Does educational inequality lead to income inequality? Evidence from Pakistan

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Abstract: One of the main issues that developing nations like Pakistan are dealing with is income inequality. Education, inter Alia, plays a key role in reducing income inequality. Theoretically, in developing countries, it is anticipated that there exist two groups: the bourgeoisie (have) and the proletariat (have not), as suggested by Karl Marx, and there is an educational difference between these two groups, and Pakistan is no exception. This study aims to investigate the impact of educational inequality on income inequality at the provincial level of Pakistan with a rural-urban break up for the period from 1998-99 to 2018-19 (pooled data). Keeping in view the nature of the data, panel data techniques are applied. Appropriate tests (i.e., the F-test and the Hausman Specification test) suggest that Fixed Effect Model is the preferred model. The results show that there is a statistically significant positive link between educational inequality and income inequality. The results are robust to various proxies of educational inequality and income inequality (i.e., Gini coefficient, Generalized Entropy, and Atkinson Index) as well as to control variables (i.e., income and poverty). Further, the study found the negative relation between income and income inequality to be statistically significant, indicating that an increase in income leads to a decrease in income inequality. Moreover, the impact of poverty on income inequality is positive and statistically significant. The policy insinuation is that the government should focus on reducing educational inequality to reduce income inequality in Pakistan.

Keywords: *Educational inequality, Income inequality, Pakistan, Panel data models, Per capita income, Poverty.*

1. Introduction

Income inequality (InIn) is a threat to every country's economic development. Therefore, ININ has become the most interesting topic among researchers and policy makers over the last many years. As InIn increases, it influences the country's development process. InIn increases during the initial stages of development and then passes to its maximum, while on the later development stage it declines. This is known as the inverted U-shaped link between InIn and economic development, called Kuznets curve [1]. The unequal distribution of income enhance educational inequality (EduIn) between different income groups (i.e., bourgeoisie (have) and proletariat (have not)) and generates further InIn for coming generations [2]. Moreover, human capital is the most crucial element for enhancing economic growth as well as income [3]. If the educational disparity is larger, greater InIn is anticipated to exist in that nation. Equal and greater access to higher education play a vital role in decreasing InIn Gregorio and Lee [4] and Lin [5].

The African motto is "If we educate a boy, we educate one person. If we educate a girl, we educate a family and a whole nation. "Concerning the removal of EduIn, the United Nations set one of the Millennium Development Goals (MDGs) for 2015 at all levels of higher and secondary education [6]. EduIn among genders causes a reduction in the literacy rate in a country Summers [7] and Hill and King

[8]. Education investment can help to eliminate the InIn as well as poverty, which promotes country development. Existing studies demonstrate that the enhancement of education is the key factor that enhances people's income level and helps to decrease InIn Baye and Epo [9], and Ismail and Yussof [10]. In addition, other studies depicted that more education as well as even distribution of education among people leads towards the InIn reduction Gregorio and Lee [4] and Lin [5].

Moreover, female qualification also contributes to diminishing infant mortality, promoting family and child health, and stimulating educational quality as well as quantity, particularly in less developed countries. In addition, it also enhances the productivity of labor Knowles, et al. [11]. Further, Rama, et al. [12] disclosed that South Asia's richest countries have experienced more InIn, and also enhanced as countries became more developed. Children from lower-income groups face difficulties completing their education. However, female access to higher education is increasing among developed countries, but in Pakistan, in higher education, female participation is one-third. The second poorest nation in terms of gender equality is Pakistan [13].

Several studies have focused on finding the factors affecting InIn. Several economists explained factors affecting InIn Paukert [14]; Ahluwalia [15]; Papanek and Kyn [16]; Tsakloglou [17]; Randolph and Lott [18]; Jha [19]; Dawson [20]; Eusufzai [21]; Mbaku [22]; and Huang [23]. Deininger and Squire [24] used a new data set based on household surveys, consisting of all sources of income, and estimated the link between InIn and EcoG for 48 countries. They discovered relationships of inverted U-shape curves in Brazil, the Philippines, Hungary, Trinidad & Tobago, and Mexico, while relationships of U-shape curves were found in other countries, like India, the United Kingdom, and the United States. The Kuznets hypothesis was also examined by Kim, et al. [25] from 1945 to 2004 using a cross-state panel data set for the United States. The relationship between InIn and development was discovered by the study. Instead of an inverted U, a U-shaped association was discovered. It implies that inequality initially falls and subsequently rises with EcoG. In the initial stages of development, structural changes in the economy, such as the shift from agrarian to industrial or service-based economies, may cause the distribution of income to be more equitable. As the economy matures, InIn can rise as specific industries become more dominant and skilled labor becomes more valuable. Early investments in education and human capital decrease InIn, but as a country progresses, the impact of education on income diminishes, possibly leading to higher inequality.

In addition to income, different other factors have been found in the literature. Gupta, et al. [26] showed that corruption can have effects on economic inequality and poverty through different channels, like EcoG, unfair tax systems, and poorly targeted social programs. The study showed that high levels of corruption can result in high levels of inequality. Reuveny and Li [27] depicted that trade and democracy both reduce InIn. According to studies by Savvides [28], Barro [29], and Lopez [30], smaller governments, non-protectionist policies, and trade openness were linked to higher InIn. Zhuang, et al. [31] revealed that an essential portion of the agricultural sector has been transferred to other industries, which is another factor contributing to InIn. As a result, the majority of those affected by this industry are losing their jobs, which is fast widening InIn. As a result, this is yet another significant factor driving the poor into the deepest levels of poverty, where they are unable to access adequate educational opportunities. Another factor is the influence of technological development on the demand for different types of labor, which can affect income disparity. Technology has the potential to open up new work opportunities, but it may also automate some processes, which could result in job displacement and rising inequality [32]. Limiting the economic opportunities available to some groups, like discrimination based on traits like gender, color, ethnicity, and social class, can contribute to InIn [33].

There are some studies to find out the impacts of education on InIn at the international level [29, 34]. They showed that a lower level of education decreases InIn, but higher education increases it. Whereas Gregorio and Lee [4] showed that higher education reduces InIn. But Karl Marx says that society is a scene of social strife. He argued that a nation's economic system can best explain the goal and function of its social institutions. His theory contends that the social institutions and educational system support the two main socioeconomic groups that make up the existing social structure: the bourgeoisie,

who have, and the proletariat, who do not. In this system, the proletariat has no base and can only make ends meet by selling their labor for a wage. The "haves" run the economy, control the means of production, and oversee social structures. His theory holds that educational institutions give the bourgeois class access to the labor market. The educational system propagates the ruling class's worldview, maintaining the status quo. Public and private school systems have been formed as a result of this. People who cannot afford expensive tuition are meant to send their children to public schools, which are for the general population. The other school types are private, and they admit students whose parents have more money, resources, and opportunities in life [35, 36].

Another study that explained the meaning of inequality in education by writing the voice belongs to a 12-year-old Tanzanian girl who is currently enrolled in the third grade [37]. These words capture the reality of the global education problem in developing nations. She says, "I attend classes because I wish to learn. People who are educated live better lives. But there are numerous issues at our school. There are no blackboards or chalkboards, and the classrooms are extremely crowded. While some kids have textbooks, the parents of the less fortunate kids can't afford to buy their kids any books, notebooks, or pencils. My parents struggle to pay the school expenses. My village has a large number of kids whose parents cannot afford to send them to school. My siblings both left their school studies due to my father's financial situation." It means that there is inequality in education. Education is the primary factor in determining earnings; variations in educational attainment are among the main drivers of earnings disparities. The richer get their education from good-quality institutions, so they earn higher wages, whereas the poor get their education from public institutions that are not of good quality, and they may earn lower wages. Differences in educational attainment are a major factor contributing to wage differences [38]. The differences in education between the richer and the poorer are shown in Figure 1.
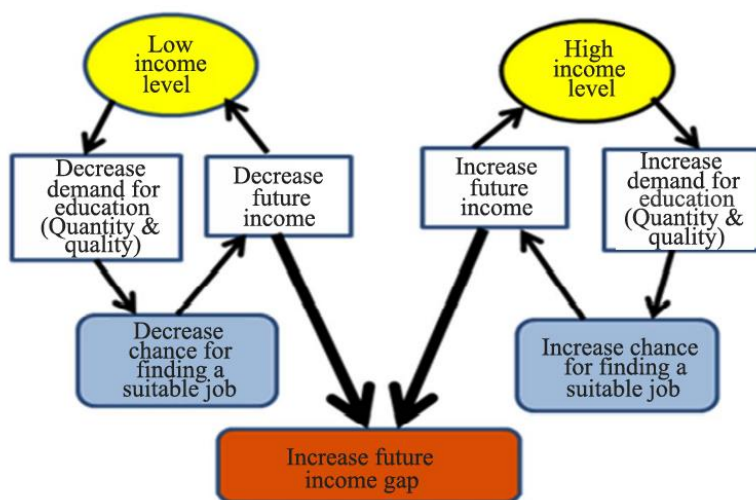

Figure 1.
Flow chart of income inequality.
Source: Abdelbaki [39].

There are studies to find the effects of educational inequality (henceforth EduIn) on InIn at the international level. Some researchers discovered a negative relationship between them [40]. As far as the association between EduIn and InIn at the national level is concerned, some studies have shown that EduIn increases InIn [41, 42]. The former study used district-level Multiple Indicator Cluster Survey (henceforth MICS) data (MICS 2007-08 and 2014) only in one province (i.e., Punjab). The second study checked the effects of EduIn on InIn in South Asian countries. The study used macro-level data from six South Asian nations, including Bangladesh, India, Pakistan, Nepal, the Maldives, and Sri Lanka, from 1980 to 2010.

First, this research aims to analyze the effect of EduIn on InIn in Pakistan. The study by Cheema and Sial [43] examined the nexus between poverty, growth, and InIn, but this study ignores the crucial role of EduIn. To the best of our knowledge, there is no study about the nexus between EduIn and InIn in Pakistan. Second, our study to estimate the relationship between EduIn and InIn used the rural and urban data of the provinces of Pakistan. In existing research, no study investigated this relation using the regional data of Pakistan. Third, this study uses the various proxies of EduIn and InIn such as the Gini coefficient, Generalized Entropy, and Atkinson Index. The scheme of the study is structured as follows: the second section explains the data and methodology. The third section gives the details of the results and discussion. The last section presents the conclusion and policy recommendations.

2. Data and Methodology

2.1. Data

The present study aims to analyze the effect of EduIn (henceforth EduIn) on InIn in Pakistan. Both variables are estimated from Pakistan Social and Living Standard Measurement surveys (henceforth PSLM), and there are breaks between these surveys[1]. Pakistan consists of 4 provinces (i.e., Punjab, Sindh, KPK, and Baluchistan) with a rural-urban breakup. Thus, the study estimated the InIn and EduIn for rural and urban areas of provinces and used eight observations per year. Based on PSLM availability, the study used ten PSLM data sets (i.e., 1998-99, 2001-02, 2004-05, 2005-06, 2007-08, 2010-11, 2011-12, 2013-14, 2015-16, and 2018-19) for the period 1998-99 to 2018-19. So, the study used pooled data and eighty observations. Further, Gini coefficient, Generalized Entropy, and Atkinson Index proxies are used to measure EduIn and InIn in this study.

2.2. Methodology

Before estimating the relationships between InIn and EduIn the study estimates these variables from PSLM survey data.

2.2.1. Estimation of Income Inequality

Following Cheema and Sial [44], the InIn is estimated as follows:

2.2.1.1. Gini Coefficient

The Gini index is used to measure educational inequality.

$$Gini = \frac{1}{2n^2\overline{Y}} \sum_{i=1}^{n} \sum_{j=1}^{n} |y_i - y_j|$$

Where its value is between 0 and 1. The lower the Gini coefficient value, the more equitably the allocation of education is dispersed. If the value of the Gini Coefficient is high, then it shows a more uneven distribution of income; its value is zero, which shows everyone has an equal level of income; when its value is 1, it indicates complete inequality [44].

2.2.1.2. Generalized Entropy

Generalized entropy (henceforth GE) is estimated as below:

$$GE(\alpha) = \frac{1}{\alpha^2 - \alpha} \left[\frac{1}{n} \sum_{i=1}^{n} \left(\frac{y_i}{\overline{Y}} \right)^{\alpha} - 1 \right]$$

Where n is the sample size (number of persons), Yi is the participant's level of education, and i = (1, 2, n) is the sample size's arithmetic mean level of education. Yi is the education of the individual. The GE measure ranges from 0 to ∞, with zero indicating an equal distribution and higher values indicating more levels of inequality [44].

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[1]In Pakistan, there is no time series data for these two variables.

2.2.1.3. Atkinson Index

The Atkinson index is estimated to be under:

$$A_\varepsilon = 1 - \left[\frac{1}{n} \sum_{i=1}^{n} \left(\frac{y_i}{\overline{Y}} \right)^{1-\varepsilon} \right]^{\frac{1}{(1-\varepsilon)}}$$

Where ε is the inequality aversion parameter $0 < \varepsilon < \infty$: The greater the value of ε the more worried society is about inequality. A low value of ε indicates that society is less worried about inequality [44].

2.2.2. Estimation of Educational Inequality

Education is measured by years of schooling. After this, the above-mentioned measures of inequality are estimated.

2.2.3. Estimation of Income and Poverty

These variables are estimated following Cheema and Sial [45] and Cheema and Sial [46].

2.2.4. Relationships between Income Inequality and Educational Inequality

To estimate the relationship between InIn and EduIn, following Suleman and Cheema [47], the econometric model is utilized as follow:

$$InIn_{it} = \beta_0 + \beta_1 EduIn_{it} + \beta_2 income_{it} + \beta_3 poverty_{it} + u_i + \mu_{it}$$

Where: InIn = Income inequality, EduIn = Inequality in education, Income = Per capita income, Poverty = Headcount ratio, μ_{it} = Error term, u = Fixed or Random effects, i represents a panel which is provinces in this study, and t represents the period.

2.3. Hypotheses of the Study

H_0: $\beta_1 = 0$ (There is no connection between InIn and EduIn.)

H_1: $\beta_1 > 0$ Munir and Kanwal [42], Akram, et al. [41], and Islam, et al. [48] showed that there is a positive and significant relationship between InIn and EduIn. So, it is expected that there may be a positive connection between them).

H_0: $\beta_2 = 0$ (There is no relationship between InIn and income in Pakistan).

H_1: $\beta_2 \neq 0$ Bigsten and Levin [49], Heshmati [50], Breunig and Majeed [51], and Onwuka [52] showed that there exists a negative relationship between InIn and income. Income and income disparity are negatively correlated. When wealth rises, impoverished individuals can maintain their standard of living and pursue appropriate education. These individuals may go on to earn high incomes as a result of their education, therefore closing the income gap. InIn is decreasing as economic growth occurs.

H_0: $\beta_3 = 0$ There is no relationship between InIn and poverty in Pakistan.

H_1: $\beta_3 > 0$ McKnight [53] and Beker [54] showed that there exists a positive relationship between InIn and poverty in Pakistan. Poverty increases the level of InIn, as poor people have less education due to a lack of financial resources, which ultimately leads to inequality in education that ultimately reduces their income level. So, it is expected that there is a positive relationship between poverty and InIn.

Initially, the fixed effect model (henceforth FEM) is estimated to determine whether FEM or pooled regression is more suitable for our analysis. To accomplish this, the F-test is applied. The F-test is statistically significant, so FEM is preferred to pool. Following this, the Random Effect Model (henceforth REM) is estimated to determine whether REM or pooled regression is more suitable. The Breusch-Pagan test is significant, so the REM is preferred to pooled regression. To make a final choice between FEM and REM, the Hausman test is used.

H_0: = REM is suitable.

H_1: = EFM is suitable.

The p-value is less than 0.005, so it suggests a notable disparity in coefficient between REM and REM. We proceed with utilizing the FEM.

3. Results and Discussion

This section describes the findings of this study that explain the association between InIn and EduIn by utilizing the province-level data of Pakistan from 1998-99 to 2018-19. Table 1 presents the descriptive statistics.

Table 1.
The descriptive statistics.

Variables	Observations	Mean	Std. dev	Min.	Max.
Income gini	80	0.262	0.052	0.173	0.376
incomeGE0	80	0.116	0.046	0.048	0.230
incomeGE1	80	0.133	0.058	0.050	0.280
incomeGE2	80	0.196	0.111	0.056	0.481
incomeA0.5	80	0.060	0.024	0.024	0.118
incomeA1	80	0.109	0.040	0.047	0.205
incomeA2	80	0.186	0.059	0.089	0.323
Edugini	80	0.221	0.018	0.183	0.264
eduGE0	80	0.093	0.014	0.065	0.128
eduGE1	80	0.081	0.013	0.057	0.114
eduGE2	80	0.078	0.014	0.053	0.112
eduA0_5	80	0.042	0.006	0.030	0.058
eduA1	80	0.089	0.013	0.063	0.120
eduA2	80	0.198	0.028	0.145	0.272
Income	80	1591	1424	695	7622
Poverty	80	44.948	19.119	9.778	84.214

First of all, the study plots the two-way scatter diagrams to determine the relationship between InIn and EduIn that is given in Figure 2. The two-way scatter diagrams given below show the positive relationships between them.
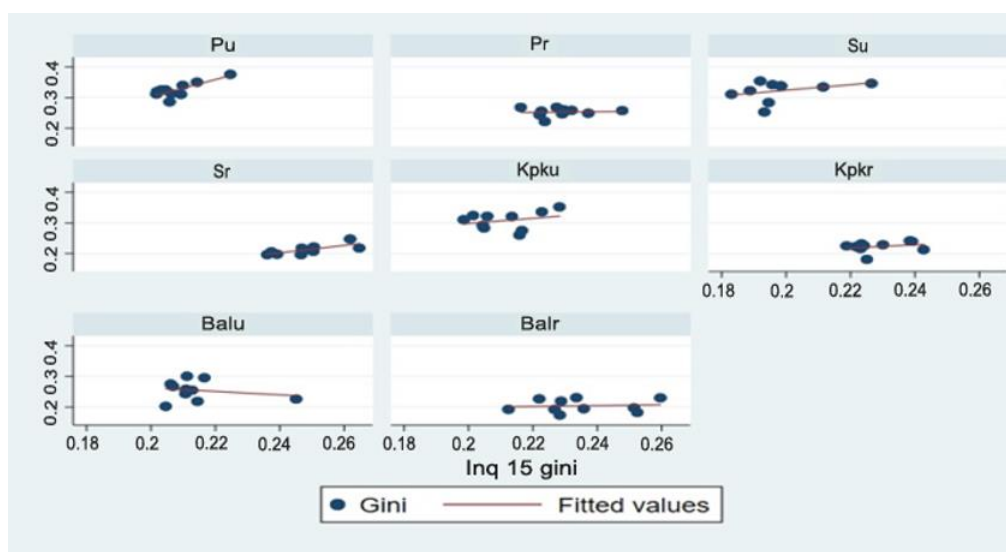

Figure 2.
Relationship between income inequality and educational inequality.

The results of the relationship between InIn and EduIn estimated econometrically are presented in Table 2.

Table 2.
Role of educational inequality on income inequality.

Variables	Gini	Geo	Ge1	Ge2	A0.5	A1	A2
Constant	0.147 (2.48) ***	0.203 (8.10) ***	0.199 (6.77) ***	0.204 (6.72) ***	0.139 (23.12) ***	0.201 (7.58) ***	0.204 (8.96) ***
EduIn	0.521 (1.94) **	0.629 (2.34) **	0.768 (2.13) **	0.752 (1.95) **	2.047 (20.45) ***	0.697 (2.35) **	0.299 (2.60) ***
F-test	23.75 (0.000)	34.22 (0.000)	27.22 (0.000)	23.83 (0.000)	8.48 (0.000)	34.17 (0.000)	43.62 (0.000)
Hausman	21.32 (0.000)	18.32 (0.000)	20.14 (0.000)	19.63 (0.000)	51.32 (0.000)	1.87 (0.172)	8.55 (0.004)
M-W test	44.44 (0.000)	49.21 (0.000)	51.35 (0.000)	53.20 (0.000)	89.27 (0.000)	48.71 (0.000)	46.62 (0.000)
Wooldridge-test	4.542 (0.662)	2.804 (0.125)	4.129 (0.073)	4.924 (0.053)	3.565 (0.092)	2.885 (0.124)	0.962 (0.352)

Note:
1) M-W stands for modified Wald test for heteroskedasticity.
2) Wooldridge test is used to find the problem of autocorrelation which shows there is no problem.
3) Within brackets are t-values based on heteroskedasticity corrected standard error.
4) ** and *** show level of significance at 0.05 and 0.01 percent

Table 2 reveals that the findings of the fixed effect model show that there is a positive and significant relationship between EduIn and InIn. If EduIn increases by 1%, InIn rises by 0.521%. As poor people get their education from public institutes and rich people get their education from private sectors, there exists a gap between the qualities of education.

Good education produces good communication skills and raises opportunities to get a better job, earn more income, and live a better standard of living. So, the education gap produces an income gap, which causes the problem of InIn. These findings are in line with those of Munir and Kanwal [42], Akram, et al. [41], and Islam, et al. [48]. Other columns show the result when EduIn is measured in terms of other inequality measures. Our results remain stable with the inclusion of other proxies of InIn (i.e., generalized entropy and Atkinson). These results are consistent with those of Munir and Kanwal [42], Akram, et al. [41], and Islam, et al. [48].

3.1. Sensitivity Analysis

It has been established that income is an important factor in affecting InIn [55, 56]. It is also established that there is a positive relationship between InIn and poverty [55, 56]. So, these variables are also included, and the results are presented in Table 3.

The table reveals the same result between EduIn and InIn as the previous ones (positive and significant). The results also show that there is a negative relationship between InIn and income. A 1% increase in income is associated with a -0.008% decrease in the Gini coefficient (InIn), and it is statistically significant. All other measures also show the same result, and the results are consistent with those of Breunig and Majeed [51], Bigsten and Levin [49], and Onwuka [52]. When benefits are transferred to the lower class, then their income may rise, and as a result of the rise in income, InIn may decrease.

As far as poverty is concerned, the findings show that there is a positive relationship between them, as was expected, and this relationship is statistically significant. Estimation shows that a 1% rise in poverty is associated with a 0.0002% increase in the Gini coefficient. The results are in line with Beker [54] and McKnight [53]. Poverty rises when the poor become poorer and the rich become richer; all benefits are transferred to the rich society, but only the income of the poor is further reduced, which ultimately causes a rise in InIn.

Table 3.
Role of educational inequality on income inequality.

Variables	Gini	Geo	Ge1	Ge2	A0.5	A1	A2
Constant	0.160	0.216	0.213	0.218	0.212	0.212	0.215
	(3.48) ***	(12.20) ***	(9.86) ***	(9.28) ***	(10.6)***	(11.4) ***	(13.20) ***
EduIn	0.489	0.557	0.678	0.645	1.309	0.619	0.265
	(2.29) **	(2.83) ***	(2.46) **	(2.06) **	(2.67) **	(2.86) **	(3.18) ***
Income	−0.008	−0.008	−0.008	−0.008	−0.008	−0.008	−0.008
	(−6.70) ***	(−6.32) ***	(−6.40) ***	(−6.52) ***	(−6.34) ***	(−6.31) ***	(−6.35) ***
Poverty	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(1.87)	(2.00) *	(1.92) *	(1.87)	(1.96)	(2.01)	(2.13)
F-test	31.12	43.91	35.02	30.54	38.78	43.87	55.80
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Hausman	48.72	51.56	50.45	48.73	51.32	51.48	46.22
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.0000)
M.W test	225.00	104.87	182.10	301.27	136.87	105.39	82.25
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Wooldridge-test	2.743	2.49	2.77	2.85	2.701	2.539	1.133
	(0.132)	(0.148)	(0.130)	(0.125)	(0.135)	(0.146)	(0.315)

Note: 1) M-W stands for modified Wald test for heteroskedasticity.
2) Wooldridge test is used to find the problem of autocorrelation which shows there is no problem.
3) Within brackets are t-values based on heteroskedasticity corrected standard error.
4) *, ** and *** depict the level of significance at 0.10, 0.05 and 0.01 percent.

4. Conclusion and Policy Recommendation

The present study explores the role of EduIn in reducing InIn in Pakistan by using pooled data estimated from different surveys of PSLM for the period of 1998-99 to 2018-19. The study uses three different proxies for EduIn and InIn (Gini, Generalized Entropy, and Atkinson Index). The F-test and Hausman test suggest that FEM is suitable for estimation, and the study used a fixed effect model to find out the relationship among variables. The study findings indicate a positive association between InIn and EduIn in Pakistan. Income and InIn have a negative relationship. Further, the results reveal that there is a positive relationship between InIn and poverty. Based on the study findings, improving income and reducing EduIn should be the main priorities for policymakers to lower InIn in Pakistan.

Institutional Review Board Statement:
Not applicable.

Transparency:
The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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The authors declare that they have no competing interests.

Authors' Contributions:
All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

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