

Chapter 2

The Impact of ICTs on Women's Economic Empowerment

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Abstract It is widely argued that ICTs enable the inclusion of low-skilled and traditionally marginalized groups, such as women, people with disabilities, and workers at the base of the pyramid (BoP), in the labor market. In this paper, we investigate the determinants of female participation in the labor market in developing countries with a focus on the impact of the use of ICTs on female labor force participation. We conduct a panel study analysis for 60 developing countries in the time period 2000–2014. Our results confirm that there is rather a positive impact from the use of ICTs on female labor force participation in developing countries. Moreover, we show that gross national income (GNI) per capita, fertility rates, and income inequalities influence to some extent the level of women's engagement in the labor market. Our results are robust against different control variables, as well as different ICT proxies.

Keywords ICTs • Female labor force participation • Panel data • Development level • Income inequalities

2.1 Introduction

Over the past few decades, information and communication technologies (ICTs) have played an important role as a key solution for comprehensive development, poverty elimination, and the empowerment of groups discriminated against in society. One of the important effects of the proliferation of ICTs is the influence on the labor market, both through the creation of new jobs (ICTs as a sector) and making labor markets more inclusive, innovative, flexible, and transparent (ICTs as a tool). The relationship between ICT adoption and labor market outcomes is worth studying, as reflected in numerous studies. On the one hand, it is widely argued that ICTs enable the inclusion of low-skilled and traditionally marginalized groups, such as

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women, people with disabilities, and workers at the base of the pyramid (BoP), into the labor market [21]. On the other hand, a variety of female labor force participation rates are observed across countries, reflecting differences in economic development, social norms, education levels, and fertility rates. Moreover, labor force participation among women is more varied than among men [26].

In this paper, we examine the influence of ICTs on the labor market in developing countries. The motive for undertaking this research is that there is on the one hand a wide range of literature arguing the positive effect of ICTs on female participation in the labor market and on the other hand statistics showing rather stable levels of female labor force participation in developing countries over the last 15 years, despite rapid changes in ICT indicators. Therefore, the main goal of this study is to examine if and how ICTs shape and change work with regard to the female labor force in the labor market. From our point of view, it is interesting to investigate the determinants of female participation in the labor market in developing countries. To do this, we conduct a panel study analysis for 60 developing countries over the time period 2000–2014.

In our article, we contribute to the relevant literature by examining the relationship between the use of ICTs and the level of the female labor force. As a response variable, we use the female labor force participation rate (as the percentage of the female population aged 15+), modeled as an international labor office (ILO) estimate. As explanatory variables, we employ two different ICT indicators, such as mobile cellular telephone subscriptions per 100 inhabitants and percentage of individuals using the Internet. In this way, we compare the influence of different ICT measures on women's economic empowerment.

Our results confirm that the use of ICTs exerts a positive influence on female labor force participation in developing countries. Moreover, we find that gross national income (GNI) per capita, fertility rates, and income inequalities influence the level of women's engagement in the labor market. Our results are robust against different control variables, as well as different ICT proxies. The remainder of the article is as follows. The second section addresses the role of ICTs in the labor market and in particular in the process of women's empowerment. The third section is devoted to the description of the data and the methodology. In the fourth section, we show and discuss our results. The last section concludes.

2.2 ICTs, the Labor Market, and Women's Empowerment

In the literature, the most popular approach to determining the female labor force participation rate is based on the U-shaped hypothesis [5], according to which the female labor force participation rate is higher in poor countries, slightly lower in middle-income countries and greater in highly developed countries [16]. It is important to remember that the female labor supply should be considered both as a driver and an outcome of a country's development. Moreover, the analysis of women's labor force participation seems to be multifaceted. The empowerment of women

may be driven simply by poverty (especially in less-developed countries) but also by women's increasing educational attainment and work opportunities created in modern countries [26]. Analyzing the drivers of female labor force participation in poor countries, we observe push factors, which force women to work, in contrast to well-developed countries, where pull factors draw women into the labor market [13].

At the same time, a considerably greater variation is found in the labor force participation of women than men across developing countries. This variation is driven by a wide variety of economic factors. The study of the determinants of women's economic participation is complex, and many researchers state that the involvement of women is associated with economic, sociodemographic, and cultural factors [23]. There are several factors that influence female labor force participation. First of all, despite the common claim that women's empowerment and economic development are closely interrelated, economic development alone is insufficient to enable significant progress in women's empowerment [7]. Some empirical studies show rather weak evidence on the pure influence of changes in gross domestic product (GDP) per capita on the evolution of female labor force participation [26]. Moreover, some research results show that rising urbanization causes a fall in women's engagement in the labor market as they are withdrawn from the agricultural labor market [26]. The other important factor influencing female labor force participation addressed in the literature is educational attainment, which also shows a U-shaped curve. Moreover, educational level determines the quality of employment through an increase in the reservation wage [26] and therefore is predominantly considered an investment in education [20]. Besides this, a range of social determinants are considered determinants of female labor force participation, such as marriage, fertility, women's role outside the household, and household and spousal characteristics.

Moreover, the role of the quality of female employment is often discussed in analyzing the determinants of female labor force participation. It is therefore crucial to understand and investigate the nature of women's jobs, especially in developing countries where employment is often a last resort to prevent poverty rather than a means of self-development. Due to the implementation of ICTs, the creation of better and more qualified jobs becomes possible. However, Dell'Anno and Solomon [6] argue that the benefits of the influence of ICTs on business performance are greater for highly skilled workers. This leads to the assumption that the effect of ICT adoption is greater in more developed countries.

During the past decade, the international community has focused considerable efforts on strategies to help the people of the world's poorest countries share in the benefits of globalization and escape the trap of poverty [19]. Against this background, it seems increasingly important to examine the role played by ICTs in improving people's level and quality of life [14–16]. In this section, we describe the effects of using ICTs on the labor market and in particular on employment opportunities. The literature suggests that these effects should be analyzed in a complex manner. Three major drivers that enhance the role of ICTs in the labor market can be distinguished: greater connectivity, the digitization of the economy, and the globalization of skills [21]. Greater connectivity means that due to the use of ICT

technology, mostly the Internet, people have more opportunities to find a job, and employers have more opportunities to find the right workers. For instance, according to the McKinsey Global Institute, in developing countries, the use of mobile Internet tools influences the productivity of certain types of work [21]. The second driver, the digitization of the economy, is strictly related to the contemporary nature of work, which has been reshaped, as relationships between workers and between workers and employers. Moreover, digitization creates work that is not joined to location and is disaggregated across space and time. Nowadays, through telecommuting and outsourcing, workers can cooperate globally no matter where they live. Moreover, some ICT tools are widespread and available even for small entrepreneurs, which facilitates international collaboration. The third driver is the globalization of skills, which can be observed in the global chain of production processes. The global share of labor creates an opportunity for high-skilled workers from developing countries to obtain well-paid jobs. The implementation of ICT tools is a core factor in inclusion in global value chains, next to knowledge of foreign languages.

The effects of ICTs on the labor market are complex as the impact of ICT on employment can be considered both positive and negative. The negative influences concern job losses and work displacement due to the automatization and transformation of jobs [21]. However, it is primarily the positive effects of ICT proliferation, especially in developing countries, that are discussed in the literature. Therefore, in this section we focus on the positive outcomes of ICT for the labor market.

In general, the impact of ICTs can be considered in terms of ICT as a sector and ICT as a tool. The most obvious effect of ICT adoption is the direct creation of jobs in the ICT sector through the production of ICT and the intensive use of ICT. However, from a broad perspective, ICTs help to make labor markets more inclusive, innovative, flexible, and transparent [21], and thus ICTs can also be considered a tool used in labor market processes. In this sense, every country is touched by ICT, and in the labor market, there are clear implications for productivity and labor. In other words, ICTs empower workers and not only those hired in the ICT sector [21]. In particular, ICTs are helpful in enabling workers to find jobs and employers to find skilled workers as they make it possible to overcome social, cultural, and physical barriers in the labor market [21]. In this way, the labor market has become more transparent and efficient. Moreover, ICTs support new forms of employment, e.g., by creating opportunities for online contracting (working online) [21]. It is important to note that online contracting covers jobs performed not only for larger firms but also SMEs and is related not only to ICT jobs but also to non-ICT work. Another form of ICT-enabled work is microwork. Microwork involves dividing a large task into smaller micro-tasks, which can be performed by individuals regardless of geographical distance [21].

The interaction between ICT adoption and women's empowerment has been described widely in the literature. A growing body of studies shows that the impact of ICTs is increasingly related to women's empowerment, both in economic and social and cultural respects. It is argued that ICTs allow women to transform knowledge and information into innovative products and services [1, 4, 17] and increase the

flexibility of their participation in the labor supply, e.g., through facilitating distance work and flexitime [8]. Moreover, ICTs help in creating women's leadership and participation in community and economic development [2]. Most previous research, based mainly on national case studies, has indicated that ICTs increase employability, and thus women's empowerment can be advanced [3, 9–12, 18, 22–24, 27].

In general, empirical research concerning the effects of ICTs on women's empowerment has been based on case study methodology. Predominantly, there is evidence of a positive influence of ICT adoption on the labor market. In addition, numerous initiatives have been undertaken to empower women through the use of ICTs [25]. However, although the interaction between ICT adoption and women's economic empowerment has been described widely in the literature, there is still a lack of international comparisons confirming or rejecting the hypothesis of a positive influence of ICTs on the labor market.

2.3 Data and Methodology

Our data set contains panel data from 2000 to 2014 for 60 developing countries, which are strongly balanced. As a response variable, we use a female labor force participation rate, which is calculated as the proportion of female aged 15 and older who are economically active.¹ As explanatory variables, we employ different ICT indicators, such as mobile cellular telephone subscriptions per 100 inhabitants and percentage of individuals using the Internet. In this way, we can compare the influence of different ICT technologies on women's economic empowerment. Moreover, to ensure the robustness of our results, we use several control variables. Based on existing knowledge concerning the determinants of female labor force participation, we choose the following outcomes as control variables: GNI per capita, the fertility rate, the population sex ratio, the ratio of urbanization, and the GINI index as a measure of income inequality. All data are drawn from 19th edition of the World Telecommunication/ICT Indicators database and the World Development Indicators database. Table 2.1 reports the summary statistics for all the data used in the empirical analysis.

We conduct a random-effects GLS regression with the use of panel data for 60 developing countries over the time period 2000–2014. We have chosen a random effect model because we assume that the differences across analyzed countries have some influence on the dependent variable. Moreover, as an advantage of the use of random effect model, we can include time invariant variable (GINI coefficient), which also seems to be significant while explaining the variability of female labor force participation rate. In this way, we assume random heterogeneity for countries over time and across countries.

¹The female labor force participation rate is modeled according to Key Indicators of the Labour Market provided by International Labour Organization.

Table 2.1 Descriptive statistics

Variable	Mean	Std.Dev.	Min.	Max.
<i>lfpf</i>	54.39533	20.10276	13.0000	88.8
<i>mcts</i>	34.70828	36.36511	0.0000	149.0691
<i>iuu</i>	7.596558	10.39419	0.0000	56.8
<i>GNI</i>	1108.917	914.9262	80.0000	4490.0000
<i>WFR</i>	4.097187	1.5316	1.085	7.738
<i>PF</i>	50.14627	1.111045	46.26004	53.78802
<i>UP</i>	50.14627	1.111045	46.26004	53.78802
<i>GINI</i>	39.97569	7.712084	24.55	60.79

Source: Authors' own elaboration

Data description: *lfpf* female labor force participation rate, *mcts* mobile cellular telephone subscriptions per 100 inhabitants, *iuu* percentage of individuals using the Internet, *GNI* gross national income (GNI) per capita, *WFR* fertility rate, *PF* percentage of females in population, *UP* urban population as percentage of total population, *GINI* coefficient

2.4 Results

In this section, we conduct panel regressions to examine the determinants of female participation in the labor market and in particular to investigate the association between women's empowerment in the labor market and the use of ICTs. *Ceteris paribus*, we expect the female participation rate to be positively correlated with the use of ICTs and the percentage of females in the population and negatively correlated with the fertility rate and the urban population rate. In case of the control variable *GNI* per capita, the direction of influence for female participation in the labor market seems to be problematic; however, according to the U-shaped curve, in developing countries, the sign should be negative. Table 2.2 presents the results of the panel data estimation. As the ICT indicator can be described in several ways, we first use the statistics for the percentage of individuals using the Internet as an ICT proxy.

The results presented in Table 2.2 confirm our initial expectations concerning the determinants of the female labor force participation rate. We conduct five regressions with different control variables as explanatory variables. Analyzing each of the five models, we observe a positive, statistically significant influence of the use of ICTs on female participation in the labor market. Moreover, the results of the estimations indicate that the female labor force participation rate is dependent on *GNI* per capita in a negative manner. Thus, in developing countries, an increase in income is correlated with lower engagement of women in the labor market. The reason for this is that women are no longer forced to work to prevent poverty, as widely reported in the literature. Similarly, the participation of women in the labor market will be higher if there is greater income inequality in a given economy. Moreover, our results confirm that women's empowerment in the labor market is also related to female fertility in that a higher fertility rate causes lower participation in the labor market. We find no statistically significant result for the influence of the ratio of females in the total population.

Table 2.2 Panel data estimation results (I)

Dependent variable: female labor force participation rate					
	(1)	(2)	(3)	(4)	(5)
iu	0.0043 ^a (0.0015)	0.0135 ^a (0.0031)	0.0108 ^a (0.0034)	0.0110 ^a (0.0034)	0.0113 ^a (0.0034)
GNI		−0.0295 ^a (0.0089)	−0.02978 ^a (0.0090)	−0.0306 ^a (0.0091)	−0.0320 ^a (0.0092)
WFR			−0.0693 ^b (0.0308)	−0.0691 ^b (0.0309)	−0.0712 ^a (0.0310)
PF				−0.1421 (0.3475)	−0.1309 (0.3495)
GINI					0.8531 ^a (0.2340)
R-squared	0.0175	0.1327	0.0209	0.0147	0.1411
Observations	879	821	821	821	812
Wald chi2 test	8.83 (0.03)	19.55 (0.0001)	24.72 (0.000)	24.79 (0.0001)	37.80 (0.000)

Source: Authors' own elaboration

All panel regressions include a country random effect. Standard errors are reported in parentheses. In all regressions a constant is also included but not reported

^a1% confidence level

^b5% confidence level

Although we observe a positive impact from the determinants analyzed on the female labor force participation rate, we should interpret the results obtained with caution. First of all, we should be aware of the potential underreporting of data and therefore the fact that data on women's participation rates may not accurately reflect women's work. Moreover, as reported in Table 2.2, the estimated models are fitted rather weakly to the empirical values. The reason for this seems to be twofold. Firstly, the female labor force participation rates in the given countries are rather stable over the period of analysis. Secondly, we observe a significant increase in ICT measures over this time period in the developing countries analyzed. Based on the above, it would be impossible to indicate a good fit for the models estimated. Consequently, we point out two important findings. On the one hand, we indicate the positive impact of ICTs technologies on women's empowerment, but on the other hand, the power of the influence is rather scarce. Therefore, our results are very helpful in understanding the role of ICTs in women's empowerment, as they show moderate relation between those variables. We argue that there is no simple shift between the increase in ICT technologies usage and the growth of female labor force participation. The problem is more complex and no simple conclusions should be drawn. However, bearing in mind the differences between the countries analyzed, we stand by the conclusions drawn above.

In the next stage, to ensure the robustness of our results, we conduct further regressions with the use of another ICT proxy: mobile cellular telephone subscriptions per 100 inhabitants (mcts). Table 2.3 presents the estimates of five models, which include different control variables.

Table 2.3 Panel data estimation results (II)

Dependent variable: female labor force participation rate					
	(1)	(2)	(3)	(4)	(5)
mcts	0.0036 ^a (0.0011)	0.0132 ^a (0.0022)	0.0130 ^a (0.0024)	0.0130 ^a (0.0024)	0.0131 ^a (0.0024)
GNI		−0.0426 ^a (0.0084)	0.0428 ^a (0.0084)	0.0417 ^a (0.0085)	−0.0427 ^a (0.0086)
WFR			−0.0098 (0.0318)	−0.0050 (0.0320)	−0.0096 (0.0322)
PF				0.4801 (0.3716)	0.4825 (0.3741)
GINI					0.82834 ^a (0.2346)
R-squared	0.0156	0.1418	0.1494	0.2061	0.1899
Observations	878	822	822	822	813
Wald chi2 test	9.71 (0.0018)	36.78 (0.0000)	36.84 (0.0000)	38.53 (0.0000)	51.42 (0.0000)

Source: Authors' own elaboration

All panel regressions include a country random effect. Standard errors are reported in parentheses. In all regressions a constant is also included but not reported

^a1% confidence level

The results presented in Table 2.3 confirm the previous outcomes from Table 2.2. Irrespective of the ICT proxy used, the directions of impact on determinants of female labor force participation are the same. The only difference is the loss of statistical significance in the case of the control variable women's fertility. Therefore, we argue that the use of mobile cellular telephone access and access to the Internet have a positive influence on the activity of women in the labor market.

2.5 Conclusion

Information and communication technologies (ICTs) have over the past few decades played an important role in the empowerment of groups discriminated against in society, in some contexts including women. It is highlighted that studies on the determinants of women's economic participation are complex as the involvement of women in the labor market is associated with economic, sociodemographic, and cultural factors. In this article, we aim to investigate the determinants of female participation in the labor market in developing countries, with a focus on the impact of ICTs on women's empowerment. Conducting a panel study analysis for 60 developing countries over the period 2000–2014, we show that the female participation rate is in general positively correlated with the use of ICTs measured as the percentage of individuals using the Internet and mobile cellular telephone subscriptions per 100 inhabitants. Moreover, the participation of women in the labor market seems to be higher if there is greater income inequality in a given economy. Bearing in mind that our research scope embraces only developing countries, income inequality is often related to a low level of national income, which is reflected in human poverty.

At the same time, we indicate that examining the determinants of women's engagement in the labor market is a complex task. Numerous case studies are described in the contemporary literature, but the significance of the impact of ICTs on women's empowerment should be argued with caution. Although we find a positive influence of ICTs on the women's labor market, it should be noted that the degree of explanation of the dependent variable provided by the factors used should be considered rather small. It is important to remember that we have observed a significant increase in the use of ICTs in developing countries over the period analyzed. The development of ICTs in recent years has been very rapid, while the female labor force participation rate in developing countries remains rather stable. Thus, it is difficult to explain the changes in women's empowerment over time as significant differences can be observed only across countries. Moreover, we underline that the drivers of women's engagement in the labor market are diverse and also act in different directions. In developing countries, we observe push factors, which force women to work. Our analysis confirms to some extent that in countries with higher GNI per capita, the engagement of women in the labor market is lower. This negative relation could be explained by women leaving the labor market when their work is not necessary to prevent poverty. On the other hand, if ICTs were to create the possibility of obtaining better-paid jobs, women's interest in being active in the labor market would increase. Therefore, there is still a need for further research on the influence of ICTs on women's empowerment, mostly in developing countries. While ICTs can certainly contribute to women's empowerment in the labor market, future studies should pay more attention to the quality of women's jobs.

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