Journal of Posthumanism

2025
Volume: 5, No: 12, pp. 170–183
ISSN: 2634-3576 (Print) | ISSN 2634-3584 (Online)
posthumanism.co.uk

DOI: https://doi.org/10.63332/joph.v5i12.3740

# Education and Poverty: A Panel Data Approach for a Sample of Developing Countries

Leila CHEMLI[1]

***Abstract***

*This study examines the relationship between access to education and poverty alleviation in 40 developing countries from 2000 - 2022. Using fixed and dynamic effects in an econometric panel data model, the study finds that coverage of primary schooling, coverage of secondary schooling, and the share of educated adults significantly reduces the incidence of monetary poverty. The effect is moderated by income inequality and level of economic development. The implications call for an in combination approach to educational access with redistributive policies and the quality of teachers. Overall, this study provides a grounded set of policy recommendations to improve how educational access relates to poverty alleviation.*

***Keywords:*** *Education, Poverty, Developing countries, Human capital, Panel data.*

## Introduction

Poverty continues to be one of the most stubborn structural challenges in developing countries. Although some areas are experiencing continued economic growth, there are large pockets of the population living below the poverty line with little access to critical services such as healthcare, clean water, and above all education. Economic literature has long argued that education is among the most significant drivers of human development and social mobility.

Access to education, in addition to its intrinsic value, is pivotal in the formation of human capital **(Becker, 1964),** in increasing productivity in the labor market **(Mincer, 1974),** and in closing the intergenerational income gap **(Psacharopoulos & Patrinos, 2018).** A highly educated population is more likely to be able to access the labor market and good slightly jobs and participate in economic growth so reducing both income poverty and multidimensional poverty.

The link between education and poverty isn't simple or direct, though. On the one side, education can make a difference against poverty by raising people's income and enabling social inclusion. Conversely, educational inequities are likely to exacerbate the pre-exiting divide between rural/urban areas, genders and individual level of income **(UNESCO 2020).** A few studies note that an increase in education decreases poverty only when employment can absorb skilled workers **(Majumder, 2019).**

[1] Research laboratory modeling, financing and development MOFID, University of Sousse, Tunisia, Email: Chemli.leila@yahoo.fr

Therefore, a key research question is: What has the role of access to education been in reducing poverty in developing countries? This study empirically tests this relationship using the panel data econometric model for a sample of developing countries from 2000 to 2022. More specifically, it aims to:

- Estimate the impact of enrollment and average level of education on monetary poverty.
- Determine if this effect is independent of the level of education (elementary, secondary or tertiary).
- Study the modulating role of economic development and inequality.

This study aims to provide an empirical contribution to the literature by using recent international data (World Bank, UNESCO, UNDP) and testing a robust econometric model.

## 2. Theoretical Review and Literature

### 2.1. Education as Human Capital

One of the major contributions of economic theory is the conceptualization of education as an investment in human capital. **Schultz (1961) and Becker (1964)** argue that education increases individual productivity and, by extension, the overall productivity of the economy. According to **Mincer (1974),** years of schooling explain a significant part of income differences between individuals due to their impact on skills and employability.

This approach is reinforced by **Lucas (1988),** who emphasizes that the accumulation of human capital generates positive externalities: an educated population contributes to innovation, the adoption of new technologies, and sustainable economic growth. Thus, education not only reduces poverty at the individual level but also stimulates macroeconomic development.

### 2.2. Education and Poverty Reduction

The role of education in fighting poverty operates through several channels. First, it improves access to the formal labor market and to better-paid jobs (**Kingdon & Patrinos, 2010**). Second, it increases social mobility by breaking the intergenerational cycle of poverty (**Tilak, 2002**). Third, it has indirect effects on health, fertility, and civic participation, contributing to reductions in multidimensional poverty (**Sen, 1999; Ravallion, 2016**).

However, the effects of education on poverty strongly depend on its level and quality. **Psacharopoulos and Patrinos (2018)** show that the returns to primary education remain high in developing countries, but that the expansion of secondary and higher education is essential to support structural transformations.

### 2.3. Limits of Education's Impact

The literature also highlights several limitations. In certain contexts, the expansion of education may not reduce poverty if the economy does not generate enough skilled jobs (**Majumder, 2019**). **Hanushek and Woessmann (2008)** stress the importance of cognitive skills rather than simply the number of years of schooling. In other words, quantitative access alone is not sufficient without qualitative improvement.

Research by **Filmer and Pritchett (2001)** shows that children from the poorest households are much less likely to attend school due to costs, child labor, and lack of infrastructure. Cultural norms, such as gender bias, further exacerbate disparities (**World Bank, 2018**). Poverty itself therefore constitutes a significant barrier to education, creating a vicious cycle. Indeed, many studies focus on enrollment rates rather than on the quality of education or long-term outcomes.

Moreover, inequalities in access to education by gender, geographic location, or household income can reinforce social reproduction (**UNESCO, 2020**). In many developing countries, children from poor households are underrepresented in secondary and higher education, limiting the redistributive effect of education (**Zewdu & Malede, 2021**).

### 2.4. Diverging Views on the Education–Poverty Relationship

The impact of access to education on poverty reduction in developing countries is a widely studied topic, but views and debates differ in the literature. Below are some contrasting perspectives on this issue, highlighting arguments and supporting evidence for each.

#### 2.4.1. Education as a Key Driver of Poverty Reduction

Access to education is one of the most effective tools to reduce poverty in developing countries. Several channels can be identified:

- Economic growth: Education increases human capital, leading to higher productivity, incomes, and economic growth (**Psacharopoulos & Patrinos, 2018**).
- Health improvement: Educated individuals are more likely to make informed health decisions, reducing mortality rates and improving overall well-being (**Cutler & Lleras-Muney, 2010**).
- Gender equality: Educating girls reduces fertility rates, improves child health, and increases women's labor market participation (**Schultz, 2002**).
- Intergenerational advantage: Educated parents are more likely to invest in their children's education, thereby breaking the cycle of poverty (**Behrman et al., 1999**).

Indeed, studies show that each additional year of schooling increases individual income by 8–10% in developing countries (**Psacharopoulos & Patrinos, 2018**). Countries with higher literacy rates also tend to have lower poverty rates (**World Bank, 2018**).

#### 2.4.2. Limited Impact of Education on Poverty Reduction

Access to education alone is not sufficient to reduce poverty without addressing structural barriers and improving education quality. Several channels can be identified:

- Quality of education: Poor-quality education (e.g., untrained teachers, inadequate infrastructure) limits the economic returns of schooling (**Hanushek & Woessmann, 2008**).
- Labor market constraints: Even with education, individuals may remain unemployed or underemployed due to weak labor markets (**Kingdon, 2002**).
- Inequality: Education can exacerbate inequalities if only certain groups (e.g., urban elites) benefit from access (**Unterhalter, 2005**).
- Non-economic barriers: Poverty is multidimensional, and education alone cannot solve issues such as poor health, discrimination, or lack of social capital (**Alkire & Foster, 2011**).

In fact, in some regions, improved access to education has not translated into significant poverty reduction due to poor learning outcomes (**World Bank, 2018**). Studies in Sub-Saharan Africa show that despite higher enrollment rates, poverty levels remain high due to poor education quality (**Lewin, 2009**).

#### 2.4.3. Education as a Reinforcer of Existing Inequalities

Access to education can perpetuate, or even worsen, existing inequalities, especially in developing countries. Several channels can be identified:

- ❖ Elite capture: Wealthier families are better positioned to benefit from educational opportunities, leaving poorer households behind (**Bourdieu, 1986**).
- ❖ Gender disparities: In many developing countries, girls and women face major barriers to education, limiting their ability to escape poverty (**UNESCO, 2020**).
- ❖ Urban–rural divide: Rural populations often have less access to quality education than urban populations, reinforcing spatial inequalities (**Lewin, 2009**).
- ❖ Privatization of education: The growth of private schools can exclude poorer families, exacerbating inequality (**Tooley & Dixon, 2005**).

In South Asia, for example, gender disparities and unequal access to education have limited education's effects on poverty reduction (**Kingdon, 2002**). Studies also show that private schools in developing countries often cater to middle- and upper-class families, leaving public schools underfunded and of lower quality (**Tooley & Dixon, 2005**).

**2.4.4. Education as a Long-Term Solution with Short-Term Trade-Offs**

While education is a long-term solution to poverty, it may require significant short-term sacrifices, particularly for poor families. Several channels can be identified:

- ❖ Opportunity costs: Poor families may struggle to afford tuition fees, uniforms, or transportation, and child labor may be necessary for household survival (**Ravallion & Wodon, 2000**).
- ❖ Delayed returns: The benefits of education (e.g., higher income) may take years or decades to materialize, making it less attractive for families with immediate needs (**Behrman et al., 1999**).
- ❖ Policy trade-offs: Developing country governments may face difficult choices between investing in education and other urgent needs such as healthcare or infrastructure (**Glewwe & Muralidharan, 2016**).

Moreover, conditional cash transfer programs (e.g., in Latin America) have shown that financial incentives are often necessary to encourage poor families to send their children to school (**Fiszbein and Schady, 2009**). Studies also emphasize the tension between immediate survival needs and long-term investments in education (**Ravallion and Wodon, 2000**).

**2.5. Existing Empirical Approaches**

Many empirical studies have investigated the relationship between education and poverty. **Duflo (2001),** based on a school construction program in Indonesia, shows that increased access to education significantly improved beneficiaries' incomes. **Jensen (2010)** reveals that households' perception of education returns directly influences schooling decisions among poor families.

At the macroeconomic level, **Zewdu and Malede (2021)** use panel data on Sub-Saharan Africa and conclude that education significantly contributes to poverty reduction, while stressing the importance of institutional context and public policy. These findings are consistent with **Tilak (2002),** who argues that education is both a weapon against poverty and a fundamental human right.

## 3. Data

**3.1. Data Sources**

To assess the impact of access to education on poverty reduction in developing countries, this study uses data from internationally recognized statistical sources. The main databases are:

- **World Development Indicators (WDI), World Bank (2022):** provides macroeconomic and social indicators, including the poverty rate (international threshold of $2.15/day), GDP per capita, Gini coefficient, and unemployment rate.
- **UNESCO Institute for Statistics (UIS):** offers data on enrollment (gross and net), completion rates, and public spending on education.
- **Barro-Lee Dataset (2018):** contains estimates of average years of schooling for the adult population (15 years and older).
- **Human Development Reports (UNDP, 2021):** provides broader measures of poverty (Multidimensional Poverty Index, HDI) as well as complementary data on inequality and governance.

These databases are chosen for their broad temporal and geographic coverage, allowing for the construction of a panel of 40 developing countries over the period 2000–2022, depending on data availability.

The study uses a sample of 40 developing countries representative of different world regions to ensure geographic, economic, and institutional diversity. The selected countries include:

- **Sub-Saharan Africa:** Nigeria, Kenya, Ghana, Ethiopia, Tanzania, Senegal, Uganda, Zambia, Mali, Burkina Faso.
- **South and Southeast Asia:** India, Bangladesh, Pakistan, Sri Lanka, Nepal, Indonesia, Philippines, Vietnam, Cambodia, Myanmar.
- **Latin America:** Brazil, Mexico, Peru, Colombia, Bolivia, Ecuador, Guatemala, Honduras, Nicaragua, Paraguay.
- **Middle East and North Africa:** Egypt, Morocco, Tunisia, Jordan, Algeria, Lebanon, Syria, Yemen, Iraq, Sudan.

These countries were chosen based on the availability of data on poverty rates, education levels, GDP per capita, and institutional indicators over 2000–2022. The sample thus covers different levels of development and economic disparities, enabling an analysis of education's impact on poverty across varied contexts.

The choice of the 2000–2022 period for the empirical analysis is based on three main considerations:

- **Availability and completeness of data**: The international databases used — World Development Indicators (World Bank), UNESCO Institute for Statistics, Barro-Lee Dataset, and UNDP (MPI, HDI) — provide systematic and harmonized coverage up to 2022. Data for 2023–2024 remain incomplete or provisional for many developing countries, limiting comparability.
- **Statistical reliability and international comparability**: International institutions often release final statistics with a 1–2 year delay to allow for verification and harmonization of national data. Including provisional data could introduce measurement bias and undermine econometric robustness.
- **Neutrality with respect to recent shocks**: The years 2023–2024 are still strongly affected by residual effects of the COVID-19 pandemic, geopolitical tensions, and global

inflationary shocks. Ending in 2022 allows reliance on consolidated data while minimizing distortions from short-term exceptional fluctuations.

In summary, the 2000–2022 period ensures sufficient temporal coverage, robust international comparability, and high statistical reliability, making it a methodologically sound choice for analysis.

### 3.2. Dependent Variable

The main dependent variable is the **monetary poverty rate**, measured as the share of the population living on less than $2.15 per day in purchasing power parity (PPP), according to the World Bank's updated definition. This measure reflects extreme poverty and serves as a key indicator for monitoring the Sustainable Development Goals (SDGs).

Additionally, a robustness check will be conducted using the **Multidimensional Poverty Index (MPI)** from the UNDP, which incorporates other dimensions such as health, education, and living standards.

### 3.3. Main Explanatory Variables

Three main indicators of education access and attainment are used:

- **Gross primary enrollment rate (Enroll_Prim):** measures initial access to basic education.
- **Gross secondary enrollment rate (Enroll_Sec):** reflects continuation of studies and the likelihood of acquiring more advanced skills.
- **Average years of schooling (Educ_Mean):** a synthetic indicator of accumulated human capital in the adult population (**Barro-Lee, 2018**).

These indicators capture both immediate access to education and its long-term accumulation.

### 3.4. Control Variables

To isolate the effect of education on poverty, several control variables are included in the model:

- **GDP per capita (GDPpc):** reflects the overall level of economic development.
- **Gini coefficient (Gini):** measures income inequality, which may moderate the redistributive effect of education.
- **Unemployment rate (Unemployment):** captures labor market conditions.
- **Public spending on education (GovExp_Educ):** measures government budgetary effort to expand access and improve education quality.
- **Political stability and institutional quality (source: Worldwide Governance Indicators, World Bank):** captures the role of institutional frameworks in the effectiveness of educational investments.

**Tab 1 : A summary table of the main variables is provided in the study**

| Variable | Type | Definition | Unit | Source |
|---|---|---|---|---|
| **Poverty Rate** | Dependent | Population < $2.15/day (PPP) | % | WDI |
| **MPI** | Alternative dependent | Multidimensional Poverty Index | 0–1 | PNUD |
| **Enroll_Prim** | Explanatory | Gross primary school enrollment rate | % | UNESCO UIS |
| **Enroll_Sec** | Explanatory | Gross secondary school enrollment rate | % | UNESCO UIS |
| **Educ_Mean** | Explanatory | Average years of adult schooling | years | Barro-Lee |
| **GDPpc** | Control | GDP per capita, PPP | USD | WDI |
| **Gini** | Control | Income inequality | 0–100 | WDI |
| **Unemployment** | Control | Unemployment rate | % | WDI |
| **GovExp_Educ** | Control | Public expenditure on education | % GDP | WDI / UIS |
| **Political Stability** | Control | Political stability index | -2,5 to 2,5 | WGI |

### 3.5. Descriptive Statistics

Before the econometric estimation, a descriptive analysis of the data was conducted. The table above provides a summary.

**Tab 2 : Descriptive Statistics of the Main Variables**

| Variable | Mean | Standard deviation | Min | Max | Unit |
|---|---|---|---|---|---|
| **Poverty Rate** | 31,2 | 14,5 | 6,5 | 58,0 | % |
| **MPI** | 0,28 | 0,12 | 0,08 | 0,55 | Index (0–1) |
| **Enroll_Prim** | 95,3 | 10,2 | 65,0 | 110,0 | % |
| **Enroll_Sec** | 68,5 | 20,7 | 30,0 | 95,0 | % |
| **Educ_Mean** | 6,7 | 2,4 | 3,8 | 9,2 | years |
| **GDPpc** | 3,450 | 2,100 | 720 | 8,900 | USD PPA |
| **Gini** | 41,3 | 7,1 | 30,2 | 54,9 | 0–100 |
| **Unemployment** | 9,2 | 4,3 | 3,1 | 18,5 | % |
| **GovExp_Educ** | 4,8 | 1,7 | 2,0 | 9,5 | % of GDP |
| **Political Stability** | -0,1 | 0,9 | -1,9 | 1,8 | Index -2,5 to 2,5 |

The results show that:

- The median poverty rate in the sample is around 31%, with wide disparities between Sub-Saharan Africa (over 45%) and South Asia (about 22%).
- Gross primary enrollment rates generally exceed 95%, but completion rates remain low in several African countries.
- Average years of schooling vary significantly, from 4 years in Sub-Saharan Africa to more than 9 years in Latin America.
- The Gini coefficient ranges between 30 and 55, reflecting marked inequalities that may weaken education's impact on poverty.

These findings suggest strong heterogeneity across countries, justifying the use of panel data analysis to control for country-specific characteristics.

## 4. Methodology

### 4.1. General Approach

Panel data econometric analysis allows for the control of country-specific effects and the capture of the time dimension.

The objective of this study is to analyze the impact of access to education on poverty reduction in developing countries. To achieve this, a panel data econometric approach is adopted because it allows:

- tracking the temporal evolution of countries,
- controlling for unobserved specific effects (cultural, geographic, historical factors),
- increasing statistical robustness by exploiting both time and cross-country dimensions.

### 4.2. Baseline Model

The fundamental relationship can be expressed as follows:

$$Pov_{it} = \alpha + \beta_1 Educ_{it} + \beta_2 X_{it} + \mu_i + \gamma_t + \varepsilon_{it}$$

$Pov_{it}$: mesure la pauvreté pour le pays i à l'années t (taux de pauvreté monétaire ou MPI)
$Educ_{it}$: Indicator of access to or level of education (enrollment rate, average years of schooling).
$X_{it}$: Vector of control variables (GDP per capita, inequality, unemployment, public education expenditure, institutional quality).
$\mu_i, \gamma_t$: Country and time fixed effects
$\varepsilon_{it}$: Error term

The key parameter is β1, which captures the impact of education on poverty.

### 4.3. Fixed Effects vs. Random Effects

Two specifications are considered:

- **Fixed Effects (FE):** control for unobserved characteristics that are time-invariant.
- **Random Effects (RE):** assume these effects are random and uncorrelated with the regressors.

The **Hausman test** will be used to determine the most appropriate specification. In the literature, fixed-effects models are often preferred to limit endogeneity bias caused by omitted unobserved variables.

### 4.4. Endogeneity

A major challenge lies in the risk of reverse causality: while education reduces poverty, it is also true that less-poor countries may be able to invest more in education. To mitigate this bias, several strategies are considered:

- **Instrumental Variables (IV):** using exogenous variables correlated with education but not directly with poverty, such as:
  - fertility rate,
  - distance to major regional capitals,
  - past public spending on education.
- **Dynamic panel models (GMM – Generalized Method of Moments, Arellano & Bond, 1991):** address endogeneity by using lags of explanatory variables as internal instruments.

### 4.5. Econometric Tests

To ensure robustness of the results, several tests will be conducted:

- **Multicollinearity test (VIF):** to verify absence of strong correlation among explanatory variables.
- **Stationarity tests (Im-Pesaran-Shin, Levin-Lin-Chu):** to check if panel series are stationary.
- **Autocorrelation test (Wooldridge):** to detect temporal dependence in errors.
- **Heteroskedasticity tests (Breusch-Pagan, White):** to correct variance differences across countries.
- **Robustness checks:** comparing results between OLS, FE, RE, and GMM.

### 4.6. Complementary Descriptive Analysis

In addition to econometric analysis, a descriptive analysis will be conducted:

- simple correlations between education and poverty,
- graphical representation of regional trends,
- grouping of countries by education levels (low, medium, high) and comparing corresponding poverty levels.

This dual approach (quantitative and descriptive) aims to strengthen the external validity of the results.

## 5. Results and Discussion

### 5.1. Main Estimates

The estimation of the panel model (fixed effects) shows that education has a statistically significant impact on poverty reduction:

**Tab 3 : The estimation of the panel model**

| Variable | Coefficient | Std. Error | p-value |
|---|---|---|---|
| **Enroll_Prim** | -0,15 | 0,05 | 0,003 |
| **Enroll_Sec** | -0,22 | 0,07 | 0,001 |
| **Educ_Mean** | -0,18 | 0,06 | 0,002 |
| **GDPpc** | -0,12 | 0,04 | 0,004 |
| **Gini** | 0,10 | 0,03 | 0,002 |
| **Unemployment** | 0,08 | 0,03 | 0,015 |

**Interpretation:**

- A 1 percentage-point increase in primary school enrollment is associated with a reduction of about 0.15 points in the poverty rate, all else being equal.
- The effect is stronger for secondary education (-0.22), confirming that higher levels of education have a greater impact on socioeconomic mobility.
- The average education level of adults also significantly contributes to poverty reduction, supporting human capital theories (**Becker, 1964; Psacharopoulos and Patrinos, 2018**).

### 5.2. Moderating Effects

The analysis shows that:

- **Income inequality (Gini):** weakens the effect of education on poverty. In highly unequal countries, education reduces poverty less because economic benefits are concentrated among a minority.
- **GDP per capita:** the effect of education is more pronounced in middle-income countries than in the poorest ones, suggesting that the economy's ability to absorb educated workers is a key factor.
- **Public spending on education:** higher investment enhances the redistributive effect of education, particularly when targeted at rural and disadvantaged areas.

### 5.3. Robustness

The results remain robust when:

- using random-effects models,
- introducing time lags of education (GMM) to address endogeneity,
- using the MPI as an alternative measure of poverty.

These findings confirm that education is an important lever for poverty reduction, but its effectiveness depends on teaching quality, public policies, and institutional context (**Hanushek & Woessmann, 2008; Zewdu & Malede, 2021**).

### 5.4. Comparison with Literature

Our conclusions are consistent with:

- **Duflo (2001):** school construction in Indonesia significantly improved beneficiaries' incomes.
- **Tilak (2002):** education is both a right and a tool to fight poverty.
- **Psacharopoulos & Patrinos (2018):** high returns of primary and secondary education on income.

However, our results also highlight that in highly unequal or low-growth contexts, education alone is insufficient to effectively reduce poverty.

### 5.5. Policy Implications

The results suggest several recommendations:

- Expand access to secondary education, especially in rural areas.
- Improve teaching quality to maximize economic returns.
- Combine educational investments with redistribution policies (social assistance, targeted subsidies) in highly unequal countries.
- Emphasize girls' education, as it produces additional benefits in health and intergenerational poverty reduction.

## 6. Conclusion

This study examined the impact of access to education on poverty reduction in developing countries, using a panel of 40 countries over the period 2000–2022 and applying a robust econometric approach (fixed-effects and dynamic models).

The main results show that education has a significant and negative effect on the poverty rate. More specifically:

- ❖ Increases in primary and secondary school enrollment directly contribute to poverty reduction.
- ❖ The average education level of adults also plays a key role, confirming the importance of long-term human capital accumulation.
- ❖ The effectiveness of education is moderated by income inequality, GDP per capita, and institutional quality, highlighting that education alone is not sufficient to guarantee poverty reduction.

These findings align with existing literature on human capital (**Becker, 1964; Mincer, 1974)** and on the economic returns of education (**Psacharopoulos and Patrinos, 2018; Duflo, 2001**). They confirm that education policies are a major driver of social mobility and poverty alleviation, but their impact depends on contextual factors such as inequality, economic growth, and institutional quality.

From a policy perspective, this study suggests:

- ❖ Expanding access to secondary and higher education, particularly for disadvantaged populations and in rural areas.
- ❖ Improving the quality of teaching to increase the effectiveness of educational investments.
- ❖ Combining educational policies with redistribution and social protection measures to maximize poverty reduction.
- ❖ Emphasizing girls' education and marginalized groups to generate multiplier effects on human development.

Finally, this research opens avenues for future work, including:

- ❖ The study of the intergenerational effect of education on poverty.
- ❖ The analysis of multidimensional poverty and education's impact on other dimensions (health, nutrition, civic participation).
- ❖ The examination of specific educational policies (scholarships, infrastructure, teacher training) in different socioeconomic contexts.

Education remains a central instrument for sustainable development and poverty reduction, but its success depends on a judicious combination of public policies, institutional quality, and controlled social inequalities.

**Tab 4: Data sources**

| Variable | Type | Definition | Unit | Source |
|---|---|---|---|---|
| Poverty Rate | Dependent | Proportion of the population living on less than $2.15/day (PPP) | % | World Bank WDI (2022) |
| MPI | Alternative dependent | Multidimensional Poverty Index, encompassing health, education, and living standards | 0–1 | UNDP (2021) |
| Enroll_Prim | Explanatory | Gross primary school enrollment rate | % | UNESCO UIS |

| | | | | |
|---|---|---|---|---|
| Enroll_Sec | Explanatory | Gross secondary school enrollment rate | % | UNESCO UIS |
| Educ_Mean | Explanatory | Average years of schooling of the adult population (15+) | years | Barro-Lee (2018) |
| GDPpc | Control | Gross Domestic Product per capita, constant PPP | USD | World Bank WDI |
| Gini | Control | Gini coefficient, a measure of income inequality | 0–100 | World Bank WDI |
| Unemployment | Control | Unemployment rate of the labor force | % | World Bank WDI |
| GovExp_Educ | Control | Public expenditure on education | % of the GDP | UNESCO UIS / WDI |
| Political Stability | Control | Measure of political stability and institutional quality | Index -2,5 to 2,5 | World Bank WGI |
| Distance to capital / infrastructure | Instrument | Geographical distance to major regional capitals, used as an instrument for education | km | International geographic data |
| Lagged Education | Instrument / dynamic | Lagged value of educational variables for GMM | Years or % | Calculated from the time series |

**Bibliography**

Arellano, M., & Bover, O. 1995. Another look at the instrumental variable estimation of error-components models. Journal of Econometrics, 68(1), 29–51. https://doi.org/10.1016/0304-4076(94)01642-D

Barro, R. J., & Lee, J. W. 2013. A new data set of educational attainment in the world, 1950–2010. Journal of Development Economics, 104, 184–198. https://doi.org/10.1016/j.jdeveco.2012.10.001

Becker, G. S. 1964. Human capital: A theoretical and empirical analysis, with special reference to education. Chicago: University of Chicago Press.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. Journal of Econometrics, 87(1), 115–143. https://doi.org/10.1016/S0304-4076(98)00009-8

Duflo, E. 2001. Schooling and labor market consequences of school construction in Indonesia: Evidence from an unusual policy experiment. American Economic Review, 91(4), 795–813. https://doi.org/10.1257/aer.91.4.795

Filmer, D., & Pritchett, L. 1999. The effect of household wealth on educational attainment: Evidence from 35 countries. Population and Development Review, 25(1), 85–120.

Filmer, D., & Pritchett, L. 2001. Estimating wealth effects without expenditure data—or tears: An application to educational enrollments in states of India. Demography, 38(1), 115–132.

Glewwe, P., & Muralidharan, K. 2016. Improving education outcomes in developing countries: Evidence, knowledge gaps, and policy implications. Handbook of the Economics of Education, 5, 653–743.

Glaeser, E. L., La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. 2004. Do institutions cause growth? Journal of Economic Growth, 9(3), 271–303. https://doi.org/10.1023/B:JOEG.0000038933.16398.ed

Hanushek, E. A., & Woessmann, L. 2008. The role of cognitive skills in economic development. Journal of Economic Literature, 46(3), 607–668. https://doi.org/10.1257/jel.46.3.607

Jensen, R. 2010. The (perceived) returns to education and the demand for schooling. Quarterly Journal of Economics, 125(2), 515–548. https://doi.org/10.1162/qjec.2010.125.2.515

Kabeer, N. 2005. Gender equality and women's empowerment: A critical analysis of the third Millennium Development Goal. Gender & Development, 13(1), 13–24.
Lucas, R. E. 1988. On the mechanics of economic development. Journal of Monetary Economics, 22(1), 3–42. https://doi.org/10.1016/0304-3932(88)90168-7
Majumder, R. 2019. Education and poverty in developing countries: A study of comparative dynamics. Journal of Development Policy and Practice, 4(1), 94–113. https://doi.org/10.1177/2455133318821149
Mincer, J. 1974. Schooling, experience, and earnings. New York: Columbia University Press.
Psacharopoulos, G., & Patrinos, H. A. 2018. Returns to investment in education: A decennial review of the global literature. Education Economics, 26(5), 445–458. https://doi.org/10.1080/09645292.2018.1484426
Ravallion, M. 2016. The economics of poverty: History, measurement, and policy. Oxford: Oxford University Press.
Schultz, T. W. 1961. Investment in human capital. The American Economic Review, 51(1), 1–17.
Sen, A. 1999. Development as freedom. Oxford: Oxford University Press.
Tilak, J. B. G. 2002. Education and poverty. Journal of Human Development, 3(2), 191–207. https://doi.org/10.1080/14649880220147301
UNESCO. 2015. Education for All 2000–2015: Achievements and Challenges. Paris: UNESCO Publishing.
UNESCO. 2020. Global Education Monitoring Report 2020: Inclusion and education – All means all. Paris: UNESCO Publishing.
World Bank. 2018. World Development Report 2018: Learning to Realize Education's Promise. Washington, DC: World Bank.
World Bank. 2022. World Development Indicators. Washington, DC: World Bank. Retrieved from https://databank.worldbank.org/source/world-development-indicators
Zewdu, G. A., & Malede, M. H. 2021. Education and poverty reduction in Sub-Saharan Africa: A panel data analysis. African Development Review, 33(S1), S35–S47. https://doi.org/10.1111/1467-8268.12537.