Mobile connectivity and women empowerment:

Empirical evidence from rural Bangladesh[[1]](#footnote-1)

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Abstract

Mobile technologies have the potential to enhance inclusiveness by reducing the costs associated with communication in a community. These technologies could facilitate the advancement of women in overcoming gender inequality within households and communities. Using and instrumental variable approach and nationally representative rural household surveys in Bangladesh, our findings indicate that women’s mobile phone ownership is positively associated with women's empowerment. Consequently, the results demonstrate that women’s mobile phone ownership also increases contraceptive use. Furthermore, the results reveal that less-educated women benefit more from mobile phone ownership. The results highlight the gender inclusiveness and sustainable development in the context of the digital age.

Keywords: Digital technology, Bangladesh Integrated Household Survey, Intrahousehold bargaining, Female autonomy, Birth control

1. Introduction

Women's empowerment has been centered in discussions about gender inequality. Economic theory explains that if women have more income or outside options, they have more bargaining power within a household. Mobile phones and other information and communication technologies (ICTs) contributed to many aspects of economic development.

We analyze the association between women’s ownership of mobile phones[[5]](#footnote-5) and agency and the bargaining strength of a woman within a household.

The substantial literature shows that the introduction of the ICTs enhances people’s capabilities. They improves labor market efficiencies resulting in increase in income, improving household resilience, and even poverty reduction (Amber & Chichaibelu, 2023; Bahia et al., 2024; Ma et al., 2023; Matsuura et al., 2023; Matsuura‐Kannari et al., 2024; Rajkhowa & Qaim, 2022a; Riley, 2018; Yao et al., 2023). The ICTs contribute to not only economies but also social perspective such as increase in women's autonomy, (Jensen & Oster, 2009). Not only

Our contribution to the literature is twofold. First, this is the first study to use the nationally representative household and longitudinal surveys in Bangladesh. Second, we investigate heterogeneous associations between mobile phone ownership and women empowerment based on various socioeconomic characteristics. By doing so, we could derive an appropriate policy implication for sustainable development in the digital age by avoiding mistargeting beneficiaries.

The remainder of this article is organized as follows. Section 2 presents a conceptual framework used to study the research question and derives this paper’s core testable prediction. In Section 3, data and summary statistics are introduced, first by explaining datasets that we use and then by discussing summary statistics.

1. Mobile technologies in Bangladesh

Figure 1 shows the gap in a mobile phone or internet usage between men and women in 2021.It shows that the gender digital divide is still severe in Bangladesh compared to other South Asian and lower middle-income countries.

Figure 1 The gap in a mobile phone or internet usage between men and women

Source: Authors’ calculation based on Demirgüç-Kunt et al. (2022).

1. Data
2. Dataset

We use the Bangladesh Integrated Household Survey (BIHS) 2011-2012 (hereafter 2012), 2015, and 2018-2019 (hereafter 2019), collected by the International Food Policy Research Institute. To take advantage of the longitudinal data, we dropped observations which are not collected multiple times in the surveys. In accordance with the research question, We have chosen to retain information on individuals who are married and have a spouse, following Han et al. (2023).

1. Key variables

The outcome variables we are interested in are several indicators of women empowerment. They are a synthesized women empowerment index (WEI) which consists of 1), 2), 3), 4), and 5), and contraceptive use. The contraceptive use is a variable indicating whether a women uses a contraception for birth control.

Our primary explanatory variable is women’s mobile phone ownership. Figure 2 shows the ratio of women who own a mobile phone in rural Bangladesh. From 2012 to 2019, the ratio has been increasing over a decade.

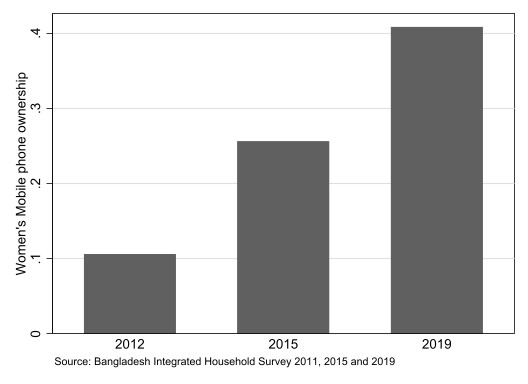


Figure 2 Share of women's mobile phone ownership from 2012 to 2019  
Source: Authors’ calculation from BIHS 2012, 2015, and 2019.

1. Summary statistics

Table 1 present

Table 1 Summary statistics in 2012

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable |  | Mean | Std. Dev. | Mean | Std. Dev. | Difference |
|  |  | Owner |  | Non-owner |  |  |
| Observation | Definition | 434 |  | 3,566 |  |  |
| Age of wife | Age of wife | 36.394 | 11.129 | 35.872 | 10.912 | 0.522 |
| Education year of wife | Years a wife went to a school | 4.885 | 3.908 | 3.179 | 3.454 | 1.706\*\*\* |
| Asset brought to marriage | 1 if a wife brought to an asset when marriage, 0 otherwise | 0.776 | 0.417 | 0.765 | 0.424 | 0.012 |
| Women’s access to credit | 1 if a wife has an access to microcredit in a community, 0 otherwise | 0.263 | 0.441 | 0.283 | 0.450 | -0.020 |
| Number of children | Number of children | 1.825 | 1.233 | 1.950 | 1.249 | -0.125\*\* |
| Age of husband | Age of husband | 45.191 | 12.833 | 44.103 | 12.628 | 1.089\* |
| Education year of husband | Years a wife went to a school | 5.306 | 4.598 | 3.190 | 3.903 | 2.116\*\*\* |
| Working status of husband | 1 if a husband works, 0 otherwise | 4.147 | 16.795 | 10.216 | 25.127 | -6.069\*\*\* |
| Farm size | decimal of owning farmland | 124.929 | 167.507 | 99.267 | 146.609 | 25.662\*\*\* |
| Wealth index | Asset index based on ownership of various assets (see a note below) | 1.330 | 1.978 | 0.078 | 1.840 | 1.252\*\*\* |
| Distance to the nearest town | Minutes to go to the nearest town from homestead | 25.302 | 15.255 | 25.062 | 15.183 | 0.240 |

Note: Authors calculation based on BIHS2012, 2015 and 2019. ∗ p < 0.1; ∗∗ p < 0.05; ∗∗∗ p < 0.01. 100 decimals are 0.4 ha. We create a wealth index of assets using principal component analysis because the value of assets owned was not collected in the datasets. sum components of wealth, such as ownership of radios, televisions, computers, animal carts, bikes, motorbikes or fridges, and cars or trucks are used for the calculation.

1. Estimation strategy
2. Specification

This analysis aims to examine the relationship between women’s mobile phone ownership and both women’s empowerment indicators and contraceptive use. Our primary variable, women’s mobile phone ownership is a self-selection variable. To address these identification concerns, we use a control function approach with an instrumental variable (IV) strategy to reduce the self-selection bias of women’s mobile phone ownership. We build a household-level instrument that measures the share of households within the same union which is the smallest administrative unit in Bangladesh—excluding the respondent’s household—in which at least one woman has a mobile phone. Thus, we estimate the following two-stage equations:

The first stage estimation is given by Equation (1), where is women’s mobile phone ownership of household *i* in year *t* which is instrumented by . In the outcome equation, depicted in Equation (2), is the outcome variable of interest and is a set of covariates to reduce an omitted variable bias.is a residual calculated from Equation (1).

1. Heterogeneous associations

To investigate the heterogeneous associations with respect to several household characteristics, we employ the control function approach in the probit model to estimate the parameters in equation[[6]](#footnote-6). Following equations are estimated:

From Equation (3) and (4), residuals are estimated. The estimated residuals are included in the outcome equation which is Equation (5). The control function approach with peer effect variables is applied to various empirical studies such as Kodama et al. (2024); Matsuura, Luh, et al. (2023).

1. Validity of instruments

Our instrument, the union-level variables as IVs for mobile phone access and use has been tested in relevant studies on the topic (Ma & Wang, 2020; Ma & Zheng, 2022; Manacorda & Tesei, 2020; Matsuura et al., 2023; Pesando, 2022; Rotondi et al., 2020; Varriale et al., 2022). We assume that the union-level variable which consists of neighborhood’s decisions affects households’ decision on women’s mobile phone ownership but does not directly affect their labor outcome variables. Therefore, we consider that the instrumental variable meets a condition of an exclusion restriction as the past studies employed the ones. Nevertheless, it is not possible to rule out with certainty that union-level mobile phone use does not correlate with the outcome variables channeled by other indirect mechanisms (Rajkhowa & Qaim, 2022a, 2022b). Therefore, we report the IV results but we shy away from causal conclusions.

1. Results and discussion
2. Links between women’s ownership of mobile phones and women’s bargaining power

Table 2 Associations between women’s mobile phone ownership and women empowerment

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) | (5) | (6) |
|  | OLS |  |  | IV |  |  |
|  | Empowerment score | Empowerment status | Contraceptive use | Empowerment score | Empowerment status | Contraceptive use |
| Women’s mobile phone ownership (WMP) | 0.018\*\*\* | 0.040\*\* | 0.007 | 0.201\*\*\* | 0.193\* | 0.359\*\*\* |
|  | (0.005) | (0.016) | (0.010) | (0.041) | (0.116) | (0.078) |
| Age of women | 0.007\*\* | 0.014 | -0.004 | 0.008\*\* | 0.015 | -0.002 |
|  | (0.003) | (0.009) | (0.007) | (0.003) | (0.009) | (0.007) |
| Age of women # Age of women | -0.000\* | -0.000 | 0.000 | -0.000\*\* | -0.000 | 0.000 |
|  | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Schooling year of women | 0.003 | 0.006 | 0.005 | 0.005 | 0.007 | 0.007 |
|  | (0.003) | (0.008) | (0.005) | (0.003) | (0.008) | (0.005) |
| Asset brought to marriage | -0.001 | -0.038\*\* | 0.013 | -0.006 | -0.043\*\* | 0.003 |
|  | (0.007) | (0.019) | (0.014) | (0.007) | (0.019) | (0.014) |
| Women's access to credit | 0.088\*\*\* | 0.270\*\*\* | 0.028\*\*\* | 0.086\*\*\* | 0.268\*\*\* | 0.024\*\* |
|  | (0.005) | (0.015) | (0.009) | (0.005) | (0.015) | (0.009) |
| Number of children | -0.011\*\*\* | -0.034\*\*\* | 0.032\*\*\* | -0.009\*\*\* | -0.032\*\*\* | 0.035\*\*\* |
|  | (0.004) | (0.010) | (0.007) | (0.004) | (0.010) | (0.007) |
| Age of husband | 0.002 | 0.003 | -0.007\*\* | 0.001 | 0.002 | -0.008\*\*\* |
|  | (0.002) | (0.004) | (0.003) | (0.002) | (0.004) | (0.003) |
| Schooling year of husband | 0.001 | 0.000 | 0.006 | -0.002 | -0.002 | 0.001 |
|  | (0.003) | (0.009) | (0.005) | (0.003) | (0.009) | (0.005) |
| Current working status of husband | -0.000 | 0.000 | -0.000 | -0.000 | 0.000 | -0.000 |
|  | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Farm size | 0.000 | 0.000\* | -0.000\*\* | 0.000\*\* | 0.000\*\* | -0.000\* |
|  | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Asset index | 0.001 | 0.007 | -0.006 | -0.003 | 0.004 | -0.013\*\*\* |
|  | (0.002) | (0.006) | (0.004) | (0.002) | (0.007) | (0.005) |
| Distance to near town (minute) | -0.000\* | -0.000 | 0.000 | -0.000\*\* | -0.000 | 0.000 |
|  | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Residual |  |  |  | -0.186\*\*\* | -0.156 | -0.359\*\*\* |
|  |  |  |  | (0.041) | (0.117) | (0.079) |
| Household FE | *Y* | *Y* | *Y* | *Y* | *Y* | *Y* |
| District FE | *Y* | *Y* | *Y* | *Y* | *Y* | *Y* |
| Year FE | *Y* | *Y* | *Y* | *Y* | *Y* | *Y* |
| Observations | 8877 | 8877 | 9740 | 8877 | 8877 | 9740 |

Source: Authors’ calculation using BIHS 2012, 2015, and 2019.

Note: Bootstrapped robust standard errors in parenthesis. OLS is used for the estimation of Columns (1) to (3) while 2SRI is used for the estimation of Columns (4) to (6). ∗ p < 0.1; ∗∗ p < 0.05; ∗∗∗ p < 0.01.

1. Heterogeneous associations between women’s mobile phone ownership and women empowerment

We further investigate the heterogeneous associations between women’s mobile phone ownership and women's empowerment.

1. Age of women

Next. we turn to the heterogeneity by age of women.

Table 4 Heterogeneity by age of women

|  |  |  |  |
| --- | --- | --- | --- |
|  | (1) | (2) | (3) |
|  | 5DE score | Empowerment status | Use contraceptive |
| WMP | 0.326\* | 0.248 | -0.580\*\* |
|  | (0.172) | (0.453) | (0.289) |
| WMP # Age of women | -0.003 | -0.001 | 0.026\*\*\* |
|  | (0.004) | (0.011) | (0.008) |
| Control variables | *Y* | *Y* | *Y* |
| Household FE | *Y* | *Y* | *Y* |
| District FE | *Y* | *Y* | *Y* |
| Year FE | *Y* | *Y* | *Y* |
| Observations | 8877 | 8877 | 9740 |

Source: Authors’ calculation using BIHS 2012, 2015, and 2019.

Note: Bootstrapped robust standard errors in parenthesis. 2SRI is used for the estimation. ∗ p < 0.1; ∗∗ p < 0.05; ∗∗∗ p < 0.01.

1. Education level of women

In this subsection, we test the heterogeneity of the education level of women. Table 5 shows that less educated women benefit less from mobile phone ownership. These results are consistent with the literature suggesting that women with lower intrahousehold bargaining power experience more intimate partner violence with their increase in income (Luke & Munshi, 2011; Heath, 2014).

Table 5 Heterogeneity by education level

|  |  |  |  |
| --- | --- | --- | --- |
|  | (1) | (2) | (3) |
|  | 5DE score | Empowerment status | Use contraceptive |
| WMP | 0.197\*\*\* | 0.195 | 0.542\*\*\* |
|  | (0.052) | (0.150) | (0.106) |
| WMP # Education level of women | 0.000 | -0.000 | -0.021\*\*\* |
|  | (0.004) | (0.012) | (0.008) |
| Control variables | *Y* | *Y* | *Y* |
| Household FE | *Y* | *Y* | *Y* |
| District FE | *Y* | *Y* | *Y* |
| Year FE | *Y* | *Y* | *Y* |
| Observations | 8877 | 8877 | 9740 |

Source: Authors’ calculation using BIHS 2012, 2015, and 2019.

Note: Bootstrapped robust standard errors in parenthesis. 2SRI is used for the estimation. ∗ p < 0.1; ∗∗ p < 0.05; ∗∗∗ p < 0.01.

1. Heterogeneity by geographical condition

In this subsection, we investigate whether those who live in geographical disadvantage areas benefit more from mobile phone ownership because the ICT devices are supposed to address a physical disadvantage such as less access to transportation infrastructure and far distance from a city center.

Table 6 Heterogeneity by distance to the nearest town

|  |  |  |  |
| --- | --- | --- | --- |
|  | (1) | (2) | (3) |
|  | 5DE score | Empowerment status | Use contraceptive |
| WMP | 0.088 | 0.013 | 0.426\*\*\* |
|  | (0.065) | (0.179) | (0.118) |
| WMP # Access to the nearest town | 0.003\*\* | 0.005 | -0.002 |
|  | (0.001) | (0.004) | (0.003) |
| Control variables | *Y* | *Y* | *Y* |
| Household FE | *Y* | *Y* | *Y* |
| District FE | *Y* | *Y* | *Y* |
| Year FE | *Y* | *Y* | *Y* |
| Observations | 8877 | 8877 | 9740 |

Source: Authors’ calculation using BIHS 2012, 2015, and 2019.

Note: Bootstrapped robust standard errors in parenthesis. 2SRI is used for the estimation. ∗ p < 0.1; ∗∗ p < 0.05; ∗∗∗ p < 0.01.

1. Conclusions and policy implications

In this study

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1. The content does not represent our affiliations’ views. All errors are our own. [↑](#footnote-ref-1)
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4. Bangladesh Agricultural University [↑](#footnote-ref-4)
5. Definition of mobile phones includes handset phones, cell phones, and smartphones because the dataset we use do not distinguish them each other. [↑](#footnote-ref-5)
6. In non-linear parametric model including probit model, a control function approach or two-stage residual inclusion (2SRI) method gives more consistent estimators compared to two-stage least squared (2SLS) method (Terza et al., 2008). [↑](#footnote-ref-6)