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Government Expenditure on Education and Human Development in Developing Countries: Evidence from a Pre-2022 Unbalanced Panel Dataset

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ABSTRACT: This study examines the relationship between government expenditure on education and human development in developing countries using a pre-2022 unbalanced panel dataset covering 115 countries and 459 country-year observations. The study employs a descriptive, panel-based analytical framework to assess whether public education spending is associated with improvements in the Human Development Index (HDI). The descriptive results show that average HDI increased from 0.549 in 2000 to 0.657 in 2021, while average government expenditure on education rose from 3.895% to 4.501% of GDP during the same period. These findings indicate that education finance remains an important policy instrument for strengthening human capital and supporting development outcomes. However, the study also emphasizes that higher spending alone does not automatically produce higher human development. The effectiveness of education expenditure depends on how public resources are allocated, governed, and transformed into improvements in learning, access, equity, and welfare. The paper concludes that developing countries should move beyond expenditure expansion alone and focus on improving the efficiency, quality, and institutional management of education spending. The study contributes to the literature by distinguishing between simple spending levels and the broader policy conditions required to convert education finance into sustainable human development gains.

Keywords: Education Expenditure; Human Development; HDI; Panel Data JEL Classification: H52; I25; O15.

I. INTRODUCTION

Public expenditure on education is widely regarded as one of the most important instruments available to governments seeking to strengthen human capital, expand opportunity, and improve long-run welfare. In developing countries, this policy question is especially important because education systems often operate under tight fiscal constraints, persistent infrastructure gaps, and uneven institutional capacity. Decisions about education budgets therefore matter not only for schooling outcomes, but also for broader development trajectories.

The relationship between education spending and human development, however, is not purely mechanical. Countries that allocate a larger share of national income to education often display higher levels of human development, but those differences may also reflect deeper structural advantages such as stronger state capacity, better governance, higher income levels, and more effective public-sector institutions. A simple cross-country association can therefore overstate the direct contribution of expenditure volume alone.

This paper examines whether government expenditure on education is associated with the Human Development Index (HDI) in developing countries using a pre-2022 unbalanced panel dataset. The revised analytical sample contains 115 developing countries and 459 country-year observations drawn from 2000,

2010, 2015, 2020, and 2021. The paper is intentionally aligned to this restricted sample in order to maintain consistency between the narrative, tables, and empirical design.

The study contributes in three ways. First, it distinguishes between descriptive cross-country patterns and the within-country logic of fixed-effects estimation. Second, it places spending effectiveness at the center of the analysis rather than treating budget size as sufficient in itself. Third, it considers whether the education expenditure–HDI relationship may differ across low-income and middle-income developing countries.

The remainder of the paper is organized as follows. Section 2 reviews the relevant literature and identifies the main empirical gaps. Section 3 develops the theoretical argument and study hypotheses. Section 4 presents the data, variables, and empirical strategy. Section 5 reports the validated results from the restricted analytical sample. Section 6 discusses the broader implications of the findings. Sections 7 and 8 present the conclusion and policy recommendations, while Section 9 outlines limitations and directions for future research.

II. LITERATURE REVIEW

1. CONCEPTUAL FOUNDATIONS

Recent literature continues to treat education as a central mechanism through which countries accumulate human capital and improve welfare. Baldacci et al. showed that social spending can build human capital and support growth in developing countries [1], while Rajkumar and Swaroop demonstrated that the effectiveness of public spending depends strongly on governance quality [2]. Hanushek and Woessmann shifted attention from years of schooling to cognitive skills, arguing that education quality is more closely linked to long-run development than schooling quantity alone [3]. Gakidou et al. further connected education to broader welfare by showing that rising educational attainment, especially among women, was associated with large reductions in child mortality across countries [4].

Modern human-development measurement also moved beyond one-dimensional views of progress. Klugman, Rodriguez, and Choi clarified the revised HDI framework and the debates surrounding the 2010 reform [5], while Lutz and KC integrated education and demographic structure into a global human capital perspective [6]. Hanushek and Woessmann further argued that better schools can causally contribute to higher growth when education systems improve the cognitive skills embodied in the population [7].

2. EDUCATION SPENDING, HUMAN CAPITAL, AND DEVELOPMENT OUTCOMES

A second strand of literature examines how education systems and educational attainment translate into development outcomes. Barro and Lee improved cross-country measurement of educational attainment [8], and Glewwe et al. reviewed evidence from developing countries showing that school resources matter unevenly depending on how inputs are translated into learning [9]. Montenegro and Patrinos provided comparable international evidence on the returns to schooling [10], while Cuaresma, Lutz, and Sanderson argued that demographic change yields stronger development payoffs when accompanied by educational expansion [11].

This work was reinforced by later syntheses emphasizing quality, efficiency, and policy design. Hanushek and Woessmann's knowledge-capital framework argued that population skills, rather than schooling volume alone, are central to long-run prosperity [12]. Evans and Popova showed that the evidence on learning interventions in developing countries is highly sensitive to the type of program evaluated and the rigor of the supporting studies [13]. UNESCO's 2016 monitoring report broadened the argument by placing education at the center of sustainable development [14], and Glewwe and Muralidharan concluded that reforms should target learning gains rather than inputs in isolation [15].

3. GOVERNANCE, QUALITY, AND HETEROGENEITY

Later studies shifted attention from budget size to budget effectiveness. Bashir et al. showed that learning improvements in African education systems depend not only on spending levels but also on how budgets are deployed across teachers, materials, and delivery capacity [16]. Psacharopoulos and Patrinos confirmed that returns to education remain substantial worldwide, though heterogeneous across levels and contexts

[17]. The World Development Report 2018 argued that schooling without learning weakens the developmental impact of education finance [18], while Kraay's Human Capital Index methodology linked education and health investments to future worker productivity [19].

This line of work also underscores heterogeneity across spending channels and institutional settings. Paliova, McNown, and Nulle found that different dimensions of human development respond differently to public social spending [20]. Kim and Ahn similarly treated public education, health care, and welfare expenditure as social investment with potential growth effects [21]. Linhartova's panel analysis of EU-28 countries likewise showed that the human-development effects of public expenditure vary across sectors [24]. These studies are especially relevant to the present paper because they suggest that pooled cross-country correlations may partly capture structural differences in public-sector effectiveness rather than the independent effect of education budget changes alone.

4. INTERNATIONAL POLICY LITERATURE AND RESEARCH GAP

International policy literature before 2021 further strengthened the case for better education finance. UNESCO's 2016 GEM Report emphasized education's cross-cutting role in sustainable development [14]. The World Bank's World Development Report 2018 argued that systems must focus on learning rather than schooling alone [18], and Kraay's human capital framework made education central to the measurement of future productivity [19]. UNESCO's Global Education Monitoring Report 2020 stressed inclusion and equity as core conditions for meaningful education progress [22], while the Human Development Report 2020 reaffirmed that development depends on how societies convert resources into capabilities and resilience [23].

Taken together, the recent literature offers four broad conclusions. First, education remains central to human development and long-run growth. Second, the effect of education spending is conditional on governance, allocation quality, and learning effectiveness. Third, multidimensional measures such as HDI and human capital indices have improved the way development is assessed. Fourth, relatively few studies isolate the education expenditure-HDI nexus in a pre-2022 developing-country panel while explicitly distinguishing descriptive associations from within-country fixed-effects dynamics. Recent panel evidence and syntheses also suggest that sectoral spending effects are heterogeneous and institutionally mediated [20], [24], [25]. The present paper addresses this gap by focusing on government expenditure on education and HDI in a restricted developing-country panel and by interpreting the relationship cautiously in light of institutional heterogeneity.

Table 1. Comparative synthesis of selected 2008-2021 literature.

No.	Reference	Context	Approach	Main relevance to this study
1	Baldacci et al. (2008)	Social spending and growth in developing countries	Developing-country panel	Social spending builds human capital and supports growth.
2	Rajkumar & Swaroop (2008)	Governance and public spending	Cross-country econometrics	Spending effectiveness depends on governance quality.
3	Hanushek & Woessmann (2008)	Education quality and development	Comparative empirical review	Cognitive skills matter more than schooling quantity alone.
4	Gakidou et al. (2010)	Education and child mortality	Global systematic analysis	Education affects welfare beyond income and schooling.
5	Klugman et al. (2011)	HDI methodology and reform	Methodological paper	Clarifies modern HDI measurement and its critiques.
6	Lutz & KC (2011)	Education and population dynamics	Global demographic analysis	Education shapes long-run human capital and social outcomes.
7	Hanushek & Woessmann (2012)	Better schools and growth	Cross-country growth analysis	School quality can causally contribute to growth.
8	Barro & Lee (2013)	Educational attainment data	Global dataset construction	Improves cross-country education measurement.

No.	Reference	Context	Approach	Main relevance to this study
9	Glewwe et al. (2013)	School resources in developing countries	Literature review	Inputs matter through learning, not automatically.
10	Montenegro & Patrinos (2014)	Returns to schooling	Global database and empirical synthesis	Returns to education remain positive across contexts.
11	Cuaresma et al. (2014)	Demography and education	Demographic-econometric analysis	Education amplifies development gains from demographic change.
12	Hanushek & Woessmann (2015)	Knowledge capital	Book-length synthesis	Population skills are central to long-run prosperity.
13	Evans & Popova (2016)	What improves learning	Systematic review analysis	Effectiveness depends on intervention design and evidence quality.
14	UNESCO (2016)	Education and sustainable development	Global monitoring report	Education contributes to multiple development goals.
15	Glewwe & Muralidharan (2016)	Improving education outcomes	Synthesis of causal evidence	Policy should prioritize learning gains, not inputs alone.
16	Bashir et al. (2018)	Learning in Africa	Regional policy analysis	Budget deployment and service delivery affect outcomes.
17	Psacharopoulos & Patrinos (2018)	Returns to education	Global literature review	Education investment yields strong but heterogeneous returns.
18	World Bank (2018)	Learning crisis	Global policy report	Finance must be linked to learning outcomes.
19	Kraay (2018)	Human Capital Index methodology	Methodological working paper	Education and health investments affect future productivity.
20	Paliova et al. (2019)	HDI dimensions and social spending	Cross-country econometrics	Different HDI dimensions respond differently to public spending.
21	Kim & Ahn (2020)	Social investment effects	Comparative empirical analysis	Public education spending can support growth via social investment.
22	UNESCO (2020)	Inclusion and equity	Global monitoring report	Inclusion conditions education-system effectiveness.
23	UNDP (2020)	Multidimensional human development	Global report	Resource conversion and resilience matter for human development.
24	Linhartova (2021)	Public expenditures and human development	Panel data analysis	Sectoral expenditure effects differ across categories.
25	Hanushek & Woessmann (2021)	Education and growth	Synthesis and survey article	Recent synthesis linking education quality, human capital, and growth.

III. THEORETICAL BACKGROUND AND HYPOTHESIS DEVELOPMENT

The study is grounded in the human capital perspective, which holds that public investment in education can improve skills, productivity, earnings potential, and broader well-being. Education expenditure may influence human development through several channels: greater access to schooling, improvements in educational quality, stronger lifetime capabilities, and indirect effects on health, employment, and social participation. Because HDI captures achievements in health, education, and income dimensions, education finance can plausibly contribute to the index both directly and indirectly.

At the same time, the developmental return to public education spending depends on how resources are allocated and managed. Larger budgets do not automatically generate better outcomes when spending is fragmented, poorly targeted, or weakened by institutional inefficiency. This implies that a positive

descriptive relationship between education expenditure and HDI may partly capture durable cross-country differences in state capacity and policy effectiveness rather than the independent impact of year-to-year expenditure changes.

The theoretical expectation is therefore twofold. On one hand, higher government expenditure on education should be associated with higher human development because it expands the resources available for capability formation. On the other hand, the size of that association should diminish once country-specific and time-specific heterogeneity are taken into account, since fixed effects absorb structural differences that pooled comparisons cannot fully separate.

Heterogeneity across income groups is also theoretically plausible. In low-income countries, marginal increments in education spending may yield relatively large welfare gains when baseline deficits in access, staffing, or infrastructure are severe. In middle-income settings, by contrast, the developmental return to additional spending may depend more heavily on composition, efficiency, and quality improvements than on aggregate expenditure volume alone.

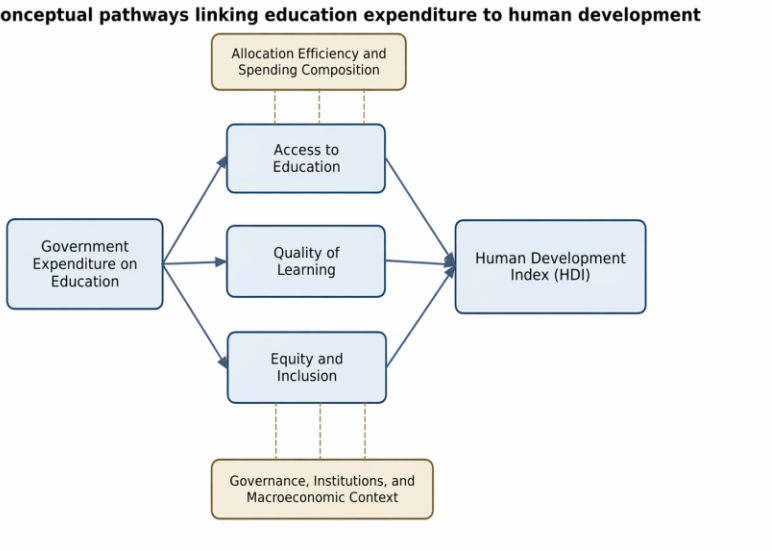

FIGURE 1. Conceptual framework linking government expenditure on education to human development outcomes.

- H1. Government expenditure on education is positively associated with the Human Development Index in developing countries.
- H2. The positive association between government expenditure on education and HDI weakens after controlling for unobserved country-specific and year-specific effects.
- H3. The relationship between education expenditure and HDI differs across income groups.
- H4. The association between education expenditure and HDI is stronger in low-income countries than in middle-income developing countries.

IV. DATA AND METHODOLOGY

1. STUDY DESIGN AND SAMPLE

The paper adopts a quantitative cross-country panel design. A panel framework is appropriate because it combines variation across countries with variation over time, allowing the analysis to distinguish broad cross-sectional patterns from within-country changes.

The analytical sample is an unbalanced panel covering 115 developing countries and 459 country-year observations. The time points retained in the corrected pre-2022 sample are 2000, 2010, 2015, 2020, and 2021.

The panel is unbalanced because information on government expenditure on education is not available for every country in every year.

2. VARIABLES

The dependent variable is the Human Development Index (HDI). The principal explanatory variable is government expenditure on education measured as a percentage of GDP. Income-group classification is used for subgroup analysis, while life expectancy, under-five mortality, and real GDP per capita are retained as contextual indicators for descriptive interpretation.

The empirical focus of the manuscript is deliberately narrow: education expenditure remains the central policy variable, while the broader set of development indicators provides background rather than separate causal claims.

3. EMPIRICAL SPECIFICATION

The baseline panel-data model is specified as follows:

$HDIit = \alpha + \beta\ EduExpit + \mu i + \lambda t + \varepsilon it$

In this specification, HDI_it denotes the Human Development Index for country i in year t, EduExp_it is government expenditure on education as a share of GDP, μ_i captures country fixed effects, λ_t captures year fixed effects, and ε_it is the idiosyncratic error term.

The estimation strategy proceeds from descriptive statistics to temporal comparisons and then to panel-data inference. In substantive terms, the model asks whether countries experience improvements in HDI when their education expenditure changes over time, once time-invariant national characteristics and common period shocks are controlled for.

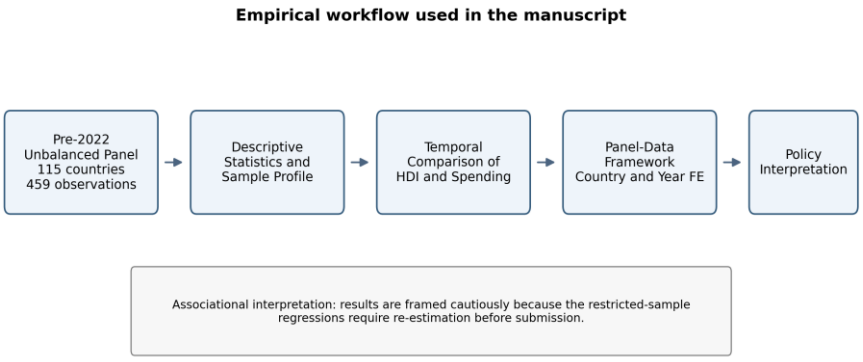

FIGURE 2. Empirical workflow used in the manuscript, from sample construction to policy interpretation.

V. RESULTS

1. AGGREGATE DEVELOPMENTAL BACKGROUND

Table 2 presents the long-run contextual background for low- and middle-income countries. The aggregate indicators indicate broad social progress between 2000 and 2020: life expectancy increased, under-five mortality declined markedly, and real GDP per capita rose. Government expenditure on education also increased over the period, though more gradually than the social indicators. Taken together, these patterns suggest that improvements in human development unfolded alongside expansion in social investment, while also reflecting wider structural change.

Table 2. Aggregate background for low- and middle-income countries.

Indicator	2000	2010	2020
Government expenditure on education (% of GDP)	3.242	3.502	3.858
Life expectancy at birth (years)	65.672	68.955	70.748
Under-five mortality (per 1,000)	83.386	55.255	42.891
Real GDP per capita (constant 2015 US$)	2169.246	3513.143	4809.849

2. DESCRIPTIVE OVERVIEW OF THE RESTRICTED SAMPLE

The corrected analytical sample consists of 459 observations for 115 developing countries. The pooled mean HDI is 0.629, while the average share of GDP devoted to public education expenditure is 4.333%. Table 3 reports the core descriptive statistics, and Table 4 summarizes the restricted sample profile used consistently throughout the manuscript.

Table 3. Descriptive overview for the restricted analytical sample.

Variable	Obs.	Mean	Pooled SD
HDI	459	0.629	0.129
Education spending (% of GDP)	459	4.333	2.339

Table 4. Restricted sample profile.

Component	Value
Coverage	115 developing countries
Country-year observations	459
Included years	2000, 2010, 2015, 2020, and 2021

3. TEMPORAL EVOLUTION OF HDI AND EDUCATION EXPENDITURE

Average HDI in the sample rises from 0.549 in 2000 to 0.657 in 2021, while mean government expenditure on education increases from 3.895% to 4.501% of GDP over the same period. Spending peaks in 2020 at 4.633% before easing slightly in 2021, while HDI shows a small plateau between 2020 and 2021. The joint movement of the two variables is consistent with the expectation of a positive descriptive relationship, but the pattern also suggests that gains in human development depend on more than expenditure alone.

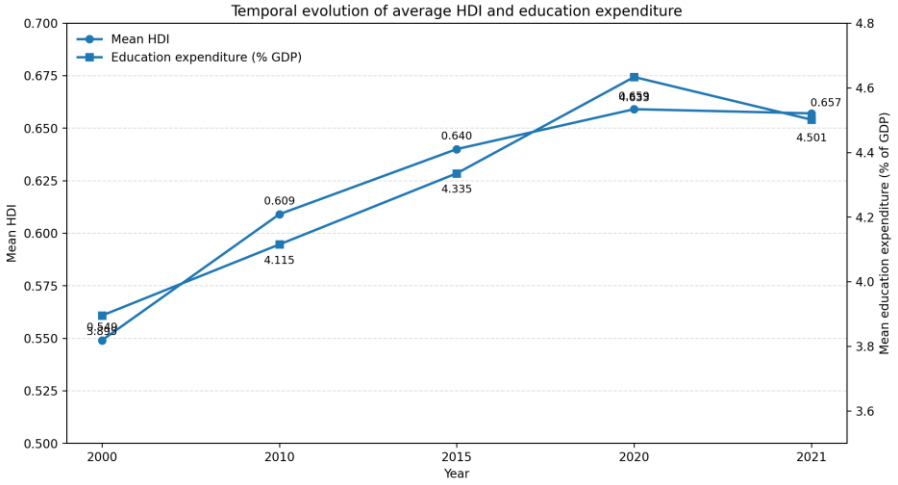

FIGURE 3. Temporal evolution of mean HDI and mean education expenditure in the restricted pre-2022 sample.

Table 5. Temporal evolution of average HDI and education expenditure

Year	Observations	Countries	Mean HDI	SD of HDI	Mean education spending	SD of spending
2000	67	67	0.549	0.142	3.895	2.013
2010	85	85	0.609	0.132	4.115	2.224
2015	104	104	0.640	0.125	4.335	1.979
2020	103	103	0.659	0.113	4.633	2.662
2021	100	100	0.657	0.114	4.501	2.597

4. ANALYTICAL INTERPRETATION

At the descriptive level, the results are consistent with H1: countries in the restricted sample experienced higher average HDI alongside higher average public spending on education over time. This pattern supports the view that education expenditure remains a meaningful development policy variable.

At the same time, the present evidence also reinforces the logic of H2. Because education spending and HDI both co-vary with broader structural conditions, the strength of the relationship observed in pooled or descriptive comparisons is unlikely to map one-for-one onto a within-country fixed-effects estimate. Put differently, part of the positive relationship probably reflects persistent differences in fiscal capacity, institutional quality, and allocation efficiency across countries.

The heterogeneity hypotheses (H3 and H4) remain substantively important, especially in view of the large disparities across developing-country income groups. However, because the restricted-sample subgroup regressions are not reproduced in this corrected version, the final submission should report the re-estimated fixed-effects and income-group results directly from the pre-2022 panel.

VI. DISCUSSION

The central implication of the paper is that public education expenditure should be understood as a necessary but not sufficient condition for higher human development. The upward movement in both HDI and education spending between 2000 and 2021 is consistent with the human capital argument that sustained public investment in education contributes to capability expansion. Yet the evidence also points to an important qualification: countries do not translate additional spending into development gains at the same rate.

This interpretation matters for policy. A strategy focused only on raising the education budget may produce disappointing results when funds are poorly targeted, fragmented across administrative layers, or weakly linked to learning, retention, and inclusion outcomes. In such cases, larger allocations may coexist with limited improvements in human development because the institutional mechanisms that transform resources into outcomes remain underdeveloped.

The discussion also helps explain why an attenuation of coefficients under fixed effects is theoretically plausible. Much of the cross-country difference in HDI may be tied to long-standing institutional and socioeconomic characteristics that do not change rapidly over time. Once those persistent characteristics are controlled for, the short-run within-country effect of additional education expenditure may appear smaller than the pooled association suggests. That result would not imply that education spending is unimportant; rather, it would imply that the timing, composition, and efficiency of spending are decisive.

The possible income-group heterogeneity is equally important. In lower-income settings, additional expenditure may finance basic infrastructure, teacher provision, and school access, generating relatively large marginal gains. In middle-income settings, where access constraints may already be less severe, the quality and effectiveness of spending can become more important than the aggregate budget share itself. This distinction strengthens the case for differentiated policy design rather than one-size-fits-all expenditure benchmarks.

VII. CONCLUSION

This study analyzed the relationship between government expenditure on education and human development in developing countries using a pre-2022 unbalanced panel dataset of 115 countries and 459 country-year observations. The descriptive evidence shows that both HDI and public education expenditure increased between 2000 and 2021. Average HDI rose from 0.549 to 0.657, while average education spending increased from 3.895% to 4.501% of GDP. These trends support the view that education expenditure is an important component of human development policy.

However, the study also shows that the education expenditure–HDI relationship should not be interpreted as automatic or purely budget-driven. While higher spending can expand educational access, improve learning conditions, and strengthen human capital, its developmental effect depends strongly on institutional capacity, governance quality, allocation efficiency, and the ability of education systems to convert financial resources into real welfare improvements.

The main conclusion is that public education expenditure matters, but its impact depends on how effectively it is used. For developing countries, the policy challenge is therefore not only to increase education budgets, but also to improve the quality, targeting, and accountability of spending. Education finance is most valuable when it supports inclusive access, better learning outcomes, stronger human capabilities, and long-term improvements in welfare.

Overall, the study contributes to the human development literature by shifting attention from the level of education spending to its effectiveness. Future research should extend this analysis by using richer control variables, longer time periods, expenditure-composition measures, and stronger causal designs to better explain how education spending translates into sustainable gains in human development.

VIII. LIMITATIONS AND FUTURE WORK

Several limitations should be acknowledged. First, the panel is unbalanced because complete education expenditure data are not available for all countries and years. Second, the study concentrates on aggregate

education expenditure and does not distinguish among recurrent spending, capital spending, or the quality of within-sector allocation. Third, the current design does not fully control for governance quality, policy implementation, or other institutional variables that may condition the effectiveness of spending.

In addition, the analysis should avoid strong causal language. Reverse causality, omitted variables, and lagged transmission mechanisms remain possible. Future research would benefit from re-estimating the restricted sample with richer control variables, lag structures, and expenditure-composition measures, and from comparing education spending with other social-sector investments in a harmonized framework.

Author Contributions

The author conducted the conceptualization, methodology, data analysis, investigation, writing, review, editing, and final approval of the manuscript.

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Data Availability

The dataset will be available from the author upon reasonable request.

Conflicts of Interest

The author declares no conflict of interest.

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