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EQUAL EDUCATIONAL OPPORTUNITIES: A CATALYST FOR SUSTAINABLE ECONOMIC DEVELOPMENT

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ABSTRACT

The study holds significance in revealing how ensuring fair access to education can fuel economic growth, promote social cohesion, and guide policymaking for sustainable development. The objective of current research is to empirically examine the relationship between gender disparity in educational attainment within social, and ecological systems. The data is collected for the period 1990-2022. In the presence of cross-sectional dependence 2nd generation unit root test is applied. CS-ARDL technique is considered to examine the short-run as well as the long-run relationship between Gender disparity in education and the socio-ecological system. Achieving environmental sustainability and minimizing our ecological footprints depend critically on gender parity in education. Equal access to high-quality education gives women the knowledge, analytical abilities, and self-assurance to stand up for their communities and themselves. Findings describe that in the long run, there is a statistically significant negative correlation between the GINI-Coefficient and school enrollment tertiary and School enrollment primary. This indicates that, over time, a decrease in income disparity is linked to an increase in enrolment in primary and postsecondary education. In the long run, the GINI-Coefficient and Secondary school enrollment has a positive and statistically significant relationship. The data in Model 2 appear to indicate that the relationship between education and environmental sustainability is more intricate than the EKC hypothesis predicts. Higher education can raise one's knowledge and understanding of environmental issues, but it can also increase consumption and have an adverse effect on the environment. The findings of the study suggest that implementing policies with the goal of removing obstacles to education based on gender. This could entail giving families financial incentives to send their daughters to school and making sure that all genders have access to high-quality education.

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INTRODUCTION

Gender disparity refers to the imbalances and inequalities that exist between individuals based on their gender. This inequality shows up in the social, political, and economic spheres of life, among others. The gender wage gap, in which women often receive less than men for equivalent work, is one well-known example. The underrepresentation of women in leadership positions, both in business and politics, is another indicator of gender inequality. There can be obstacles in the way of girls' access to education, which would explain differences in their educational performance (Gaye et al., 2010).

Gender discrepancies are also evident in the healthcare sector, where they impact treatment options, health outcomes, and access to medical care (Su et al., 2022). Disparities are exacerbated by discrimination and gender stereotypes, which have an impact on possibilities for advancement, employment, and promotions. The goal of fostering gender equality is to guarantee that people, irrespective of gender, have equal rights, opportunities, and treatment in all spheres of life. This is a common emphasis of efforts to alleviate gender disparity. In order to create a society that is more inclusive and equitable, a number of advocacy groups and organizations strive to abolish gender inequality. Gender disparity in educational attainment refers to the differences in educational outcomes between individuals of different genders. While progress has been made in many parts of the world to promote gender equality in education, disparities may still exist in various forms. These disparities can occur at different levels of education, including primary, secondary, and tertiary (higher) education (Khan and Khan, 2004).

In some regions, girls may face barriers to accessing education, such as cultural norms, societal expectations, or economic constraints. These barriers can limit girls' enrollment in schools and contribute to a gender gap in educational opportunities. Even when girls have access to education, there may be disparities in completion rates between genders. Factors such as early marriage, pregnancy, or gender-based violence can disproportionately affect girls, leading to higher dropout rates. Gender disparities may also manifest in the choice of academic subjects and fields of study, where certain subjects or disciplines may be associated with one gender, leading to underrepresentation in specific fields. Girls are disproportionately affected by factors including early marriage, pregnancy, and gender-based violence, which raises the dropout rate (Lloyd et al., 2009).

The selection of academic courses and fields of study can also be a sign of gender inequality, since some disciplines or subjects may be more closely linked to one gender than the other, resulting in underrepresentation in particular fields. Even though the number of women enrolled in higher education has increased, gender differences may persist in some sectors or at the graduate level,

especially in STEM subjects (science, technology, engineering, and mathematics).

In order to reduce the gender gap in educational attainment, policies and programs that support equitable access to education for all people, regardless of gender, are frequently put into place. Scholarships, overcoming cultural obstacles, and dispelling gender preconceptions in the classroom are a few examples of these initiatives. In the end, realizing gender equality in education is essential to building inclusive communities and enabling all people, male or female, to realize their full potential. The disparity between genders in educational attainment has significant effects on a number of socio-ecological variables, most notably income inequality and environmental sustainability (Brown, 2004). A complex web of socio-ecological effects can result from unequal access to education based on gender, as extensive research has demonstrated. This inequality can exacerbate environmental concerns and prolong income inequities (Knight et al., 2013).

First of all, effective participation in environmental sustainability initiatives might be hampered by low educational possibilities for one gender, typically women. Promoting knowledge and comprehension of environmental issues, sustainable practices, and the effects of resource depletion all benefit greatly from education. The unequal exclusion of one gender from educational opportunities results in a substantial segment of the population without the information and skills required to make a meaningful contribution to sustainable development (Mwita and Murphy, 2017). Gender disparities in education contribute to income inequality in India, which is the second most unequal country in the world (Dev, 2018).

Moreover, gender differences in educational attainment deepen social and economic gaps by adding to income disparity. Gender disparity in education reduces human per capita income, and improving women's education can improve human development (Daraz et al., 2018). For the underprivileged gender, unequal access to education limits work prospects, earning potential, and upward mobility. This keeps people in a cycle of poverty that affects entire communities as well as individuals. Wider socioeconomic development can be hampered by the concentration of resources and decision-making power in the hands of a privileged few, which is made worse by gender differences in educational attainment and income disparity. Regarding the environment, the adoption of sustainable practices at the home and community levels may be hampered by the absence of educational opportunities tailored to a particular gender. Studies indicate that women with higher levels of education have a higher propensity to embrace eco-friendly practices, like family planning and sustainable resource management. Therefore, the adoption of eco-friendly practices might be hampered by gender discrepancies in education, which can undermine long-term sustainability efforts and contribute to environmental damage.

Achieving income equality and environmental sustainability both depend on addressing gender differences in educational achievement. Gender-inclusive education, scholarships for underprivileged populations, and dismantling social norms that support gender-based educational disparities are all vital causes. Achieving environmental sustainability and minimizing our ecological footprints depend critically on gender parity in education. Equal access to high-quality education gives women the knowledge, analytical abilities, and self-assurance to stand up for their communities and themselves (Grogan, 1999). They are then better equipped to decide on sustainable living, resource management, and conservation techniques. Women with higher levels of education are more likely to embrace eco-friendly practices, such as supporting sustainable agriculture, adopting renewable energy sources, and disposing of waste in an appropriate manner. Additionally, they might be more qualified to take part in environmental decision-making processes, guaranteeing a range of viewpoints and community-beneficial solutions. Moreover, educated women frequently have important responsibilities to play in educating the next generation by imparting values and information that place a premium on environmental care.

The socio-ecological systems are significantly impacted by gender differences in educational attainment. The propagation of discriminatory attitudes and stereotypes via the educational system is a major factor in the perpetuation of gender inequality (García et al., 2023). It was stated by Ehrmann and Massey (2008) that even though women currently complete more years of education than men do in many nations, gender differences in education still exist in some areas. Academic performance is impacted by gender differences in educational attainment, with a tendency for females to be more affected by ecological factors than males (Herd et al., 2019). But still further research is required to determine the reasons behind males' susceptibility to resource shortages in households and girls' higher average academic performance (Grant and Behrman, 2010). Establishing school settings that support respect, equity, and social justice requires an understanding of and commitment to resolving gender discrepancies in educational attainment (Deepika and Devardhi, 2012).

Saâd and Ella (2019) applied the GMM technique to empirically examine the effect of economic complexities on the gender parity index (GPI). Saâd and Ella (2019) conclude that in the worldwide sample, economic complexity has a favorable impact on the gender parity index (GPI) at both the primary and secondary levels. they also conclude that, in the case of the high-income country and the Middle East and North Africa sample, economic complexities have a negative effect on the gender parity index (GPI) at the tertiary level. Anyanwu (2016) conducted an empirical analysis of gender equality in African secondary schools from 1970 to 2010. The study finds a positive correlation between gender equality and real GDP per capita, but it also observes a hump-shaped pattern that may indicate a threshold impact. The number of female teachers, rates of domestic investment, and oil-exporting status are factors that contribute to gender equality. Notably, a growing population is linked to a lower level of gender equality.

Ghosh (2019) highlights the drawback of the gender parity index and describes the Gender Parity Index (GPI) as a socio-economic measurement utilized in higher education to assess the proportion of male and female students enrolled in programs. However, this index is not without restrictions. It never indicates whether the rise in the GPI is attributable to a rise in female enrollment or a fall in male enrollment in postsecondary education. According to the research by Ghosh (2020), returns on higher education are extremely unequal and have a significant influence on India's economic disparity. The recommended course of action is to set up a differentiated higher education price based on home income. Scholarships are available for female students who demonstrate exceptional natural aptitude. The viability of designing such schemes, however, is a political matter that is outside the purview of scholarly discourse.

It was described by Angeles et al. (2021), that there are gender differences in educational achievement all around the world, though to differing degrees depending on the location. Girls'

enrollment in elementary education is 78% in low-income countries compared to the global average of 88%, while their enrollment in secondary school is only 31% in these countries compared to the global average of 66%. Reeves and Smith (2022) stated that gender disparities in education exist in the United States and other developed economies, where young women are more likely than their male counterparts to hold a bachelor's degree. Eshetu (2015) describes that these differences can be linked to a number of societal, cultural, and economic factors and are reflected in variables like literacy rates and academic attainment. Pumar (2021) stated that improving access to education, addressing social attitudes, and advocating for gender equality in educational opportunities and outcomes are just a few of the many strategies needed to address these discrepancies. Batool et al. (2021c) stated that gender disparities can only be eliminated if females are provided with equal opportunities in decision-making and jobs. Batool et al. (2021c) concluded that for sustainable economic development, it is important that females in rural areas also provide digital literacy females should know how to use technology and have access to the internet at low prices.

Chidi (2021) stated there are a number of reasons why there are gender differences in educational achievement, such as poverty, societal biases, cultural standards, and resource limitations. Cultural prejudices favour boys' education over girls' in some areas, and these differences are furthered by low funding for girls' education and socioeconomic issues like poverty. Saadat et al. (2022) furthermore, prejudices and views held by society, as well as a lack of parental or familial support for girls' education, might have an impact on gender differences in educational attainment. The intricate and diverse character of gender differences in educational attainment is influenced by these factors, underscoring the necessity of focused initiatives to tackle these problems. Holmlund et al. (2023) conducted qualitative and quantitative research and concluded that financial hardships may prevent some people from pursuing higher education since families would rather spend money on needs than on education.

Chisamya et al. (2012), Batool et al. (2021b), and Saadat et al. (2022) described that Cultural norms and traditional gender roles might affect educational opportunities and results. For instance, girls may be encouraged in some countries to prioritize taking care of the home and their children over going to school. Quenzel and Hurrelmann (2013) preconceived notions and stereotypes can affect both males' and girls' academic success. For example, bias on the part of teachers, attitudes on learning from students, and self-confidence can all contribute to the gender gap in education. Gender disparities in education may be influenced by differences in the intellectual abilities of boys and girls. Nonetheless, this element by itself is unable to account for the difference because girls typically possess stronger cognitive capacities. Batool et al. (2021a), Hek et al. (2016) and Tebaldi and Bilo (2019) stated that the potential of social protection programs which include those promoting women's empowerment to overcome gender differences in educational attainment is being increasingly acknowledged. Improving cultural attitudes, expanding educational options, and promoting gender equality in educational attainment are all vital to resolving these gaps. Beutel and Axinn (2002) examine how gender affects educational achievement as mass education spreads, paying particular attention to enrolment and dropout rates during the beginning of universal education. This research anticipates how macro-level changes in educational, employment, and consumer options will boost school attendance. It also looks at how community-level social changes affect individual educational attainment.

Considering the significance of gender equality in education, this study is designed to address global issues like gender inequality and achieve sustainable development, it is imperative to look at how gender differences in education affect socio-ecological systems. This study explores the complex relationships that exist between the level of education that girls and women acquire and a number of societal issues, including poverty, economic growth, and environmental management. We can develop evidence-based strategies to advance gender equality in education, enhance the wellbeing of people and communities, and eventually accomplish the Sustainable Development Goals by comprehending these intricate relationships.

This multifaceted strategy will not only direct actions and policies but also increase theoretical knowledge of the interdependence of social and ecological systems by considering varying educational attainment, and intersecting factors. To put it briefly, researching this important subject could open doors for everyone towards a more equitable and sustainable future.

Hypothesis of the Study

The current study empirically examines the long-run and short run relationship between gender disparities in education and its impact on the social-ecological system in the region of South Asia. By considering the objective of this study following hypothesis is tested

Model 1

H0: there is no significant impact of gender disparities in educational attainment on income inequality

H1: gender disparities in educational attainment have a significant impact on income inequality

Model 2

H0: there is no significant impact of gender disparities in educational attainment on environmental sustainability

H1: gender disparities in educational attainment have a significant impact on environmental sustainability

Research Gap

A brief review of the literature revealed that there exists a nexus between gender disparity in education and income inequality (Banu, 2016; Chaudhry, 2007). To the best of my knowledge, no study has been conducted in the region of South Asia. This study is also unique in terms of methodology, previous studies were conducted by ignoring the cross-sectional dependence while current research examines the nexus of gender disparities in education and socio-ecological outcomes by applying a cross-sectional autoregressive distributed lag model (CS-ARDL). Figure 1 shows the most used words in the literature review.

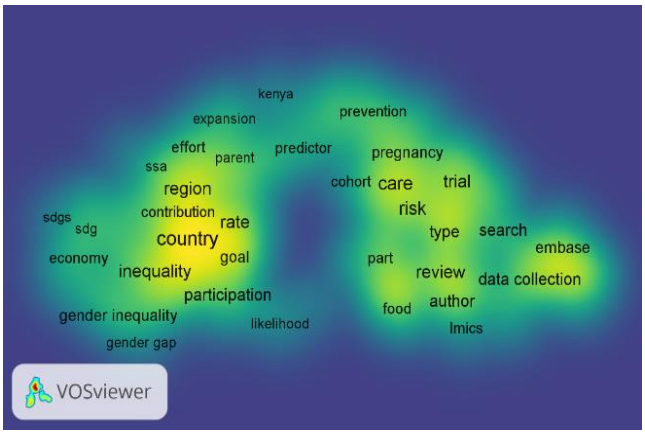

Figure 1. Most used words in the literature review; Source: Author.

Theoretical Relevance

Fleischhauer (2007) stated that human capital results from increased productivity and earnings of an individual due to education. Women are disadvantaged and have less economic potential due to unequal access to education, which leads to an unequal allocation of human capital. Regarding socio-ecological consequences decreased female human capital can worsen poverty, restrict access to healthcare, weaken bargaining power, and increase social inequality. McCann and Kim (2016) described that Feminist theory explores many facets of life, examining the ways in which gender influences experiences in the fields of politics, education, labour, sexuality, and family. It promotes social change and gender equality in all domains by criticizing organizations and behaviours that discriminate against women. Feminist theory inspires people and communities to confront injustices and fight for a society where everyone, regardless of gender, has the opportunity to flourish and realize their full potential by challenging the status quo and uncovering hidden biases. Figure 2 describes the conceptual framework of the research.

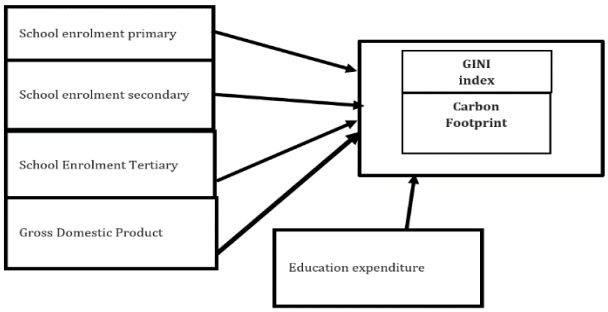

Figure 2. Conceptual framework.

METHODOLOGY

To empirically examine the relationship between gender disparities in education and socio-ecological outcomes two models are established Model-1 describes the social dimension of the objective under consideration, while Model-2 covers the ecological dimension.

Model 1

$$GINI\ index_{it} = \beta_0 + \beta_1 \mathrm{SEP}_{it} + \beta_2 SES_{it} + \beta_3 SET_{it} + \beta_4 LGDP_{it} + \beta_5 EE_{it} + \varepsilon_{it} \quad (1)$$

Model 2

$$Carbon\ footprint_{it} = \beta_0 + \beta_1 SEP_{it} + \beta_2 SES_{it} + \beta_3 SET_{it} + \beta_4 LGDP_{it} + \beta_5 EE + \varepsilon_{it} \quad (2)$$

In Model 1 GINI index is the dependent variable, representing income inequalities, school enrollment primary (SEP), school enrollment secondary (SES), and school enrollment tertiary (SET) are taken as independent variables. When analyzing the differences in educational attainment between genders, the Gender Parity Index (GPI) is a useful instrument. The computation involves dividing the gross enrollment ratio (GER) for females at a given education level (primary, secondary, etc.) by the GER for males, then multiplying the result by 100.

Perfect gender parity is shown by a GPI of 1, which means that the same proportion of boys and girls are enrolled at that educational level. A gender parity index less than one denotes a disadvantage for girls' access to education since there are fewer girls enrolled than boys. A gender parity index greater than one indicates that more girls than boys are enrolled, which may point to a preference for girls in that particular setting.

While Gross domestic product (GDP) and Government education expenditures (GEE) are taken as control variables. One important issue affecting environmental sustainability is CO2 emissions. They encircle the Earth like a blanket, trapping heat and resulting in global warming. Sea levels rise, weather patterns are thrown off, and glaciers melt as a result of global warming, which has dire repercussions for both the earth and its people. In model 2 the environmental dimension of carbon footprint is taken as the dependent variable. Variables and their description in detail are described in Table 1.

Sample size

The data for empirical analysis has been collected from 1990-2022 for the South Asian countries (Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka) from the world development indicators.

Cross-Sectional Augmented Autoregressive Distributed Lag Model (CS-ARDL)

To evaluate the relationship between gender disparities in education and their impact on socio-ecological outcomes, the study applied a panel data technique by considering cross-sectional dependence, a unit root test. This study applied the Cross-Sectional Augmented Autoregressive Distributed Lag CS-ARDL model.

Erülgen et al. (2020) stated that the pooled mean group (PMG) and mean group (MG) are unable to discuss the problem of cross-sectional dependence. CS-ARDL discusses the problem of cross-sectional dependence by taking the average value of cross-sectional correlation in error terms (Chudik and Pesaran, 2015). It is stated by Erülgen et al. (2020) that CS-ARDL provides better results when the time period is sufficiently large in comparison to cross-section (T>N), but the technique is also applied on micro panel data where (T<N) (Usman et al., 2022). In the case of micro panel CS-DL technique can also be used but this method of estimation only provides long-run results.

Table 1. Description of variables.

Variables	Description	Unit	Source
GINI index	Income inequality (range between zero to one)	%	WDI
Carbon footprint	Average annual CO2 emissions per person	t CO2/cap	WDI
Sch. enrollment primary	Percentage of children of primary school age (typically 6-11 years old) currently enrolled in primary education.	%	UNESCO (UIS)
Sch. enrollment Secondary	Percentage of children of secondary school age (typically 6-11 years old) currently enrolled in secondary education.	%	UNESCO (UIS)
Sch. enrollment Tertiary	Percentage of young adults of tertiary education age (typically 18-24 years old) currently enrolled in tertiary education.	%	UNESCO (UIS)
Gross Domestic Product	Per capita (constant 2015 US$)	Log (%)	WDI
Education expenditure	Government expenditure on education, total (% of GDP)	%	WDI

CS-ARDL has the advantage it considering lags for more reliability of estimators (Usman et al., 2022; Hussain et al., 2022). The mean group (MG) technique provides reliable results of parameter averages in case of large time dimension but this technique is unable to handle the problem of cross-sectional dependence (Pesaran, 2015). The pooled mean group (PMG) technique estimates long-run likelihood procedure and estimates intercept short-run coefficient, and error correction term. Literature reveals that pooled mean group (PMG) is a suitable technique in the presence of a mixed order of integration I (0), I (1) (Usman et al., 2022).

Some Advantages of CS-ARDL are that CS-ARDL provides robust results if data is stationary at level I (0) or otherwise at first difference I (1). CS-ARDL provides both short-run and long-run results. In slope co-efficient it addresses the problem of heterogeneity. In the presence of lagged dependent variables, it provides better results, lag selection of dependent variable also reduces the problem of weak endogeneity. The analysis of this research is conducted by applying CS-ARDL.

RESULTS AND DISCUSSIONS

Descriptive Statistics

Descriptive statistics is used for having a look at basic features of data. It is an abridged form of the data and gives an over-all indication of the data collected and tested. It provides the researcher an understanding of the behavior of data and its shape including the trends it shows. What constitutes descriptive statistics include mean, median, standard deviation, Skewness, and kurtosis. From these techniques, the researcher can get the general characteristics e.g. the average range, dispersion, distribution, central tendencies, and normality of the data (Nick, 2007). Table 2 provides the descriptive statistics of all the underlying variables.

The correlation analysis presented in Table 3 describes there is exactly one correlation between GINI and GINI describes a perfect positive correlation. That means if the value of one variable increases the value of another variable will also increase. A correlation on negative one perfect negative correlation and the interpretation will be vice versa. While zero describes no linear relationship exists.

The residual cross-sectional dependence test's findings are highlighted in Table 4. The residual cross-sectional dependence tests assess the correlation between the residuals of the two models. Table 4 examines the potential correlation between the errors in the two models.

Three distinct test statistics Pesaran CD, Pesaran scaled LM, and Breusch-Pagan LM describe the significance at the 1% level, the null hypothesis that there is no cross-sectional dependence can be rejected. Stated differently, there is proof of cross-sectional dependence between the residuals.

Table 5 represents cross-sectional dependence in variables. The study applies the Breusch-pagan LM and Pesaran CD test to check the cross-sectional dependence in variables

Hoyos and Sarafidis (2006) stated that when the number of observations is large Breusch-pagan LM tests are used. This study follows the Pesaran CD test, this test provides satisfactory results in the case where T and N have almost of same magnitude or T<N. both tests have a null hypothesis of “Cross-sectional dependence”. The test indicates the presence of cross-sectional dependence. The first-generation unit root test cannot handle the problem of cross-sectional dependence in this case second generation unit root test is applied.

Table 2. Descriptive statistics.

	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
GINI Index	34.29	34.34	68.56	4.80	9.39	231
Environmental sustainability	0.68	0.63	2.02	0.09	0.23	231
Sch. enrollment primary	0.95	1.00	2.24	-0.29	0.25	231
Sch. enrollment Secondary	1.00	0.85	4.13	0.07	0.60	231
Sch. enrollment Tertiary	1.18	0.98	3.86	0.05	0.77	231
Urban population	3.23	3.02	7.22	-0.19	1.59	231
LN gross domestic product	7.34	7.17	9.31	6.04	0.85	231
Education expenditure	3.52	3.15	8.29	0.50	1.71	231

Source; Authors calculated using STATA, version 14

Table 3. Correlation analysis.

	GINI	ENS	SEP	SES	SET	UP	LNGDP	EE
GINI	1							
ENS	-0.1	1						
SEP	-0.01	0.45	1					
SES	-0.47	-0.2	0.3	1				
SET	-0.13	0.16	0.22	0.23	1			
LNGDP	-0.13	-0.1	0.51	0.67	0.19	-0.1	1	
EE	-0.08	-0.5	0.06	0.4	-0.3	0.28	0.32	1

Source: Authors' own calculation using STATA, version 14

Table 4. Residual cross-sectional dependence.

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	100.27.41	31	0.00
Pesaran scaled LM	50.32		0.00
Pesaran CD	12.23		0.00

Source: Authors calculations using E-views 10.

Table 5. Cross-sectional dependence in variables.

Variables	Breusch-Pagan LM	Pesaran CD	Status
GINI	120.70*	15.27*	Cross-Section Dependence
ENS	443.00*	17.02*	Cross-Section Dependence
SEP	193.5*	4.97*	Cross-Section Dependence
SES	166.38*	42.8*	Cross-Section Dependence
SET	127.97*	3.35*	Cross-Section Dependence
UP	150.27*	13.55*	Cross-Section Dependence
LNGDP	629.15*	25.04*	Cross-Section Dependence
EE	107.76*	13.27*	Cross-Section Dependence

Source: Calculated by the author using E-VIEWS.

Table 6. Panel unit root test.

Variables	Cross-sectional augmented Dickey– Fuller (CADF)		Cross-sectional augmented Im– Pesaran–Shin (CIPS)	
	At level	At first difference	At level	At first difference
GINI	-1.86 (-0.25)	-4.60* (-7.95)	-1.10 (-2.55)	-5.165 * (-2.55)
ENS	-0.57 (1.85)	-2.74* (2.71)	-2.58* (-2.55)	-6.09* (-2.55)
SEP	-2.50** (-2.03)	-4.30* (-7.11)	-3.07* (-2.55)	-3.86* (-2.32)
SES	-1.54 (0.65)	-3.90* (-5.98)	-2.86* (-2.55)	-3.23* (-2.32)
SET	-0.96 (-0.89)	-5.84* (-11.43)	-1.20 (-2.55)	-4.97* (-2.55)
LNGDP	-2.38** (-1.69)	-4.12* (-6.60)	-1.94 (-2.55)	-4.12* (-2.55)
EE	-3.07* (-3.65)	-6.06* (-12.07)	-3.09* (-2.55)	-6.06* (-2.55)

Note: z-values are shown in parentheses under respective statistics *, **, *** shows rejection of null hypothesis of "unit-root" at 1%, 5%, and 10% significance.

The second-generation unit root test is incorporated with the problem of cross-sectional dependence in Table 6. CADF is unique in that manner it can be applied to both balanced and unbalanced data, while CIPS can be used only for balanced data (Hashiguchi and Hamori, 2010). Data used in the current study is strongly balanced so both tests can be used but the study utilized the CIPS unit root test and CADF is applied for the robust results. As stated by Pesaran (2007) CIPS unit root test has an advantage it not only deals with the problem of cross-sectional dependence but also performs better in the presence of heterogeneity. The results of both unit root tests show the order of integration is I(0) and I(1), which means by following the CIPS unit root test school enrolment primary (SEP), environmental sustainability (ENS), and school enrolment secondary are stationary at a level while other variables are stationary at first difference. None of the variables has an order of integration at the second difference I (2).

In Table 6, t-values are given along with probability values. After keen observation of the order of integration, and cross-sectional dependence it is revealed that variables are stationary at mix order, decided to apply the CS-ARDL technique so now we check for a long-run relationship.

Model 1

As shown in Table 7, The GINI-Coefficient and School enrollment primary have a statistically significant negative association in the short term. This indicates that there is a short-term correlation between a rise in primary school enrollment and a reduction in economic disparity. The GINI-Coefficient and secondary school enrollment have a statistically significant negative association in the short term. This indicates that a short-term decrease in income disparity is linked to an increase in secondary school enrolment (Checchi, 2001). The GINI-Coefficient and Tertiary school enrollment have a considered statistically significant adverse association. This indicates that there is a short-term correlation between a rise in tertiary school enrolment and a reduction in income disparity. In the long run, there is a statistically significant negative correlation between the GINI-Coefficient and school enrollment Tertiary and Sch. enrollment primary. This indicates that, over time, a decrease in income disparity is linked to an increase in enrolment in primary and postsecondary education. In the long run, the GINI-Coefficient and Secondary school enrollment has a positive and statistically significant relationship. The results coincide with the study of Arshed et al. (2018).

Model 2

Model 2 in Table 7 describes the environmental dimension of socio-ecology in the long run. There is a negative and statistically significant correlation between environmental sustainability and school enrollment. This indicates that there is a long-term relationship between a rise in primary school enrollment and a decline in environmental sustainability. Numerous factors could be to reason for this, including increasing population growth brought on by higher primary school enrolment rates, which would put more strain on the environment and resources. shifts in the patterns of land use as more people relocate from rural to urban regions, which may cause habitat loss and deforestation. rising earnings might result in higher levels of pollution and waste production due to greater consumption of products and services.

Table 7. CS-ARDL results.

	Model.1 GINI-Coefficient			Model.2 Environmental sus		
Variable	Coefficient	St. Error	p-value	Coefficient	St. Error	p-value
Short Run Results						
Sch. enrollment primary	-.44**	.22	0.04	-0.003	0.004	0.39
Δ. Sch. enrollment primary	.04	.10	0.69	-0.007	0.006	0.27
Sch. enrollment Secondary	-.37***	.20	0.07	0.002	0.002	0.38
Δ. Sch. enrollment Secondary	.040	.031	0.19	-0.003**	0.001	0.02
Sch. enrollment Tertiary	-.078***	.044	0.074	-0.001	0.003	0.59
Δ. Sch. enrollment Tertiary	-.435	.195	0.026	0.004**	0.002	0.02
Gross Domestic Product	-.005	.017	0.772	0.330**	0.150	0.029
Δ. Gross Domestic Product	.027	.031	0.378	.048	.146	0.740
Education expenditure	-.622	1.436	0.664	.034	.042	0.409
Δ. Education expenditure	-.674	1.892	0.721	.022	.028	0.435
Error Correction Term	-1.589 *	.139	0.00	-1.37*	.142	0.000
Long-Run Results						
Sch. enrollment primary	-.250**	.134	0.063	-.189**	.102	0.063
Sch. enrollment Secondary	.031***	.018	0.090	.047	.047	0.320
Sch. enrollment Tertiary	-.360*	.137	0.009	-.235**	.1031	0.023
Gross Domestic Product	-.021	.026	0.424	.295**	.138	0.033
Education expenditure	-.368*	.134	0.006	1.023	1.376	0.457
No. Of Observations	196			196		
R-Squared MG	0.54			0.55		
CD Statistics	0.61			0.48		

Note: *, **; *** shows rejection of the null hypothesis of cross-sectional independence at 1%, 5%, and 10% levels of significance.

There is a positive and statistically significant correlation between environmental conditions and secondary school enrollment. This indicates that, over time, a higher enrollment in secondary education is linked to a longer-term rise in environmental sustainability. This discovery appears to be at odds with the prior one, and it's crucial to remember that it could be because of Reverse causality (Boca and Saraçlı, 2019). It is feasible that places with more environmentally sustainable practices also have higher rates of secondary enrollment since they are more willing to invest in this kind of education. Environmental susceptibility and Tertiary school attendance have a negative and statistically significant association. This indicates that there is a long-term relationship between a rise in postsecondary education enrollment and a decline in environmental sustainability. This result is more in line with the hypothesis that increasing consumption and environmental effects can result from higher levels of education. However, it is crucial to consider the same warnings about reverse causality, missing variables, and model limitations that were previously highlighted.

The results of Model 2 present some intriguing challenges to the Environmental Kuznets Curve (EKC) hypothesis in terms of its theoretical applicability. According to the EKC theory, environmental pollution and economic development have an inverse U-shaped relationship, with pollution rising as economies expand but finally beginning to fall as nations get wealthier and make greater investments in environmental preservation (Dinda, 2004). The data in Model 2 appear to indicate that the relationship between education and environmental sustainability is more intricate than the EKC hypothesis predicts. Higher education can raise one's knowledge and understanding of environmental issues, but it can also increase consumption and have an adverse effect on the environment. This indicates that there is a long-term correlation between rising secondary school enrolment and rising income inequality, which is contrary to economic theory the reason might be the omitted variables, political institutions, labor market dynamics, and cultural norms.

CONCLUSIONS

By incorporating SDG goal 4 of quality education and goal 5, gender equality, the current study empirically examined the relationship between gender disparity in education and the social-ecological system. By applying CS-ARDL the current research concludes that a decrease in gender disparity in the long run will also decrease income inequality in the South Asian region. In model 2, enrollment in secondary schools is positively and statistically significantly correlated with environmental conditions. This suggests that an increase in secondary school enrollment over time is associated with a longer-term rise in environmental sustainability.

Despite major advancements in recent decades, gender inequality in education continues to pose a serious concern throughout South Asia. Although there has been progress, girls' enrollment rates are still lower than those of males, and their completion rates are consistently lower at all educational levels. There are significant ramifications for people, communities, and the growth of the area from this inequality. This disparity affects people's lives on an individual, community, and regional development level. It is caused by deeply held beliefs, economic challenges, and unequal access to high-quality education. Poverty may make it necessary to prioritize males' education, yet illiterate girls have far-reaching effects that limit their access to economic possibilities, take away their agency, and prolong poverty cycles.

Thankfully, a number of projects are addressing this problem. International organizations supply assistance, NGOs raise awareness, and governments grant scholarships and focused actions. With persistent work, South Asia may realize its full potential as a people and create a better future where all girls get the top-notch education they need.

The current research has some limitations, a complete picture may be presented if urbanization is not excluded because cities face particular environmental stresses and gender dynamics. Due to migratory patterns, informal economies, and restricted access to high-quality education in urban slums, urbanization might worsen gender gaps in educational attainment. Gender roles and interactions with the environment can be strongly influenced by cultural norms, economic structures, and political contexts. For a deeper comprehension, a more thorough investigation could examine these interconnected aspects.

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