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Exploring the Gender-Specific Impacts of Disabilities in Developing Economies: Using the Example of Pakistan

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Academic Editor: Florian Schramm

Submitted: 26 October 2024 Revised: 23 May 2025 Accepted: 16 September 2025 Published: 29 June 2026

Abstract

This study addresses a critical gap in the literature by examining the impact of disabilities on the earnings of men and women, an area that has received limited attention in developing countries. Using data from the 2021 Labour Force Survey (LFS), the research analyzes earnings disparities among males and females with disabilities in a developing-country context. Applying quantile regression, the study assesses how various disabilities—self-care, seeing, hearing, walking, and remembering—affect monthly income. The results reveal that self-care disability leads to the largest earnings loss, followed by seeing and walking disabilities, while hearing and remembering disabilities have no significant effect on income. A further breakdown by gender shows that males experience greater income losses due to disabilities than females, likely reflecting higher labor force participation rates and earnings among men. Notably, the study highlights the important role of education in mitigating income disparities: each additional year of schooling increases females' earnings more than males', underscoring the importance of promoting female education to narrow both the gender pay gap and the disability-related earnings gap. The findings underscore the need for disability-inclusive policies and gender-sensitive educational initiatives to foster a more equitable labor market. The study provides actionable insights and policy recommendations for reducing income disparities and promoting workforce inclusivity.

Keywords: earnings disparities; disability and income; gender pay gap; educational attainment; quantile regression

JEL: C21, J14, J16, J31

1. Introduction

The gender pay gap has been a focal point of economic and sociological research for decades. Numerous studies have meticulously examined the disparities in earnings between men and women across various sectors, industries, and regions, revealing a consistent pattern of unequal pay (Blau and Kahn, 2017; Goldin, 2014). This extensive body of research has illuminated how factors such as occupation, education, and experience contribute to these disparities (Borjas, 2019). However, a crucial and relatively underexplored dimension of this discourse is the intersection between gender pay disparities and disability status. While the overarching gender pay gap is well-documented (Krogstad et al., 2016), there remains a notable deficiency in studies that specifically investigate how disabilities affect earnings and how these effects vary by gender (Jones and Kaya, 2023).

Disability status can significantly influence an individual's earning potential, yet the impact of gender and disability on earnings has not been comprehensively analyzed. Existing literature predominantly focuses on either general gender disparities (Kunze, 2018) or the economic challenges faced by individuals with disabilities (Burkhauser et al., 2012), often neglecting the nuanced interactions between these two critical factors. This oversight is partic-

ularly pronounced in developing countries like Pakistan, where the intersection of gender, disability, and economic outcomes presents a unique set of challenges and opportunities for policy intervention (Hussain et al., 2022; Hussain et al., 2020).

This study aims to address this research gap by examining the role of disabilities in shaping earnings for both males and females in Pakistan. By utilizing the nationally representative data from the Pakistan Labor Force Survey (LFS) 2021, the research applies advanced statistical techniques, specifically quantile regression, to explore how various disabilities such as self-care, seeing, hearing, walking, and remembering affect monthly income. The objective is to provide a detailed analysis of the relative impact of these disabilities on earnings, with a specific focus on gender disparities and the role of educational attainment in mitigating these effects.

To achieve this objective, the study seeks to answer the following research questions (RQ):

RQ1. How do different types of disabilities (self-care, seeing, hearing, walking, remembering) affect monthly earnings in Pakistan? This question aims to isolate the specific impacts of each disability type on income and assess the overall economic burden of disability (Schur and Kruse, 2021).



RQ2. What are the gender-specific impacts of disabilities on earnings? This inquiry explores how disabilities affect earnings differently for males and females, providing insights into gender-specific economic disadvantages (Kaye et al., 2011).

RQ3. What implications do these findings have for policy and practice in addressing disability-related income loss? This question seeks to translate the research findings into actionable recommendations for policymakers and stakeholders to address disability-related income disparities better (Jajtner et al., 2020).

Most existing studies have concentrated exclusively on gender-based earnings disparities (Glauber, 2018) or focused on the economic challenges faced by individuals with disabilities (Burtless, 1990) without delving into how these factors intersect. This study aims to bridge this gap by providing a comprehensive examination of how various disabilities impact earnings differently for males and females. Furthermore, it evaluates how educational attainment influences these outcomes, thus offering a more nuanced understanding of the effects of disability and gender on income (Mitra and Palmer, 2023).

This research is significant for several reasons. Firstly, it provides a clear understanding of how different types of disabilities influence earnings across genders. By identifying the specific disabilities that contribute most significantly to income loss and examining how workplace flexibility can expand employment access, the study enriches the broader discourse on labor accommodations (Schur and Kruse, 2021). The findings offer valuable insights for policymakers, employers, and advocacy groups by highlighting areas where targeted interventions can be implemented (Kaye et al., 2011).

Moreover, the study's finding that education has a differential impact on earnings for males and females underscores the need for tailored educational policies. It suggests that enhancing educational opportunities for women could be a strategic approach to reducing the gender pay gap and addressing disability-related income disparities (Hout, 2012).

The study makes several key contributions to the literature and policy practice. Empirically, it provides new evidence on the earnings impact of various disabilities in Pakistan, contributing to the broader understanding of disability and income inequality (Burkhauser et al., 2012). By revealing the gender-specific differences in earnings loss associated with disabilities, the study informs more equitable and effective policy interventions (Borjas, 2019).

Additionally, the research highlights the critical role of education in mitigating the gender pay gap, suggesting that policies aimed at increasing educational attainment for women could significantly reduce income disparities (Mitra, 2017; Mitra and Palmer, 2023). The findings advocate for concrete measures to address disability-related income loss, thus contributing to more inclusive economic policies

and practices (Burtless, 1990). In summary, this study addresses a critical research gap and offers actionable insights for improving economic outcomes for individuals with disabilities, particularly in the context of gender disparities.

2. Literature Review

The exploration of the gender pay gap has been a central focus of economic research for several decades. However, the impact of gender and disability on earnings has been less extensively studied. This section synthesizes the relevant literature on gender pay disparities and the impact of disabilities on earnings, particularly in developing countries like Pakistan, and highlights the educational implications for mitigating these disparities.

The gender pay gap has been a persistent issue across both developed and developing economies. Blau and Kahn (2017) found that despite the increasing participation of women in the workforce, wage disparities between men and women continue to prevail across industries and sectors. Contributing factors include differences in occupation, work experience, and educational attainment (Borjas, 2008, 2019; Goldin, 2014). In Pakistan, gender pay disparities have similarly been observed, exacerbated by traditional gender roles and limited access to quality education and employment opportunities for women (Moysner, 2019).

Most studies have emphasized structural factors like occupational segregation, with women often concentrated in lower-paying roles, and differences in experience and working hours (Blau and Kahn, 2017; Goldin, 2014; Kunze, 2018). Yet, the intersection of gender with other dimensions of inequality, such as disability, remains underexplored. This is particularly relevant in developing countries where the burden of disability and gender discrimination is intertwined with social norms and economic barriers (Ahmed, 2024).

Disabilities, whether physical or cognitive, impose additional barriers to economic participation, resulting in significant earning losses for individuals. The study has shown that individuals with disabilities earn less than their non-disabled counterparts, even when controlling for factors such as education and experience (Burkhauser et al., 2012). Schur and Kruse (2021) noted that this earning gap is often more pronounced for individuals with severe disabilities or those requiring assistance for daily activities.

In developing countries like Pakistan, where social protection for individuals with disabilities is limited, the economic consequences of disability are even more severe (Ahmed, 2024). Disabilities such as self-care, seeing, walking, and remembering are found to have varying degrees of impact on earnings, with some forms of disability leading to greater economic exclusion than others. Burkhauser et al. (2012) highlighted that individuals with disabilities often face discrimination in the labor market, limiting their access to higher-paying jobs and promotions.

Education has long been recognized as a key determinant of earnings, and this holds particularly true for individuals with disabilities. Research indicates that every additional year of education increases the earning potential for individuals, and this effect is often more pronounced for women (Hout, 2012). In Pakistan, the LFS 2021 data reveals that while disabilities lead to earning losses for both genders, the impact of education in offsetting these losses is greater for females. Educated women with disabilities appear to benefit more from educational attainment than their male counterparts, likely because education helps overcome some of the traditional barriers to female employment (Mitra, 2017).

The differential impact of education on male and female earnings suggests that policies aimed at increasing access to education for women, particularly those with disabilities, could be a strategic way to reduce both the gender pay gap and disability-related earning disparities. This underscores the need for more inclusive educational programs that cater specifically to the needs of disabled women (Schur and Kruse, 2021).

The findings from existing literature and this study underscore the urgent need for policy interventions that address the economic disadvantages faced by individuals with disabilities, particularly women. Holm et al. (2024) argue that policymakers must focus on reducing the economic burden of disabilities through targeted support programs and inclusive labor market policies. In Pakistan, where social protection for individuals with disabilities is limited, the introduction of more comprehensive disability-inclusive policies is essential.

Policy interventions should also prioritize educational access and quality for women with disabilities. Enhancing educational opportunities for these women can help them acquire the skills needed to participate more fully in the labor market, thus reducing both the gender pay gap and the income disparities associated with disabilities (Hout, 2012).

Governments and employers should collaborate to create more inclusive labor markets accommodating individuals with disabilities. This could involve enforcing anti-discrimination laws, offering vocational training programs tailored to the needs of disabled individuals, and incentivizing employers to hire people with disabilities (Burkhauser et al., 2012) such policies would help mitigate the income loss associated with disabilities and ensure that individuals with disabilities have equal employment opportunities.

Investment in education, particularly for women with disabilities, is crucial for reducing income disparities. Programs that provide scholarships, vocational training, and job placement services for disabled women can help bridge the gap between education and employment (Mitra and Palmer, 2023; Moyser, 2019). Furthermore, awareness campaigns aimed at changing societal perceptions of women with disabilities can reduce the stigma that of-

ten limits their participation in the workforce (Otten and Alewell, 2020; Woerdeman and van der Meulen Rodgers, 2006; Zhang et al., 2024).

While the gender pay gap has been widely studied, the specific impacts of disabilities on earnings and how these effects differ by gender require further investigation, particularly in developing countries like Pakistan. The literature reviewed highlights the significant economic disadvantages faced by individuals with disabilities, especially women, and underscores the potential of education as a key factor in reducing these disparities. By implementing disability-inclusive policies and improving access to education, policymakers can take meaningful steps toward addressing both gender and disability-related income inequalities.

3. Understanding Disability Recognition in Pakistan: Definition, Classification, Diagnosis, and Labor Market Implications

3.1 Definition and Classification of Disabilities

Disability in Pakistan is generally defined under international frameworks such as the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) and the World Health Organization (WHO)'s International Classification of Functioning, Disability, and Health (ICF). In Pakistan's national labor market and policy framework, disabilities are categorized based on their impact on an individual's ability to perform daily activities and participate in economic and social life.

In the LFS 2021, five specific disabilities are identified as binary variables, where individuals are classified as either having a particular disability (coded as 1) or not having it (coded as 0). The dataset includes the following categories of disabilities:

1. Self-care disability—Individuals who have difficulty performing basic daily activities such as eating, dressing, or personal hygiene (1 = 137, 0 = 93,229).

2. Seeing disability—Those who experience vision impairments, ranging from partial sight loss to complete blindness (1 = 1743, 0 = 91,623).

3. Hearing disability—Individuals with partial or complete hearing loss that affects their ability to communicate or process auditory information (1 = 362, 0 = 93,004).

4. Walking disability—Those who experience mobility issues, ranging from difficulty walking to complete immobility (1 = 1769, 0 = 91,597).

5. Remembering disability—Individuals who face cognitive impairments affecting memory retention, concentration, or decision-making (1 = 168, 0 = 93,198).

These classifications are crucial in understanding the economic challenges faced by people with disabilities (PWDs), particularly in labor market participation and income disparities.

3.2 Diagnosis and Certification Process

In Pakistan, the process of diagnosing and certifying disabilities varies by region and is governed by a mix of medical assessments, self-reported declarations, and government-issued disability certificates. The system generally follows these steps:

1. Medical Diagnosis:

- Individuals seeking formal recognition of disability typically undergo a medical evaluation at a government hospital or a designated healthcare facility.
- Medical practitioners assess the severity of impairment and its impact on daily functioning.

2. Government Certification:

- Those diagnosed with a disability may apply for a Disability Certificate through provincial Social Welfare Departments.
- The certification process is inconsistent, and many PWDs remain uncertified due to bureaucratic challenges, lack of awareness, or limited access to healthcare facilities.

3. Self-Reported Disability (as in LFS 2021):

- The Pakistan LFS relies on self-reported data, meaning respondents themselves declare whether they have a disability without necessarily providing official medical certification.
- This introduces potential discrepancies, as some individuals might underreport their disabilities due to stigma or lack of awareness, while others might overreport based on personal perception rather than formal medical criteria.

4. Legal and Policy Framework:

- Pakistan has enacted laws such as the Disabled Persons (Employment and Rehabilitation) Ordinance, 1981, and later amendments that mandate employment quotas (usually 2% for persons with disabilities in public and private organizations).
- However, implementation remains weak, with many organizations either unaware of or non-compliant with these requirements.

3.3 Implications for Labor Market Participation

The classification and recognition of disabilities significantly impact the labor market participation of individuals with disabilities in Pakistan. The key implications are as follows:

1. Barriers to Employment:

- PWDs face higher unemployment rates due to discrimination, lack of workplace accommodations, and limited access to vocational training.
- The stigma associated with disabilities often results in lower hiring rates and underemployment, particularly in formal sector jobs.

2. Earnings Disparities:

- The study finds that self-care, seeing, and walking disabilities are associated with substantial earnings losses, particularly for men, who generally have higher labor force participation.

- Hearing and remembering disabilities show no significant impact on earnings, potentially due to less severe workplace restrictions or stronger coping mechanisms for affected individuals.

3. Role of Education:

- Education significantly mitigates income disparities. The study highlights that each additional year of schooling increases females' earnings more than males', suggesting that investing in education for women with disabilities can be a key strategy for reducing gender and disability-related income gaps.

- However, access to education remains a challenge for many PWDs, particularly in rural areas where inclusive educational facilities are scarce.

4. Disability-Related Labor Market Policies:

- The 2% employment quota for PWDs in public and private organizations is often not met, highlighting the need for stricter enforcement and incentives for inclusive hiring practices.
- There is a pressing need for workplace accommodations, such as assistive technologies, flexible work arrangements, and skill development programs, to improve employment outcomes for PWDs.

3.4 Ethical Considerations and Data Anonymization

The dataset used in this study is derived from the Pakistan LFS 2021, which is anonymized and complies with ethical standards for research involving human subjects. The self-reported nature of disability data, while valuable for broad trends, should be interpreted with caution, as it may not always align with officially recognized disability statuses.

3.5 Labor Market Characteristics and the Inclusion of Persons with Disabilities in Pakistan

Understanding the characteristics of Pakistan's labor market is essential to contextualize the employment challenges faced by PWDs. The labor force participation rate stands at approximately 44.9%, with a significant gender disparity: 61% for men and 22% for women. The unemployment rate is about 6.3%, but PWDs often experience higher unemployment due to barriers such as discrimination and inadequate workplace accommodations.

The labor market is predominantly informal, with around 72% of workers engaged in informal employment lacking social protections and disability accommodations. This informality poses challenges for PWDs in securing stable and equitable employment. Sector-wise, agriculture employs 38% of the workforce, industry 23%, and services 39%. PWDs often find more opportunities in the services sector, which may offer roles better suited to varying abilities.

Wage disparities are evident, with male workers generally earning more than their female counterparts. PWDs, particularly those with self-care, seeing, and walking dis-

abilities, face substantial income gaps due to limited access to suitable employment and necessary accommodations. Education emerges as a critical factor in bridging these gaps; each additional year of schooling has a more pronounced positive impact on the earnings of female PWDs, underscoring the importance of educational initiatives for this group (INTERNATIONAL LABOUR OFFICE, 2018).

Despite legislative measures like the Disabled Persons (Employment and Rehabilitation) Ordinance of 1981, which mandates employment quotas for PWDs, enforcement remains inconsistent. Challenges such as discrimination, lack of accessible workplaces, and limited vocational training opportunities continue to hinder the full economic integration of PWDs in Pakistan.

4. Data and Methodology

4.1 Data

The study is based on nationally representative data from the Pakistan LFS 2021. The data are publicly available on Pakistan Bureau of Statistics website (<https://www.pbs.gov.pk/labour-force-publications>), the bureau has been collecting data from labor since 1963 using two-stage stratified sampling. The survey covers all urban and rural areas across Pakistan's four provinces, Islamabad, and military-restricted zones, excluding 2% of semi-autonomous tribal regions. Data were gathered through direct interviews, primarily with the head of each household, who provided information about all members. If the head of the household was unavailable at the time of the visit, another informed family member was interviewed. The Pakistan Bureau of Statistics uses the Washington Group on Disability Statistics short set (WG-SS) of questions to measure disabilities among people, regardless of whether they live in urban or rural areas or have a higher or lower status. The questions are designed using modern ideas about disability and are based on the World Health Organization's ICF framework. For instance, to measure the self-care disability a question is asked, "[Do/does] [you/he/she] have difficulty with self-care, such as washing all over or dressing?" the response is recorded into four options ranging from no difficulty to cannot do at all. The sample was evenly distributed across quarters to balance seasonal variations, with information reflecting the week before each interview. In total 96,442 households were interviewed; however, we only considered 18 to 65 years old labor and dropped those who had more than one disability to better capture the impact of one disability. We finally ended up with 93,366 observations. Quantile regression is employed to explore how these variables influence earnings across different points in the income distribution.

4.2 Variables

Y: individuals' monthly earnings (income), measured in Pakistani Rupees (PKR), ranging from 833 PKR to 1.2 million PKR (1 PKR = 0.00359 USD).

- **Gender (G):** A binary variable where $G = 1$ for males and $G = 0$ for females, we had 82,407 males and 10,959 females in our data set.

- **Age:** Continuous variable ranging from 18 to 65 years old laborers.

- **Education (E):** Continuous variable representing years of formal education ranging from 1 to 15 years of education.

- **Region:** A binary variable where 1 represents urban and 0 for rural, we had 26,625 from urban and 66,741 laborers from rural areas.

- **Working hours (weekly):** A continuous variable showing how many hours a laborer works in a week it ranges from 0 to 99 hours.

- **Disability types:** Five binary variables indicating the presence or absence of specific disabilities, coded as 1 for presence and 0 for absence:

D_s Self-care disability (1 = 137, 0 = 93,229).

D_v Seeing disability (1 = 1743, 0 = 91,623).

D_h Hearing disability (1 = 362, 0 = 93,004).

D_w Walking disability (1 = 1769, 0 = 91,597).

D_r Remembering disability (1 = 168, 0 = 93,198).

4.3 Methodology

To analyze the impact of gender, age, region, working hours, education, and disabilities on earnings, we employed a quantile regression model to set the quantile at 50th, it estimates the regression at median earnings instead of mean earnings that are estimated using ordinary least squares (OLS) method. Median regression provides more accurate and robust estimates mainly because it represents the actual income distribution of the data. The general quantile regression model used in this study is specified as follows:

$$Q_Y(\tau | G, E, D_s, D_v, D_h, D_w, D_r) = \beta_0(\tau) + \beta_G(\tau)G + \beta_E(\tau)E + \beta_{D_s}(\tau)D_s + \beta_{D_v}(\tau)D_v + \beta_{D_h}(\tau)D_h + \beta_{D_w}(\tau)D_w + \beta_{D_r}(\tau)D_r + \gamma_{G_s}(\tau)G \times D_s + \gamma_{G_v}(\tau)G \times D_v + \gamma_{G_h}(\tau)G \times D_h + \gamma_{G_w}(\tau)G \times D_w + \gamma_{G_r}(\tau)G \times D_r + \gamma_{GE}(\tau)G \times E \quad (1)$$

Where:

- $Q_Y(\tau | \cdot)$ is the conditional quantile of earnings at the quantile τ .

- $\beta_0(\tau)$ is the intercept quantile τ .

- $\beta_G(\tau)G + \beta_E(\tau)E + \beta_{D_s}(\tau), \dots, \beta$ are the coefficients representing the effects of age, gender, education, region, working hours, and disability types on earnings at quantile τ (50th). We ran five models on total data for each disability to capture its total impact on monthly earnings. Then in the second stage, we ran five models for males and five for females to examine the impact of each disability on males' and females' earnings separately.

Quantile regression is particularly important when analyzing wage disparities, as the impact of variables like gen-

der and disability may differ across low, median, and high earners. We estimate the model for the 50th quantile (median earnings). However, we ran the model at the 10th and 90th quantiles along with OLS to compare the coefficients (results of all these models are given in the Appendix). We chose the median earnings (50th quantile) model because of its better and more accurate estimates. The estimated coefficients $\beta(\tau)$ provide insights into how the variables impact earnings. Positive coefficients indicate a positive effect on earnings, while negative coefficients indicate a reduction in earnings. We further ran more models for males and females separately to capture the impact of independent variables on earnings. Moreover, we used the “*quantreg*” package in R software 4.5.1 (The R Foundation for Statistical Computing, Vienna, Austria) for estimating Quantile Regression models and conducting policy simulations.

4.4 Ethical Considerations

Given that the data includes sensitive information on disabilities, gender, and income, appropriate measures are taken to ensure the confidentiality of the respondents. The dataset from the Pakistan LFS is anonymized, and the analysis complies with ethical standards for research involving human subjects.

This methodology provides a comprehensive framework for analyzing the impact of gender, education, and disabilities on earnings in Pakistan. By employing quantile regression, we gain a more detailed understanding of how these factors influence different segments of the income distribution, offering valuable insights for policymakers aiming to reduce gender and disability-related income disparities.

5. Results

Table 1 presents the 50th quantile regression for combined (male and female together) data. It shows that self-care disability reduces 3391 PKR monthly, disability seeing reduces 2634 PKR, and walking disability reduces 2190 PKR monthly. However, hearing and remembering disabilities were found insignificant, implying that these two disabilities are not affecting the monthly earnings of Pakistani laborers. As we expect male laborers are earning around 8000 PKR more than female laborers, implying that there is a significant gender pay gap in the Pakistani labor force market. On the other hand, age (proxy of experience), education, working hours, and being in an urban area positively affect labor’s earnings (See Appendix Fig. 1).

Table 2 presents the 50th quantile regression for males and females separately. Interestingly, for males’ self-care disability reduced the earnings the most (3583) followed by seeing (3174) walking and remembering disabilities. While for females only remembering disability reduces 1325 PKR monthly and the rest of the disabilities were not significantly affecting earnings. Perhaps, higher male participation in the labor force market is the main reason associated

with higher male earning loss. Surprisingly, education increases female’s earnings more than male’s earnings in all models. Implying that education is foremost important for females and it can significantly reduce the gender pay gap in Pakistan. It is also shown that urbanization increases females’ earnings more than males’ earnings, however, the difference is minimal.

Although we ran the OLS, as well as the 10th, 50th, and 90th quantile regressions once (results included in the Appendix Table 3), however, we rely on the 50th quantile outcomes. This choice ensures that the results reflect the true data distribution, avoiding the biases of either inflated or deflated coefficients seen in other quantiles. Moreover, economists often prefer median earnings over mean earnings because the median is less affected by extreme values, making the 50th quantile regression more appropriate for capturing the true relationship between independent variables and income.

6. Policy Implications

The analysis highlights significant disparities in earnings based on gender, disability, and education. To foster a more inclusive and equitable labor market, policy interventions must be designed to address these factors. Below are the recommended policy actions to close the gender pay gap, support individuals with disabilities, and ensure equitable access to education:

The relevant authorities such as the Higher Education Commission (HEC) of Pakistan and the Ministry of Education should promote women into leadership positions through targeted educational programs and sponsorship opportunities. In addition, authorities should address biases in promotions, pay reviews, and performance evaluations to ensure women have equal opportunities for advancement. Breaking the “*glass ceiling*” is essential to reducing the widening income gap between men and women. Moreover, individuals with disabilities face substantial earnings penalties. Policies must focus on improving workplace accommodations and making sure that all jobs, particularly high-paying ones, are accessible to individuals with disabilities. Creating disability-inclusive hiring practices and offering tailored career development programs to help individuals with disabilities advance in their careers.

Providing specialized training and support to ensure that disabled workers are not disproportionately penalized in terms of pay. By prioritizing accessibility and equity, these policies can help individuals with disabilities fully participate in the labor market and reduce the income penalties they face. Education significantly boosts earnings, with the effect of being stronger for higher earners. However, to maximize the benefits of education for income equality, policies should ensure:

Equitable access to quality education for all socioeconomic groups, particularly lower-income individuals and underserved populations. Programs aimed at encour-

Table 1. Quantile regression results for monthly earnings on full data (male and female together).

DV: Monthly earnings	Estimates	Std. error	t value	Pr(> t)
Model 1				
(Intercept)	-8650.80	166.04	-52.10	0.000
Gender male	8092.73	105.90	76.42	0.000
Age	247.73	3.76	65.94	0.000
Education	1854.40	17.04	108.83	0.000
Region urban	2093.59	100.07	20.92	0.000
Working hours (weekly)	74.43	3.07	24.25	0.000
Disability-selfcare	-3391.52	1343.19	-2.52	0.012
Model 2				
(Intercept)	-8734.80	162.29	-53.82	0.000
Gender male	8081.96	98.57	81.99	0.000
Age	251.37	3.71	67.68	0.000
Education	1857.99	16.99	109.37	0.000
Region urban	2101.38	95.63	21.97	0.000
Working hours (weekly)	74.10	2.96	25.06	0.000
Disability-seeing	-2634.80	358.04	-7.36	0.000
Model 3				
(Intercept)	-8643.16	166.54	-51.90	0.000
Gender male	8087.46	106.97	75.60	0.000
Age	247.32	3.76	65.75	0.000
Education	1855.25	17.05	108.79	0.000
Region urban	2097.85	100.70	20.83	0.000
Working hours (weekly)	74.43	3.08	24.14	0.000
Disability-hearing	129.49	656.58	0.20	0.844
Model 4				
(Intercept)	-8712.47	167.14	-52.13	0.000
Gender male	8105.37	105.05	77.16	0.000
Age	250.63	3.77	66.47	0.000
Education	1851.76	17.11	108.22	0.000
Region urban	2125.78	101.65	20.91	0.000
Working hours (weekly)	74.07	3.06	24.22	0.000
Disability-walking	-2190.41	310.59	-7.05	0.000
Model 5				
(Intercept)	-8647.48	167.66	-51.58	0.000
Gender male	8097.88	106.73	75.88	0.000
Age	247.58	3.77	65.67	0.000
Education	1854.48	17.11	108.38	0.000
Region urban	2097.75	101.28	20.71	0.000
Working hours (weekly)	74.34	3.08	24.10	0.000
Disability-remembering	-1505.66	1350.09	-1.12	0.265

** *Notes.* DV, Dependent Variable; Number of Observations: 93,366.

aging continued education and upskilling, particularly for women and individuals with disabilities, to enhance their career prospects and earning potential. Integration of education initiatives with broader policies aimed at addressing both gender and disability inequalities in the workforce. These efforts can help bridge the income gap and ensure that education becomes a more effective tool for promoting upward mobility across all segments of society.

By implementing these targeted interventions, policymakers can address the key barriers contributing to income inequality and promote a more inclusive labor market where education, gender, and disability are no longer sources of disparity but rather opportunities for growth and equality.

7. Discussion

This study provides valuable insights into the interplay between disabilities, gender, education, and earnings

Table 2. Quantile regression for monthly earnings (male and female separately).

Models	Estimates for male		Estimates for female	
	Estimate	Pr(> t)	Estimate	Pr(> t)
Model 1				
(Intercept)	36	0.892	-7135	0.000
Age	264	0.000	125	0.000
Education	1816	0.000	1939	0.000
Region urban	2176	0.000	1284	0.000
Working hours (weekly)	55	0.000	160	0.000
Disability-selfcare	-3583	0.012	-683	0.923
Model 2				
(Intercept)	4	0.987	-7164	0.000
Age	268	0.000	125	0.000
Education	1816	0.000	1941	0.000
Region urban	2179	0.000	1261	0.000
Working hours (weekly)	53	0.000	160	0.000
Disability-seeing	-3174	0.000	-658	0.139
Model 3				
(Intercept)	21	0.937	-7135	0.000
Age	264	0.000	125	0.000
Education	1817	0.000	1939	0.000
Region urban	2182	0.000	1284	0.000
Working hours (weekly)	55	0.000	160	0.000
Disability-hearing	-131	0.863	1553	0.404
Model 4				
(Intercept)	50	0.848	-7141	0.000
Age	266	0.000	125	0.000
Education	1811	0.000	1939	0.000
Region urban	2188	0.000	1292	0.000
Working hours (weekly)	54	0.000	160	0.000
Disability-walking	-2590	0.000	-403	0.344
Model 5				
(Intercept)	13	0.961	-7135	0.000
Age	264	0.000	124	0.000
Education	1817	0.000	1939	0.000
Region urban	2178	0.000	1287	0.000
Working hours (weekly)	55	0.000	160	0.000
Disability-remembering	-1361	0.000	-1325	0.002

** *Notes.* DV, Dependent Variable; Number of Observations for Male = 82,407; Female = 10,959.

in the context of a developing country, specifically using data from the Pakistan LFS 2021. The findings align with previous literature, particularly in highlighting the significant economic disadvantages faced by individuals with disabilities. The quantile regression analysis reveals that income loss varies depending on the type of disability, with self-care disabilities leading to the most significant reduction in earnings, followed by vision and walking disabilities. These findings resonate with studies cited in the literature review, which also point to the economic barriers faced by individuals with disabilities in labor markets globally. However, our study diverges from some previous studies by

showing that hearing and memory disabilities do not have a statistically significant impact on earnings, an outcome that warrants further exploration in future research.

A key finding of this study is that males experience greater earnings losses due to disabilities than females, a pattern that contrasts with the findings from the literature review, which suggests that women tend to face higher economic barriers in labor markets, especially in developing countries. This discrepancy may be attributed to the physical demands of male-dominated sectors such as agriculture and construction, where disabilities may severely limit earning potential. In contrast, women in our study

appear to experience less income loss due to disabilities, which could reflect the gendered structure of the labor market where women are more likely to work in lower-paying, less physically demanding sectors. Nevertheless, the broader economic challenges faced by women, particularly in gender-unequal labor markets, remain significant, echoing the issues identified in prior studies (Manzoor et al., 2022; Rashid, 2023).

The study also underscores the critical role of education as a mitigating factor, particularly for women. Our findings align with the literature review, which highlights that education plays a significant role in enhancing employment opportunities and earnings, particularly for women. In this study, each additional year of education significantly increases female earnings, more so than male earnings, emphasizing education's role in closing the gender pay gap. This is consistent with prior research that suggests education is a powerful tool for promoting gender equality, providing women with greater access to higher-paying jobs and economic mobility (Hauenstein et al., 2022).

While education provides substantial benefits for all individuals, its impact is disproportionately greater for women in this context, making it a critical mechanism for reducing income inequality. These results support the argument in the literature that expanding educational opportunities for women can significantly enhance their participation in the labor market and improve their economic outcomes. However, this finding also suggests that further attention should be paid to overcoming gender-based barriers to education and employment to fully realize the potential of education as an equalizer.

The implications of these findings are clear: targeted interventions are necessary to address both gender- and disability-related inequalities in the labor market. Policymakers must focus on promoting disability-inclusive employment practices, improving access to education for women and individuals with disabilities, and reducing gender- and disability-based discrimination in the workplace. These efforts align with the recommendations presented in the literature review for creating a more inclusive labor market. Expanding workplace accommodations, ensuring equal pay, and providing education and training programs for underrepresented groups are essential to fostering a more equitable labor market.

Furthermore, it would be interesting to consider how the transferability of these findings might vary in countries with more developed social security systems. In countries where social safety nets are stronger, the economic disadvantages associated with disabilities may be mitigated to some extent, potentially altering the dynamics observed in Pakistan. Future research could explore how differences in social security systems influence the economic outcomes of individuals with disabilities and how these systems might buffer the economic disparities tied to both disability and gender (Emmett and Alant, 2006).

In conclusion, this study contributes to the growing body of research on the intersections of disabilities, gender, education, and earnings in developing countries. While it affirms many findings in the literature, such as the importance of education in reducing gender disparities, it also provides new insights into the gendered and disability-specific dimensions of income inequality. By focusing on inclusive policies that enhance access to education and promote equitable employment practices, Pakistan, and other developing countries, can work toward a more inclusive labor market that reduces income inequality across society.

8. Conclusion

This study provides valuable insights into the interplay between disabilities, gender, education, and earnings in the context of a developing country, specifically using data from the Pakistan LFS 2021. The quantile regression analysis sheds light on the profound economic disadvantages faced by individuals with disabilities, with varying degrees of income loss depending on the type of disability. Notably, self-care disabilities lead to the most significant reduction in earnings, followed by vision and walking disabilities, while hearing and memory disabilities do not have a statistically significant impact on earnings.

A key finding of the study is that males experience greater earnings losses due to disabilities than females. This is likely influenced by the physical demands of male-dominated sectors such as agriculture and construction, where disabilities can severely limit earning potential. In contrast, females appear to experience less income loss due to disabilities, but this does not diminish the broader economic challenges they face, particularly in a gender-unequal labor market.

The study also highlights the critical role of education as a mitigating factor, particularly for women. Each additional year of education significantly increases female earnings, more so than male earnings, suggesting that education serves as a powerful tool for closing the gender pay gap. This finding underscores the importance of promoting gender equality in education, as education not only boosts women's earning potential but also helps them access higher-paying jobs, especially at the upper end of the income distribution.

The overall findings suggest that while education provides significant benefits for all individuals, it disproportionately improves the earnings of women, making it a key mechanism for fostering economic mobility and reducing income inequality. These results highlight the need for policies that address both gender- and disability-related inequalities in the labor market.

To address these disparities, targeted interventions are essential. Policymakers should focus on promoting disability-inclusive employment practices, improving access to education for women and individuals with disabilities, and reducing both gender and disability-based dis-

Table 3. OLS results in 10th, 50th, and 90th quantile regressions.

Variables	OLS		QR 50th		QR 10th		QR 90th	
	Beta	p-value	Beta	p-value	Beta	p-value	Beta	p-value
Gender	8937	<0.001	8093	<0.001	3975	<0.001	12,422	<0.001
Age	381	<0.001	248	<0.001	70	<0.001	578	<0.001
Education	2391	<0.001	1854	<0.001	651	<0.001	3523	<0.001
Region	3333	<0.001	2094	<0.001	2047	<0.001	4049	<0.001
Weekly working hours	80	<0.001	74	<0.001	65	<0.001	119	<0.001
Disability self-care	-4752	0.026	-3392	0.012	-3190	<0.001	-6674	0.2

OLS, Ordinary Least Squares; QR, Quantile Regression.

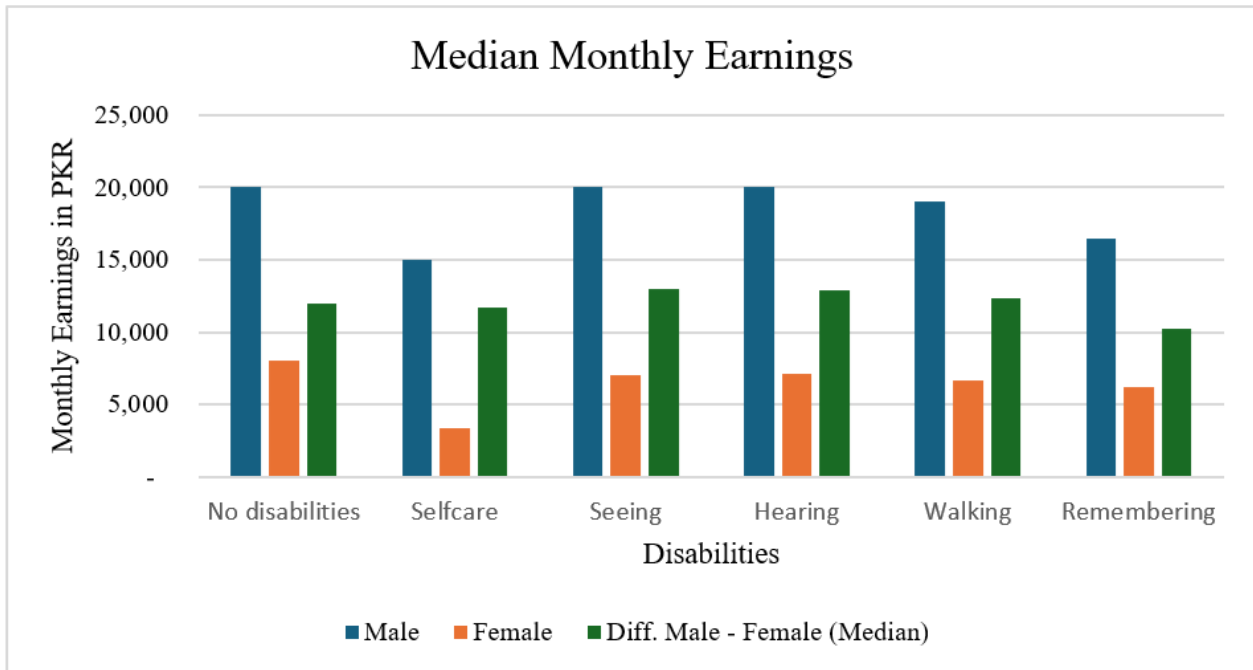


Fig. 1. Monthly earnings based on different disabilities. PKR, Pakistani Rupees. Note. 1 PKR = 0.00359 USD. Conversely, 1 USD is worth approximately 278.52 PKR.

crimination in the workplace. Efforts such as expanding workplace accommodations, ensuring equal pay, and offering education and training programs for underrepresented groups are crucial for creating a more equitable labor market.

In conclusion, the findings emphasize that education is a critical equalizer in reducing gender disparities in earnings, while the substantial income losses associated with disabilities call for urgent action. By focusing on inclusive policies that enhance access to education and promote equitable employment practices, Pakistan can foster a more inclusive labor market and reduce income inequality across society.

9. Limitations and Future Research

While this study provides important insights into the intersections of disability, gender, education, and earnings, several limitations should be acknowledged. The primary

limitation is the reliance on cross-sectional data, which offers only a snapshot of the variables at a single point in time. This restricts the ability to establish causal relationships between disability, gender, education, and earnings, as the data does not account for the temporal dynamics that could influence these factors. A longitudinal approach would be more effective in capturing how the impact of disabilities and gender on earnings evolves, as well as how education influences earnings trajectories for different groups in the long term. Additionally, this study does not account for regional and sectoral variations in the impact of disabilities on earnings. Given the diverse economic conditions and labor market structures in developing countries, the effects of gender and disabilities on earnings may vary significantly across different regions and industries. Future research should explore how these factors differ across regions and sectors, which would provide a more nuanced understanding of the challenges different groups face and help design

more targeted and effective policy recommendations. Despite these limitations, this study advances our understanding of how disabilities and gender jointly shape economic outcomes in the context of developing countries. It provides both theoretical and practical implications, serving as a foundation for more inclusive policies aimed at reducing income inequality and supporting marginalized groups in the labor market.

Availability of Data and Materials

The datasets used or analysed during the current study are available from the corresponding author on reasonable request.

Author Contributions

MI, MH, and LF conceptualized and designed the research study. All authors performed the research, contributed to data analysis, and provided technical help and advice. MI led the methodological development and data processing; MH coordinated the analytical framework and interpretation; LF focused on validation and refinement of the study design. MI, MH, and LF drafted the manuscript and contributed to critical editorial revisions. All authors read and approved the final manuscript and agreed to be accountable for all aspects of the work.

Acknowledgment

Not applicable.

Funding

This research was funded by the National Foreign Expert Project (Foreign Youth Talent Program) under Grant No. Y20240101, awarded to Mohammad Heydari. The grant supported the corresponding author's contribution and was administered through Associate Professor Mingxing Li at the School of Management, Jiangsu University. The authors gratefully acknowledge the program's generous support, which played a crucial role in the successful completion of this study.

Conflicts of Interest

The authors declare no conflicts of interest.

Appendix

See Table 3 and Fig. 1.

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