints by using mobile money. Based on analyses of data from Kenya, we provide evidence that female-owned enterprises can reduce their relative performance disadvantage by using mobile money for financial transactions. More specifically, we provide evidence that female-owned businesses could eliminate about 42.5% of their performance disadvantage that stems from obstacles in accessing finance by using mobile money technologies for financial transactions. The findings suggest that female-owned enterprises, which tend to be more financially constrained that their male-owned peers, could use mobile money to reduce their relative performance disadvantage.

These findings have several implications for researchers, female-entrepreneurs, and policy makers and regulators. First, our finding that the performance enhancing effect of a firm's use of mobile money is observed only in women-owned firms in Kenya aligns with that of notion of Kabengele and Roessling (2022) that firms with higher transaction costs are more likely to benefit from the use of mobile money for financial transactions. However, it contradicts the observation of Konte and Tetteh (2023) that performance improvements attributable to mobile money use by a firm are likely to accrue only to those firms with access to traditional financial services. Our findings, along with those of Kabengele and Roessling (2022) and Konte and Tetteh (2023), imply that taking granulated approaches to the investigation of the consequences of firms' use of mobile money would illuminate deeper insights regarding the forces that underpin firm-level outcomes. Second, the finding that female-owned businesses could decrease the performance disadvantage associated with financial constraints by using mobile money technologies implies that Kenyan female entrepreneurs ought to seriously consider the use of mobile money. Third, given our findings, policy makers and regulators in Kenya should consider interventions that would promote the adoption and intensive use of mobile money by female-owned enterprises. The primary reason for the reluctance and low engagement among women towards DFS and mobile money is the exorbitant fees. The mobile money industry can reduce fees by intensifying competition.

Our study was based on firms drawn from Kenya, a country where the adoption and use of mobile money is about the highest in the world. Although our findings align with those of Kabengele and Roessling (2022), they appear to contradict the findings in Konte and Tetteh (2023), both of which were multicounty studies. Conflicting findings in previous studies suggest that our findings may not be generalizable to other settings. Thus, there is a need for more single-country case studies of similar nature and those that examine the institutional and macroeconomic drivers of the variation the in relationship between a firm's use of mobile money and its performance outcomes. Furthermore, future research that explores mechanisms through which the observed gendered effect of a firm's use of mobile money is transmitted to firm-level performance outcomes would bring additional insights to the existing literature.

Notes

1. In the context of this study, digital financial services (DFS) refer to financial products and services that allow the transfer, saving or borrowing of money using mobile telephones, without necessarily needing a bank account (Suri, 2017).

2. www.enterprisesurveys.org

3. A detailed exposition on the WBES surveys see: https://www.enterprisesurveys.org/

4. We calculate the change in performance outcome when we move the GENDER value from MOE to FOE as follows: 100*[exp(β)-1] = 100*[exp (-0.805)-1] = -55.3% (Bardasi et al. (2011).

5. We formally tested for endogeneity using the two-step Hausmann-Whu test and failed to reject the null hypothesis of exogeneity of the digital financial services (DFS) variable.

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Appendix A: Definition of variables

Variable Name	Label	Definition
Firm Performance	*PERFORM*	The natural logarithm of total annual sales revenue scaled by the number of fulltime employees.
Digital Financial Services	*DFS*	A composite score measuring the extent to which a firm uses digital financial services (DFSs), ranging between 0 to 3, with 0 indicating the firm using no DFSs and 3 the firm using DFSs for receiving loans from lenders, making payments to suppliers, and making collections from customers. The score is formed by aggregating the scores obtained from three elements of DFSs: A firm will be assigned a score of "1" if it used mobile money for receiving loans, and "0" otherwise. A firm will be assigned a score of "1" if it used mobile money for making payments to suppliers, and "0" otherwise. A firm will be assigned a score of "1" if it used mobile money for making collections from customer, and "0" otherwise.
Access to finance obstacles	*FIN_OBST*	A dummy variable set to 1 if a firm perceives as a moderate or more severe obstacles in accessing finance, and 0 otherwise.
Female-owned businesses	*GENDER*	A dummy variable set to 1 if a female(s) owns 50% or more of the firm, and 0 otherwise.
Firm Location	*LOCAT*	A dummy variable set to 1 if a firm is headquartered in Nairobi, and 0 otherwise.
Manufacturing	*MANUFACT*	A dummy variable set to 1 if a firm operates in the manufacturing sector, 0 otherwise. Manufacturing sector includes those classified by WBES as food processing, textile and garments, fabricated metal products, motor vehicles, and other manufacturing.
Listing status	*LISTED*	A dummy variable set to 1 if a firm is listed on a stock exchange, 0 otherwise.
Foreign ownership	*FOREIGN*	Is an inverse measure of foreign ownership proxied by a dummy variable set to 1 if a firm's local ownership is larger than 49%, 0 otherwise.
Small	*SMALL*	A dummy variable set to 1 if the number of fulltime employees of a firm are between 5 and 19, 0 otherwise.
Medium	*MEDIUMZ*	A dummy variable set to 1 if the number of fulltime employees of a firm are between 20 and 99, 0 otherwise.
Large	*LARGE*	A dummy variable set to 1 if the number of fulltime employees of a firm are greater than 100, 0 otherwise.
Firm age	*F_AGE*	The natural logarithm of the age of the firm since establishment.

continued next page

Appendix A Continued

Variable Name	Label	Definition
Exporting status	*EXPRT*	A dummy variable set to 1 if a firm earns at least 1% of its sales from export of goods and services, 0 otherwise.
Export intensity	*EXPRT_INT*	The ratio of a firm's direct export sales to total sales.
Power outage	*PWR_OUT*	The total duration of power outage (in hours) experienced by a firm in a typical month.
Own electricity	*OWN_ELEC*	A dummy variable set to 1 if a firm owns a generator, and 0 otherwise.
Managerial experience	*MGT_EXP*	Years of experience of the top manager in a similar sector.
Formal	*FORMAL*	A dummy variable set to 1 if a firm was formally registered at inception, and 0 otherwise.
Land obstacle	*LAND_OBST*	A dummy variable set to 1 if a firm perceives as a moderate or more severe obstacles in accessing finance, and 0 otherwise.

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Middle East Bank Towers,
3rd Floor, Jakaya Kikwete Road
Nairobi 00200, Kenya
Tel: +254 (0) 20 273 4150
communications@aercafrica.org