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## **Use of mobile financial services among farmers in Africa: Insights from Kenya**

by Martin Parlasca, Constantin Johnen, and Matin Qaim

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## Use of mobile financial services among farmers in Africa: Insights from Kenya

### 1 Introduction

Access to financial services presents a major challenge for farmers in sub-Saharan Africa (SSA) (Ouma et al., 2017). The last two decades, however, have brought forth an increasing range of different digital financial services accessible via mobile phone.<sup>1</sup> These mobile financial services (MFS) include mobile money, mobile banking, mobile payments, mobile savings, as well as mobile credit (AFI, 2016). Many MFS are designed such that they place minor demands on their users in terms of necessary infrastructure and integration into the formal sector. Operation and handling of most MFS are relatively easy and do not require much education or previous experience with financial tools. Unlike financial services, for example through formal banks, MFS could therefore in principle also be used widely by farmers living rural areas with weak infrastructure and low levels of education (Wamuyu, 2014). Given the scarcity of alternative affordable, accessible and reliable finance for agriculture, MFS are therefore seen as an important contributor to the financial inclusion of farmers in SSA (Baumüller, 2018).

A growing body of empirical research shows that MFS can have several positive effects for farmers living in SSA (Aggarwal et al., 2020; Batista and Vicente, 2020; Gopane, 2020; Hartmann et al., 2020; Kikulwe et al., 2014; Krone and Dannenberg, 2018; Rutten and Mwangi, 2012; Sekabira and Qaim, 2017). So far, however, research on farmers' use of MFS has focused solely on two specific MFS, namely mobile money and mobile savings, and is exclusively based on case studies with specialized samples. As a consequence, it is still largely unknown how many farmers really use different types of MFS and why they use them.

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<sup>1</sup> Digital financial services are defined as the broad range of financial services accessed and delivered through digital channels, including payments, credit, savings, remittances and insurance (AFI, 2016).

In this article, we use nationally representative data from Kenya to address this gap and target three main research objectives. The first objective is to analyze the dissemination of MFS among farmers for payments, savings, and loans. The second objective is to analyze how common it is for farmers to use MFS for activities that are directly related to farming. The third objective of this article is to explore possible reasons why farmers use some MFS more than others. We distinguish between farmers with different market channels to highlight how MFS usage patterns depend on farmer types.

The results presented in this article are based on descriptive statistics from the latest Financial Access (FinAccess) survey from 2018 conducted in Kenya. The country is an interesting and telling case for such an analysis as Kenya is one of the world leaders in innovations around MFS: for example, the mobile money service M-PESA established in 2007 is one of the first and most successful mobile money services worldwide but other kinds of MFS are also widely disseminated in Kenya. The mobile banking service M-Shwari, for example, was introduced in 2012 and is used by nearly 70% of Kenya's adult population (Bharadwaj and Suri, 2020). Despite the focus on Kenya, the analyses presented here are also of interest for the development prospects of MFS in many other sub-Saharan countries, since such services have also started to spread quickly in other countries over the last decade (Afawubo et al., 2020; Demirgüç-Kunt et al., 2018; Murendo et al., 2018; Peprah et al., 2020; Tabetando and Matsumoto, 2020).

This article places itself in the larger body of literature concerned with the digitalization of agriculture and contributes in several important ways. To the best of our knowledge, this article is the first to assess the use of MFS among farmers using samples that are regionally or nationally representative. We are also not aware of any study – representative or not – concerned with mobile banking and mobile loans among farmers. Both the distinction between whether a farmer uses an MFS in general or for an agriculture-related activity, as well as disaggregation across a wide range of farmer types are critical to the assessment of the relevance of these services to the agricultural sector but have so far not been carried out. Finally, this is the first article to explore potential reasons for different levels of usage across digital financial services.

The remainder of this article is organized as follows. Section 2 presents the data and overview statistics of the sample. Section 3 analyses general use of MFS of farmers and section 4 analyses farmers' use of MFS for agricultural activities. In section 5, results are discussed and potential barriers for agricultural MFS use are explored. In section 6, we derive policy implications and conclude.

## **2 Data and sample overview**

This study builds upon cross-sectional data from the 2019 (FinAccess) household survey conducted by the Central Bank of Kenya, the Kenya National Bureau of Statistics, and the Financial Sector Deepening Kenya. Data were collected in 2018. The survey represents the fifth of a series of surveys with the primary objective of measuring drivers and usage of financial services in Kenya. Agriculture and farming have not been central aspects of the four previous surveys conducted in earlier years (2006, 2009, 2013, and 2016). The 2019 FinAccess survey is the first to devote one section specifically for agricultural finance.

According to FSD Kenya et al. (2019), data were collected using a two-stage stratified cluster sampling design. In the first stage, 1,000 clusters were selected based on the National Sample Survey and Evaluation Program. Subsequently, eleven households were randomly chosen from each of the clusters, and for each selected household, the survey was conducted with a random person in the household with at least 16 years of age. All selections were done without replacement, yielding a final total sample of 8,669 observations (FSD Kenya et al., 2019). Throughout the analyses in this article, sampling weights are used so that results are representative at a national and sub-regional level.

Due to the random selection within the household, the interviewed respondent is not always the head of the household. However, 82% of the respondent mentioned to be either solely responsible or jointly responsible with another household member for the households' financial decisions. In the following analyses, we consider all observations regardless of their position within the household but provide key statistics also for

the subsample of financial decision makers in the appendix. It can be stated in advance that the results are generally very insensitive to this alternative specification.

Table 1 presents the proportions of respondents involved in agriculture with and without sampling weights. A little more than half of the respondents have done some kind of agricultural activity in the twelve months prior to the survey and approximately one third has earned money through their agricultural activity. Approximately a fourth of the sample mentions agriculture as their main source of income. Since we are interested in financial aspects of farming, we focus on the subsample of farmers, who have earned money through an agricultural activity, which entails 3,041 unique observations.<sup>2</sup> For the remainder of this article we use the term ‘farmer’ to refer to this group and unless stated otherwise only present results with sampling weights.

**Table 1: Involvement into agricultural activities**

Proportion of respondents who...	With weights	Without weights
... do any type of agricultural activity	53.5	57.2
... have earned money through their agricultural activities in past year	31.9	35.1
... have agricultural activities as their main source of income	23.4	26.3

Note: N = 8,669.

An important aspect of this study is the differentiation of results across different types of farmers. The FinAccess survey contains little information on respondents’ agricultural production and marketing patterns, only providing information on the broad types of products sold by the respondents (food crops, cash crops, livestock, livestock products, fish) as well as on the respondents’ main market channel. This information in itself is unlikely to resemble the full complexity of most farmers’ agricultural production and marketing patterns, since farmers, for example, often sell output through several different market channels. Despite this limitation, information on the types of products sold by the respondent as well as her main market

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<sup>2</sup> The number of 3,041 observations arises from the total number of observations in the sample (8,669) multiplied with the proportion of respondents who have earned money through their agricultural activity in the past year (35.1%).

channel help account for the heterogeneity across farmers at least to some degree and is therefore useful to detect potential differences with respect to the questions if, how, and why farmers use different types of MFS.

Table 2 presents the share of farmers selling their produce through one of the four respective market channels, as well as the share of farmers selling different types of food products for each of the four main market channels. Farmers could give multiple answers with respect to the types of food that they sell. The main market channel for most farmers are local traders, wholesalers, or transporters along the road side, closely followed by farmers who mainly sell on the nearest market center or to neighbors, friends, or family. Farmers in both of these groups mostly sell food crops, and also to some extent livestock, while cash crops are sold relatively rarely. Companies, manufacturer, factory, or exporter as well as farmers' cooperative represent the main market channel for nearly 9% and 8% of the farmers respectively. Within these two groups, farmers are much more likely to sell cash crops and less likely to sell food crops compared to farmers from the other two market channels. A version of Table 2 considering only decision makers is presented in the Online Appendix.

**Table 2: Distribution of main market channels and food types sold within each market channel**

(percent)

Share of farmers who mostly sell their products <sup>a</sup> ...	Share of the total population of farmers	Share of farmers within each group of main market channel, who sell <sup>b</sup> ...		
		...food crops	...cash crops	...livestock, livestock products, fish
... to local traders, wholesalers, or transporters along the road side	42.5	77.0	7.1	34.0
... on the nearest market center or to neighbors, friends, or family	38.1	75.6	4.6	31.2
... to a company, manufacturer, factory, or exporter	8.8	40.5	72.7	30.1
... through a farmers' cooperative	7.9	34.9	66.0	36.8

Note: N = 3,041.

<sup>a</sup> multiple answers were not possible.

<sup>b</sup> multiple answers were possible.

### 3 General use of mobile financial services among farmers

In Table 3, we first explain and summarize the types of activities that mobile money and mobile banking allow their users to perform. We focus on the mobile money service M-PESA and the two mobile banking services M-Shwari and KCB M-Pesa due to their dominating position in Kenya’s MFS market. M-PESA is by far the most common mobile money provider. A few other providers exist but only 1.1% of the farmers in the sample who used mobile money did not mentioned M-PESA as their most frequently used money provider. More than 91% of the farmers in the sample who used mobile banking mentioned M-Shwari as the most frequently used mobile banking service and 5.7% of the sampled farmers mentioned KCB M-Pesa. These market-dominating MFS are all operated by Safaricom and very closely interlinked. Everyone who has used M-PESA for more than six months automatically can open both an M-Shwari and/or KCB M-Pesa account by agreeing to a set of terms and conditions (Cook and McKay, 2015). Users can transfer funds from their mobile money account to their mobile banking account and vice versa at no charge.

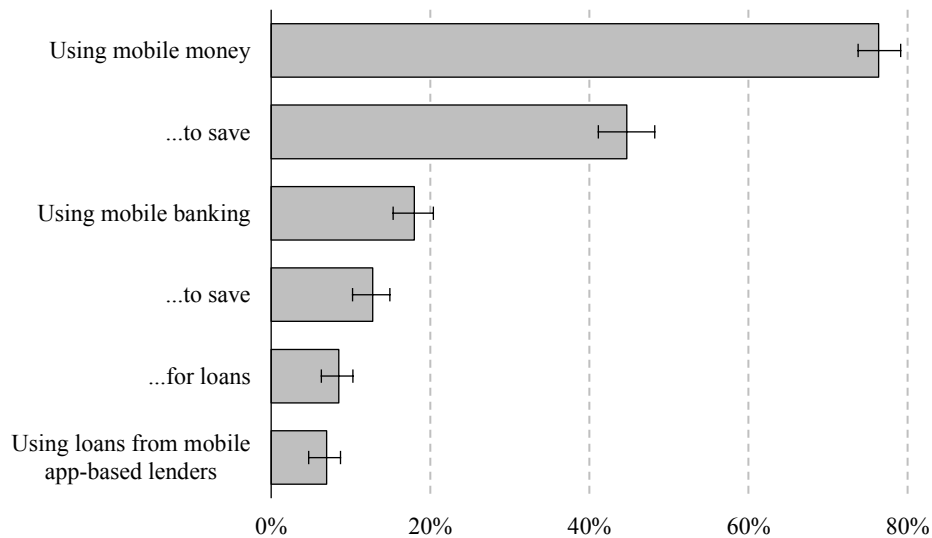
**Table 3: Overview of most important mobile money and mobile banking services**

	Mobile Money		Mobile Banking	
Name of specific service	M-PESA		M-Shwari	KCB M-Pesa
Provider	Safaricom		Safaricom & Commercial Bank of Africa	Safaricom & KCB Bank Kenya
Launched in	2007		2012	2015
<i>Available Features</i>				
Payments to others	Yes. But values are limited to 150,000 KSh per transaction and 300,000 KSh per day <sup>a</sup>		No. Funds are deposited/withdrawn from own M-PESA account for free (but daily M-PESA transaction value limits apply)	
Savings	Yes, but without interest and maximal account balance of 300,000 KSh		Yes, with interest and no maximal account balance <sup>b</sup>	
Loans	No		Yes	

Note: <sup>a</sup> These limits are active since March 2020. The limits that applied to M-PESA transaction during the time of data collection are 70,000 KSh per transaction and 150,000 KSh per day. <sup>b</sup> Savings beyond 100,000 KSh have some additional requirements, such as the physical submission of a national ID or tax ID (Cook and McKay, 2015). At the time of the survey, 1KSh  $\approx$  0.01USD.



We now consider the extent to which farmers use MFS in general, meaning without particular focus on MFS use for agricultural purposes. Figure 1 shows the proportions of farmers using mobile money at all, using mobile money to save, using mobile banking at all, using mobile banking to save, having received a loan via mobile banking, and having received a loan via mobile app-based lenders. Farmers in Kenya indeed use several MFS. The finding that more than 75% of farmers used mobile money within the twelve months preceding the survey shows that MFS can be accessed by a fairly wide range of farmers. Mobile banking is still less common than mobile money, but a usage rate of nearly 20% is still notable. So far, farmers use mobile banking slightly more for saving than for loans, but the fact that more than 8% of all farmers have used a loan from mobile banking shows that such mobile loans are not irrelevant for farmers. The proportion of farmers using digital loans from app-based lenders, which are small and collateral free loans from non-bank companies, is similar.



**Figure 1: Proportions of farmers using MFS.** Proportions and 99% Wilson Confidence Intervals are shown for farmers using MFS within the past year. Source: Own calculations based on FinAccess 2019 Survey data.

How much farmers with different main market channels deviate from sample averages is shown in Table 4. The heatmap reveals two notable patterns. First, farmers who mainly sell their produce on the nearest

markets or to neighbors, friends, or family are a consistently less likely to use MFS compared to the sample average. This holds for all MFS applications. Second, the differences across types of farmers are slightly more pronounced for the use of mobile money compared to mobile banking and loans from app-based lenders. Absolute proportions are shown in Table A1 in the Appendix and the respective table considering only decision makers is presented in the Online Appendix.

**Table 4: Deviations from the sample average for general MFS use**  
(percentage points)

	Local traders, wholesalers, transporters	Nearest market center, neighbors, friends, family	Company, manufacturer, factory, exporter	Farmers' cooperative
Using mobile money	+0.6	-3.7	+7.7	+5.0
...to save	+2.0	-4.0	+5.9	+4.7
Using mobile banking	+1.4	-4.5	+0.5	+3.9
...to save	+1.6	-2.4	+1.2	+2.8
...for loans	+0.9	-2.2	+3.4	+3.3
Using mobile app-based lenders	+0.1	-1.9	+2.7	-1.5

Note: Differences from the sample mean are shown in percentage points supported by a quantile-based color scale from blue (lowest) to white (0) to red (highest). N = 3,041.

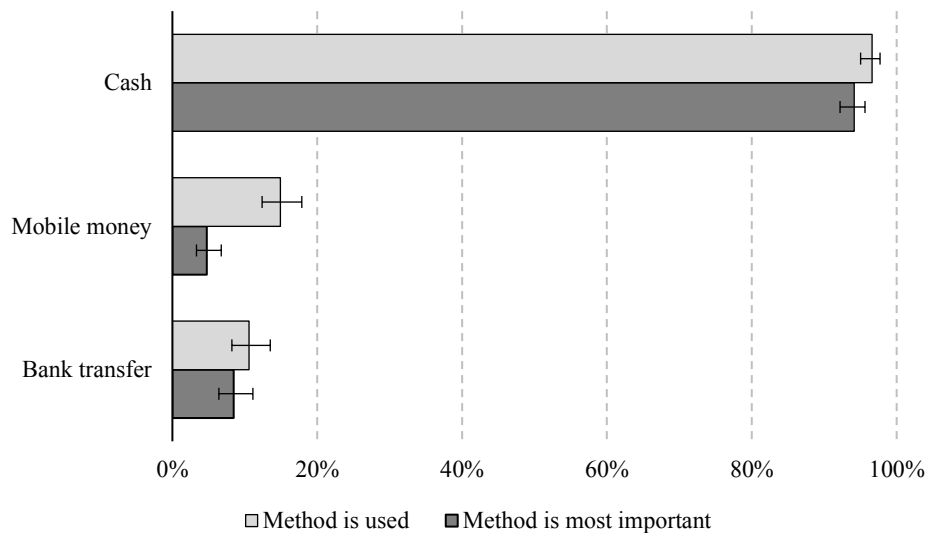
#### 4 Descriptive Statistics on the use of MFS for farming activities

Shifting the focus from mere usage of MFS, this section considers the degree to which farmers use these services for activities that are directly related to agriculture. We first consider payments, followed by savings and loans.

##### 4.1 Payments

Figure 2 presents the proportion of farmers who have made or received any kind of payment for their agricultural activity via mobile money for the twelve months prior to the survey and the proportion of

farmers for whom mobile money is the most important method to either make or receive agricultural payments. For comparison, we also show the same proportions for two other channels for making and receiving payments for agriculture, namely cash and formal bank transfers. All options for potential channels for payments were explicitly read out to the respondents.



**Figure 2: Methods to make or receive agricultural payments.** Proportions and 99% Wilson Confidence Intervals are shown for farmers using different payment methods for agricultural activities within the past year. N=3,041. Source: Own calculations based on FinAccess 2019 Survey data.

Cash is still unsurprisingly the most common method for farmers to make or receive agricultural payments, with more than 96% of the pooled sample of farmers having either made or received a payment for their agricultural activity in cash in the twelve months prior to the survey. The respective proportion of farmers who use mobile money for such payments is much smaller with a usage rate of approximately 15%. This rate of use is not much larger than the proportion of farmers using bank transfers for agricultural payments. This low rate of mobile money use for agricultural payments among farmers is startling considering that the general use of mobile money is much more pervasive among farmers. A rate of use of 15% implies that only one in five farmers who use mobile money actually uses it to make or receive agricultural payments. In

terms of being the most important method to make or receive agricultural payments, mobile money is the least relevant payment method falling behind bank transfers.

Deviations from the sample average use of cash, mobile money, and bank transfers for agricultural payments for different farmer types are shown in Table 5. Compared to the general use of mobile money shown in Table 4, there are some substantial differences across farmers with different main market channels. Bank transfers are the payment method with the highest disparity. Bank transfers are widely used by farmers who sell to companies, manufacturers, factories, exporters, or through a farmers' cooperative and even represent the most important method for agricultural payments for many of these farmers. Farmers whose main market channel are local traders, wholesalers, transporters, the nearest market center or neighbors, friends, or family are, however, much less likely to use bank transfers for agricultural payments. Differences with respect to using mobile money for agricultural payments are also substantial, albeit not as extreme as is the case of bank transfers. In particular, farmers whose main market channel is the nearest market center or neighbors, friends, family, are nearly more than 10 percentage points less likely to use mobile money for agricultural payments compared to the sample mean. The absolute proportions of farmers using cash, mobile money, or bank transfers to make or receive agricultural payments are shown in Table A2 in the Appendix. Extended versions of Table A2 which also differentiate between making agricultural payments and receiving agricultural payments for the different methods of payment for the full sample and decision makers only are presented in the Online Appendix. Results for the full sample and only decision makers are nearly identical.

**Table 5: Difference to the sample average for agricultural payment methods**

(percentage points)

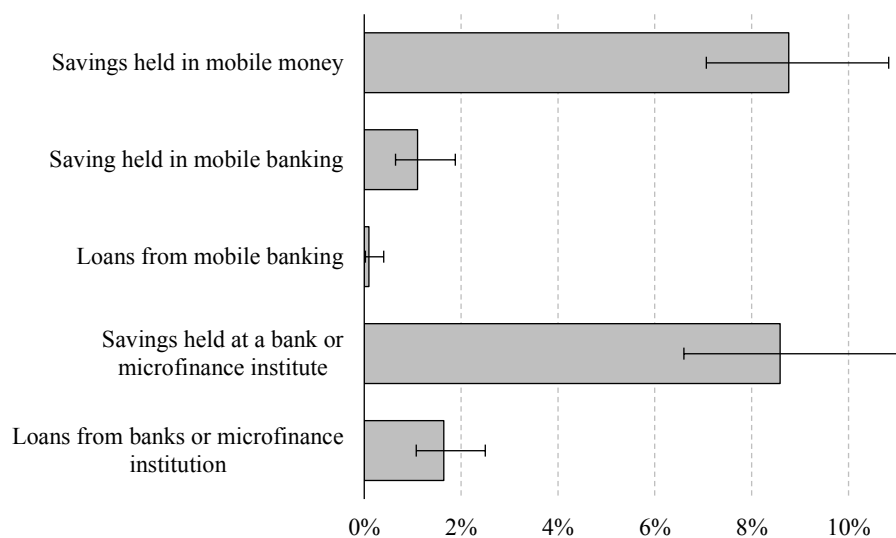
Method	Relevance	Local traders, wholesalers, transporters	Nearest market center, neighbors, friends, family	Company, manufacturer, factory, exporter	Farmers' cooperative
Cash	Used	+3.0	-0.4	-12.8	-2.2
	Most important	+3.0	+0.9	-13.7	-9.0
Mobile money	Use	+4.1	-10.9	+15.0	-1.5
	Most important	+2.0	-4.7	+5.9	-2.5
Bank transfers	Use	-6.2	-3.3	+42.3	+11.6
	Most important	-6.5	-1.1	+38.0	+8.8

Note: Differences from the sample mean are shown in percentage points supported by a quantile-based color scale from blue (lowest) to white (0) to red (highest). N=3,041.

## 4.2 Savings and loans

We now analyze how often farmers use MFS-enabled savings and loans to finance their agricultural operations. As part of the FinAccess survey, farmers were asked about their main source of finance for their agricultural operations. Figure 3 presents the results for a few selected answering options, namely savings via a mobile money provider, savings via mobile banking, loans from mobile banking, savings via banks or microfinance institutions, and loans from a bank or microfinance institution.<sup>3</sup> Digital loans from mobile app-based lenders were given as a valid answering option, but not mentioned by any respondent as their main source to finance agricultural activities. The service is therefore not explicitly mentioned in Figure 3.

<sup>3</sup> For the question on main sources of finance, the survey combined loans from banks and loans from microfinance institutions.



**Figure 3: Farmers’ main source to finance agricultural activities.** Proportions and 99% Wilson Confidence Intervals are shown for farmers’ main source of agricultural finance. N=3,041. Source: Own calculations based on FinAccess 2019 Survey data.

Most farmers do not rely on MFS as a main source for agricultural finance. Savings held in mobile money accounts represent the most mentioned MFS and accounts for approximately 9% of the pooled sample in contrast to only 1.1% and 0.1% of the respondents who mentioned savings in mobile banking and loans from mobile banking as their main source for agricultural finance respectively. To put this into perspective, approximately 5% of the farmers in the sample mentioned savings in a secret hiding place as their main source of finance for agricultural activities.

Compared to MFS, farmers are nearly equally likely to use a formal bank or microfinance institute as a main source to finance their agricultural activity. Mobile financial services thus have not overtaken banks or microfinance institutions with respect to either savings or loans for agricultural related investments so far. Alternative sources of finance such as gift from family (22%), sale of livestock (17%), or income from salary or other activities (17%) (not shown in Figure 3) still dominate agricultural finance in Kenya.

In Table 6 we again present deviations of different farmer types from the overall sample averages with respect to using different sources for agricultural finance. There are several notable patterns which can be closely linked to some of the patterns observed in Table 5. First, farmers who mainly sell on the nearest market center or to neighbors, friends, or family are less likely to rely on any form of finance from MFS or banks. These are also the types of farmers who are less likely to use mobile money or bank transfers for agricultural payments compared to farmers with other main market channels. Second, farmers whose main outlet are companies, manufacturers, factories, exporters, or cooperatives are much more likely to finance their agricultural activities through a bank, be it via savings or loans, and these are also farmers who are much more likely to use bank transfers to make and receive payments compared to other farmers.

Farmers who mainly sell to local traders, wholesalers, or transporters are the farmers that are most likely to use savings held in mobile money to finance their agricultural activities compared to other farmers. With respect to their methods used for agricultural payments, these farmers constitute an interesting case between the previous two extrema. Agricultural payments of farmers who mainly sell to local traders, wholesalers, or transporters are relatively often done via mobile money compared to the sample average, and relatively rarely done via bank transfers compared to the sample average. This combination of relatively high mobile money use but relatively low use of banks could explain why mobile money savings (and to a lesser degree mobile banking savings) are important for farmers mainly selling to local traders, wholesalers, or transporters. Absolute proportions are presented in Table A3 in the Appendix and the respective table considering only decision is presented in the Online Appendix.

**Table 6: Difference to the sample average for main sources of agricultural finance**

(percentage points)

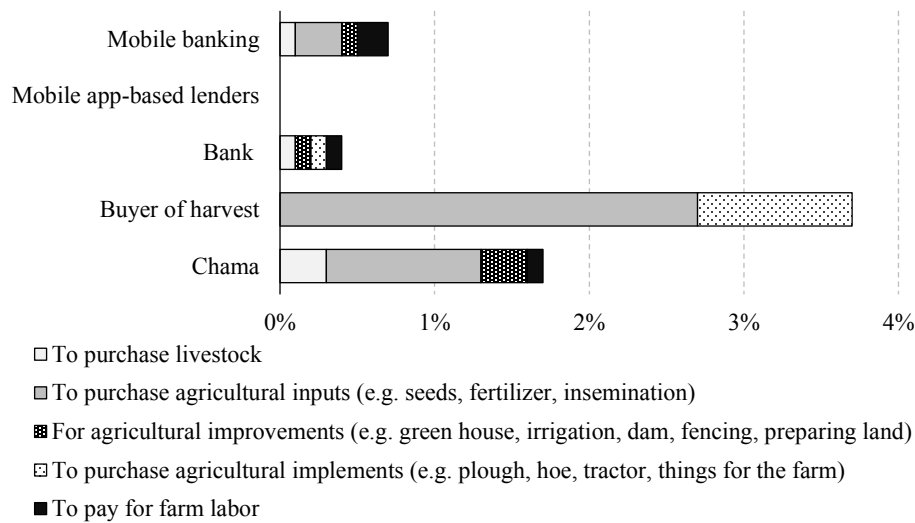
Provider	Type	Local traders, wholesalers, transporters	Nearest market center, neighbors, friends, family	Company, manufacturer, factory, exporter	Farmers' cooperative
Mobile money	Savings	+3.9	-2.7	-4.6	-4.5
Mobile banking	Savings	+0.4	-0.7	-0.4	+0.7
	Loans	-0.1	+0.0	+0.3	-0.1
Bank/ Microfinance institution	Savings	-0.6	-5.7	+20.0	+10.5
	Loans	-0.7	-0.8	+2.3	+5.8

Note: Differences from the sample average are shown in percentage points supported by a quantile-based color scale from blue (lowest) to white (0) to red (highest). N=3,041.

Figure 2 and Table 6 relate to questions about farmers' most important source for agricultural finance and may therefore not fully represent the degree to which farmers generally use MFS to save money or obtain loans for agricultural activities. The FinAccess survey does not entail data on the extent to which different tools and services are used to save for agricultural activities. The survey does, however, provide such information for credit. Figure 4 presents the proportion of farmers who have used credit in the last year for agricultural purposes from mobile banking, banks, buyer of harvest and chamas to finance different agricultural activities, namely to purchase livestock, agricultural inputs, agricultural improvements, agricultural implements, or to pay for farm labor.<sup>4</sup> Paying for fishing equipment or transport of agricultural produce to the market were also viable answer options. Since no farmer mentioned these two purposes, they are not listed in Figure 2.

<sup>4</sup> Chamas are informal cooperative societies, which are widely disseminated in Kenya.





**Figure 4: Proportion of farmers using credit for agricultural activities.**  
 N=3,041. Source: Own calculations based on FinAccess 2019 Survey data.

As foreshadowed in Figure 3, farmers use virtually no digital credit at all for agricultural activities, whether through mobile banks or mobile app-based lenders.<sup>5</sup> Only 0.6% of all farmers have used a loan from mobile banks for an agricultural activity. This low figure cannot entirely be explained by lack of access to credit by farmers, since Figure 1 previously showed that more than 8% of farmers have in fact obtained at least one loan from a mobile bank. The purpose of this type of loan is typically not part of the application procedure and therefore does not influence whether or not the loan is granted. That means that even from those farmers who have taken a loan via mobile banking, only 7% have used it for an agricultural activity, which shows that agricultural purposes play a relatively small role even for farmers who in principle use or have used

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<sup>5</sup> If a respondent has taken more than one loan from a certain source, the data only provide detailed information such as size, duration, collateral or purpose only for the most recent loan from that source. For example, if a farmer had obtained a loan from a mobile bank and used it for agricultural purposes prior to his or her most recent loan from a mobile bank, these purposes are not accounted for in Figure 4. The proportions therefore represent a lower bound of the usage of digital loans for agricultural purposes. However, more than 40% of the farmers who have taken a loan from a mobile bank in the last 12 months have actually only taken one loan from a mobile bank. We therefore do not expect the true usage rates to be substantially higher.

digital credit. None of the most recent loans obtained via mobile app-based lenders are used for agricultural activities.

For comparison, Figure 4 also shows two more traditional sources for obtaining credit, such as credit from *chamas* or buyer-seller agreements. If farmers use credit to finance agricultural activities, they are relatively more likely to use these two sources, even though absolute proportions are still relatively small. All other options to obtain loans to finance agricultural activities through other sources, such as Savings and Credit Cooperative Organizations (SACCO), micro-finance institutions, employer, friend/family/neighbors, shopkeeper, or hire purchase are used even less frequently and therefore not shown in Figure 4. These overall very small proportions of farmers using credit to finance agricultural activities such as the purchase of inputs are in line with previous research from several other sub-Saharan countries (Adjognon et al., 2017).

## **5 Discussion and exploration of barriers to agricultural MFS use**

It is a reoccurring theme for all MFS analyzed in the previous section that the proportions of farmers who generally use different MFS are substantially larger than the proportions of farmers who use them within their agricultural operations. In the discourse on the use of MFS in the agricultural sector, this discrepancy between general and agricultural use has been virtually unaddressed, a case study on commercial and export oriented horticultural small-scale farmers in Central Kenya by Krone and Dannenberg (2018) being the only exception that we are aware of. In this section, we therefore compare and contrast the results drawn from the previous section to findings of earlier research on MFS among farmers and explore obstacles that farmers may face for both the use of MFS in general and the integration of these services into agricultural operations.

The descriptive statistics shown in this article indicate that to date, the proportion of farmers using MFS directly for agricultural activities has remained fairly modest. However, beyond the ‘direct’ activities related to agricultural finance that are mentioned in this article, there are several indirect effects through which the use of MFS may affect farmers’ agricultural activities. This includes, for example, time savings achieved

through mobile money transfers, improved opportunities of off-farm income generation, or remittances that are received via mobile money (Batista and Vicente, 2019; Kikulwe et al., 2014; Kirui et al., 2013; Sekabira and Qaim, 2017). How much MFS affect farmers through these ‘indirect’ effects cannot be answered with the data at hand and therefore constitute important agenda for future research.

The large proportion of farmers in Kenya that generally use mobile money shown in Figure 1 is consistent with previous research in Kenya (Hartmann et al., 2020; Kikulwe et al., 2014; Kirui et al., 2013; Kirui et al., 2012), and holds for all types of farmers, regardless of their main market channels. The finding that farmers relatively rarely make or receive agriculture-related payments via mobile money (Figure 2) is therefore somewhat surprising, also since the Global Findex Survey recently stated that 79% of Kenya’s adult population makes or receives digital payments (Demirgüç-Kunt et al., 2018). Claims that Kenyan farmers are equally likely to receive agricultural payments into cash or into an account (Klapper et al., 2019) are also far off from the usage rates observed in this article.

Even though digital payments are not used excessively, there is some heterogeneity across different farmer types that deserves attention: farmers mainly selling to companies, manufacturers, factories, or exporters have the highest propensity to make or receive payments via mobile money relative to all other farmers. This suggests that digital transfers facilitate participation in modern value chains or vice versa. At the same time, the differences across farmer types also reinforce an issue raised earlier in this article, namely that extrapolation of findings from previous research on farmers’ use of mobile money transfers, which is almost exclusively based on samples of farmers who grow cash crops and/or are integrated into modern value chains, causes a substantial overestimation of the importance of mobile money transfers for farmers generally, and in particular for farmers who mainly grow food crops and work in more traditional supply chains. For example, only 8% of the farmers mainly selling on the nearest market center or to neighbors, friends, or family use, make or receive agricultural payments via mobile money and for less than 2% does mobile money present the most important channel to do so. Since these farmers make up nearly 40% of

Kenya's farming population (see Table 2), adequate representation of these farmers' reality in future academic research on MFS is imperative.

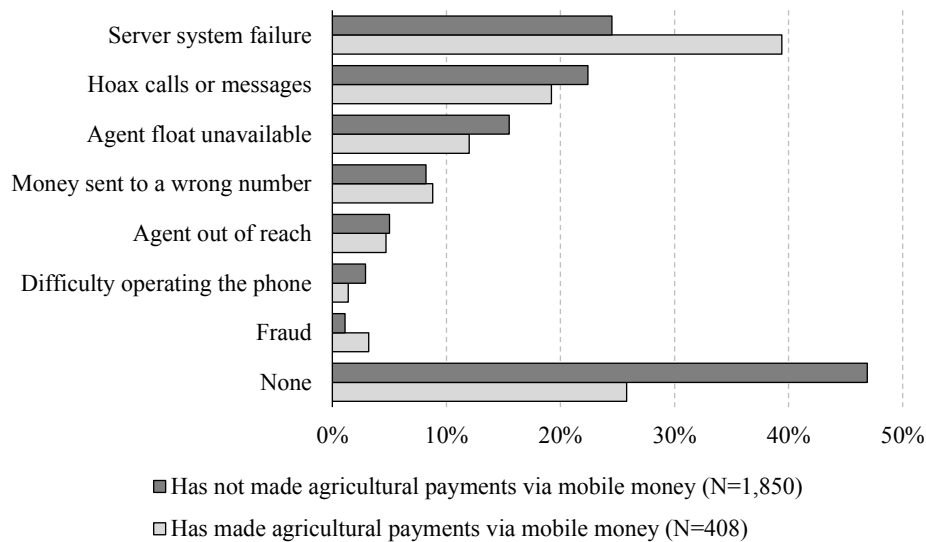
What are potential reasons why many farmers in principle use mobile money but are much less likely to use it for agricultural activities? Based on qualitative evidence, Krone and Dannenberg (2018) propose that safety, transparency issues, as well as high fees cause reluctance among farmers to use mobile money for agricultural payments.<sup>6</sup> Even though the FinAccess survey does not provide data precisely on reasons for or against using mobile money for agriculture-related payments, the survey entails a question on any negative experience with mobile money over the past twelve months. Figure 5 shows the answers for the sample of mobile money-using farmers, separated by whether or not they have made or received a payment for an agricultural activity in the past twelve months. The issues farmers mention most frequently relate to external barriers such as server system failure or mobile money agent float unavailability. Float unavailability occurs when a mobile money agent does not have enough cash stored or does not want to convert mobile money into cash or vice versa. The proportions of farmers who mention personal challenges related to fraud or difficulties in operating the phone are small and unexpected charges or unclear transaction fees, which could hint towards issues of transparency, are virtually not mentioned at all.

Many of those farmers who use mobile money for agriculture-related payments are also people who use mobile money more often for other purposes. Therefore, Figure 5 should not be used for any causal interpretations on reasons for or against using mobile money for agricultural payments. Still, the fact that very few farmers mentioned fraud, unclear transaction fees, or unexpected charges as an issue with mobile money is still in contrast to findings by Krone and Dannenberg (2018) and suggest that safety and

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<sup>6</sup> An example of fraudulent behavior using mobile money in this context is the revocation of a mobile money payment shortly after having received a farmer's produce.

transparency issues are unlikely to be the main reason for the discrepancy between farmers' general mobile money use and use for agricultural payments.



**Figure 5: Negative experiences with mobile money accounts among registered users within one year.** Proportions are shown. Multiple answers were possible. Fraud relates to either someone other than the owner accessing the mobile money account, or that the recipient did not get the money while the senders account was deducted, or that a sender reversed a genuine transaction. Other reasons that are not shown in this table include issues of unexpected charges, unclear transaction fees, poor service at the branch or agent, and contact by a third party which are only very rarely mentioned.

Instead, it seems more plausible that the business situation in which farmers typically interact with buyers or sellers rarely reap the benefits of mobile money payments. Digital payments have an advantage over transactions in cash if the person with whom the transaction takes place is far away (Akinyemi and Mushunje, 2020). When inputs and outputs are bought and sold in comparably small quantities, as is typically the case for smallholder farmers offering their products on local markets or selling them to friends and neighbours, buyer and seller often meet in person. Due to the transaction fees associated with mobile money transfers, the incentives to use mobile money over cash in these circumstances are low. When inputs

and outputs are bought and sold in bulk quantities, as would more often be the case for farmers who sell cash crops to cooperatives, exporters, companies, or factories, the transaction limits of mobile money may reduce the usefulness of mobile money payments (see Table 3). While the issue of transaction limits has also been suggested by Krone and Dannenberg (2018), it was not a valid answering option in the FinAccess survey and therefore its actual severity remains to be determined. Nevertheless, the reasons for the relatively low use of mobile money for agriculture-related payments are likely to differ across farmer types and the data suggest that the fees that are associated with any transaction, as well as transaction limits, and issues around server system failure and agent float unavailability are decisive.

While mobile money transfers are often considered to be the primary function of mobile money (Babcock, 2015; Kirui et al., 2013), our findings indicate that at least for activities directly related to agriculture, saving money via the mobile money provider seems to be more important. So far, the literature on MFS among farmers has paid less attention to mobile money savings compared to mobile money transfers, and recent evidence on the effects of savings through a mobile money on fertilizer use and farmers' agricultural investments is mixed (Batista and Vicente, 2020). However, we find that farmers do use mobile money savings as a tool to finance agricultural activities, especially those farmers who sell to local traders, wholesalers, or transporters. Among this group of farmers, nearly 13% mentioned savings via mobile money as their most important tool to finance agricultural activities. Whether farmers are more likely to save via mobile money or via banks differs across main market channels. Farmers who primarily sell to a company, manufacturer, factory, exporter, or farmer's cooperative are much more likely to use savings held in formal banks to finance agricultural activities rather than mobile money. The lack of data on specific saving purposes for each saving tool, however, prohibits more detailed analysis in this regard.

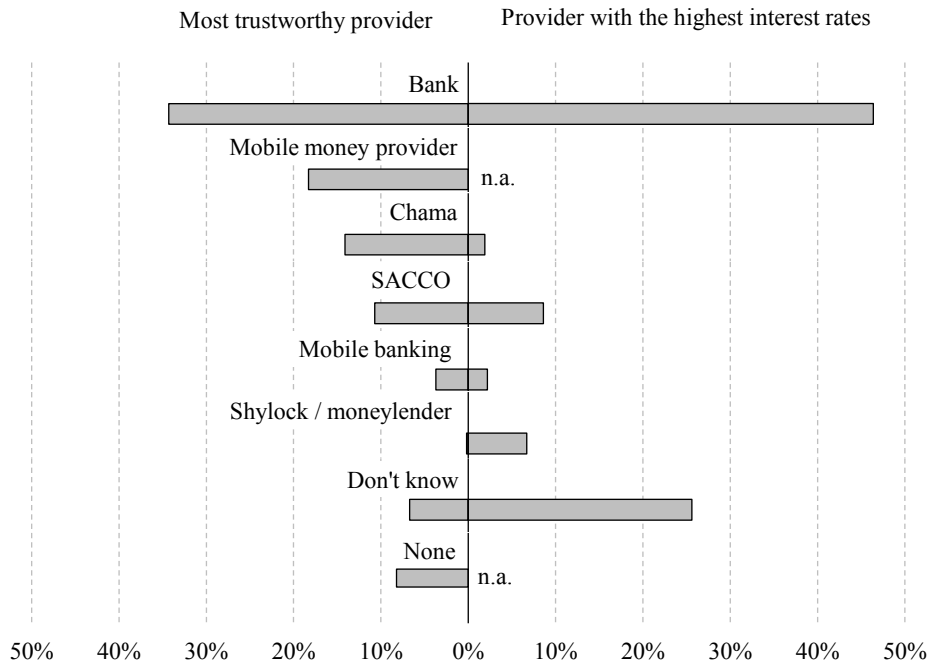
It is puzzling that when farmers finance agricultural activities mainly through savings, farmers are substantially more likely to use a mobile money account rather than a mobile banking account (9% vs. 1% for the pooled sample). The product characteristics shown in Table 3 suggest that neither unequal access to

the respective service nor financial considerations can plausibly explain this substantial difference between the proportion of farmers using mobile money and mobile banking for savings. Every active M-PESA user gets access to a mobile banking account and can save money, funds can be moved free from one's mobile money account to one's mobile banking account and vice versa, and most mobile banking savings yield interest rates well above the weighted formal banking average (Cook and McKay, 2015). Why then, are farmers choosing to save money in mobile money accounts, rather than mobile banking accounts?

Figure 6 shows which financial provider farmers perceived as the most trustworthy financial provider as well as which financial provider farmers perceived to have the highest interest rates. Trust towards mobile money and mobile banking providers have shown to be potentially important drivers of adoption and use of such services in developing countries (Malaquias and Hwang, 2016; Okello Candiya Bongomin and Ntayi, 2020b). Perhaps with little surprise, most farmers mention banks as both the most trustworthy financial provider as well as the one with the highest interest rates. More importantly, however, there is a considerable gap between the share of farmers who view mobile money providers as the most trustworthy provider and the share of farmers who view mobile banking as the most trustworthy provider. However, as mentioned earlier in Table 3, the dominant mobile money and mobile banking services in Kenya are both operated by the same company, namely Safaricom. It is therefore likely that the higher level of trust farmers have towards their mobile money provider does not primarily come from the provider but rather from the higher level of experience that farmers have with the service, since M-PESA was introduced a couple of years before the two most important mobile banking services (see Table 3).

Figure 6 can also be linked to farmers' main choice of agricultural finance (Figure 3) and use of credit for agriculture (Figure 4) in a few other interesting ways. The fact that more than 8% of the sampled farmers do not view any of the possible answering options as trustworthy, can explain why a substantial share of the population still keeps savings in a secret hiding place. Furthermore, the findings that relatively many farmers view chamas as particularly trustworthy, but only very few farmers perceive the interest rate from chamas

to be particularly high could help explain why chamas are relatively often used as a provider of credit for agricultural activities.



**Figure 6: Perceptions on financial providers.** Proportions of farmers mentioning a certain provider as the most trustworthy provider (left-hand side) and as the provider with the highest interest rates (right-hand side) are shown. N=3,041.

Source: Own estimations based on the FinAcces 2019 Survey.

While the generally very small proportions of farmers using credit for agricultural activities shown in Figure 4 are in line with previous research (Adjognon et al., 2017), it is still surprising that usage rates for mobile loans are even smaller and virtually no farmer used mobile loans to finance agricultural activities. Mobile loans provide users with nearly instant funds and can be used even by farmers in rural areas and without prior formal credit history. In theory, such type of credit should be well-suited to the needs and environments in which many farmers live and therefore have a higher demand. The extremely low usage rates, however, imply that the current form of mobile credit is not as expedient for farmers as one could expect, or that the



usefulness of mobile credit has not yet translated into actual adoption by farmers. Most likely, it is a combination of both.

Mobile credit in its current form has several limitations, both with respect to general use and use for agricultural activities. Most of the mobile loans that were available during the time period of the survey were characterized by high interest rates (7.5% per months), which makes mobile credit a very expensive source of finance. Also, loan volumes are very small for users who have not yet build up a positive credit history and therefore may not provide farmers with the fund necessary for capital-intensive investments, such as the installment or extension of plots or the adoption of new technologies.

Another critical issue of mobile credit for agricultural finance is the short repayment period of only 30 days, which can be renewed only once (Bharadwaj et al., 2019; Cook and McKay, 2015). Since bridging the time gap between input use and cash inflow that is associated with most crop production systems is a key function of agriculture-related credit, both the low volumes as well as the short repayment period of credit from mobile banking strongly reduce its attractiveness for agricultural finance. The short duration of loans is not a problem that is unique to mobile loans as it also represents a key challenge of many group-based microcredit schemes (Meyer, 2013). Additionally, loans from mobile banking are also likely to be held back by farmers' relatively low trust in mobile banking (Figure 6).

### **Conclusions and policy implications**

Mobile financial services are widely seen as a promising tool to improve the predicament of agricultural finance for farmers in sub-Saharan Africa. In this article, we have investigated both the extent to which farmers generally use mobile money and mobile banking for payments, saving, and credit, and whether farmers also use these services for agricultural activities. We find that the general use of mobile financial services, and mobile money in particular, among farmers is substantial. However, the proportion of farmers

who have integrated mobile money-related services directly into their agricultural activities is actually fairly small and proportions of farmers using services from mobile banking for agriculture are even smaller.

Our results show that farmers in traditional supply chains hardly use MFS, which is presumably due to the fact that in these cases MFS present only few benefits compared to other alternatives. It is therefore unlikely that strategies to increase the availability of MFS, for example through better network coverage or electricity, will have strong effects on agriculture-related use of MFS among these farmers. In more modern supply chains, MFS are of somewhat greater use, yet it appears that for these farmers, formal banks are the preferred providers of financial services related to payments, savings, and loans. For agriculture-related financial services, MFS are therefore currently only niche instruments. While the focus of this article has been on Kenya – a country with a pioneering role in the innovation of widely accessible digital financial services – it is likely farmers in most other sub-Saharan countries exhibit even lower agriculture-related MFS use. The findings presented in this article therefore raise the question of whether mobile financial services are already having a truly transformative impact on the agricultural sector in Africa .

There are some limitations of this article worth mentioning. Since agriculture is not a core aspect of the dataset used in this article, some key agriculture-related characteristics of the respondents, such as agricultural income or land size, could not be integrated into the analysis. The differentiation by main market channel conducted in this article provides some important insights into differences of agriculture-related MFS use across farmers, but a more detailed analysis along other dimensions could certainly be useful. Furthermore, the findings on barriers to agriculture-related MFS use presented in this article remain purely descriptive and do not allow strong causal interpretations. Future research using experimental or quasi-experimental approaches to corroborate on barriers of agriculture-related MFS use and how such barriers can be reduced are therefore encouraged. Third, just like most other research on MFS, this article focuses on Kenya. As mentioned earlier, Kenya is a telling and suitable study context for such research, but since such services become increasingly relevant also in other sub-Saharan countries, representative research on

agriculture-related MFS use in other countries is needed to better understand the use of MFS by farmers in Africa.

How can policy makers leverage the benefits that farmers can reap from MFS use for their agricultural activities? Since MFS are designed by the respective provider, most issues with MFS use mentioned by farmers, such as server system downtime, fees for mobile payments, or repayment periods of loans are largely outside of the control of policy makers. We therefore concur with previous research calling for the establishment of a consumer-friendly legal and regulatory environment around MFS that also provides accessible recourse mechanisms to report transaction problems or fraud as a viable and useful contribution of policy makers (Okello Candiya Bongomin and Ntayi, 2020a). The establishment and effective communication of consumer protection to farmers is particularly important for mobile banking services, since this article indicated that lack of trust in such services is a relevant barrier for using mobile banking for many farmers.

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## Appendix

**Table A1: Proportion of farmers using MFS**

(percent)

	Full sample	Local traders, wholesalers, transporters	Nearest market center, neighbors, friends, family	Company, manufacturer, factory, exporter	Farmers' cooperative
Using mobile money	76.3	76.9	72.6	84.0	81.3
...to save	44.7	46.7	40.7	50.6	49.4
Using mobile banking	18.9	20.3	14.4	19.4	22.8
...to save	12.8	14.4	10.4	14.0	15.6
...for loans	8.5	9.4	6.3	11.9	11.8
Using mobile app- based lenders	7.0	7.1	5.1	9.7	5.5

Note: N=3,041.

**Table A2: Proportion of farmers using different methods for agricultural payments#**

(percent)

Method	Relevance	Full sample	Local traders, wholesalers, transporters	Nearest market center, neighbors, friends, family	Company, manufacturer, factory, exporter	Farmers' cooperative
Cash	Used	96.6	99.6	99.2	86.4	84.2
	Most important	94.1	97.1	98.0	84.3	75.3
Mobile money	Use	14.9	19.0	8.1	23.1	21.6
	Most important	4.7	6.7	2.0	7.9	5.4
Bank transfers	Use	10.6	4.4	1.1	43.4	55.0
	Most important	8.5	2.0	0.9	38.9	47.7

Note: N=3,041.

**Table A3: Farmers' main source to finance agricultural activities**

(percent)

Provider	Type	Pooled sample	Local traders, wholesalers, transporters	Nearest market center, neighbors, friends, family	Company, manufacturer, factory, exporter	Farmers' cooperative
Mobile money	Savings	8.8	12.7	6.1	4.2	4.3
Mobile banking	Savings	1.1	1.5	0.4	0.8	1.8
	Loans	0.1	0.0	0.1	0.4	0.4
Bank/ Microfinance institution	Savings	8.6	8.0	2.9	28.6	19.1
	Loans	1.6	0.9	0.8	4.0	7.4

Note: N = 3,041



## Online Appendix

**Table OA1: Distribution of main market channels and food types sold within each market channel (main decision maker only)**

(percent)

Share of farmers who mostly their products <sup>a</sup> ...	Share of the total population of farmers	Share of farmers within each group of main market channel, who sell <sup>b</sup> ...		
		...food crops	...cash crops	...livestock, livestock products, fish
... to local traders, wholesalers, or transporters along the road side	42.6	77.4	6.9	34.1
... on the nearest market center or to neighbors, friends, or family	37.4	76.2	4.9	30.5
... to a company, manufacturer, factory, or exporter	9.1	40.6	73.2	32.2
... through a farmers' cooperative	8.2	35.7	65.2	40.4

Note: N = 2,492.

<sup>a</sup> multiple answers were not possible.

<sup>b</sup> multiple answers were possible.

**Table OA2: Proportion of farmers who use MFS (main decision maker only)**

(percent)

	Full sample	Local traders, wholesalers, transporters	Nearest market center, neighbors, friends, family	Company, manufacturer, factory, exporter	Farmers' cooperative
Using mobile money	78.5	76.7	74.3	85.3	87.3
...to save	45.5	47.9	40.4	50.2	46.0
Using mobile banking	18.9	21.1	15.0	21.5	24.6
...to save	13.2	14.3	10.7	16.3	17.7
...for loans	9.0	9.5	6.6	13.6	13.8
Using mobile app-based lenders	7.0	7.0	5.0	11.3	5.6

Note: N = 2,492.

**Table OA3: Usage of cash, mobile money, or bank transfers for payments related to agricultural activities (full sample)**

(percent)

	Cash			Mobile money			Bank transfer or bank check		
	receive	make	receive or make	receive	make	receive or make	receive	make	receive or make
Pooled sample	92.7	92.0	96.6	10.6	11.0	14.9	9.2	5.0	10.6
By main market channel:									
Local traders, wholesalers, or transporters	97.8	97.8	99.6	13.9	15.2	19.0	4.1	1.3	4.4
Nearest market center or to neighbors, friends, family	97.1	95.3	99.2	5.2	4.2	8.1	1.0	0.5	1.1
Company, manufacturer, factory, or exporter	73.4	78.2	86.4	15.7	18.1	23.1	36.3	20.4	43.4
Farmers' cooperative	74.2	69.6	84.2	16.5	17.8	21.6	48.8	31.5	55.0
<i>Share of farmers for whom a method is the important payment method [%]</i>									
Pooled sample	87.6	91.8	94.1	3.1	3.1	4.7	6.9	4.4	8.5
By main market channel:									
Local traders, wholesalers, or transporters	94.0	94.1	97.1	4.0	5.2	6.7	1.5	0.5	2.0
Nearest market center or to neighbors, friends, family	94.8	98.3	98.0	1.7	0.6	2.0	0.9	0.4	0.9
Company, manufacturer, factory, or exporter	60.1	75.6	84.3	5.6	2.8	7.9	31.6	19.6	38.9
Farmers' cooperative	56.4	66.2	75.3	3.1	4.5	5.4	39.0	28.8	47.7

Note: N = 3,041.

**Table OA4: Usage of cash, mobile money, or bank transfers for payments related to agricultural activities (main decision maker only)**

(percent)

	Cash			Mobile money			Bank transfer or bank check		
	receive	make	receive or make	receive	make	receive or make	receive	make	receive or make
<i>Share of farmers that use a payment method [%]</i>									
Pooled sample	92.5	92.1	96.4	11.6	11.6	15.7	10.1	5.7	11.6
By main market channel:									
Local traders, wholesalers, or transporters	98.0	97.7	99.6	15.0	16.2	20.2	4.5	1.5	4.9
Nearest market center or to neighbors, friends, family	96.8	96.5	99.1	5.3	3.4	7.4	1.2	0.7	1.3
Company, manufacturer, factory, or exporter	73.4	77.7	84.8	18.2	18.7	24.5	36.8	21.2	43.2
Farmers' cooperative	72.3	66.4	83.2	18.5	20.0	24.6	52.1	33.8	59.2
<i>Share of farmers for whom a method is the important payment method [%]</i>									
Pooled sample	87.0	91.0	93.8	3.4	3.4	5.3	7.6	4.9	9.3
By main market channel:									
Local traders, wholesalers, or transporters	93.6	93.4	96.7	4.4	5.8	7.4	1.6	0.6	2.2
Nearest market center or to neighbors, friends, family	95.0	98.1	98.3	1.9	0.7	2.3	1.1	0.5	1.1
Company, manufacturer, factory, or exporter	58.9	74.9	82.4	6.5	3.1	9.0	31.4	20.2	37.9
Farmers' cooperative	52.8	63.5	73.3	3.6	4.5	5.5	52.7	31.4	47.7

Note: N = 2,492

**Table OA5: Farmers' main source to finance agricultural activities (main decision maker only)**

(percent)

Provider	Type	Pooled sample	Local traders, wholesalers, transporters	Nearest market center, neighbors, friends, family	Company, manufacturer, factory, exporter	Farmers' cooperative
Mobile money	Savings	9.0	12.9	6.3	4.1	5.0
Mobile banking	Savings	1.1	1.9	0	0.9	2.1
	Loans	9.6	9.2	3.5	28.1	20.8
Bank/ Microfinance institution	Savings	0.1	0.1	0	0.5	0
	Loans	1.7	1.0	0.9	3.6	7.7

Note: N = 2,492