

The Impact of Internet Availability on Female Employment and Income in Pakistan

Senior Year Project
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Introduction

Women in Pakistan have a significantly lower labour force participation rate than men. According to data from the World Bank, in 2021 the male labour force participation was 82.7% whereas the female labour force participation was a mere 22.5%. Globally, the average female participation in the labour market accounts to 61.4%, if I compare these numbers with Pakistan I see a significant divergence.

Along with the disparity in employment rate amongst genders, there is a significant gender wage gap across the globe, however, this wage gap is more pronounced in developing regions. A study conducted by the World Bank in 2021, concluded that the gender wage gap in Pakistan accounted for almost 34%.

Reasons

There are several reasons for these differences in the labor force participation numbers and the gender pay gap in Pakistan.

Firstly, societal norms play a crucial role, since it is expected that women would act as primary caretakers in the household. These norms put an additional burden on women for household chores, that make it difficult for them to pursue a full-time job, and set ambitious career goals. As a result, most women pursue part-time roles or take extended breaks. This leads to reduced work experience, lower skillset, lack of access to high paying jobs, and limited opportunities for growth in their careers. In order to tackle these social norms, changes are required at an institutional level to foster a supportive environment for women by creating a flexible and inclusive workspace. Restructuring the norms, can bridge the gender gap by increasing women's employment rate and reducing the wage disparity.

In Pakistan there is a considerable educational gap between men and women, unequal access to education limits access to acquire skills required for employment. In Pakistan, economic constraints at a household level results in preferential treatment between boys and girls with respect to education and other resources. Consequently, boys' education is given priority over

girls. As a result, in the formal labour force, women are faced with limited job opportunities and low paying positions. It is essential that this educational disparity is reduced to ensure equitable job opportunities for everyone. Encouraging girls to get better education increases their likelihood of performing better in the labour market.

Moreover, occupational segregation is another factor that restricts the role of women in the labour force. Biases against women tend to confine women to traditionally female dominated occupations such as domestic work, teaching, and administrative roles. This results in women facing barriers in high paying jobs, which limits their opportunities for career advancement and increases the gender pay gap.

One of the other contributing factors that restricts the entry of women in the labour force is the decision making process at households. Traditionally, the men are the household heads and exercise autonomy in primary decision making, ranging from finances to important family issues. This limits the role of women in making their own choices regarding pursuing interests and aspirations. Therefore, it is common to see under-utilization of resources towards female education.

Importance

It is important to encourage higher women's labour force participation (WLFP) due to several reasons. Firstly, it leads to a boost in economic growth and productivity levels in the population. When women enter the labour force, the overall labour pool expands leading to greater output in the country. Additionally, as WLFP increases, the household income rises, which can trigger the multiplier effect on consumer spending, this stimulates GDP growth and encourages economic activity.

Moreover, an increase in women's employment can play a pivotal role in alleviating poverty. When women are able to participate in the workforce, they provide households with a supplemental income that not only allows them to meet basic needs such as food, housing and education but also improve the standard of living of these households.

Increasing WLFP can help achieve gender equality, in both social and economic terms. Having equal opportunities in the labour force leads to financial independence and empowerment. This bridges the social disparity between men and women, as gender biases are challenged and women can exercise greater autonomy.

Role of Internet

The Internet plays a pivotal role in revamping job opportunities and the labour market landscape. Within the context of this research paper, the internet can increase the prospects of employment for women by providing access to better education. The Internet provides access to free courses, tutorials and educational material. These can be used by women to improve their qualifications. The improved accessibility of information through the internet can help women advance in their careers through skill development opportunities which were previously far-fetched.

Online work has transformed the workplace dynamics by improving flexibility and accessibility. As discussed previously, women are expected to be the primary caregivers at home, hence remote work has allowed them to work flexibly and within the comfort of their homes, which has readily improved their willingness to become a part of the labour force. Hence, it can be said that the internet can help empower women in pursuing professional careers without compromising on other responsibilities.

Research Question

The following research paper addresses the questions, “How does internet availability impact female employment and income in Pakistan?”. The paper aims to study the correlation between internet accessibility and female employment and income levels in Pakistan. The primary focus of this research paper is to analyze how internet accessibility changes the labour market landscape for women. Another tangible variable to scrutinize when studying financial independence for women is average income. Therefore, the study aims to focus on the trends between average female income and access to the internet.

Since the labour market is interconnected and there are several variables that can impact wages and employment, therefore, the research focuses on understanding the impact of other socio-economic factors such as age, education, and marital status. By examining the following, the research aims to provide a thorough understanding of how the internet can revamp the labour market for women.

Literature Review

The relationship between women labour force participation and internet availability has become relevant for economists and policymakers across the globe. Therefore, several research papers have been written that have analysed this correlation.

One such paper is, “The impact of internet availability on female labour market outcomes in Indonesia” by Kusumawardhani et al. The paper acknowledges that the relationship between internet penetration and economic growth is positive in developed countries. However, in developing countries such as Indonesia the correlation is much more complex. The empirical analysis conducted by the paper shows a modest positive relation between women labour force participation for young and low-educated women. At the same time, however, the internet has a negative impact on the ability of these women to acquire high-skilled and high-paying jobs. This highlights that internet availability in Indonesia favors low-income and educated women by improving the employment rates, however, it has little impact on improving social mobility. Moreover, the research recognizes that highly educated women have significantly higher benefits through the internet. One of the key takeaways from the paper is that although internet accessibility can lead to positive trends in female employment, it is necessary to ensure that the internet is used for inclusive growth. Without adequate policies, the internet may widen the social and economic differences within society (Kusumawardhani et al., 2023).

Another paper that examines a similar relationship is, “Does the Internet Reduce Gender Gaps? The Case of Jordan” by Viollaz and Winkler. The research uses individual level panel data for the period between 2010 and 2016. The findings of the study highlight that internet adoption has a minimal positive effect on women labour force participation in Jordan. However, it does lead

to a significant increase in the number of women searching for jobs online. The most important findings from the study is the impact of the internet on gender-based social norms. The data shows that as internet accessibility increases, there is a significant reduction in marriages and birth rates. Both of these are important factors that restrict the entry of women in the labour force. Therefore, the internet can have a positive impact by lowering barriers for female employment (Viollaz and Winkler, 2020).

The research paper, “Internet and Economic Growth in Less-developed Countries: A Case of Managing Expectations?” by Charles Kenny discusses that the internet can have negative impacts on developing countries. The paper explains how there is little empirical evidence of economic growth led by “information revolutions”. It appears that less developed countries (LDCs) are not fully equipped to harness the benefits of the internet and technology due to the lack of physical and human capital coupled with weak institutions (Kenny, 2003).

Similarly, “The impact of ICTs on Women Economic Empowerment” by Nikulin studies the relationship between ICT and women labour force participation in developing countries. Using data from 60 countries between 2000 and 2014, the study confirms that there is a positive relationship between ICT and WLFP. However, there are other factors such as GNI, fertility rates and income equality across the countries that can impact women’s employment rates. The following paper highlights that there is a need to develop the ICT sector in a way that promotes equitable and inclusive growth in the labour market (Nikulin, 2016). Additionally, another paper “Measuring the Effect of the Internet on Economic Growth: The Case of Saudi Arabia” shows evidence that increasing internet through broadband can stimulate economic growth in the country because internet helps in revolutionizing several sectors in the economy leading to increased growth and creationg of jobs (Bardesi, 2020).

All of the research papers highlight the multi-faceted impact of the internet on female labour market outcomes in developing and LDCs.

On the other hand, the research paper, “Broadband Infrastructure and Economic Growth” investigates the impact of broadband on economic growth in OECD countries from 1996 to

2017. The study finds that a 10% increase in broadband penetration leads to an annual per capita growth of 0.9 to 1.5 percentage points. The paper highlights how broadband leads to the spread of information and ideas that create innovation, competition and development which are essential for economic growth. Since the data used comprises various countries over a timeline of more than 20 years, this paper gives solid evidence of the effectiveness of the internet in accelerating economic activity in developed countries (Czernich, 2011). Another research, "Digitalisation and Women's Workforce Participation in the Indo-Pacific " by Watson et al. suggested that there is evidence for a positive relationship between broadband penetration and female employment rates in the United States. The study highlights that empirical evidence from other papers shows that the internet and technology has helped reduce the gender wage gap in the United States too (Watson, 2018).

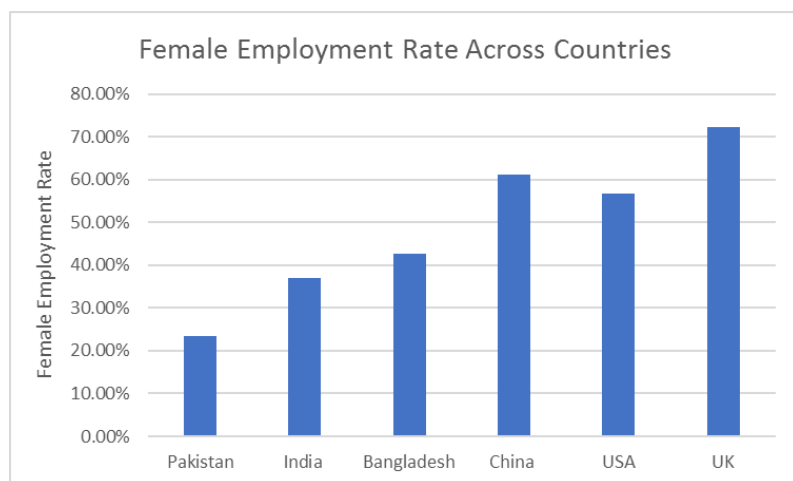
The thorough analysis of literature signifies that internet availability has a direct increase on employment and wages for women in developed countries. However, in developing regions this relationship is not distinctive. Instead there are several other socio-economic factors that are pivotal in determining if the benefits of internet accessibility are harnessed for the growth of females in the labour force to increase employment and income. Since Pakistan is a developing country too, the following research question becomes crucial in understanding how the growth in internet and technological growth over the past few years has impacted women in the country.

Country Context

The table below ([Graph 1](#)) shows the female employment rate across different countries in the world. There is a significant difference between the employment rates between developed and developing countries. However, it is noticeable that although the three developing countries in question Pakistan, India, and Bangladesh have several similarities such as cultural norms, traditions, language, the female employment rate in Pakistan is significantly lower compared to India and Bangladesh. Possible reasons for this difference can be education and workforce policies. Both India and Bangladesh have taken steps to improve female education. Moreover, they have implemented reforms to encourage greater employment opportunities for women such as microfinance and entrepreneurship programs in Bangladesh. Another valid reason can be

safety concerns. Throughout the last few decades, Pakistan faces serious security challenges that threaten the safety of the population. These concerns are exacerbated for female workers. Therefore, it is critical for Pakistan that this issue is researched upon in greater detail to identify factors that limit women's participation in the workforce and implement suitable policies.

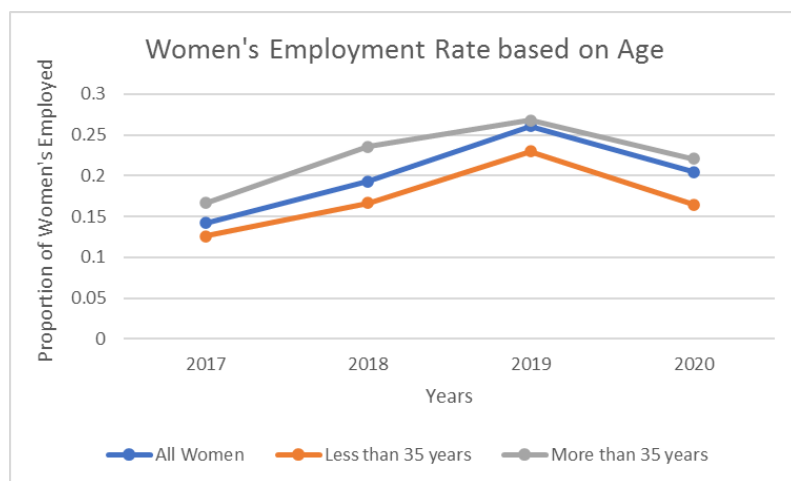
Graph 1



Women's Employment Rate

The graph below ([Graph 2](#)) shows the trend in the employment for women in Pakistan segmented on age. Age is an important factor that can play a critical role in determining the ease of entering the labour force for women. The graph has three lines, one for all women across Pakistan, one for ages less than 35 (age: 16-35), and for ages greater than 35 years. All lines depict an overall increase in the employment rate for women. Women with an age of more than 35 years have a higher employment rate. One of the main reasons for this trend can be that younger women in Pakistan are expected to spend more time at home for starting a family and taking care of young children. However, with the passage of time the societal pressure eases and women decide to work to provide a supplemental income to the household. The decline in female employment between 2019 and 2020 is due to COVID that resulted in lockdowns and the losses of jobs.

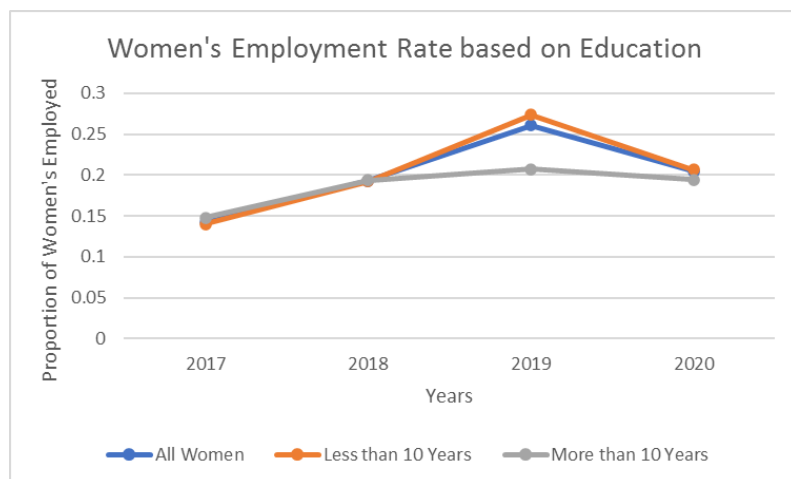
Graph 2



Another line graph ([Graph 3](#)) shows the female employment rate segmented on education.

Contrary to expectations, a significantly higher proportion of less educated women are a part of the workforce compared to more educated females. The main reason for this occurrence is that a bulk of the employment opportunities for women are in the primary sector which are low paying jobs that require minimal skills and qualifications. Another important trend to analyse within this graph is the trend from 2019 to 2020. The graph shows a steep decline in the employment rate between 2019 to 2020 due to the pandemic. However, this decline is more pronounced for less educated women, and the line for highly educated women is fairly stable. This can be comprehended that better education and qualification does increase job security for women, since the number of substitutes available in the labour market are lower.

Graph 3

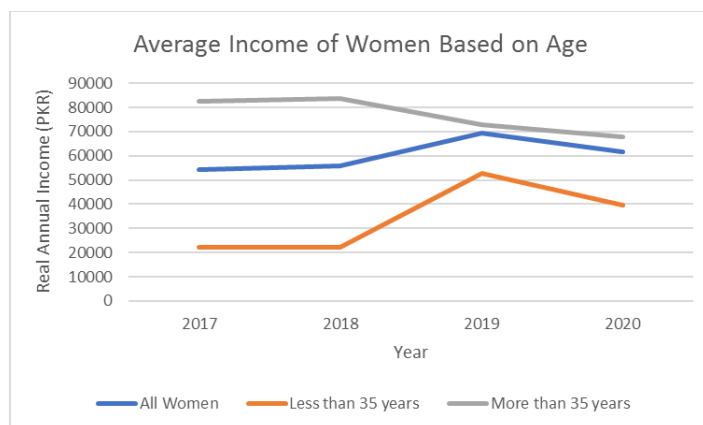


Average Income

This section of the paper deals with average income of women based on factors such as age and education. In order to take into account inflation, the average annual income has been converted to real income by taking the CPI for 2017 as the base year.

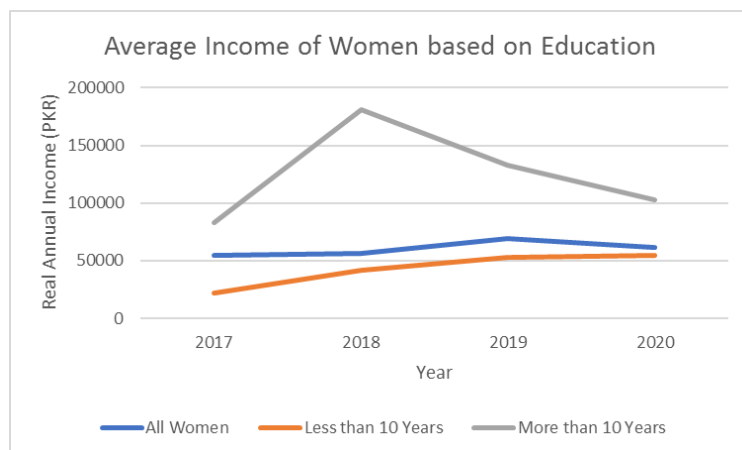
[Graph 4](#) shows that older women, those older than 35 years, have considerably higher wages than younger women. This disparity can be attributed to greater experience within the labour market.

Graph 4



Moreover, the segmentation of annual income for women based on education ([Graph 5](#)) shows that highly educated women, that is those with greater than 10 years of education, have a significantly higher real annual income than those with lower education. The primary reason for this difference is that better education allows individuals to get employed in well-paying jobs.

Graph 5

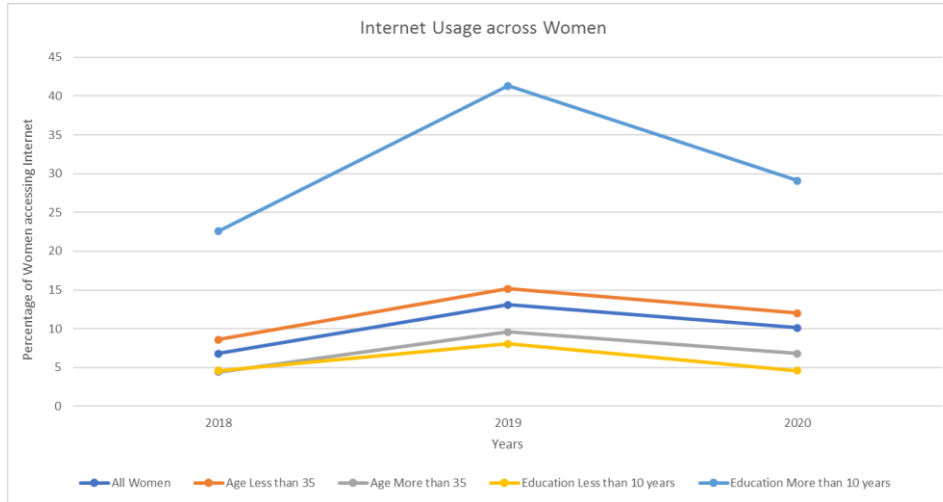


Internet Usage

The following table ([Graph 6](#)) shows the trend of internet usage in Pakistan. Overall, between 2018 and 2020 internet usage has remained fairly constant. The lines in the graph show internet accessibility for women based on age and education. Educated women, that is those women who have more than 10 years of education, have a considerably higher usage of the internet. Moreover, younger women that are less than 35 years old have higher accessibility to the internet than older women. Thus, the data shows the young and educated women in Pakistan are better

equipped to access the internet due to their flexibility in terms of improved learning and better skill-set development.

Graph 6



Data

The research was done on the Pakistan Social and Living Standard Measurement Survey (PSLM) data for the last four years (2017-202). In each year's data there were 17 different folders containing information regarding each aspect of PSLM. After thoroughly studying the questionnaire it was found that four of those seventeen files are required each year for this analysis. So, I separated the Education, Information and Communication Technology (ICT), Employment and Roster files from each year to make use of in the final data. After merging these four files for each year, there were four total merged files, and at last those total four files for every year were appended to have all the data in one file which is cleaned as well.

Empirical Strategy

$$Y_{it} = B_0 + B_1 I_{it} + B_x X_{it} + \alpha_t + \varepsilon_i$$

The main equation that is used for this paper's regression analysis is the one shown above. Y_{it} is the labor market outcome of woman i at time t . The following labour market outcomes will be the main focus of this paper: (i) Employment; (ii) Total Income.

For Employment, three columns were taken into consideration: Primary Occupation (which focused on each individual's main occupation), Enterprise Occupation (which considered each individual's business or enterprise) and Other Work (which included any other forms of work not present within the other two). If any of these columns showed that an individual is working in that specific occupation, the Employment variable was assigned a value of 1, else it was given a zero as this is a binary variable. All missing values were dropped to perform regression analysis on the final data.

For Total Income, the way this variable was made was that all income sections from the primary PSLM data were taken, added together for each individual and calculated to find the total income of that particular individual. These sections included: Primary Income, Secondary Income, Other Earnings, Pay From Other Work and Pensions. Once all calculations were done for every row, the Total Income variable was generated, and all missing entries in the data were discarded for the final regression analysis.

The main independent variable is I_{it} , defined as the internet availability for individual i at time t . To make use of this, a proxy variable was generated from the main data known as Internet Usage. This made use of the column 'Internet Used in the Last 12 months' which measured whether a particular individual had used the internet in the past 12 months or not. Hence, the binary variable 'Internet Usage' was created from this, taking a value of 1 if the individual used internet in the last 12 months. Once again, all missing values were dropped to perform the final regression analysis.

X_{it} is the individual level control variable which includes all such control variables like Region (Rural or Urban), Education, Marital Status, Household Head etc. For Education Level, 4 variables were created including: Primary Education (If the individual completed 5th grade), Secondary Education (If the individual completed 10th grade), Senior Secondary Education (If the individual completed 12th grade) and Finished Degree (If the individual completed university

education). For Marital Status, 3 variables were created including: Married, Divorced and Widowed.

Finally, α_t is the time-fixed effect to account for time-specific factors that may influence the dependent variable but are constant across all individuals or entities over time.

Summary statistics for the variables used in the estimation can be shown in [Table 0](#):

Table 0

	Mean	SD
Employed	.7265484	.4457642
Age	42.53969	14.49579
Finished Primary School	.8021648	.3983972
Finished Secondary	.8483163	.358741
Finished Senior Secondary	.9385147	.2402364
Finished Degree	.039086	.1938141
HH-Head	1.975195	1.857375
Married	.4873722	.4998781
Divorced	.0153337	.1228856
Widowed	.3967228	.4892543
Region	.2961515	.456593

N

6652

Results and Discussions

Final Sample

The main regression results focus on females only. The results show that Internet Usage has a negative and statistically significant impact on Employment, but a positive and statistically significant impact on Total Income.

Table 1

	(1)	(2)
VARIABLES	Employment	Total Income
Internet Usage	-0.0877*** (0.0257)	33,117*** (8,533)
Constant	0.526*** (0.0501)	61,548*** (16,642)
Observations	6,652	6,652
R-squared	0.190	0.143

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

As shown by [Table 1](#) (for complete results visit [A2](#) in the [Appendix](#)), an increase in Internet Usage by 1 unit leads to a fall in Employment by 0.087 units. Now, even though this is a small amount, the fact that it is significant shows that there is an impact of internet usage on the level of female employment in the country. The reason for such a fall is that greater internet accessibility allows people to get jobs or start businesses within the e-commerce industry through online stores, drop-shipping, freelancing etc., or to take part in work related to social media, for example as Tiktokers, Instagram influencers, vloggers, YouTubers etc. And, since these forms of employment were not reported in the data, because no such question was asked about it within the PSLM survey, they did not lead to an increase in the level of employment in the country. Instead, it results in unemployment, as people can leave their existing jobs to take part in such jobs associated with the usage of the internet, thus decreasing the level of employment. In addition, greater internet usage also means that greater time is wasted on social media use, and as time is a huge opportunity cost, the time wasted leads to a greater chance of people being laid off, or them wanting to leave their jobs in general. And, because women generally stay at home and take care of the household in Pakistan, this would make sense as well.

On the other hand, [Table 1](#) shows that an increase in Internet Usage by 1 unit leads to an increase in Total Income by approximately Rs. 33,117. Once again even though this is a small amount, given that this is the yearly increase in women's total income, the fact that it is significant shows that internet usage affects the amount of income earned by women in Pakistan. The reason for such an increase can once again be linked to the reason stated before, about how people can get jobs within the e-commerce industry, freelancing or work related to social media. And, as women already have difficulty finding and maintaining high paying jobs in the country, such kind of work allows them the opportunity to become independent and earn better incomes through their own work, which is facilitated by the internet.

Hence, it can be seen that given that women face many constraints in the amount of opportunities they are provided when it comes to they types of jobs they are given, which are mostly manual labour jobs with low levels of income, and the fact that not many women are part of the labour

force as well, it makes sense to see that the accessibility provided by the internet would facilitate the shift towards jobs related to it as well, however with a smaller but significant degree of impact.

Heterogeneity Through Age and Education

Within these regression results, there exists a potential source of heterogeneity through women's age and the years of education they have completed. As shown by Table [A2](#), the variable Age shows that an increase in a woman's age increases the level of employment by a small but significant amount (a 1 unit increase in Age leads to a 0.0149 unit increase in Employment), though the impact on Total Income is less significant. Moreover, since Age² has a negative but significant impact on Employment, it shows that as age increases, it increases employment at a decreasing rate, hence reducing its impact through time. With regards to the level of education, Table [A2](#) also shows that the variable Finished Degree is positive and significant for Total Income (a 1 unit increase in Finished Degree leads to a Rs. 118,365 increase in Total Income), showing a very large impact on the income earned by women. But, the variable Finished Primary School is negative and significant for Total Income with a relatively smaller impact on the income earned by women (a 1 unit increase in Finished Primary School leads to a Rs. 26,857 decrease in Total Income). *

For Age, the sample was divided into two parts: women aged 35 and below and women above the age of 35. [Table 2](#) and [Table 3](#) show the results of these regressions respectively.

Table 2

	(1)	(2)
VARIABLES	Employment	Total Income
Internet Usage	-0.111***	17,696***

	(0.0382)	(6,311)
Constant	0.562***	32,185
	(0.148)	(24,420)
Observations	2,140	2,140
R-squared	0.072	0.112

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

As shown by [Table 2](#) (for complete results visit [A3](#) in the [Appendix](#)), women aged 35 and below experience results consistent with the original regression carried out on the final sample i.e. Employment has a negative and significant impact, while Total Income has a positive and significant impact. However, it can be seen that the impact on Employment is greater, with a 1 unit increase in Internet Usage leading to a fall in Employment by 0.111 units, while the impact on Total Income is lower, with a 1 unit increase in Internet Usage leading to a rise in Total Income by Rs.17,696 only. The reason for such results is that women of the younger population would be having a fairly recent start within the industries related to internet usage, as mentioned before. Hence the fall in employment would be greater due to greater prospects within these industries, thus motivating the younger generation of women to leave their jobs and shift to such fields of work. Adding on to this, since they are younger, they would be slightly inexperienced, and hence would not be able to earn as much income at the start, thus showing the lower levels of total income within the results.

Table 3

	(1)	(2)
VARIABLES	Employment	Total Income
Internet Usage	-0.0996*** (0.0348)	59,457*** (13,179)
Constant	0.779*** (0.143)	87,815 (54,098)
Observations	4,512	4,512
R-squared	0.227	0.140

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

[Table 3](#) (for complete results visit [A4](#) in the [Appendix](#)) shows that women above the age of 35 also experience consistent results with the original regression, however with slightly different results than with the other age group. It shows that the impact of Employment is smaller, with a 1 unit increase in Internet Usage leading to a fall in Employment by 0.0996 units only, while the impact on Total Income is greater, with a 1 unit increase in Internet Usage leading to a rise in Total Income by Rs.59,457. The reasons for such changes are the same as before, but the reason for the difference in the level of impact is due to the fact that women that are part of the older population would be more settled in to the industries associated with internet usage, and so

would have established themselves as workers of these industries, thus reducing the level of unemployment that occurs. In addition, these women would also have more experience and would have developed greater skills to excel in these fields, thus resulting in the greater increase in total income.

For years of education, the sample was once again divided into two parts: women with less than 10 years of education and women with 10 or more years of education. The reason for choosing 10 years instead of 12 (which is the years of education needed to finish a degree) as the point of division was to account for a standard of error within the years of education to avoid overfitting the results to data focused on participants having a degree. [Table 4](#) and [Table 5](#) show the results of these regressions respectively.

Table 4

	(1)	(2)
VARIABLES	Employment	Total Income
Internet Usage	-0.0845** (0.0345)	23,477*** (8,420)
Constant	0.769*** (0.168)	190,996*** (41,056)
Observations	5,678	5,678
R-squared	0.147	0.080

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

As shown by [Table 4](#) (for complete results visit [A5](#) in the [Appendix](#)), women with less than 10 years of education experience results which are once again consistent with the original regression results. It shows that there is a negative but significant impact on Employment, and a positive and significant impact on Total Income. The impact on both these variables is also quite low, with a 1 unit increase in Internet Usage leading to a fall in Employment by 0.0845 units, and a 1 unit increase in Internet Usage leading to a rise in Total Income by Rs.23,477 only. This fits well with the general norm of lower education levels leading to lower levels of employment and lower incomes being earned, and even more so with women, most of whom are unable to receive a decent education in Pakistan. Consequently, this would incline women to find jobs by learning skills through use of the internet and thus taking part in freelancing jobs or social media work, which does not require much skills to begin with. However, due to the lack of education, such women would find some trouble in navigating their way across the internet to be able to fully learn and develop the skills they need to earn through the internet, hence leading to a smaller rise in total income.

Table 5

	(1)	(2)
VARIABLES	Employment	Total Income
Internet Usage	-0.0426 (0.0417)	37,870 (26,188)
Constant	0.887*** (0.130)	-69,570 (81,933)

Observations	974	974
R-squared	0.372	0.171

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

[Table 5](#) (for complete results visit [A6](#) in the [Appendix](#)) shows that women with more than 10 years of education also experience results consistent with the original regression results in terms of the changes to the dependent variables (Employment and Total Income), however the results are too insignificant to be interpreted, hence they are disregarded.

Combined Sample

Once all the results on the final sample were found, a regression was run on the cumulative sample of both men and women, to check if the results were consistent with those found only for women, and whether gender has an impact on the amount of change in both dependent variables.

Table 6

	(1)	(2)
VARIABLES	Employment	Total Income
Internet Usage	-0.0473*** (0.00369)	119,045*** (6,031)

Constant	0.588*** (0.00626)	119,290*** (10,232)
Observations	154,157	154,157
R-squared	0.220	0.032

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

As shown by [Table 6](#) (for complete results visit [A7](#) in the [Appendix](#)), an increase in Internet Usage by 1 unit leads to a fall in Employment by 0.0473 units, which is a small but negative and significant impact on the level of employment. This would make sense as, with the inclusion of men in the sample, most of them would be able to utilise the internet within their respective businesses or fields of work, by combining their work with the e-commerce industry for example and selling their goods online, and so would not have to leave those jobs or businesses. And, even if they are unable to incorporate the use of the internet within their work, they can end up having a secondary occupation, one which makes use of the internet to earn money like freelancing or social media work, and hence would not have to leave their jobs. Hence the level of employment reduces by such a small amount overall in Pakistan.

[Table 6](#) also shows that an increase in Internet Usage by 1 unit leads to an increase in Total Income by approximately Rs. 119,045, which is a very large, positive and significant amount. Once again, the reasoning for such a large and significant increase in income is the greater utilization of the internet by men within their businesses, thus expanding them through greater sales and use of better technology for their output. Adding on to this, with the addition of a

secondary occupation, more work would lead to greater incomes being generated, hence the increase in total income would be greater overall.

Hence by including both men and women within the regression results, I find a much greater impact on both Employment and Total Income, due to the fact that men are usually considered the breadwinners in Pakistan, hence providing them an incentive to work and earn more for their families.

Further Insights

Impact of Use of Internet

To gain further clarification on how exactly internet usage impacts both Employment and Total Income, the sample was further extracted and additional variables were created. 'Home' refers to all those women who make use of the internet at their homes, while 'Work ' refers to all those women who make use of the internet for their work. Results for this regression are shown in [Table 7](#) (for complete results visit [A8](#) in the [Appendix](#)).

Table 7

	(1)	(2)
VARIABLES	Employment	Total Income
Home	0.157** (0.0641)	57,460* (32,930)
Work	0.275**	24,939

	(0.108)	(55,421)
Constant	0.770***	168,497
	(0.248)	(127,427)
Observations	443	443
R-squared	0.246	0.189

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

As shown in [Table 7](#), an increase in the use of internet at Home by 1 unit leads to an increase in Employment by 0.157 units, which is a small and positive amount, however it is only partially significant. The reason for this could be greater opportunities to work remotely, particularly in places that are far away from commercial hubs, most of which are located in more developed cities, thus providing women the access to such industries whilst not having to leave their homes and managing the household as well. The impact on Total Income is insignificant however, so that is not considered.

Similarly, an increase in the use of the internet at Work by 1 unit leads to an increase in Employment by 0.275 units, which is once again a small and positive amount that is only partially significant. The reason for this is greater utilization of the internet to support and expand businesses and make certain forms of work more efficient, which lead to greater output and larger sales, resulting in the need for more employees, including women, hence the level of employment increases. The impact on Total Income is once again insignificant however, so that is not considered.

The reason for such lower levels of significance within the results is due to the smaller sample size for this regression, for a total of 450 women reporting their reasons for the usage of the internet.

Impact of Type of Occupation

To understand which types of occupations were impacted more through the increase in the use of the internet, the sample was once again further extracted and additional variables were created.

‘Paid Employee’ refers to all those women who are under someone else's employment, while ‘Self Employed’ refers to all those women who have their own businesses or start-ups, or operate alone. [Table 8](#) and [Table 9](#) show the impact of both these types of occupations respectively.

Table 8

	(1)	(2)
VARIABLES	Employment	Total Income
Internet Usage	-0	31,571*** (9,117)
Paid_Employee	0	-41,903*** (3,391)
Constant	1	46,327*** (17,785)

Observations	4,557	4,557
R-squared		0.077

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

As shown in [Table 8](#) (for complete results visit [A9](#) in the [Appendix](#)), for women who are paid employees, an increase in Internet Usage by 1 unit leads to an increase in Total Income by Rs. 31,571. This is a positive and significant increase in income. The reason for such an increase is due to greater efficiency in the work environment, through learning better skills over the internet and utilising those skills at work, leading to greater growth and improvement. This results in greater incomes being made by the employees, but as these employees are women, the impact is relatively smaller due to lesser women being part of the workforce.

Table 9

	(1)	(2)
VARIABLES	Employment	Total Income
Internet Usage	0	31,571*** (9,117)
Self_Employed	0	41,903***

		(3,391)
Constant	1	4,424
		(17,540)
Observations	4,557	4,557
R-squared		0.077

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Similarly, [Table 9](#) (for complete results visit [A10](#) in the [Appendix](#)) shows that for self employed women, an increase in Internet Usage by 1 unit leads to an increase in Total Income by Rs. 31,571. Again, this is a positive and significant increase in income. The reason for this increase is due to greater expansion, greater market access and better innovation and efficiency of businesses and start-ups, to generate more output and increase the number of sales. Thus the total income generated from these businesses increases, however, by a smaller amount due to fewer women being part of the workforce, and thus fewer women having their own businesses to operate.

Sources of Bias

While the primary analysis provides valuable insights, it is crucial to address potential biases that could impact the model's accuracy and generalizability. Hence, I move further to tackle these potential sources of bias.

One source of bias is time fixed effects, to account for time-specific factors that may influence the dependent variable but are constant across all individuals or entities over time. Including time fixed effects is a way to control for unobserved time-varying factors that might otherwise bias the estimated coefficients. Hence variables for all 4 years of the data were included: 2020, 2019, 2018, 2017.

Table 10

	(1)	(2)
VARIABLES	Employment	Total Income
Internet Usage	-0.0877*** (0.0257)	33,117*** (8,533)
2020	0.0813*** (0.0178)	16.52 (5,910)
2019	0.0553*** (0.0192)	9,794 (6,384)
2018	-0.0179 (0.0154)	6,102 (5,097)
2017	-	-
Constant	0.526*** (0.0501)	61,548*** (16,642)

Observations	6,652	6,652
R-squared	0.190	0.143

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

As shown by [Table 10](#) (for complete results visit [A2](#) in the [Appendix](#)), the years 2020 and 2019 have a positive and significant impact on the level of employment, but no significant impact on Total Income, relative to the base period of 2017.

I then address the issue of Multicollinearity. Multicollinearity arises when independent variables are highly correlated, inflating standard errors and making individual parameter estimates unreliable. To assess this issue, I employed the variance inflation factor (VIF) method. VIF calculates the proportion of each variable's variance unexplained by other independent variables, with values exceeding 5 typically indicating problematic levels of multicollinearity. Our VIF analysis identified age as the primary culprit, exhibiting the highest value. It is logical for age to correlate with the level of education, regional distribution, and household/marital status of an individual. Consequently, I re-ran the regression after excluding age.

Table 11

	(1)	(2)
VARIABLES	Employment	Total Income
Internet Usage	-0.0831*** (0.0258)	32,736*** (8,532)

Constant	0.767***	41,222***
	(0.0382)	(12,635)
Observations	6,652	6,652
R-squared	0.183	0.143

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

As shown by [Table 11](#) (for complete results visit [A11](#) in the [Appendix](#)), this model modification resulted in highly significant coefficients for our model. With a statistically significant level of 1%, I observe that the individuals who used the internet in the last 12 months experienced a Rs. 32,736 increase in their income. However, this usage of the internet was negatively related to the employability of an individual. This suggests that age potentially acted as a confounding variable, hiding the true strength of the association between internet usage and income. Hence, controlling age revealed a potential trade-off between internet usage and employability, suggesting further investigation.

Finally, another source of bias that I identified was Reverse Causality. Reverse causality occurs when the dependent variable influences the independent variable, potentially generating misleading causal relationships. Since an individual's income and his/her employment status affects the frequency and purpose of internet usage, I identify a potential threat of reverse causality in our model. To address this concern, I adopted the instrumental variable (IV) technique. IV (z-variable) acts as a proxy for the independent(x) variable, directly impacting it but having no direct effect on the dependent(y) variable. This effectively creates a "natural experiment" where changes in the IV can be used to estimate the causal effect of the true independent variable on the outcome. Upon thorough search of our PSLM dataset, I identified

smartphone usage as a potential IV. I made a binary column of whether the individual used a smartphone or not. The logic behind its use as an IV is the availability of internet access through smartphones. Hence, there is a high probability of internet usage of an individual with a smartphone compared to one with no access, hence establishing a direct relationship among the 2 variables. On the other hand, I find no studies/evidence highlighting the relationship among smartphone ownership and income/employment status. This indirect link combined with a previously established direct link allows us to employ smartphone usage as our IV. To utilize the IV, I conducted a two-stage least squares (2SLS) regression. In the first stage, I regressed internet usage on smartphone usage. In the second stage, I replaced the actual internet usage values with the predicted values from the first stage and regressed them on employment/income

Table 12

	(1)	(2)
VARIABLES	Employment	Total Income
Smart Phones	-0.131 (0.0947)	144,358*** (30,886)
Constant	0.674*** (0.0270)	91,396*** (8,794)
Observations	420	420
R-squared	0.004	0.050

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

As shown by [Table 12](#) above, the 2SLS analysis yielded immense changes in our results. The change in income from internet usage increased from 33,117 Rs. from our previous results to a massive 144,358 Rs. in our IV generated model. The presence of IV further rejects any relationship between internet usage and employment status. present the key findings, including coefficient estimates, standard errors, and F-statistics. Explain the implications of these results for the causal relationship between internet usage and employment/income). The substantial increase in the coefficient estimate after accounting for reverse causality suggests that the initial model underestimated the true impact of internet usage on income levels. However, it is crucial to interpret these findings with caution. While the IV approach strengthens the argument for causality, it does not definitively establish it. Further research employing different IVs and robustness checks is necessary to solidify the causal relationship between internet usage and income.

By addressing multicollinearity and reverse causality, I have enhanced the robustness and reliability of our model's estimates. Overall, this comprehensive approach offers a more nuanced understanding of the underlying relationships between the variables in our study.

Appendix

A1 (Summary Statistics)

	Mean	SD
Employed	.7265484	.4457642
Age	42.53969	14.49579
Finished Primary School	.8021648	.3983972
Finished Secondary	.8483163	.358741
Finished Senior Secondary	.9385147	.2402364
Finished degree	.039086	.1938141
HH_Head	1.975195	1.857375
Married	.4873722	.4998781
Divorced	.0153337	.1228856
Widowed	.3967228	.4892543
Region	.2961515	.456593
<i>N</i>	6652	

A2 (Main Regression Results)

	(1)	(2)
VARIABLES	Employment	Total Income
Internet Usage	-0.0877*** (0.0257)	33,117*** (8,533)
Age	0.0149*** (0.00203)	-1,262* (672.7)
Age ²	-0.000234*** (2.13e-05)	34.43*** (7.078)
Region	-0.132*** (0.0122)	3,631 (4,063)
Finished Primary School	0.0948*** (0.0239)	-26,857*** (7,927)
Finished_Secondary School	0.0326 (0.0283)	-28,520*** (9,402)
Finished Senior Secondary School	-0.0410 (0.0369)	-117.5 (12,246)
Finished Degree	0.0188 (0.0415)	118,365*** (13,782)
Married	-0.0204 (0.0217)	15,156** (7,215)
Divorced	-0.0211 (0.0452)	9,275 (15,007)

Widowed	-0.181*** (0.0252)	27,761*** (8,354)
Household Head	0.0930*** (0.0169)	15,840*** (5,602)
2020	0.0813*** (0.0178)	16.52 (5,910)
2019	0.0553*** (0.0192)	9,794 (6,384)
2018	-0.0179 (0.0154)	6,102 (5,097)
2017	-	-
Constant	0.526*** (0.0501)	61,548*** (16,642)
Observations	6,652	6,652
R-squared	0.190	0.143

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

A3 (Sample Regression for Woman Aged 35 and Below)

VARIABLES	(1)	(2)
	Employment	Total Income
Internet Usage	-0.111*** (0.0382)	17,696*** (6,311)
Age	0.0181* (0.0109)	-344.1 (1,807)
Age ²	-0.000285 (0.000209)	23.28 (34.49)
Region	-0.106*** (0.0220)	207.5 (3,638)
Finished Primary_School	0.0599* (0.0359)	-5,146 (5,923)
Finished_Secondary School	-0.0435 (0.0456)	-2,420 (7,528)
Finished Senior Secondary School	-0.00201 (0.0676)	-15,549 (11,163)
Finished Degree	-0.00999 (0.0750)	18,990 (12,389)
Married	-0.0644** (0.0297)	1,300 (4,905)
Divorced	-0.0300 (0.0711)	-26,718** (11,737)

Widowed	-0.138***	4,662
	(0.0440)	(7,261)
Household Head	0.116***	16,011***
	(0.0332)	(5,482)
2020	0.0429	7,831
	(0.0352)	(5,819)
2019	0.0775**	41,583***
	(0.0382)	(6,314)
2018	-0.0426**	-864.4
	(0.0214)	(3,533)
2017	-	-
Constant	0.562***	32,185
	(0.148)	(24,420)
Observations	2,140	2,140
R-squared	0.072	0.112

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

A4 (Sample Regression for Woman Aged Above 35)

	(1)	(2)
VARIABLES	Employment	Total Income
Internet Usage	-0.0996*** (0.0348)	59,457*** (13,179)
Age	0.00198 (0.00479)	-1,796 (1,813)
Age ²	-0.000119*** (4.33e-05)	36.68** (16.38)
Region	-0.135*** (0.0147)	3,329 (5,579)
Finished Primary_School	0.120*** (0.0316)	-39,079*** (11,945)
Finished_Secondary School	0.0511 (0.0363)	-35,665*** (13,742)
Finished Senior Secondary School	-0.0605 (0.0439)	7,137 (16,621)
Finished Degree	0.0364 (0.0498)	158,981*** (18,841)
Married	0.0623 (0.0448)	18,122 (16,943)
Divorced	0.0325 (0.0660)	30,523 (24,976)

Widowed	-0.112**	35,027**
	(0.0443)	(16,748)
Household Head	0.0898***	10,051
	(0.0199)	(7,545)
2020	0.0945***	1,705
	(0.0211)	(7,998)
2019	0.0529**	3,032
	(0.0227)	(8,606)
2018	0.0106	10,428
	(0.0216)	(8,161)
2017	-	-
Constant	0.779***	87,815
	(0.143)	(54,098)
Observations	4,512	4,512
R-squared	0.227	0.140

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

A5 (Sample Regression for Women With Less Than or Equal to 10 Years of Education)

VARIABLES	(1)	(2)
	Employment	Total Income
Internet Usage	-0.0845** (0.0345)	23,477*** (8,420)
Age	0.0154*** (0.00218)	-689.3 (533.5)
Age ²	-0.000220*** (2.30e-05)	19.84*** (5.614)
Region	-0.140*** (0.0133)	-2,192 (3,253)
Finished Primary_School	0.0884*** (0.0238)	-26,887*** (5,807)
Finished_Secondary School	0.00335 (0.0776)	38,297** (18,957)
Finished Senior Secondary School	-0.273 (0.179)	-189,965*** (43,769)
Finished Degree	-	-
Married	-0.0197 (0.0251)	9,402 (6,122)
Divorced	-0.0220 (0.0504)	-12,521 (12,306)

Widowed	-0.189*** (0.0293)	20,133*** (7,143)
Household Head	0.0812*** (0.0183)	20,961*** (4,458)
2020	0.0665*** (0.0193)	6,594 (4,718)
2019	0.0302 (0.0210)	14,781*** (5,132)
2018	-0.0164 (0.0162)	4,252 (3,951)
2017	-	-
Constant	0.769*** (0.168)	190,996*** (41,056)
Observations	5,678	5,678
R-squared	0.147	0.080

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

A6 (Sample Regression for Women With More Than 10 Years of Education)

	(1)	(2)
VARIABLES	Employment	Total Income
Internet Usage	-0.0426 (0.0417)	37,870 (26,188)
Age	-0.00277 (0.00610)	1,410 (3,836)
Age ²	-0.000138** (6.28e-05)	47.73 (39.47)
Region	-0.0343 (0.0303)	7,623 (19,047)
Finished Primary_School	-	-
Finished_Secondary School	-	-
Finished Senior Secondary School	-0.0328 (0.0374)	8,356 (23,511)
Finished Degree	0.0397 (0.0422)	115,927*** (26,503)
Married	0.00395 (0.0438)	10,105 (27,499)
Divorced	-0.0721	121,597*

	(0.101)	(63,525)
Widowed	-0.142***	50,831*
	(0.0484)	(30,443)
Household Head	0.206***	-33,676
	(0.0434)	(27,251)
2020	0.143***	-8,437
	(0.0449)	(28,212)
2019	0.169***	5,927
	(0.0466)	(29,281)
2018	-0.0801*	14,026
	(0.0471)	(29,621)
2017	-	-
Constant	0.887***	-69,570
	(0.130)	(81,933)
Observations	974	974
R-squared	0.372	0.171

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

A7 (Combined Sample Regression for Both Women and Men)

VARIABLES	(1)	(2)
	Employment	Total Income
Internet Usage	-0.0473*** (0.00369)	119,045*** (6,031)
Age	0.0167*** (0.000243)	1,816*** (397.7)
Age ²	-0.000238*** (2.60e-06)	12.93*** (4.246)
Gender	-0.172*** (0.00305)	-57,619*** (4,988)
Region	-0.0287*** (0.00115)	-53,958*** (1,888)
Finished_Primary_School	0.0356*** (0.00163)	-17,947*** (2,659)
Finished_Secondary School	0.0185*** (0.00182)	-20,154*** (2,977)
Finished_Senior Secondary School	0.0237*** (0.00280)	-35,843*** (4,580)
Finished Degree	-0.00291 (0.00351)	35,651*** (5,744)
Married	-0.0257*** (0.00329)	-8,620 (5,382)

Divorced	-0.0322*** (0.0102)	-42,439** (16,690)
Widowed	-0.101*** (0.00437)	-4,758 (7,151)
Household Head	0.0482*** (0.00352)	36,924*** (5,755)
2020	0.0691*** (0.00245)	-73,894*** (4,004)
2019	0.0645*** (0.00255)	-65,072*** (4,177)
2018	0.0475*** (0.00323)	22,206*** (5,281)
2017	-	-
Constant	0.588*** (0.00626)	119,290*** (10,232)
Observations	154,157	154,157
R-squared	0.220	0.032

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

A8 (Sample Regression for Internet Usage at Home and Work)

VARIABLES	(1)	(2)
	Employment	Total Income
Home	0.157** (0.0641)	57,460* (32,930)
Work	0.275** (0.108)	24,939 (55,421)
Age	-0.00214 (0.00958)	-7,357 (4,925)
Age ²	-0.000151 (9.77e-05)	143.7*** (50.19)
Region	0.0492 (0.0471)	1,976 (24,202)
Finished Primary_School	-0.0824 (0.0901)	4,589 (46,323)
Finished_Secundary School	-0.00508 (0.0927)	-23,192 (47,664)
Finished Senior Secondary School	-0.0300 (0.0707)	28,394 (36,315)
Finished Degree	0.0815 (0.0687)	88,451** (35,324)
Married	0.0724 (0.0789)	9,314 (40,524)

Divorced	0.101	229,775***
	(0.142)	(72,745)
Widowed	0.0111	17,664
	(0.0858)	(44,086)
Household Head	0.157	-96,172
	(0.135)	(69,556)
2020	0.0156	-40,194
	(0.0680)	(34,958)
2019	-	-
2018	-	-
2017	-	-
Constant	0.770***	168,497
	(0.248)	(127,427)
Observations	443	443
R-squared	0.246	0.189

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

A9 (Sample Regression for Impact of Internet Usage on Female Paid Employees)

VARIABLES	(1)	(2)
	Employment	Total Income
Internet_Usage	-0	31,571*** (9,117)
Paid Employee	0	-41,903*** (3,391)
Age	0	1,178 (752.8)
Age ²	0	-7.567 (8.545)
Region	-0	-11,045*** (4,135)
Finished_Primary_School	-0	-7,612 (7,998)
Finished Secondary School	0	-7,198 (9,770)
Finished Senior Secondary School	0	-22,721* (12,873)
Finished Degree	0	49,864*** (14,226)
Married	0	2,895 (7,016)

Divorced	-0	20,865 (13,687)
Widowed	-0	6,847 (8,043)
Household Head	0	17,018*** (5,500)
2020	-0	2,663 (5,755)
2019	-0	15,943** (6,309)
2018	-0	1,196 (5,004)
2017	-	-
Constant	1	46,327*** (17,785)
Observations	4,557	4,557
R-squared		0.077

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

A10 (Sample Regression for Impact of Internet Usage on Self Employed Women)

VARIABLES	(1)	(2)
	Employment	Total Income
Internet_Usage	0	31,571*** (9,117)
Self Employed	0	41,903*** (3,391)
Age	0	1,178 (752.8)
Age ²	-0	-7.567 (8.545)
Region	0	-11,045*** (4,135)
Finished_Primary_School	0	-7,612 (7,998)
Finished Secondary School	-0	-7,198 (9,770)
Finished Senior Secondary School	0	-22,721* (12,873)
Finished Degree	0	49,864*** (14,226)
Married	-0	2,895 (7,016)

Divorced	0	20,865 (13,687)
Widowed	0	6,847 (8,043)
Household Head	0	17,018*** (5,500)
2020	-0	2,663 (5,755)
2019	-0	15,943** (6,309)
2018	0	1,196 (5,004)
2017	-	-
Constant	1	4,424 (17,540)
Observations	4,557	4,557
R-squared		0.077

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

A11 (Main Regression Analysis Without the Variable Age to Account for Multicollinearity)

	(1)	(2)
VARIABLES	Employment	Total Income
Internet Usage	-0.0831*** (0.0258)	32,736*** (8,532)
Age ²	-8.09e-05*** (4.71e-06)	21.48*** (1.558)
Region	-0.129*** (0.0123)	3,406 (4,062)
Finished Primary School	0.0954*** (0.0240)	-26,905*** (7,928)
Finished_Secundary School	0.0275 (0.0284)	-28,093*** (9,401)
Finished_Senior Secondary School	-0.0463 (0.0370)	326.9 (12,246)
Finished Degree	0.0171 (0.0417)	118,509*** (13,785)
Married	0.0664*** (0.0183)	7,825 (6,067)
Divorced	0.0643 (0.0439)	2,059 (14,508)
Widowed	-0.0947*** (0.0224)	20,475*** (7,398)

Household Head	0.112***	14,255**
	(0.0167)	(5,539)
2020	0.0869***	-449.6
	(0.0179)	(5,906)
2019	0.0635***	9,101
	(0.0193)	(6,375)
2018	-0.0160	5,939
	(0.0154)	(5,097)
2017	-	-
Constant	0.767***	41,222***
	(0.0382)	(12,635)
Observations	6,652	6,652
R-squared	0.183	0.143

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

A12 (Regression Analysis on Final Sample Using Instrumental Variable to Account for Reverse Causality)

	(1)	(2)
VARIABLES	Employment	Total Income
Smart Phones	-0.131 (0.0947)	144,358*** (30,886)
Constant	0.674*** (0.0270)	91,396*** (8,794)
Observations	420	420
R-squared	0.004	0.050

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

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