Narrowing the rural gender gap:

Mobile phones, female labor force participation in Bangladesh[[1]](#footnote-1)

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Abstract

Women have been behind men in social and economic development. Female labor force participation is still lower than male’s one in South Asia. Gender digital divide is also a problem in this region. Mobile technologies have the potential to improve inclusiveness by reducing the costs associated with communication in a community and transactions in a labor market. Using instrumental variable methods and national representative household panel surveys, we find that women’s mobile phone ownership increases possibility of women’s self-employment as extensive margin. Consequently, the results demonstrate that women’s mobile phone ownership also. 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: ICT, Bangladesh Integrated Household Survey, Off-farm employment, Gender inclusiveness, Digitalization

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 (ICT) contributed to many aspects of economic development (Matsuura‐Kannari et al., 2024). It mitigates the negative impacts of weather shocks on rural livelihoods (Matsuura, Islam, et al., 2023).

The substantial literature shows that the introduction of cable television have contributed to a reduction in the acceptability of domestic violence towards women and son preference, as well as an increase in women's autonomy and a decrease in the gender pay gap (Jensen & Oster, 2009).

We analyze the association between women’s ownership of mobile phones and agency and the bargaining strength of a woman within a household.

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. 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). Moreover, we constructed a balanced panel

1. Key variables

Outcome variables we are interested in are several indicators about a wife’s working status such as

Our primary explanatory variable is women’s mobile phone ownership. Figure 1 shows the share of women’s mobile phone ownership in rural Bangladesh. From 2012 to 2019, The share of women’s mobile phone ownership is increasing.

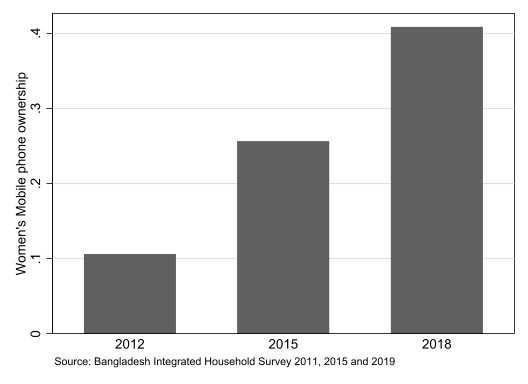


Figure 1 Share of women's mobile phone ownership from 2012 to 2019  
Source: Authors’ calculation from BIHS 2012, 2015, and 2019.

1. Summary statistics

Table 1 shows the descriptive statistics

Table 1 Descriptive 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 build the table using 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. Conceptual framework and econometric models

The share of women’s mobile phone ownership has been increasing over the decade as shown in Figure 1. It shows that women’s mobile phone ownership has been expanding. This analysis aims to examine the relationship between women’s mobile phone ownership and women’s empowerment. Our primary variable, women’s mobile phone ownership is a self-selection variable. To address these identification concerns, the analysis uses 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. , , and are household fixed effect, division fixed effect, and year fixed effect, respectively. Moreover, presents an outcome variable and   is a predicted by 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[[7]](#footnote-7). 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 reliability of 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, Islam, et al., 2023; Pesando, 2022; Rotondi et al., 2020; Varriale et al., 2022). We assume that union-level variables which consists of neighborhood’s decisions do not directly affect the household’s decision. Therefore, we consider that the instrumental variable meets a condition of an exclusion restriction. 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. Therefore, we report the IV results but we shy away from causal conclusions.

1. Results and discussion
2. Mobile phone ownership and off-farm employment

We estimated Equation (1) and (2) and Table 2 shows that

Table 1 Association between women's mobile phone ownership and off-farm employment:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) |
| Panel A: Extensive margin | IV-FE |  |  |  |
|  | Off-farm employment | Casual wage employment (non-agriculture) | Salaried employment | Self-employment |
| Women's mobile phone ownership | 0.035 | -0.003 | 0.010 | 0.037 |
|  | (0.040) | (0.020) | (0.028) | (0.026) |
| Household FE | *Y* | *Y* | *Y* | *Y* |
| District FE | *Y* | *Y* | *Y* | *Y* |
| Year FE | *Y* | *Y* | *Y* | *Y* |
| Observations | 10,608 | 10,608 | 10,608 | 10,608 |
|  | (5) | (6) | (7) | (8) |
| Panel B: Intensive margin | IV-FE |  |  |  |
|  | Off-farm employment | Casual wage employment (non-agriculture) | Salaried employment | Self-employment |
| Women's mobile phone ownership | 0.177 | -0.070 | 0.173 | 0.145 |
|  | (0.301) | (0.140) | (0.251) | (0.140) |
| Household FE | *Y* | *Y* | *Y* | *Y* |
| District FE | *Y* | *Y* | *Y* | *Y* |
| Year FE | *Y* | *Y* | *Y* | *Y* |
| Observations | 10,608 | 10,608 | 10,608 | 10,608 |

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

Note: Robust standard errors in parenthesis. ∗ p < 0.1; ∗∗ p < 0.05; ∗∗∗ p < 0.01. Outcome variables in Panel A are dummy variables while outcome variables in Panel B are continuous variables. Control variables include age of wife, schooling year of wife, asset brought to marriage, women’s access to credit, age of husband, schooling year of husband, wealth index household size, and cultivated farm size.

1. Heterogeneity and mechanism 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 2 Heterogeneity by age of women: IV-Panel FE

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Panel A: Extensive margin | (1) | (2) | (3) | (4) |
|  | Off-farm employment | Casual wage employment (non-agriculture) | Salaried employment | Self-employment |
| WMP | 0.344\*\* | 0.002 | 0.189\* | 0.153\* |
|  | (0.148) | (0.059) | (0.104) | (0.090) |
| WMP # Age of wife | -0.008\*\* | -0.000 | -0.005\* | -0.003 |
|  | (0.002) | (0.001) | (0.002) | (0.001) |
| Household FE | *Y* | *Y* | *Y* | *Y* |
| District FE | *Y* | *Y* | *Y* | *Y* |
| Year FE | *Y* | *Y* | *Y* | *Y* |
| Observations | 10,608 | 10,608 | 10,608 | 10,608 |
| Panel B: Intensive margin | (5) | (6) | (7) | (8) |
|  | Off-farm employment | Casual wage employment (non-agriculture) | Salaried employment | Self-employment |
| WMP | 2.149\*\* | -0.017 | 1.669\* | 0.472 |
|  | (1.065) | (0.402) | (0.899) | (0.438) |
| WMP # age of wife | -0.050\*\* | -0.001 | -0.038\* | -0.008 |
|  | (0.024) | (0.009) | (0.020) | (0.009) |
| Household FE | *Y* | *Y* | *Y* | *Y* |
| District FE | *Y* | *Y* | *Y* | *Y* |
| Year FE | *Y* | *Y* | *Y* | *Y* |
| Observations | 10,608 | 10,608 | 10,608 | 10,608 |

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

Note: Bootstrapped robust standard errors in parenthesis. ∗ p < 0.1; ∗∗ p < 0.05; ∗∗∗ p < 0.01. From Columns (1) to (5), outcome variables are dummy and from Columns (6) to (10), the outcome variables are continuous. Control variables include age of wife, schooling year of wife, asset brought to marriage, women’s access to credit, age of husband, schooling year of husband, wealth index household size, and cultivated farm size.

1. Education level of women

In this subsection, we test the heterogeneity of 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 3 Heterogeneity by education level

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Panel A: Extensive margin | (1) | (2) | (3) | (4) |
|  | Off-farm employment | Casual wage employment (non-agriculture) | Salaried employment | Self-employment |
| WMP | -0.047 | -0.012 | 0.004 | -0.039 |
|  | (0.055) | (0.028) | (0.040) | (0.029) |
| WMP # schooling year of wife | 0.013\*\* | 0.001 | 0.002 | 0.010\*\*\* |
|  | (0.005) | (0.002) | (0.004) | (0.003) |
| Household FE | *Y* | *Y* | *Y* | *Y* |
| District FE | *Y* | *Y* | *Y* | *Y* |
| Year FE | *Y* | *Y* | *Y* | *Y* |
| Observations | 10,608 | 10,608 | 10,608 | 10,608 |
| Panel B: Intensive margin | (5) | (6) | (7) | (8) |
|  | Off-farm employment | Casual wage employment (non-agriculture) | Salaried employment | Self-employment |
| WMP | -0.072 | -0.112 | 0.272 | -0.236 |
|  | (0.500) | (0.197) | (0.450) | (0.149) |
| WMP # schooling year of wife | 0.051 | 0.007 | 0.004 | 0.049\*\*\* |
|  | (0.047) | (0.015) | (0.043) | (0.017) |
| Household FE | *Y* | *Y* | *Y* | *Y* |
| District FE | *Y* | *Y* | *Y* | *Y* |
| Year FE | *Y* | *Y* | *Y* | *Y* |
| Observations | 10,608 | 10,608 | 10,608 | 10,608 |

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

Note: Bootstrapped robust standard errors in parenthesis. ∗ p < 0.1; ∗∗ p < 0.05; ∗∗∗ p < 0.01. From Columns (1) to (5), outcome variables are dummy and from Columns (6) to (10), the outcome variables are continuous. Control variables include age of wife, schooling year of wife, asset brought to marriage, women’s access to credit, age of husband, schooling year of husband, wealth index household size, and cultivated farm size.

1. Distance to the nearest town

Information and communication technology could overcome the geographical disadvantage because people can connect with others without physical mobility. In this subsection, we investigate whether women who live far from a central area of a town benefit more from mobile phone ownership.

Table 4 Heterogeneous by distance to town

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Panel A: Extensive margin | (1) | (2) | (3) | (4) |
|  | Off-farm employment | Casual wage employment (non-agriculture) | Salaried employment | Self-employment |
| WMP | 0.118\* | 0.033 | 0.051 | 0.039 |
|  | (0.063) | (0.034) | (0.043) | (0.039) |
| WMP # Distance to town | -0.002\* | -0.001 | -0.001 | -0.000 |
|  | (0.001) | (0.001) | (0.001) | (0.001) |
| Household FE | *Y* | *Y* | *Y* | *Y* |
| District FE | *Y* | *Y* | *Y* | *Y* |
| Year FE | *Y* | *Y* | *Y* | *Y* |
| Observations | 10,608 | 10,608 | 10,608 | 10,608 |
| Panel B: Intensive margin | (5) | (6) | (7) | (8) |
|  | Off-farm employment | Casual wage employment (non-agriculture) | Salaried employment | Self-employment |
| WMP | 0.806\* | 0.142 | 0.474 | 0.204 |
|  | (0.422) | (0.237) | (0.335) | (0.202) |
| WMP # Distance to town | -0.019\* | -0.006 | -0.010 | -0.002 |
|  | (0.011) | (0.006) | (0.009) | (0.005) |
| Household FE | *Y* | *Y* | *Y* | *Y* |
| District FE | *Y* | *Y* | *Y* | *Y* |
| Year FE | *Y* | *Y* | *Y* | *Y* |
| Observations | 10,608 | 10,608 | 10,608 | 10,608 |

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

Note: Bootstrapped robust standard errors in parenthesis. ∗ p < 0.1; ∗∗ p < 0.05; ∗∗∗ p < 0.01. From Columns (1) to (5), outcome variables are dummy and from Columns (6) to (10), the outcome variables are continuous. Control variables include age of wife, schooling year of wife, asset brought to marriage, women’s access to credit, age of husband, schooling year of husband, wealth index household size, and cultivated farm size.

1. Conclusions and policy implications

We investigated

Reference

Han, X., Zhang, H., & Zhu, W. (2023). The impact of digital finance on women’s bargaining power: Evidence from China. *China Economic Review*, *80*, 102007. https://doi.org/10.1016/j.chieco.2023.102007

Heath, R. (2014). Women’s Access to Labor Market Opportunities, Control of Household Resources, and Domestic Violence: Evidence from Bangladesh. *World Development*, *57*, 32–46. https://doi.org/10.1016/j.worlddev.2013.10.028

Jensen, R., & Oster, E. (2009). The Power of TV: Cable Television and Women’s Status in India. *The Quarterly Journal of Economics*, *124*(3), 1057–1094. https://doi.org/10.1162/qjec.2009.124.3.1057

Kodama, W., Morgan, P., Azhgaliyeva, D., Trinh, L., & Kim, K. (2024). Family business during the COVID-19 pandemic in Asia: Role of government financial aid and coping strategies. *World Development*, *182*, 106653. https://doi.org/10.1016/j.worlddev.2024.106653

Luke, N., & Munshi, K. (2011). Women as agents of change: Female income and mobility in India. *Journal of Development Economics*, *94*(1), 1–17. https://doi.org/10.1016/j.jdeveco.2010.01.002

Ma, W., & Wang, X. (2020). Internet Use, Sustainable Agricultural Practices and Rural Incomes: Evidence from China. *Australian Journal of Agricultural and Resource Economics*, *64*(4), 1087–1112. https://doi.org/10.1111/1467-8489.12390

Ma, W., & Zheng, H. (2022). Heterogeneous impacts of information technology adoption on pesticide and fertiliser expenditures: Evidence from wheat farmers in China. *Australian Journal of Agricultural and Resource Economics*, *66*(1), 72–92. https://doi.org/10.1111/1467-8489.12446

Manacorda, M., & Tesei, A. (2020). Liberation Technology: Mobile Phones and Political Mobilization in Africa. *Econometrica*, *88*(2), 533–567. https://doi.org/10.3982/ECTA14392

Matsuura, M., Islam, A. H. Md. S., & Tauseef, S. (2023). Mobile Money Mitigates the Negative Effects of Weather Shocks: Implications for Risk Sharing and Poverty Reduction in Bangladesh. In S. Bera, Y. Yao, A. Palit, & D. B. Rahut (Eds.), *Digital Transformation for Inclusive and Sustainable Development in Asia*. Asian Development Bank Institute. https://doi.org/10.56506/HSDC4319

Matsuura, M., Luh, Y., & Islam, A. H. Md. S. (2023). Weather shocks, livelihood diversification, and household food security: Empirical evidence from rural Bangladesh. *Agricultural Economics*, *54*(4), 455–470. https://doi.org/10.1111/agec.12776

Matsuura‐Kannari, M., Islam, A. H. Md. S., & Tauseef, S. (2024). Mobile phones, income diversification, and poverty reduction in rural Bangladesh. *Review of Development Economics*, rode.13110. https://doi.org/10.1111/rode.13110

Pesando, L. M. (2022). Safer If Connected? Mobile Technology and Intimate Partner Violence. *Demography*, *59*(2), 653–684. https://doi.org/10.1215/00703370-9774978

Rotondi, V., Kashyap, R., Pesando, L. M., Spinelli, S., & Billari, F. C. (2020). Leveraging mobile phones to attain sustainable development. *Proceedings of the National Academy of Sciences*, *117*(24), 13413–13420. https://doi.org/10.1073/pnas.1909326117

Terza, J. V., Basu, A., & Rathouz, P. J. (2008). Two-stage residual inclusion estimation: Addressing endogeneity in health econometric modeling. *Journal of Health Economics*, *27*(3), 531–543. https://doi.org/10.1016/j.jhealeco.2007.09.009

Varriale, C., Pesando, L. M., Kashyap, R., & Rotondi, V. (2022). Mobile Phones and Attitudes Towards Women’s Participation in Politics: Evidence from Africa. *Sociology of Development*, *8*(1), 1–37. https://doi.org/10.1525/sod.2020.0039

1. The content does not represent our affiliations’ views. All errors are our own. [↑](#footnote-ref-1)
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4. Asian Development Bank [↑](#footnote-ref-4)
5. International Food Policy Research Institute [↑](#footnote-ref-5)
6. Bangladesh Agricultural University [↑](#footnote-ref-6)
7. 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-7)