



# Can mobile phones improve gender equality and nutrition? Panel data evidence from farm households in Uganda



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## ABSTRACT

Since 2000, mobile phone technologies have been widely adopted in many developing countries. Existing research shows that use of mobile phones has improved smallholder farmers' market access and income. Beyond income, mobile phones can possibly affect other dimensions of social welfare, such as gender equality and nutrition. Such broader social welfare effects have hardly been analyzed up till now. Here, we address this research gap, using panel data from smallholder farm households in Uganda. Regression results show that mobile phone use is positively associated with household income, women empowerment, food security, and dietary quality. These results also hold after controlling for possible confounding factors. In addition to the household-level analysis, we also look at who within the household actually uses mobile phones. Gender-disaggregation suggests that female mobile phone use has stronger positive associations with social welfare than if males alone use mobile phones. We cautiously conclude that equal access to mobile phones cannot only foster economic development, but can also contribute to gender equality, food security, and broader social development. Further research is required to corroborate the findings and analyze the underlying causal mechanisms.

## 1. Introduction

Since 2000, mobile phone technologies have been widely adopted in developing countries. Mobile phones have significantly improved people's access to information, especially for the rural poor who were never connected to landline phones before. Mobile phones have also reduced other types of transaction costs, thus improving the functioning of markets (Jensen, 2007; Duncombe and Boateng, 2009; Aker and Mbiti, 2010; Aker, 2011; Aker and Ksoll, 2016; Blauw and Franses, 2016; Nakasone and Torero, 2016). Currently, about 4 billion people globally are using mobile phones. More than two-thirds of these people live in developing countries. With adoption rates around 90%, the highest penetration of mobile phones is found in sub-Saharan Africa (PRC, 2015).

In Africa, people generally use their mobile phones for a large number of activities and services, including communication with business partners and friends via calls and text messages, access to news and various other types of information, financial transactions, and entertainment (PRC, 2015; UCC, 2015). A growing body of literature has used micro-level data to analyze the effects of mobile phone use on market access, input and output prices, agricultural production patterns, and household income (Donner, 2007; Jensen, 2007; Aker, 2010, 2011; Aker and Mbiti, 2010; Kikulwe et al., 2014; Aker and Ksoll, 2016;

Nakasone and Torero, 2016; Sekabira and Qaim, 2017). However, mobile phones can possibly also affect various other dimensions of social welfare, such as gender equality and nutrition. Understanding such broader effects is important especially against the background of the United Nations' Sustainable Development Goals, which go far beyond a narrow set of economic development indicators. While a few recent studies have conceptually discussed how mobile phones could influence food security and other welfare dimensions (e.g., Aker and Mbiti, 2010; Nakasone et al., 2014; Nakasone and Torero, 2016), empirical evidence is scarce.

Here, we address this research gap by using panel data from a farm household survey carried out in Uganda. In particular, beyond looking at income effects, we analyze possible effects of mobile phone use on gender equality and nutrition. As in other African countries, mobile phones were adopted very rapidly in Uganda during the last 10 years and are now widely used even by very poor households in remote rural locations (Muto and Yamano, 2009; UCC, 2015; Munyegera and Matsumoto, 2016). Due to self-selection, establishing clear causality between mobile phone use and social welfare is difficult. We use a pseudo fixed-effects panel estimator to control for time-invariant unobserved heterogeneity, but other potential issues of endogeneity may occur. Therefore, results should not be over-interpreted in a causal sense. Nevertheless, due to the dearth of quantitative evidence on the

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broader social implications of mobile phone use, even associational analysis can add to the literature and possibly stimulate follow-up research.

How can mobile phone use possibly influence gender equality and nutrition? A few early studies discussed potential effects on gender roles (Bayes, 2001; Nath, 2001), yet without evaluating them empirically. For farming households, improved market access through mobile phones will likely increase the degree of commercialization, which could reduce the decision-making power of women. Agricultural commercialization is often associated with men taking stronger control of agricultural production and income (Udry, 1996; Fischer and Qaim, 2012). On the other hand, women are often particularly constrained in their access to markets and information. Hence, if women themselves were able to use mobile phones, they could possibly benefit even more than men (Aker and Ksoll, 2016). This could contribute to women empowerment and improved gender equality within the household. Some of our data in Uganda were collected in gender-disaggregated form, so we are able to examine such aspects.

Possible nutrition effects of mobile phone use could occur through various pathways. Better market access and related income gains are typically associated with improved food security and dietary quality (Sibhatu et al., 2015). Changing gender roles within the household can also influence nutrition (Fischer and Qaim, 2012). As women tend to spend more on healthcare and dietary quality than men, women empowerment can improve nutrition even in the absence of income gains (Quisumbing and Maluccio, 2003; Hoddinott, 2012). Furthermore, easier access to all sorts of news services and information through mobile phones may raise people's nutrition knowledge and awareness, which could also contribute to improved dietary practices.

## 2. Materials and methods

### 2.1. Farm household survey

We use panel data collected in two survey rounds from randomly selected farm households in Masaka and Luwero Districts, Central Uganda. Farmers in these districts grow coffee as their major cash crop, in addition to banana, maize, sweet potato, and various other food crops. Within the two districts, we used a two-stage sampling procedure, first selecting three counties and then randomly selecting farmers in each of these counties. The first survey round was conducted in 2012 and covered 419 farm households (Chiputwa et al., 2015). The second survey round was conducted in 2015, targeting the same households. Out of the initial 419 households, 25 could not be re-surveyed in 2015, either due to migration or longer-term absence of the household head and other potential respondents. Hence, the sample includes 394 households for which we have two rounds of data, leading to a total of 788 observations. We use this balanced panel for the analysis. Comparing key socioeconomic variables for the 2012 sample with and without the 25 attrition households included shows no significant differences (Table A1 in the online appendix in the online appendix), so that we do not expect attrition bias.

In both survey rounds, we used a structured questionnaire for face-to-face interviews with the household head. Certain sections of the questionnaire were also answered separately by the spouse of the household head. The questionnaire focused on agricultural production and marketing, non-farm economic activities and income sources, household consumption, as well as other socio-demographic and contextual details. Household diets were assessed through a 7-day food consumption recall covering more than 100 different food items. We also asked for mobile phone ownership and use at the household level, as well as separately for different household members. In this study, we are particularly interested in the mobile phone use by male and female adults in each household. Similarly, ownership of assets was captured in a gender-disaggregated way.

As the small-farm households in Uganda do not keep written records

of their economic activities, the data build on respondents' recalls and are therefore prone to measurement error. We tried to minimize such error by carefully designing the questionnaire using common formats for agricultural household surveys (Deaton, 1997), pre-testing the questionnaire in the local context, and thoroughly training the team of interviewers. Most of the questions related to mobile phone ownership and use were "yes" or "no" type of questions, which were easy to answer for respondents. For some of the continuous outcome variables, the data may be less precise. However, we do not expect systematic differences in the precision of the responses between users and non-users of mobile phones, so that measurement error should not lead to bias in the estimation results.

### 2.2. Measurement of key variables

The main explanatory variable of interest is mobile phone (MP) use. We consider a household to be a MP user if at least one adult household member owned and used a mobile phone during a particular survey year. MP use is captured through a dummy variable at the household level. Furthermore, we define a second dummy variable for female mobile phone (FMP) use. This second dummy – also measured at the household level – takes a value of one if at least one female adult in the household owned and used a mobile phone, and zero otherwise. Note that FMP-using households are a subset of the group of MP-using households: the remaining MP users are those where only male adults owned and used a mobile phone.

In terms of outcome variables, we are particularly interested in household income, gender equality within the household, and nutrition.<sup>1</sup> Household income is measured as the total income of the household from all sources over a period of 12 months. For farm income, this also includes the value of production not sold in the market. The cost of production was subtracted for all income derived from self-employed activities. Annual household income is expressed in Ugandan shillings (UGX) (1 US\$ = 2690 UGX). To be able to compare incomes between the two survey rounds, income in 2012 was adjusted to 2015 using the official consumer price index (UBOS, 2015).

Gender equality within the household is measured in terms of the proportion of productive assets owned by women or jointly by male and female household members. The proportion refers to the monetary value of the assets. Looking at asset ownership is common in the literature when assessing the economic situation of women within households (Quisumbing and Maluccio, 2003; Alsop et al., 2006; Doss et al., 2014). We are interested in how mobile phone use may influence asset ownership. In order to reduce possible issues of reverse causality, we do not consider very durable assets such as land or buildings. We only include short- and medium-term productive assets such as agricultural equipment (hoes, saws, wheelbarrow, sprayers, etc.) and vehicles (bikes, motorbikes, trucks, etc.). In male-dominated households, such assets are predominantly owned by the male household head or other male members. A larger proportion of such assets owned by females or jointly owned by male and female household members can be interpreted as a higher degree of women empowerment.

Nutrition outcomes can be measured in different ways, including anthropometric indicators, food consumption based measures, and households' subjective assessments of food access (Ruel, 2003; Masset et al., 2012; Shiferaw et al., 2014; Kabunga et al., 2014; Chiputwa and Qaim, 2016). Here, we are particularly interested in how mobile phones affect household food consumption and dietary practices, which we measure through household dietary diversity scores. Dietary diversity

<sup>1</sup> In the descriptive analysis, we also look at agricultural yield, market access, and farm and off-farm income as intermediate outcomes. However, as effects of mobile phone technology on such intermediate outcomes were analyzed in a number of previous studies (Donner, 2007; Jensen, 2007; Aker, 2010; Kikulwe et al., 2014; Aker and Ksoll, 2016; Nakasone and Torero, 2016), we concentrate on household income, gender equality, and nutrition as broader indicators of social welfare in the econometric analysis.

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