A New Approach to Empirical Investigation under Persistence, Endogeneity, and Heterogeneity for South Asia: Understanding of the Deeper Dynamics of the Relationship Among Income Disparity and Education

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ABSTRACT

This study experimentally explores the income disparity and education expansion association, that is, strengthening average years of schooling and shrinking schooling disparity, using a sample of South Asian nations from 1980 to 2015 with five years regular interval. South Asian economies are frequently investigated in the literature on disparity, and the World Development Report primarily focused on educational problems and expounded on a high level of learning disparity in South Asia. The dynamic panel Arellano-Bond Following current work, the study employs GMM estimating approaches to report questions of 'persistence and endogeneity'; we notice a huge, optimistic, statistically important, and steady average years of schooling and income disparity association in South Asian economies. The average years of education are positively correlated with income disparity, which is consistent with constant or rising returns to more years of education. We also find a slight and not necessarily statistically significant positive association among educational expense and income disparity, as well as a statistically significant unfavorable relationship among income disparity and immature associates. Statistical tests show that our identification instruments and vibrant indicators are both reliable. The increase of schooling is likely to continue lowering disparity, according to policy worries. This function will decline as nations grow, but it might be strengthened by putting more effort into lowering educational quality disparities.

1.   Introduction

The extension of extreme and, in numerous countries, emerging income disparity in current spans is a major issue for policymakers around the world, and it has garnered more

attention from economists and public discourse (Dabla-Norris, Kochhar, Suphaphiphat, Ricka, & Tsounta, 2015). According to the literature, the rising disparity can be ascribed to a diversity of influences, comprising 'globalization' and 'liberalization' of labor and goods marketplaces; expertise-predisposed industrial modification; upsurges in 'labor force participation' by unskilled labors; deteriorating top peripheral proceeds tax rates; augmented negotiating supremacy of high earners; and a mounting portion of elevated-income pairs and solitary-paternal households (Alvaredo, Atkinson, Piketty, & Saez, 2013). Many of these variables, however, have aided growth and poverty reduction in many economies (Chen & Ravallion, 2010).

A large set of literature on socio-economic determinants of income inequality has highlighted the importance of the level of schooling in reducing income disparities in developing countries. Tchamyou, Asongu, and Odhiambo (2019) investigates the role of ICT and education on income inequality in African Countries, and claimed the education as lifelong learning leads to enhance to income level of the poor and the rich-poor gap reduces over time. Şenol and Orhan (2021) raise importance of conducting research on income inequality in the emerging economies and found that the improvement in education level and health leads to reduce income inequality in the OECD countries (Gillani, Ahmed, Khan, & Hussain, 2022). Ahmad, Shafiq, and Gillani (2019) shows that remittances have an impact on health and education but it improves health in high income countries more as compare to low-income countries while school enrollment increased in low-income countries more (Shafiq & Gillani, 2018). Moreover, Riaz, Nasir, and Nasir (2020) investigates the role of education in income inequality in case of Pakistan using time series data and signified the relationship for effective policy to achieve equality in the level of income. The case of studying south Asian economies has found limited in the empirical literature, thus there is dare need to conduct a joint penal study to evaluate the importance of education expansion on income inequality in case of South Asia.

The current study primarily examines the connection among increased educational attainment and economic disparity using a sample of South Asia. Increasing educational opportunities is frequently viewed as a crucial policy tool for limiting rising economic disparity over the medium term. In addition to being seen as essential for fostering economic development Barro (2013); Hanushek (2013), education expansion can also aid in reducing disparity of opportunity and intergenerational transmission of poverty Corak (2013), lowering future income disparity. Expanding educational opportunities would decrease income disparity and the requirement for financial reorganization during unfavorable financial procedures like progressive income taxation or means-tested payments. Thus, expanding education can be a "win-win" from this angle. The paper adds to the existing empirical literature in various ways. It widens the econometric investigation to discourse key assessment contests not lectured in the prevailing works, focusing on South Asia. It is a one-of-a-generous study in the South Asian case; no previous evidence in the literature determining the current study's subject matter has been uncovered. It also considers variations in the connection relating to educational attainment and income disparity among working-age people. Evidence suggests that experience and education are corresponding components in human capital development, suggesting that yields to education and income disparity can be predicted.

A thorough examination of the pertinent literature, a thorough methodology for empirical and theoretical validation of the topic, and empirical results utilizing proper econometric analytic techniques were all provided in later sections of the work. After reviewing the findings and their potential policy ramifications, the conclusion is presented.

2.   Literature Review

Historical and contemporary literature often examines the connection between increased educational attainment and wealth disparity. Numerous studies support the findings of the present study. For instance, De Gregorio and Kim (2000) examined the association between

wealth disparity and education expansion in seven countries at various stages of development. He discovered a link between increased educational opportunities and reduced income disparity. The study concludes that a stronger and more positive relationship exists among education and income disparity as a nation develops. However, the study needs to consider the issue of persistence or endogeneity with empirical estimation. Coady and Dizioli (2017) conducted a study that addressed issues that had been overlooked in previous literature; they used penal of developed, emerging, and developing countries on five-year interval data to estimate the relationship among education expansion and income disparity under persistence, endogeneity, and heterogeneity problems. To have consistent and efficient parameters, they calculated Arellano Bond difference GMM, System GMM, and long difference estimates. They conclude that education expansion has a strong positive association with income disparity, that average years of schooling also have a positive impact on income disparity, and that cohort schooling years have a unfavorable impact on income disparity.

Several research went into detail on how vital income disparity is for development. Studies by Bonnefond, Clément, and Combarnous (2015) and Dabla-Norris et al. (2015) examined the connection among rising income disparity and various economic and social problems. Using human development models, numerous other researchers have established the essential effects of increased educational opportunities on income disparity. Gillani, Shafiq, and Ahmad (2019) found that countries with low military expenditure have good health. Studies by Colclough (2010) and Castelló-Climent and Doménech (2021) found that increasing income disparity will unquestionably follow an increase in the average level of education in developing economies. Shafiq, Yang, and Nawaz (2022) examined that remittances increase the educational level in developing countries. Similarly, Psacharopoulos and Patrinos (2004) concluded that increasing income disparity will unquestionably follow an increase in the average level of education if the return to an extra year of education is larger at higher levels of education. But if, as much of the empirical research suggests, returns fall off as education levels rise.

A discussion of GMM estimations, which are crucial to the current study, is provided in the literature on methodological issues in estimating the relationship among education expansion and income disparity by Arellano and Bond (1991); Blundell and Bond (1998), Arellano and Bover (1995) and (Blundell & Bond, 1998). Galor and Moav (2004), within the early stages of development, physical capital amassing may be a prime source of financial development whereas within the afterward stages; human capital gets to be the prime motor of financial development. In this prepare, returns to human capital increments as physical capital gets supplanted by human capital. Checchi (2000) watched a U-shaped relationship between normal a long time of tutoring and wage disparity with lower turning point at 6.5 a long time, in a board information ponder covering 94 nations amid 1965–90. The creator contended that beginning extension in instruction and income inequality appears to be contrarily related; in more later years, further extension in tutoring within the world populace has been went with by an extending within the scattering of wage dissemination. Institutional quality also matters for the economic growth of a country (Khalil, Hussain, Bhatti, & Ibraheem, 2022). Lin (2007) watched decay in salary disparity in reaction to an increment in normal level of tutoring disparity in case of Taiwan.

Shukla and Mishra (2020) empirically investigate that impact of education expansion on income inequality in India using cross-sectional data and found that with increase in years of schooling leads to reduce income inequality in urban India, however there is no significant relationship between years of schooling and income inequality in rural India. Tchamyou et al. (2019) investigates the role of ICT and education on income inequality in 48 African Countries, by flowing the penal econometric analysis using GMM the study claimed the education as lifelong learning leads to enhance to income level of the poor and the rich-poor gap reduces over time. Şenol and Orhan (2021) raise importance of conducting research on income inequality in the emerging economies and the empirical analysis reveals that the improvement in education level and health leads to reduced income inequality in the OECD countries. Moreover, Riaz et al. (2020) investigates the role of education in income inequality in case of Pakistan using time

series data from 1980 to 2019 and using ARDL cointegration approach signified the relationship for effective policy to achieve equality in the level of income.

From the above short discussion on the previous literature, it is found that there is very little literature available about South Asia. The global south has a large share in developing and emerging economies and the level of education is improving gradually with high growth rates which in return can impact income inequality. As earlier data and estimations difficulties were prevalent in empirical evidence validations, there was almost little literature on the subject. As a result, the current study adds to the existing literature on South Asia.

3. Methodology

The study adopts a basic hypothetical construction for analyzing the association concerning increased educational attainment and income disparity in the conventional 'human capital' model, following Gregorio and Lee (2002) and Coady and Dizioli (2017). According to this hypothesis, the degree and spreading of education (or schooling) among the inhabitants determines income distribution (or wages). The wages (Y) of a person with Sch years of education can be roughly calculated using this model as in equation I.

$$logY_{sch} = logY_{in} + r_{ads} + u \qquad (1)$$

Where:
Y_{in}: wages of people with no formal education
r_{ads}: returns with advanced education.
u: Error term

The earnings distribution of a population can then be expressed as follows, with bar superscript signifying mean values:

$$Var(logY_{sch}) = \bar{r}^2 Var(Sch) + Var(r_{ads})Var(Sch) + \bar{S}^2 Var(r_{ads}) + 2\bar{r}\bar{S}Cov(r_{ads},S) + Cov(r_{ads},Sch)^2 + Var(u) + 2Cov(rS,u) \qquad (2)$$

By maintaining the mean level of education and additional parameters coefficient, an increase in education disparity, Var(S), unquestionably leads to an increase in income disparity; in other words, the first two terms are unquestionably favorable. The effect of expanding the mean intensity of education, Sch, while leaving additional variables recurring, will depend on the connection among r_{ads} and Sch, or Cov (r_{ads}, Sch), or the total influence of the 3rd and 4th terms. Assume that the benefit of an additional time of school is equal for all levels of education, as shown by Cov(r_{ads}, Sch)=0. In this aspect, an intensification in mean schooling directs to increased income disparity. By the same token, if the advantage of an additional time of education is larger at advanced educational stages Castelló-Climent and Doménech (2014); Colclough (2010), an increase in average educational level surely produces a significant difference in income. Increases in income disparity will be attenuated, and if negative, may even contribute to a rise in average education, resulting in a net reduction in income inequality, if the effect is more minor at higher levels of education, as most empirical publications have found (Psacharopoulos & Patrinos, 2004).

To examine the observed connection among income disparity, average educational attainment, and educational disparity, we use the country-panel specification described below in equation III:

$$I_{it} = \beta_0 + \beta_1 S_{it} + \beta_2 E_{it} + \beta_3 X_{it} + \alpha_i + \varepsilon_{it} \qquad (3)$$

I: income disparity
S: An average number of years of education
E: education cost
X: Control variables
i : Country
T: Year
The following variables were added to the model throughout the study to better improve it:

$$INEQ_{it} = \beta_0 + \beta_1 S_{it} + \beta_2 E_{it} + \beta_3 GDP_{it} + \beta_4 GDP_{it}^2 + \beta_5 INF_{it} + \beta_6 HDI_{it} + \beta_7 HEX_{it} + \beta_8 DC_{it} + \beta_9 TO_{it} + \beta_{10} YP_{it} +$$
$$\beta_{11} OP_{it} + \beta_{12} UP_{it} + \alpha_i + \varepsilon_{it} \qquad (4)$$

The following are the data sources for the analysis's primary indicators of income disparity and level of education:

Table 1
Description of Variables and Data Sources

Variable	Description	Data source
INEQ	Income disparity (GINI coefficient)	WDI, Bastagli, Coady, and Gupta (2012)
Average Schooling years	Mean years of Schooling	UNDP
GDP	Gross domestic product (real growth)	WDI
Domestic credit	Domestic credit to private sector (% of GDP)	WDI
Inflation	Yearly % change in CPI	WDI
HDI	Human Development index	UNDP
Health expenditures	Net foreign direct investment inflow (% of GDP)	WDI
Education expenditures	Government expenditures on education (% of GDP)	WDI
Population (below 15)	Proportion of population aged below 15	WDI
Population (above 65)	Proportion of population aged 65 and above	WDI
Urbanization	Urban Population (% to total population)	WDI
Trade openness	Total trade % of GDP	WDI

The research expands the estimating technique by following existing literature to solve two econometric difficulties, namely persistence and endogeneity: For the empirical analysis the study has extracted the data from various resources, since the data of Income Inequality and HDI has not been published on regular yearly basis, so the study used 5-year intervals which creates smooth availability of the data. The Data used from 1980 to 2015, extracted from World Development Indicators, United Nations Development Program Country reports and the data of income inequality has been extrapolated with reference to a paper published by (Bastagli et al., 2012).

3.1. Econometric Implication for Persistence of Income Disparity

Over the sample period, there was a little within-country fluctuation in income disparity, which suggests that some slowly changing, probably unobserved factors may be responsible for this insistence. For instance, this stately enslavement may manifest barriers to intergenerational mobility, making it more difficult for someone born into poverty to advance in society than someone born into the middle class (Corak, 2013). The calculated OLS and fixed-effects measurements may be inaccurate if these disregarded factors are linked with educational outcomes.

3.2. Endogeneity Problem and application of GMM

Any reported association among educational results and economic disparity may indicate inverse causality, implying that wealth disparity influences educational attainment and dispersion. As a result, any disregarded influences influencing income disparity and educational results can skew the calculated link among education and income disparity.

To tackle these two problems, we utilize dynamical panel approximation methods. To interpretation for continuation, past income disparity levels are usually included as a supplementary standalone variable. This, by design, indicates that the fixed-effects estimator's exogeneity assumption is violated, resulting in biased fixed-effects estimates (Nickell, 1981). To tackle this obstacle, Arellano and Bond (1991) recommend adopting a first-differenced GMM estimate, which involves initial differencing the data and after that using appropriately insulated principles of the autonomous and explained variables as instruments. This estimate also addresses the issue of endogeneity. The Diff-GMM measure, however, exhibits the ineffective instrument problem when there are few time periods, and this bias is increased when the time series are persistent, as demonstrated by (Blundell & Bond, 1998). By utilizing level limitations, which persist revealing equal in the existence of endurance, the Sys-GMM (system GMM estimator), created by Blundell and Bond (1998) reports the ineffective instrument obstruction introduced by (Arellano & Bover, 1995). As a result, the Sys-GMM estimator can significantly outperform the traditional Diff-GMM estimate in situations when there are few time periods and persistence. As a result, the Sys-GMM estimator is our chosen model.

4. Results and Discussion

The study follows the prescribed econometric analysis to reach the conclusion and to give valid and justifiable policy suggestions. In the first step of findings, we applied simple data descriptive analysis to understand the trends and locative indicators of data used in analysis.

Table 2
Descriptive Statistics

Variables	Mean	Median	Maximum	Minimum	Std. Dev.	Obs.
GINI	35.684	34.300	49.400	26.400	5.053	56
Schooling years	4.089	3.400	10.900	0.800	2.556	56
Education expenditures	3.159	2.966	7.362	0.937	1.299	56
Inflation	7.742	7.042	26.145	-1.175	5.315	56
Domestic credit	25.248	23.119	64.749	2.425	14.105	56
HDI	0.492	0.489	0.766	0.245	0.124	56
Health expenditures	4.316	3.826	9.525	2.135	1.657	56
GDP	4.824	5.397	11.731	-13.129	4.105	56
Population (below 15)	37.070	38.501	47.267	21.243	6.541	56
Population (above 65)	4.212	4.022	9.299	2.461	1.245	56
Urbanization	24.170	24.883	45.536	6.091	8.862	56
Trade openness	65.748	46.174	358.660	13.040	56.875	56

Descriptive statistics include the Mean, Median, Standard deviation, minimum and maximum values. These statistics are given by combining the data of 7 South Asian countries named, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. To elaborate more specifically the data of income disparity is given in figure 2 to make comparison of all countries in panel.
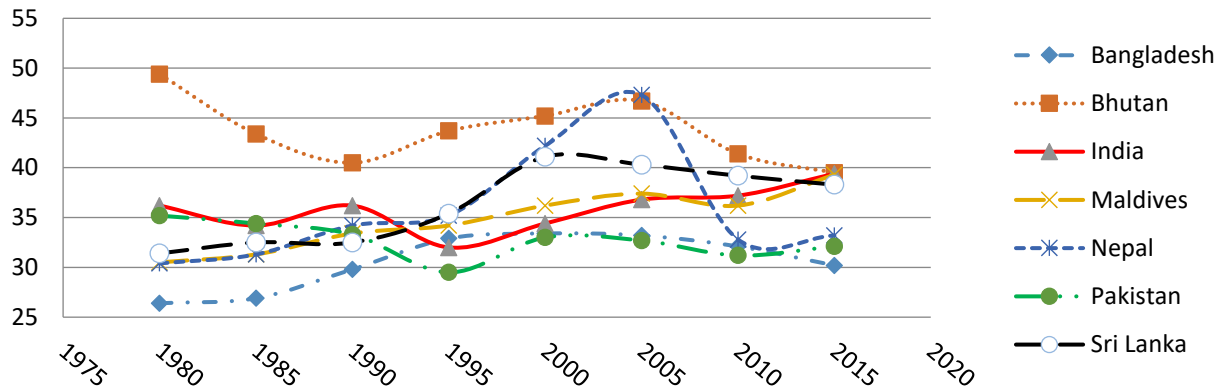
Figure 1: Income Inequality in South Asia

Figure 1 plots the data of income disparity of South Asian economies used in empirical analysis. There is overall persistent and increasing trend in income disparity in all economies except Bhutan. Data Source: WDI, and Authors extraction from (Bastagli et al., 2012).
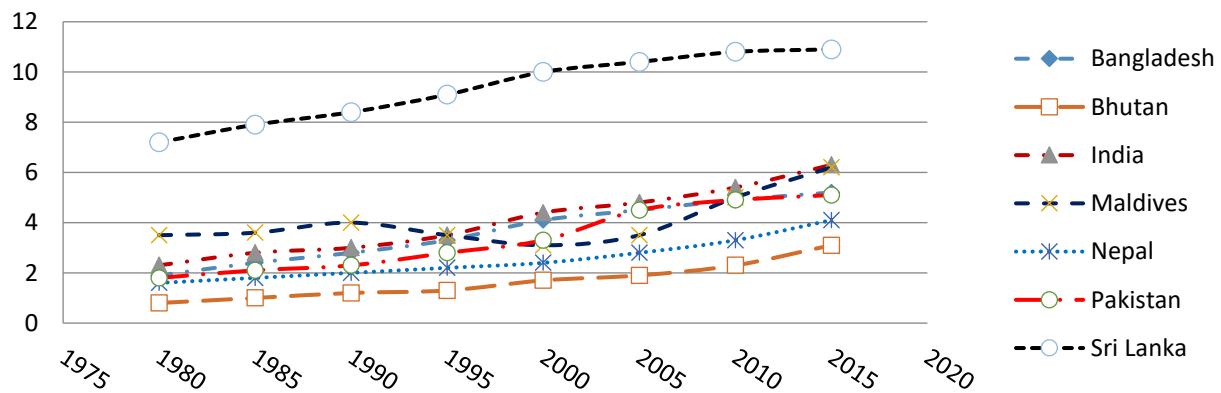

Figure 2: Average years of Schooling in South Asia

Figure 2 shows the mean years of schooling in south Asian economies that shows increasing trend in all the countries, the data is sourced from United Nations estimates.

In the next step to estimate parameters to address empirical evidence the study applied Arellano Bond dynamic model GMM. The results of different models are given in table 3.

Table 3 provides the results of difference GMM and system GMM in three different models, the first model is estimated with Arellano Bond AR (1) and AR (2) in difference GMM. The results of model one is not significant as the f-test is not significant, however model estimated under sys-GMM is significant and we can report these results as AR (1) test is significant and AR(2) is not significant so the persistence of income disparity is only at AR(1). Average schooling years have significant and positive statistical relationship with income disparity in sys-GMM results. Educational is also significant and positive in contributing to income disparity. Other variables used in the model inflation and domestic credit are significantly reducing income disparity. The proportion of young population ages less than 15 is also significant and contributing to increase in income disparity. HDI and GDP are not statistically significant in our analysis. However, the signs of the parameters are according to existing literature.

The empirical section of the study reveals some key findings; first, the income inequality has found to be persistent in South Asia, as the lagged Gini coefficient observed significant with

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positive sign in each model estimated. Second, the mean years of schooling leads to impact positively and significant on income inequality in South Asa, similarly, the expenditure on education has also a positive and significant impact on income inequality. Third, the increase in inflation leads to reduce income inequality with significant parameter. Fourth, GDP and GDP squared has positive and significant impact on income inequality, however, the GDP squared coefficient is less than GDP which means that with increase in the national income the income inequality may rise fast and the rate of increase in inequality will decline with higher national income growth.

Fifth, human development index may reduce the income inequality with negative sign of coefficient, but the parameter is insignificant in each model estimated. Sixth, the increase in the domestic credit to private sector will significantly reduce the income inequality in South Asia. Seventh, the increase in the proportion of young population (aged 15 or less) will lead to increase in the income inequality, similarly the proportion of old age population (aged 65 or above) will lead cto increase the income inequality. It means that the higher proportion of dependents may affect adversely on income equality in the South Asia. The empirical findings of the study are supported with the standard diagnostics which justified that the findings of the study are robust for designing appropriate policy to reduce income inequality.

Table 3
Results using Arellano-Bond Dynamic Panel GMM for Income Disparity

VARIABLES	Diff-GMM Income Disparity	Sys-GMM(1) Income Disparity	Sys-GMM(2) Income Disparity
Lag(1) Income disparity	0.855**	0.636***	0.529***
	(0.372)	(0.134)	(0.166)
Mean years of Schooling	4.960	1.869***	1.482***
	(3.732)	(0.669)	(0.331)
Education expenditures	0.673	1.479**	1.426**
	(1.404)	(0.697)	(0.661)
Inflation	-0.520**	-0.284*	-0.198
	(0.243)	(0.144)	(0.153)
Population(below15)	0.766	0.256***	0.218***
	(0.551)	(0.0638)	(0.0751)
Domestic Credit to private sector			-0.122**
			(0.0532)
Health expenditures			0.737
			(0.658)
Trade openness			-0.0262
			(0.0200)
GDP growth			0.0728
			(0.207)
GDP^2			0.0199
			(0.0199)
Population (65 and above)	-5.545*	-0.789	
	(3.106)	(0.992)	
HDI	28.73	-6.969	
	(38.32)	(10.69)	
Instruments for first differences equation Standard	D.(EDU HE UP)	D.(EDU HE UP)	D.(EDU HEX UP TO)
F-Statistics	1.55	948.92	641.10
Prob > F	0.182	0.000	0.000
Arellano-Bond test for AR(1)	Pr > z = 0.031	Pr > z = 0.008	Pr > z = 0.005
AR(2)	Pr > z = 0.732	Pr > z = 0.612	Pr > z = 0.879
Sargan test of Overid. restrictions (Prob > chi2)	0.534	0.668	0.806

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Findings of the study have been justified from the previous literature, the econometric analysis are followed from the study by Bastagli et al. (2012), and the use of instruments for mean years of schooling are also justified from the literature. The signs and magnitude of the parameters are addressed reasonably compared to previous studies. The findings are supported with standard diagnostic test, such as Hausman test for endogeneity, and the persistence of the income inequality is test by Autoregressive Model, and both are found significant to support the instrumental variable regressions under Arleno Bond estimates from GMM.

5. Conclusion

This study uses a five-year period from 1980 to 2015 to provide empirical evidence on the connection among increased educational attainment and economic disparity in South Asia. The study has incorporated the Gini coefficient for income inequality estimates at national level, gross national income and real gross domestic product growth has been used for the economic growth, total trade as percentage of GDP is used for trade openness, consumer price index has been used for inflation, mean years of schooling is used for the level of education at national level. For demographic indicators, proportion of population aged 65 and above is used for the old age impact and the proportion of population under age 15 is used for the cohort effect. Proportion of urban population to total population is used for the urbanization. The empirical analysis has been carried out from 7 countries penal data using standard econometric procedure, in the first step of estimation the study has verified the unit root by applying the ADF-Fisher test and claimed that all the variables are stationary at level, further the study has tested the endogeneity which is found significant, moreover, the estimation of persistence the autoregressive model has been adopted. The study has a dynamic understanding in terms of hypothesis and the econometric analysis so, it adds to the body of knowledge on South Asia in several ways: first, it addresses crucial econometric difficulties overlooked in the existing research, such as the requirement to account for the continuation of income disparity and the endogeneity property of education, and disparity outcomes, that necessitate dynamic panel analysis. Second, the research looks for differences in these correlations among countries, income levels, and age cohorts. Third, the research employs five-year intervals of dependable income disparity to address relates about the attribute of income disparity data presently extensively sourced in the field and to lengthen the analysis timeframe.

The evaluation shows how crucial it is to control persistence, endogeneity, and heterogeneity. The optimistic education and income disparity association grows pointedly, is statistically significant, and remains stable across all indicators when dynamic panel estimating approaches are used. This supports our theoretical conclusions established on the human capital model and demonstrates that increasing educational opportunities dramatically reduces income disparity by reducing the number of developmental phases. However, the association between economic disparity and educational attainment is found to be favorable but tiny and only occasionally statistically significant. Our dynamic indicator is consistent, and our identifying instruments are valid according to statistical testing. The study concludes that education expansion, persistent income disparity, and other drivers of income disparity are essential. Policymakers are advised to devise strategies to address this issue, in the long run, to regulate and reduce income disparity in South Asia through education expansion.

Data statement
Data is freely available on World Development Indicators.
https://databank.worldbank.org/source/world-development-indicators

Authors Contribution
Faisal Munir: The idea of the research has been established and analysis
Fatima Farooq: Review the final draft.

Rashid Ahmad: Help in the data analysis and discussion.
Rifat Rafeeq: Provided guidance for data analysis, reviewed the citations and references.

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