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# The Role of Per Capita GDP in Intergenerational Mobility in Education: A Cross-Country Study

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**Abstract:** This study investigates the mechanism of how per capita GDP impacts intergenerational mobility in education. We propose an analytic framework in which per capita GDP affects educational mobility through government spending on education and other channels. Following this framework, this study conducts five-round estimations to examine the connections among per capita GDP, educational mobility, and government expenditure on education, using multiple data sources. The estimations demonstrate the following findings: (1) There is a positive non-linear relationship between per capita GDP and educational mobility, with higher disparities in less developed countries. This suggests that other factors, such as social arrangements, mediate the relationship. (2) Government expenditure on education is positively associated with intergenerational mobility in education. However, the effectiveness of government expenditure on education varies, particularly in developing countries. (3) The Granger causality test indicates a relationship between per capita GDP and Government expenditure on education for a short term (2-7 years), although a bidirectional relationship emerges between these variables in the longer term of 8-12 years. Government expenditure on education is more responsive to per capita GDP in developed countries than in less developed countries. (4) Through 2SLS estimations, two paths from per capita GDP to educational mobility are identified: One through increased average schooling and another through direct policy interventions. These paths highlight the importance of both economic development and targeted educational policies in enhancing educational mobility. In addition, the study suggests that higher educational mobility can lead to economic growth, though identifying the precise causal mechanisms remains challenging.

**Keywords:** Intergenerational Mobility in Education, GDP, Educational Expenditure on Education, Cross-Country Study

## Introduction

Intergenerational social mobility is often seen as an indicator of economic and social development (Breen *et al*., 2016; OECD, 2018). Higher social mobility indicates greater chances for individuals to perform better regardless of their social origins. Accelerated social mobility is both socially desirable and economically preferable. This leads us to the first question: Does higher social mobility result from public policy, or is it an outcome of overall social and economic development? Historically, we have seen both scenarios. For instance, higher social mobility, at least in a nominal sense, occurred in the former Soviet Union and Eastern European countries during the Communist era through forced equalization policies (Long, 1984; Bereday and Pennar, 1960). However, such approaches have proven unsustainable.

Conversely, ascending social mobility and healthy social and economic development have evolved in present-day developed countries. This has led us to explore the following: What is the general pattern for improving social mobility? What are the driving forces and mechanisms behind it?

Answers to the above questions rely on cross-country comparisons among countries with different social and economic contexts and a well-defined framework for

analysis. Recent studies have explored the patterns of intergenerational mobility in education, such as Hertz *et al*. (2008) on 42 countries, Leone (2019) on 148 countries worldwide, Causa and Johansson (2010) on OECD countries, and Fan (2011) on transitional countries.

Many studies, such as Causa and Johansson's (2010) study, provide a valuable framework for linking parental educational background and their offspring's educational outcomes. Contrasting theoretical frameworks have been used to explain intergenerational social mobility. Social reproduction theory was initially formulated in Karl Marx's Das Kapital. Alternatively, the modernization theory identifies the social variables to explain the process of social evolution (Diesing, 1987).

A general trend observed is that as economies develop, social welfare improves, and social mobility increases (Yaish and Andersen, 2012; Chetty *et al*., 2014; Güell *et al*., 2018; Neidhöfer *et al*., 2024). Although the positive correlation between economic development and intergenerational mobility in education is observed, it is essential to recognize that this does not necessarily indicate causation and the relationship can vary depending on various factors (Corak, 2013; Yaish and Andersen, 2012).

This study focuses on cross-country comparisons, exploring the role of economic development, measured by GDP per capita, on intergenerational mobility in education. The following research questions will be addressed:

(1) What are the general relationship patterns between per capita GDP and intergenerational mobility in education across countries and generations?
(2) What impact does government expenditure on education have on intergenerational mobility in education?
(3) Can we confirm the Granger causality between per capita GDP and government expenditure on education?
(4) If the answer to 3) is yes, can we further explore the pathways from per capita GDP to intergenerational mobility in education?
(5) What are the impacts of educational mobility on economic development?

Answers to these questions will help us understand the direct and indirect pathways through which economic development affects intergenerational mobility in education across countries and time. We conduct five-round estimations using various country-level data sources to answer the five questions listed above. We follow a specified framework for interpreting the results.

## *Theoretical Background and Analytic Framework*

The correlation between intergenerational mobility and economic conditions is well-documented in both developing and developed countries (Güell *et al*., 2018; Neidhöfer *et al*., 2024; Iversen *et al*., 2021; Yaish and Andersen, 2012). However, the mechanisms of intergenerational mobility in education may vary among countries with different economic contexts and policy arrangements. Multiple factors are considered when explaining developing countries' challenges in advancing intergenerational mobility (Iversen *et al*., 2021; Blanden, 2013). There are a few reasons for the disparity among countries.

First, economic development provides the resources necessary for intergenerational mobility. Considering education as human capital, parents invest in children's education for a higher return. By investing in education as a means of forming human capital, the advantages from parents, including genetic inheritance, imparted social values, financial stability, and career paths, are passed on to the succeeding generation (Becker and Tomes, 1979, 1986; Björklund and Salvanes, 2011). This process of social reproduction can also lead to lower educational mobility and affirm social hierarchies (Christopher, 2019; Burger and Walk, 2016; Picchio, 1992), which is more likely to occur when the country is underdeveloped. Economic development is not a sufficient condition for social mobility. More likely, economic conditions, e.g., measured in GDP, provide the basis for other factors to impact intergenerational mobility. However, the relationship between economic development and educational mobility is not straightforward or linear; this relationship may vary from region to region (Blanden *et al*., 2004; Neidhöfer *et al*., 2024). Here, we need to make it clear that in our analytic framework (illustrated in Fig. 1), disparities in educational mobility among the countries with the same level of economic development, measured in per capita GDP, are explained with the following logic: Keeping economic conditions constant, the disparities in educational mobility are explained by factors other than economic conditions. Although this study focuses on per capita GDP, such disparities highlight the importance of other factors, meaning that policy arrangements can still make a big difference in educational mobility, even when economic development is low.

Second, government policies, such as government involvement in education, provide opportunities for children from low-educated families and limit the educational disparities between children from different social statuses in both developed and developing countries (Holter, 2015; Tang *et al*., 2021; Blanden, 2013; Stuhler, 2018). Government expenditure on education is believed to reduce the financial gaps in families' investment in education between wealthy and low-income families and improve educational mobility (Becker and Tomes, 1979; 1986). However, the impact of government investment in public education is also influenced by the extent of complementarity between public and private spending on education.

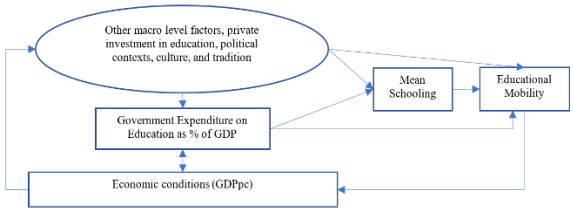


**Fig. 1:** Paths to educational mobility at the macro level

Third, while the two factors mentioned above can indirectly or directly contribute to intergenerational social mobility, economic development creates conditions for better social welfare, such as increased spending on public education. Consequently, per capita GDP can function as a variable behind government expenditure on education to affect intergenerational mobility. Conversely, if we view government spending on public education as an investment in human capital that is expected to boost GDP growth (Nelson and Phelps, 1966; Romer, 1990), it becomes essential to identify the causal link between per capita GDP and government expenditure on education, for example, through the Granger causality test.

Fourth, there are different pathways through which per capita GDP impacts educational mobility. As per capita GDP increases and the economy develops, average schooling increases. Importantly, as per capita GDP increases, the government has more resources to spend on primary education, improving educational outcomes for children of lower social status and the average schooling completed by the general population (Hajebi *et al*., 2023). Whichever the path is, educational mobility improves. Therefore, in our framework, average schooling is an intermediate variable through which intergenerational mobility in education improves.

Fifth, higher social mobility encourages individuals' participation in economic activities, which implies higher efficiency and economic development, as seen in many countries (OECD, 2018; Buchmann and Hannum, 2001). However, high educational mobility does not necessarily lead to higher efficiency, as evidenced by the Communist world before the transition. During the Communist era, forced equalization resulted in very low intergenerational persistence in education (Bereday and Pennar, 1960; Long 1984). This type of high social mobility led to low efficiency and contributed to the collapse of the Soviet Union and the "centrally-planned" economy in Eastern Europe in the late 1980s. These cases illustrate the conditional relationship between intergeneration mobility in education and economic development. Although the direct effects of political contexts on educational mobility are often straightforward, the long-term impacts on educational mobility can be complex. This complexity is evidenced by the undesired outcomes in social development, as seen in the former Communist countries. The intricacies of the political contexts are beyond the scope of this study.

Considering the above points, our analytical framework can be illustrated in Fig. (1).

In this framework, multiple macro-level factors affect educational mobility, including economic conditions measured by per capita GDP, Government expenditure on education and other macro-level factors, private investment in education, political contexts, culture, and tradition. This framework contains the following components and links among these components:

(1) Per capita GDP provides the foundation for government expenditure on education as a percent of GDP and other macro-level factors. The relationship between per capita GDP and government expenditure on education can exhibit bidirectional causality marked by the bidirectional arrow in Fig. (1), which can be tested by time series analysis. Conducting a statistical analysis to estimate the impact of educational mobility on per capita GDP is challenging because many factors affect economic performance and educational mobility is only one of them.
(2) Government expenditure on education can impact educational mobility in two ways: The first is the direct impact through public spending targeting the children from disadvantaged families; the second is through the improvement of the education of all population, which increases the mean schooling of the country and consequently improves social mobility. These two paths can be estimated using 2SLS methods.
(3) The effects of educational mobility, the arrow from Educational Mobility to Economic Conditions (GDPpc) in Fig. (1), are lasting and may take decades to become apparent. Given the available data, we can compare the correlation coefficients between intergenerational mobility in education of different cohorts and per capita GDP over nine decades. The coefficients one or two decades after people of the cohort were born may indicate the impact of the educational mobility of this cohort on per capita GDP. Although the limitation is that the estimates of this link using correlation analysis do not rule out the confounding variables affecting economic development other than educational mobility, these estimates can still provide some ideas for this relationship.

Although this model is not a highly refined framework, estimating its links would provide relevant policy implications and confirm the critical role of targeted government interventions in enhancing educational mobility and informing policy choices within specific economic conditions.

## Data, Variables and Methods

### *Data Sources*

The units of analysis of this study are countries. For the purpose of this study, we need time series data spanning nine decades, from 1930-2023. For example, we need to discuss the effects of per capita GDP on the educational mobility of five cohorts from the 1940s to the 1980s and the possible impacts of educational mobility on per capita GDP:

(a) The primary data set used in this study is the Global Database on Intergenerational Mobility (GDIM) of the World Bank, released in 2023. The GDIM was collected from various nationally representative longitudinal surveys between 1991-2017 by the World Bank Group and has been publicly available since 2018 (Weide *et al*., 2021). This data set contains information on intergenerational mobility in education of 153 economies, including the educational attainment of the respondents and their parents' education for five different cohorts of citizens born in the last 40 years (born between 1940 and 1989), which demonstrates the spectrum of educational mobility among countries and the trends over time. The key variable we use from this data set is the BETA coefficient derived from regressing children's years of schooling on their parents' years of schooling. We choose the BETAs for all parents (fathers and mothers) and children (daughters and sons). Additionally, we have data on the average schooling of the children in this study. We include 142 economies (countries) in this study, which is further reduced in the analysis due to missing micro-level data.
(b) GDP per capita data are taken from Gapminder's (2022) data file that contains GDP per capita in constant PPP (in 2017 international $). This data set is compiled from various sources, including the World Bank, The Maddison Project Database, Penn World Table, and Gapminder's estimation for historical data. We use Gapminder's GDP data between 1930 and 2023 for 141 countries to analyze the role of GDP, excluding Kosovo due to unavailable GDP data.
(c) We use combined data sources for Government Expenditure on Education as a percentage of GDP from Our World in Data (2023) for 1970-2009 and World Development Indicators, The World Bank 2023 for 2010-2020. The earliest year that government spending on education across nations available is 1970. Although there are more missing values from the 1970s and 1980s, these data can still support our analysis for the Granger causality test between per capita GDP and government expenditure on education

### *Measurements and Variables*

### *Intergenerational Mobility in Education*

We will consider a relative mobility measurement that captures the degree to which respondents' education depends on their parents. The regression coefficient, or BETA, precisely indicates how much one year of additional schooling of parents is transmitted to their children on average. BETA has a clear and straightforward interpretation of the "intergenerational persistence of education," which is the opposite of "intergenerational mobility in education." The term "intergenerational persistence of education" has been used in previous studies, e.g., by Hertz *et al*. (2008).

We use the BETAs by cohorts reported in GDIM. We use the terms intergenerational persistence of education and intergenerational mobility in education interchangeably but with opposite meanings. Higher intergenerational persistence of education means lower intergenerational mobility in education. We use BETA derived from the regression with the average schooling of the parents (parents = "average") and child = "all" in the GDIM database. We use BETA to represent intergenerational persistence in education and, likewise, -BETA to represent intergenerational mobility in education.

### *Mean Schooling*

This variable is from the GDIM data set, defined as the "Mean of children's years of schooling." Higher levels of average schooling and educational mobility are not the same concept, but countries with higher average levels of education often exhibit higher educational mobility. Both a higher level of per capita GDP and increased government expenditure on education contribute to higher average schooling, which is one way that per capita GDP impacts educational mobility.

### *GDPpc*

Per capita GDP (GDPpc) is in 2017 constant PPP international dollars. Per capita GDP provides the basis for other factors affecting intergenerational mobility in education. In other words, per capita GDP affects educational mobility through different variables. Since the relationship between per capita GDP and the measurement of educational mobility is not linear, we use both per capita GDP as it is and the logarithm of per capita GDP in the linear regression.

### *Government Expenditure on Education as a Percentage of GDP*

This variable is defined as its name indicates and the measurement is percentage points. It is a macro-level indicator of government involvement in public education that benefits the disadvantaged population and improves educational mobility. Therefore, it is a policy variable.

### *Methods*

We use multiple methods to explore how macro-level factors affect educational mobility. To begin with, the factors, per capita GDP and government expeditors, also interact with each other. We need to test the causalities among these factors to understand the paths and show how these factors affect educational mobility. For these purposes, the following methodologies are used in this study:

(1) One-way ANOVA test: We use simple statistics to compare the differences in educational mobility among the five cohorts. These comparisons will visualize how educational mobility evolved and intertwined with economic development and government expenditure on education.
(2) Curve fittings: Curve fitting regressions, linear or other functions, are used to demonstrate the relationships between BETA and per capita GDP and government expenditure on education across countries over generations and time. These curve fittings visualize how educational mobility evolved and intertwined with economic development and government expenditure on education.
(3) The Granger causality test: This study identifies the links among the variables in our analytic framework illustrated in Fig. (1). Each of the variables can affect other variables, although to different extents and over various time frames. From a philosophical point of view, no sufficient observations exist to "prove" causality (Popper, 2002). However, any endeavor, whether inductive or deductive, to explore causality enriches our understanding of the relationships we are concerned with. Different criteria are used in various fields. For example, Hill's criteria are widely used in epidemiologic studies (Hill, 1965; Fredericks and Relman, 1996) and causal inference in statistics (Morgan and Winship, 2015; Pearl, 2009) is a standard in practice. The Granger causality test (Granger, 1969) is widely used in studying causal inference in different areas, especially in economics.

Identifying Granger casualty includes three essential elements to establish a causal relationship between X as the cause and Y as the effect:

(a) Temporality: X precedes Y in time. This is an obvious necessity
(b) Association: Observable evidence indicates a strong relationship between X and Y
(c) Logical plausibility: This may include several considerations but can be simplified as excluding non-causal relationships between X and Y. For example, a fake relationship can be excluded by controlling for confounding and extraneous variables. With these criteria, different ways to strengthen the validity can be explored.

The choice of strategies and tools for exploring causality depends on the research issues and data availability. Given our time series data, the Granger causality test is a good choice for this study. In general, regressions estimate just correlations, but Granger (1969; 1977) argued that causality could be measured by estimating the future values of a time series based on the prior values of another time series. The Granger causality test defines a causal effect of X on Y at time t, given the value $Y_{t+1}$ as a random variable in a probability form:

$$P[Y(t+1) \in A|\Omega(t)] \neq P[Y(t+1) \in A|\Omega(t) - X(t)]$$

Where $P$ denotes probability, $A$ is an arbitrary non-empty set, and $\Omega$(t) and $\Omega(t) - X(t)$ represent the information available in the universe as of time t in the modified universe without X, respectively. This definition suggests that if $X$ is a cause of $Y$, then the probability of $Y$(t+1) being in a certain set A, given the information available at time t, should be different from the probability of $Y$(t+1) being in set $A$ when the information available at time t does not include $X$ in the modified universe. In this case, $X$ "Granger-causes" $Y$ (Granger, 1980).

We use Stata's Var Granger Causality test procedure to examine the causality between per capita GDP and government expenditures in education. These tests can determine whether these two variables have bidirectional or unidirectional causality. If per capita GDP causes government expenditure on education, it indicates unidirectional causality from GDP pc causes government expenditure on education; if each of these two variables causes the other, bidirectional causality exists between them.

Two-Stage Least Squares (2SLS) regressions and endogeneity tests. We use 2SLS regressions and related endogeneity tests to identify how per capita GDP affects educational mobility through other intermediates, including government expenditure on education.

## Results and Discussion

### *The Trend of Intergeneration Mobility in Education Over Four Decades*

The GDIM data set includes a variable, BETA, a coefficient derived from regressing children's years of schooling on parents' years of schooling for each cohort from 1940-1980 in each country. The numerical value of BETA indicates how many years increase in children's schooling for every one-year increase in parents' education. This BETA indicates intergenerational educational persistence, which is the opposite of social mobility. The comparisons of the coefficients among these cohorts, as shown in Table (1), reveal a clear trend.

**Table 1:** Coefficients of children's on parents' years of schooling (BETA) by cohorts

| Cohort | Mean | N | S.D. | Min. | Max. | Spread between Min and Max |
|---|---|---|---|---|---|---|
| 1940 | 0.618 | 99 | 0.332 | -0.074 | 1.989 | 2.063 |
| 1950 | 0.573 | 102 | 0.305 | -0.06 | 1.524 | 1.584 |
| 1960 | 0.528 | 103 | 0.257 | 0.12 | 1.186 | 1.306 |
| 1970 | 0.512 | 103 | 0.208 | 0.122 | 1.131 | 1.253 |
| 1980 | 0.518 | 142 | 0.209 | 0.127 | 1.353 | 1.48 |

Sources: Authors' calculation from GDIM for 142 countries

**Table 2:** ANOVA Test, BETA means among cohorts

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 0.857 | 4 | 0.214 | 3.106 | 0.015 |
| Within Groups | 37.519 | 544 | 0.069 | | |
| Total | 38.376 | 548 | | | |

Source: Ibid

First, the mean values decreased from 0.618 for the 1940 cohort to 0.528 for the 1960 cohort, then stabilized for the 1970 and 1980 cohorts. Second, the spread of BETA within the same cohort among countries decreased sharply from 2.063 for the 1940 cohort to 1.253 for the 1970 cohort and rebounded to 1.480 for the 1980 cohort.

The above information demonstrates a general downward trend of intergenerational mobility in education before the 1970s, indicating that disparities among countries increased in recent decades, breaking the convergence trend. The ANOVA test suggests that the differences among cohorts are statistically significant, as shown in Table (2).

## *Economic Development and Intergenerational Mobility in Education*

The positive correlation between economic development and educational mobility seems to be a consensus. However, this relationship may not be straightforward, such as a linear and direct relationship. The following figures present scatter plots and fit lines between the BETA of each cohort and its corresponding per capita GDP at the beginning of the decade.

We choose a simple function that produces the highest $R^2$ from the curve-fitting regressions for each cohort. The scatter plots and curving fitting from Figs. (2-6) demonstrate a similar pattern with the following features:

(1) Non-linear relationship: The curve fittings indicate that the relationship between BETA and GDPpc is not a simple linear but rather a polynomial or a logarithmic function. The curves are linear if we use logarithm GDPpc. However, for straightforward interpretation, we use GDPpc as it is for these figures.
(2) Increase in educational mobility: The BETAs decrease with the increase in GDPpc for all cohorts, indicating that intergenerational mobility in education increases with increased economic development.
(3) Distribution of BETAs: The scatter plots of Betas widely distribute when GDPpc is low and converge when GDPpc is high. The Betas converge to around 0.4 for all cohorts of the countries with the highest GDPpc. It is reasonable to believe that the pattern of social and economic arrangements in developed countries tends to be institutionalized with good welfare systems. In contrast, each developing country may experience difficulties in its own way and have unique scenarios due to unstable social, economic, and political situations that lead to their discretionary education policies. Therefore, the reasons behind the dispersed educational mobilities in low-income countries are worth more attention.
(4) The increasing role of per capita GDP over decades: The curve fittings also indicate that the role of GDP on BETA increases over the five decades, as noted in the R-square values from Figs. (2-6). These features may imply that GDPpc may also indirectly affect educational mobility through other variables, such as government expenditure on education

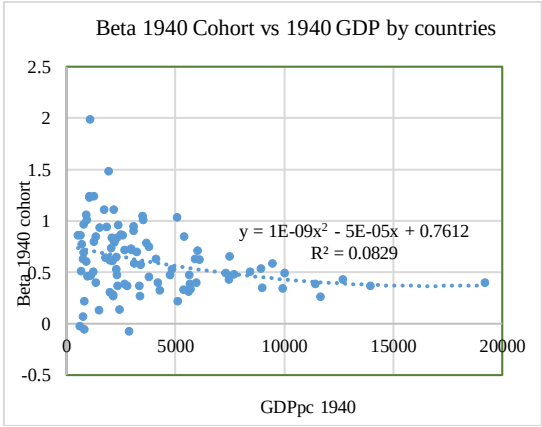


**Fig. 2:** Beta 1940 Cohort vs 1940 GDP by Countries; Sources: BATAs are from GDIM and data of GDPpc are from Gapminder (2022) in constant PPP of 2017 dollars

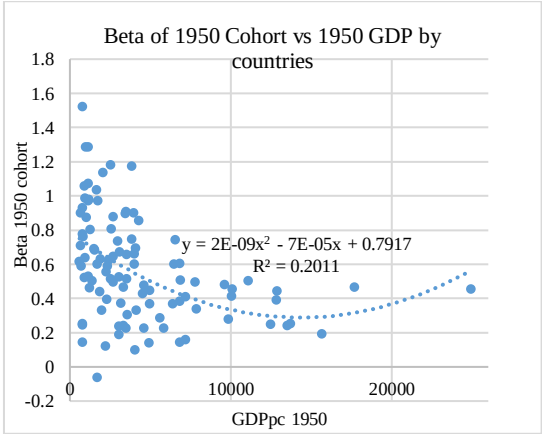


**Fig. 3:** Beta of 1950 Cohort vs 1950 GDP by countries; Sources: Ibid

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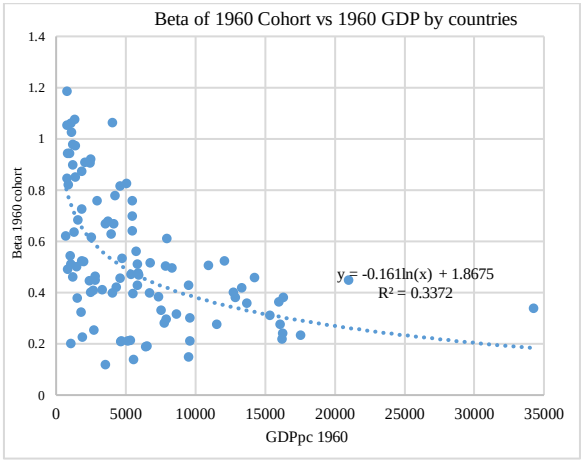


**Fig. 4:** Beta of 1960 Cohort vs 1960 GDP by countries; Sources: Ibid

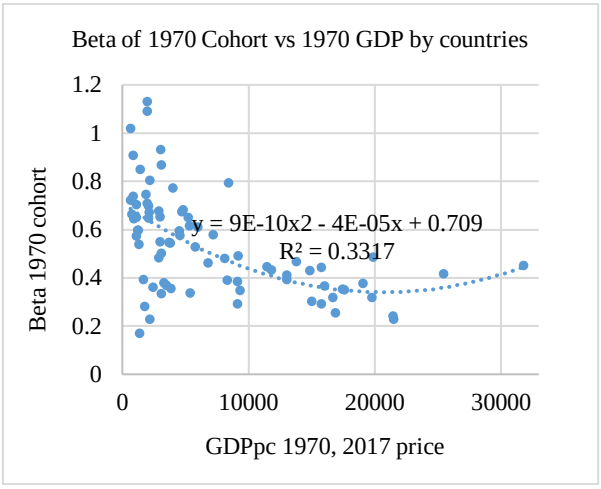


**Fig. 5:** Beta of 1970 Cohort vs 1970 GDP by countries; Sources: Ibid

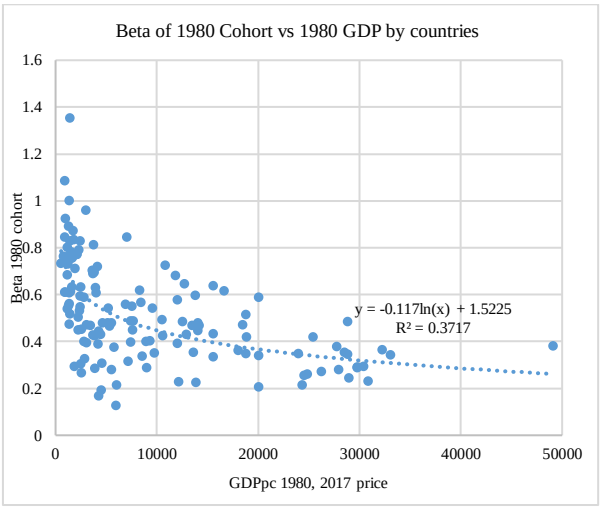


**Fig. 6:** Beta of 1980 Cohort vs 1980 GDP by countries; Sources: Ibid

Previous studies showed variations in social mobility among countries sharing a comparable level of development (Breen and Jonsson, 2005). We can see from the above charts that less developed countries demonstrated wider variations in intergenerational mobility in education.

### *Government Expenditures in Education and Educational Mobility*

Understandably, more government spending on public education provides more opportunities for individuals from low-educated families. To detect this relationship, we use the government expenditure on education at the beginning of the cohort, which may impact the education of the respect cohort. Due to the unavailability of government expenditure data on education, we can only include estimating the 1970s and 1980s cohorts. The curve fitting for the 1970 cohort in Fig. (7) indicates a somewhat polynomial curve, while in Fig. (8), the 1980 cohort shows a linear fit. The interpretation of Fig. (8) is straightforward: A one percent increase in government expenditure on education as per capita GDP was associated with approximately 0.05 reduction in BETA.

The role of government spending on education in increasing intergenerational mobility through improving opportunities for children from low social status is well documented in both developing and developed countries (Tang *et al*., 2021; Herrington, 2015). However, the scatter chart in Figs. (7-8) shows the deviation away from the fitting curves for some countries. In a few cases, the government expenditure on education was high, but the educational immobility was also high. Many African and Latin American countries experienced such patterns where increases in spending on education did not significantly improve educational mobility due to the allocation of funding not being invested in primary education (Gupta *et al*., 2002; Behrman *et al*., 2001; Torche, 2019).

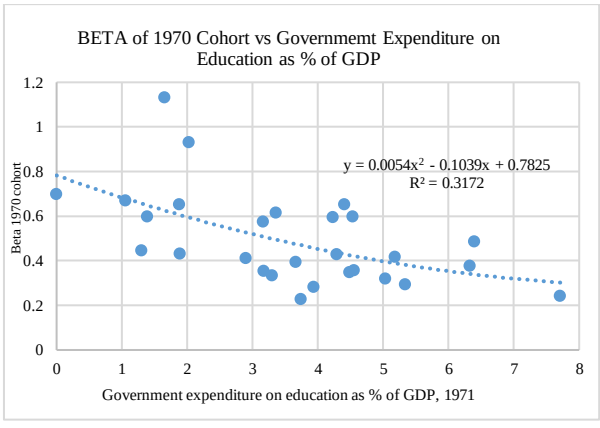


**Fig. 7:** BETA of 1970 Cohort vs Government Expenditure on Education as % of GDP; Data sources: Author's calculation based on BETA from GDIM and Education Expenditure from Our World in Data (2023)

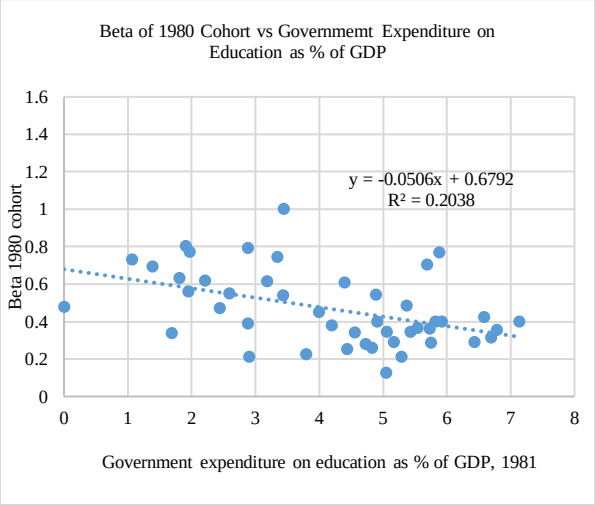


**Fig. 8:** Beta of 1980 Cohort vs Government Expenditure on Education as % of GDP; Data sources: Ibid

Then, what are the driving forces behind government expenditure on education and the allocation of educational funding? One direction is that intergenerational persistence in education tends to lead to the formation of educational systems that favor distributing and utilizing public funds among different tiers of education, which hinders educational mobility (Di Gioacchino *et al*., 2022). This is a mechanism of social reproduction (Bourdieu and Passeron, 1990). Another direction is that per capita GDP is an indicator of economic development, which provides conditions for social development, including government spending on education. We will explore this relationship in the next section.

### *Statistical Evidence of the Causal Link from GDPpc to Government Expenditure on Education*

Our preliminary time series study indicates that the pattern of the relationship between the natural logarithm of GDPpc (LnGDPpc) and Government Expenditure on Education as a percent of GDP (Edu) demonstrate somewhat different patterns among countries with varying levels of economic development. To simplify the illustration, we divided the 141 countries into four quartiles by per capita GDP, excluding Kosovo, due to the lack of available country-level data.

Following the assumptions for asymptotic analysis in the Granger causality test, we need to test the stationarity for these time series. Using Stata, we conducted an Augmented Dickey-Fuller (ADF) test for stationarity (Dickey, 1979; 1981). These tests indicate that Edu is stationary, while GDPpc is non-stationary for all four quartiles. For a valid Granger causality test, we use the Stata command *gen diff_LnGDPpc = D.LnGDPpc* to perform first-order or higher) differences on the non-stationary time series until a stationary time series is obtained. Then, we run the Granger Var test with different lagged years for all four quartiles of countries with the generated stationary time series diff_LnGDPpc. We test with different lagging years until a significant Granger causality appears for the relationship diff_LnGDPpc → Edu for each quartile. We then follow the same procedure for the relationship Edu → diff_LnGDPpc.

The results of the Granger test with Stata are illustrated in Tables (3-6). The results for each quartile are reported in two sections within one table. Each section is for the specified lagging years, including the tests for each variable as a dependent variable in one row and an independent variable in another. We only include the results for the lagged years that produce the best fit.

**Table 3:** Granger causality var tests for the top quartile 1 of GDPpc, lags (1/2) & lags (1/12)

| Dependent variable | Excluded (independent variable) | chi2 | df | Prob > Chi2 |
|---|---|---|---|---|
| Lags (1/3) | | | | |
| diff_LnGDPQ1 | EduQ1 | 4.5536 | 2 | 0.103 |
| EduQ1 | diff_LnGDPQ1 | 8.9356 | 2 | 0.011* |
| Lags (1/12) | | | | |
| diff_LnGDPQ2 | EduQ1 | 29.998 | 12 | 0.003** |
| EduQ2 | diff_LnGDPQ1 | 21.546 | 12 | 0.001*** |

Data sources: Education Expenditure from Our World in Data (2023) and GDP per capita data from Gapminder (2022); Notes: 1. diff_LnGDPQ2 denotes stationary time series of LnGDP for countries in quartile 2; Edu2 denotes government expenditure on education as a percent of GDP for countries quartile 2; 2. * for p≤0.05, ** for p≤0.01, *** for p≤0.001

**Table 4:** Granger causality var tests for quartile 2 of GDPpc, lags (1/4) & lags (1/9)

| Dependent variable | Excluded (independent variable) | chi2 | df | Prob > Chi2 |
|---|---|---|---|---|
| Lags (1/4) | | | | |
| diff_LnGDPQ2 | EduQ2 | 6.931 | 4 | 0.140 |
| EduQ2 | diff_LnGDPQ2 | 9.607 | 4 | 0.048* |
| Lags (1/9) | | | | |
| diff_LnGDPQ2 | EduQ2 | 17.508 | 9 | 0.041* |
| EduQ2 | diff_LnGDPQ2 | 21.546 | 9 | 0.010** |
| Sources & Notes: Ibid | | | | |

**Table 5:** Granger causality var tests for quartile 3 of GDPpc, lags (1/4) & lags (1/9)

| Dependent variable | Excluded (independent variable) | chi2 | df | Prob > Chi2 |
|---|---|---|---|---|
| Lags (1/4) | | | | |
| diff_LnGDPQ3 | EduQ3 | 5.028 | 4 | 0.284 |
| EduQ3 | diff_LnGDPQ3 | 11.67 | 4 | 0.020* |
| Lags (1/9) | | | | |
| diff_LnGDPQ3 | EduQ3 | 18.662 | 9 | 0.028* |
| EduQ3 | diff_LnGDPQ3 | 15.780 | 9 | 0.044* |

Sources & Notes: Ibid

**Table 6:** Granger causality var tests for the bottom quartile 4 of GDPpc, lags (1/7) & lags (1/8)

| Dependent variable | Excluded (independent variable) | chi2 | df | Prob > Chi2 |
|---|---|---|---|---|
| Lags (1/7) | | | | |
| diff_LnGDPQ4 | EduQ4 | 5.797 | 7 | 0.564 |
| EduQ4 | diff_LnGDPQ4 | 7.000 | 7 | 0.031* |
| Lags (1/8) | | | | |
| diff_LnGDPQ4 | EduQ4 | 37.578 | 8 | 0.000*** |
| EduQ4 | diff_LnGDPQ4 | 15.780 | 8 | 0.046* |

Sources & Notes: Ibid

In these tables, diff_LnGDPpcQ1-4 are the differenced time series of natural logarithms of GDPpc for quartiles 1-4 respectively; EduQ1-4 denote Government Expenditure on Education as a Percent of GDP for quartiles 1-4 respectively. Interpretation of these results is straightforward, based on the probability of rejecting the null hypothesis. If Prob > Chi2 is smaller or equal to 0.05, we can reject the null hypothesis of no Granger causality. For example, in Table (3), for a lag of two years, EduQ1 does not cause diff_LnGDPQ1 ($p = 0.103$), while diff_LnGDPQ1 is identified as a cause of EduQ1 ($p = 0.011$). The results from these tables demonstrate the following two features:

(1) A bidirectional relationship exists between diff_GDPpc and Government Expenditure on Education as a percent of GDP (Edu). First, for all the quartiles, diff_GDPpc is a Granger cause of Government Expenditure on Education lagged 2-7 years, as indicated in the second row of Table (3) (2 years), second row (4 years) in both Table (4) and Table (5); the second row (7 years) in Table (6). Second, Government Expenditure on Education is also a Granger cause for diff_GDPpc but with a lag long time (8-12 years) as indicated in the third row of Table (3) (12 years), third row (9 years) in both Tables (4 and 5) and the third row (8 years) in Table (6). Thus, this bidirectional relationship is conditional: In the short term, 2-7 years, we observe a unidirectional relationship diff_LnGDPpc → Edu. For a longer term, 8-12 years, we see a bidirectional relationship diff_LnGDPpc ↔ Edu.
(2) Comparing the results for diff_LnGDPpc → Edu relationship estimated from the four quartiles, we can see that the lag years are 3, 4, 4, and 7, increasing from the top to the bottom quartile. In other words, the effects of GDP on government expenditure on education appeared more delayed with lower levels of economic development. This estimate implies that it takes a longer time for developing low-income countries to translate GDP growth into expansion of education.
(3) Also, comparing the Edu→diff_LnGDPpc relationship estimated from these four quartiles, we see that the lag years are 12, 8, 8, and 7, decreasing from the top to the bottom quartile. In other words, the effects of government expenditure on education as a percentage of GDP are delayed by increased economic development. It is reasonable to believe that government spending on public goods promptly becomes more responsive as the economy develops. This point may explain the lagged years of Government Expenditure on Education relative to per capita GDP decrease with the increase of per capita GDP in our Granger causality test.

The above estimations for the diff_LnGDPpc→Edu relationship, as stated in (1 and 2), can be explained by Wagner's (1890) law. This law states that public goods and services, particularly those provided by the government, have an income elasticity greater than one. This law describes that the demand for public goods and services increases proportionally as income or GDP rises. Additionally, when revenue collection increases under constant taxation rates, the demand for public spending on services increases. Peacock and Wiseman (2024) provided empirical evidence in the United Kingdom between 1891 and 1955, which supports Wagner's statement in 1891 and 1955. More studies have tested this law in various contexts (Abizadeh and Gray, 1985).

The increased lagging years for the Edu→diff_LnGDPpc relationship as the level of GDPpc increases, as stated in 3) are predictable. The respondents' average years of schooling from the GDIM data are 14.34, 11.88, 8.44, and 5.94 for Quartile 1 to Quartile 4,

respectively. The increase in average years of schooling with the rise in per capita GDP may indicate that it takes longer for high per capita GDP countries to achieve an economic return to the investment in education than for low per capita GDP countries. The impact of education on economic return can be delayed (Tsamadias and Prontzas, 2012; Garza-Rodriguez *et al*., 2020). In addition, countries with high per capita GDP often rely on advanced technology and knowledge-based industries. These sectors require highly skilled workers, which necessitates extended education.

Economic development provides the resources for improving intergenerational mobility directly or through government spending on education. Thus, economic development is a necessary condition for higher intergenerational mobility but not a sufficient condition for it. On the other hand, government expenditure on education functions as an investment in human capital within the production function (Benhabib and Spiegel, 1994). More likely, economic conditions, e.g., measured in GDP, are both a direct driver and an intermediate variable for intergenerational mobility.

### *The Path from Per Capita GDP to Educational Mobility*

Following the framework specified in Fig. (1), we need to estimate the paths from per capita GDP to intergenerational mobility in education through Government Expenditure on Education. The Government Expenditure on Education may impact educational mobility directly or through improving the average schooling for the population. We perform multiple 2SLS regressions to estimate these relationships. Due to data availability, we can only estimate for the 1980 cohort:

(1) 1). We test the path *GDPpc* → Government Expenditure on Education → Mean Schooling → Intergenerational Mobility in Education (reducing BETA) in the following two steps: (a and b):

(a) We test the link from *GDPpc* to average schooling (*Mean Schooling*) with a 2SLS regression. In this regression, Mean Schooling is the dependent variable, Government Expenditure on Education as a percent of GDP in 1982 (Edu1982) is the explanatory variable and instrumented variable and per capita GDP in 1982 is the instrumental variable to test the following links:

GDPpc → Government Expenditure on Education → Mean Schooling.

From the results illustrated in Table (7), we can see the following points. First, Government Expenditure on Education is a good explanator of *Meanschool* and this relationship is statistically significant. Second, both Durbin and Wu-Hausman tests indicate the endogeneity of Government Expenditure on Education, LnGDPpc1982, as a good instrument and confirm the above link.

(b) Using the same method, we test the link from Government Expenditure on Education in 1982 (Edu1982) to educational mobility (reducing BETA), taking BETA as the dependent variable, Meanschool as the explanatory and instrumented variable, Edu1982 as the instrumental variables to test the following links:

Government expenditure on education → Average schooling → Intergenerational Mobility in Education (reducing BETA).

The estimations illustrated in Table 8 show the following results. First, *Meanschool* is a good explanator of Intergenerational Mobility in Education (in reducing BETA) and this relationship is statistically significant. Second, both Durbin and Wu-Hausman tests indicate the endogeneity of *Meanshool* and Edu1982 is a good instrument for *Meanschool*. These estimations confirm the link mentioned above.

**Table 7:** 2SLS Estimations and Endogeneity Tests for Relationship from GDPpc to Average Schooling

| | | Coefficient | SD | z | P>\|z\| |
|---|---|---|---|---|---|
| Dependent variable | Mean school | | | | |
| Explanatory variable | Edu1982 | 3.2061 | 0.8495 | 3.77 | 0 |
| | Constant | -3.4173 | 3.5026 | -0.98 | 0.329 |
| Instrumented | Edu1982 | | | | |
| Instrument | LnGDPpc1982 | | | | |
| Number of obs | 45 | | | | |
| Wald chi2(1) | 14.24 | | | | |
| Prob > chi2 | 0.0002 | | | | |
| R-squared | 0.240 | | | | |
| Tests of endogeneity: | | | | | |
| Durbin (score) chi2(1) | 33.2392 (p = 0.0000) | | | | |
| Wu-Hausman F(1 ,42) | 118.703 (p = 0.0000) | | | | |

Sources: Authors' calculation based on GDIM, Education Expenditure from Our World in Data (2023), and GDP per capita data from Gapminder (2022)

**Table 8:** 2SLS estimations and endogeneity Tests for the relationship from mean school to BETA

| | | Coefficient | SD | z | P>\|z\| |
|---|---|---|---|---|---|
| Dependent variable | BETA | | | | |
| Explanatory variable | Mean school | -0.7474 | 0.1363 | -5.48 | 0.000 |
| | Constant | 1.1742 | 0.1308 | 8.98 | 0.000 |
| Instrument | Edu1982 | | | | |
| Number of obs | 45 | | | | |
| Wald chi2(1) | 30.08 | | | | |
| Prob > chi2 | 0 | | | | |
| R-squared | 0.572 | | | | |
| Tests of endogeneity | | | | | |
| Durbin (score) chi2(1) | 4.3857 (p = 0.0362) | | | | |
| Wu-Hausman F(1 ,42) | 4.5354 (p = 0.0391) | | | | |

Sources: Ibid

**Table 9:** 2SLS Estimations and Endogeneity Tests for Relationship from Government Expenditure on Education to BETA

| | | Coefficient | SD | z | P>\|z\| |
|---|---|---|---|---|---|
| Dependent variable | BETA | | | | |
| Explanatory variable | Edu1982 | -0.1600 | 0.0410 | -3.90 | 0.000 |
| | Constant | 1.1091 | 0.1691 | 6.56 | 0.000 |
| Instrument | LnGDPpc1982 | | | | |
| Number of obs | 45 | | | | |
| Wald chi2(1) | 15.22 | | | | |
| Prob > chi2 | 0.000 | | | | |
| R-squared | 0.253 | | | | |
| Tests of endogeneity | | | | | |
| Durbin (score) chi2(1) | 15.2563 (p = 0.000) | | | | |
| Wu-Hausman F(1 ,42) | 21.5428 (p = 0.000) | | | | |

Sources: Ibid

The estimation of (a and b) together confirm the route of how per capita GDP affects educational mobility:

GDPpc → Government expenditure on education → Average schooling → Intergenerational Mobility in Education (-BETA)

(2) The confirmation of the above link, as tested in (1), does not rule out a direct link from Government Expenditure on Education → Intergenerational Mobility in Education. Therefore, we perform another two-stage regression to test this direct link. The estimation shown in Table (9) reveals the following: First, Edu (1982) is negatively associated with BETA meaning, indicating a positive relation with educational mobility and this relationship is statistically significant. Second, both Durbin and Wu-Hausman tests indicate the endogeneity of Edu1982 and GDPpc1982 is a good instrument for Edu1982. These estimations confirm the link:

GDPpc → Government Expenditure on Education → Intergenerational Mobility in Education.

The above-tested links suggest that higher per capita GDP leads to lower BETA, or higher intergeneration mobility in education, through two paths.

Path A: Higher per capita GDP leads to more significant government expenditure on education, contributing to higher average schooling and increased educational mobility. As economic development occurs, government spending on public education increases the population's average schooling, resulting in higher educational mobility.

Path B: A higher per capita GDP leads to more government expenditures on education, targeting children with lower social status and improving intergenerational education mobility. Following this path, the average schooling does not necessarily increase.

These two paths can work independently in our framework, as illustrated in Fig. (1). It is important to note that these links are part of the complicated mechanism supporting educational mobility, which does not rule out other paths and reverse directions, such as the impacts of educational mobility, as discussed in the next section.

### *The Impacts of Educational Mobility on Per Capita GDP*

Greater upward mobility in education offers individuals opportunities and incentives for economic pursuits, fosters human capital formation, and consequently facilitates economic development. However, the impact of educational mobility on the economy may not be direct and immediate. Here, we present a graph that describes the evolution of the correlation between intergenerational mobility in education (-BETA) for each cohort and the per capita GDP of the 141 countries between 1930 and 2023.

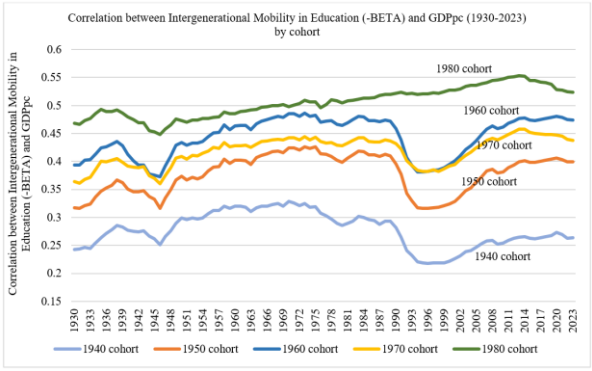


**Fig. 9:** Correlation between Intergenerational Mobility in Education (-BETA) and GDPpc (1930-2023) by cohort; Sources: Authors' calculation using BETA from GDIM and data of GDPpc from Gapminder (2022) in constant PPP of 2017 dollars

In the GDIM data, BETA is the regression coefficient representing the link between parents and children's years of schooling. The higher the BETA, the lower the educational mobility. Thus, BETA means intergenerational persistence in education; the opposite (-BEAT) represents intergenerational educational mobility. Because BETA is negatively correlated with per capita GDP, we observe negative values between BETA and per capita GDP of each cohort from 1930-2023. For better illustration, we use -BETA to represent intergenerational mobility in education in Fig. (9). The curve for each cohort represents the Pearson correlation coefficients between the cohort's -BETA and per capita GDP over the years.

From the time dimension, the curve for each cohort may carry the information from two aspects:

(a) The correlation coefficients before cohort members were born may indicate GDPpc as a cause of intergenerational mobility in education, or GDPpc → -BETA.
(b) The correlation coefficients one or two decades after the cohort members were born may indicate GDPpc due to educational mobility, or -BETA → GDPpc. The assumption for this analysis is that the educational mobility of a cohort affects economic performance two decades after members of the cohort were born. Then, taking the 1980 cohort as an example, the coefficients for the cohort before the 1980s may present GDPpc as a cause, while the coefficients after the 1990s or 2000s may indicate the effects of educational mobility on GDPpc.

As such, the curves in Fig. (9) demonstrate the following features:

(1) All correlation coefficient curves for all five cohorts are positive throughout the 93 years, meaning that economic development generally impacts educational mobility positively.
(2) These curves follow the order: 1980 cohort >1970 cohort >1960 cohort >1950 cohort >1940 cohort, except the intersections between 1970 and 1980 cohorts for two short periods.
(3) The general trend is that the coefficients increase over time in general, with two notable drops: One was during the Second World War (1938-1945) and the other one during the early 1990s' recession, when many Western countries experienced welfare reforms shifting from Welfare State to market-oriented policies (Gilbert, 2002). One exception is the smooth trend of the coefficients throughout the 1980s and 1990 for the 1980 cohort born between 1980 and 1989
(4) It is reasonable to infer that the educational mobility for cohorts before the 1980s was less related to per capita GDP during the 1990s recession. Thus, we observe a lower correlation between educational mobility and per capita GDP during this recession. While people of the 1980 cohort grew up and were educated through the 1990s and 2000, the high and smooth correlation curve between educational mobility and per capita GDP for the 1980 cohort indicates a country's economic conditions did matter in educational mobility
(5) The correction coefficients after the year of the mid-2000s can be interpreted as the impact of educational mobility on per capita GDP since all the cohorts had completed their education already. If this interpretation is correct, we observe high returns on education mobility after the mid-2000s

## *Threading Together and Conclusion Remarks*

### *Threading Together*

The focus of this study is to explore the role of per capita GDP as a macro-level factor affecting intergenerational mobility in education via government expenditure on education in a cross-country study. Using the GDIM data of intergenerational mobility in education and World Bank data, gapminder's GDP data, and Our World in Data for government expenditure on education, this study performs a five-round estimation and analysis to address most links among the components of our framework as illustrated in Fig. (1). Following our framework, our five-round estimations test the following links: The findings can be summarized as follows:

(1) The level of economic development provides the basis for other components, which in turn affect educational mobility. The estimations illustrated from Figs. (2-6) demonstrate the following features:

    (a) A positive non-linear relationship between per capita GDP and intergenerational mobility in education

(b) There is a disparity in educational mobility relative to per capita GDP among countries with low per capita GDP. This relationship becomes convergent among countries with high per capita GDP. The variations in educational mobility in less developed countries indicate differences in their social arrangements, even in similar economic conditions. This also suggests that the relationship between per capita GDP and educational mobility may not be direct but rather mediated through other variables.

(2) Government expenditure on education as a percent of GDP is negatively associated with BETA or positively related to educational mobility. One direct effect of government expenditure on primary education is the increase in the average schooling of the population and improved education for children of lower social status

(3) The Granger Causality test confirms a bidirectional relationship between per capita GDP and Government expenditure on education as a percent of GDP. These tests demonstrate three features:

(a) This relationship is conditional: For a short term of 2-7 years, the relationship runs from per capita GDP to Government expenditure on education; for a longer term of 8-12 years, a bidirectional relationship emerges
(b) The effects of per capita GDP on government expenditure on education appeared delayed with reduced economic development. The results from the Granger Causality tests align with Wagner's (1890) law and the empirical evidence (Peacock and Wiseman, 2024; Abizadeh and Gray, 1985)
(c) Furthermore, we observe that the lag period for the Government expenditure on education → GDPpc relationship decreases from 12-8 years for the top quartile to 8 years for the bottom quartile. This suggests that the effects of government expenditure on education are delayed with increasing levels of economic development.

(4) Following our framework specified in Fig. (1), we estimate the paths from per capita GDP to educational mobility using 2SLS regressions. These estimations confirm both of the following two paths:

Path A: Per capita GDP → Government expenditure on education → higher average schooling → higher intergenerational mobility in education

Path B: Per capita GDP → Government expenditure on education → Educational mobility

Path A describes a scenario in which, as economies develop, governments often both have demands for and have increased fiscal capacity to invest in public goods, including education. When governments allocate more resources to education, they can implement policies that reduce barriers to education for disadvantaged groups, resulting in improved educational mobility (OECD, 2012).

Path B involves an increase in educational mobility without necessarily increasing average schooling. This can be derived from policy arrangements that deliberately equalize educational achievement across groups. Examples of such arrangements were prevalent in the Soviet Union, China, and other former communist countries before their transition. This is known as the "forced equalization" of the "planned economy" (Bereday and Pennar, 1960; Long 1984). One of the costs of forced equalization is low efficiency and the creation of class stratification, as evidenced in the pre-transition history of these countries (Kornai, 1992; Fan, 2011). It is also possible to achieve high social mobility without a developed economy to support higher average schooling for society. In such cases, culture, tradition, and religion play crucial roles (Oberle, 2016; Weber, 1905).

It is also a reality that both Path A and Path B do not occur in cases where higher government spending on education fails to lead to higher educational mobility, as evidenced in many developing countries suffering from corruption and other issues (Gupta *et al*., 2002; Mauro, 1998).

(5) We compare and analyze the curves of correlation between intergenerational mobility in education and per capita GDP for five different cohorts (1940, 1950, 1960, 1970, and 1980) to understand the impacts of intergenerational mobility in education on per capita GDP (Fig. 9). The assumption for this analysis is that the educational mobility of a cohort affects economic performance two decades after the cohort members were born. Following this logic, these curves signify the following points:

(a) The correlation coefficient curves for all five cohorts remain positive over the years in our investigation, indicating that economic development generally positively impacts educational mobility (measured as -BETA)
(b) The correlation coefficients from the mid-2000s onward can be interpreted as the effect of educational mobility on per capita GDP, given that all cohorts have completed their education by this period. If this interpretation holds, it suggests a high return on educational mobility after the mid-2000s

Testing the causality between educational mobility and economic performance is challenging, given the data we use. Many studies explore the relationship between educational mobility and economic performance (Chetty *et al*., 2014; Black and Devereux, 2011; Aydemir and Yazici, 2019).

These studies highlight higher mobility leading to more efficient allocation of talents and resources, fostering economic growth. However, precisely identifying the causal impacts of intergenerational mobility in education on the economy remains challenging because of numerous other factors that influence economic outcomes. Disentangling the specific effect of educational mobility from these interconnected variables is challenging. Furthermore, assessing the long-term economic impacts of intergenerational mobility necessitates longitudinal data that tracks individuals and families over multiple generations. Such datasets are rare and often limited in scope, restricting the capacity to conduct comprehensive analyses.

### *Limitations and Areas for Further Study*

This study suffers a few limitations. First, an obvious one is that our framework addresses only a portion of the complex relationships affecting educational mobility, with each country having specific contexts and mechanisms for educational mobility. We do not test other macro-level factors, which may include individual investment in education, political arrangements, culture, and traditions. Each of these factors can substantially alter the landscape of educational mobility. For instance, higher private investment in education may improve average schooling and educational mobility or intensify educational inequality, depending on other social arrangements (Psacharopoulos and Patrinos, 2018). Intergenerational immobility in education is likely to persist unless public policies offer more benefits to disadvantaged populations (Corak, 2013).

Second, the disparities in educational mobility in low-income countries cannot be simply explained by levels of economic development, as shown in Figs. (2-8), beyond the explanation of the analytic framework. Various reasons and scenarios contribute to these high disparities in educational mobility in low-income countries (Aydemir and Yazici, 2019; Local Burden of Disease Educational Attainment Collaborators, 2020; Graetz *et al*., 2018). Multiple intertwined factors complicate the analysis, such as socioeconomic conditions, cultural and history, and political instability. Unlike developed countries where social structures are stable and social arrangements are constitutionalized, each developing country may face its own issues of underdevelopment, including unstable social and arbitrary decisions for public affairs.

Finally, although it is generally agreed that higher educational mobility is an indicator of a fair and efficient society (Breen and Jonsson, 2005; Robbins, 2007), identifying the impacts of educational mobility on economic development is challenging. The challenge is that many factors simultaneously affect economic performance and educational mobility is only one of them. Even if we isolate other variables, the functions of educational mobility could still be complex. On the one hand, higher educational mobility helps individuals from families with low social status achieve their aspirations, thereby contributing to the formation of human capital and increased productivity. On the other hand, the effects of educational mobility on the economy are complex and depend on how higher educational mobility is achieved. Different approaches to attaining educational equity have varying economic implications across countries with different contexts (OECD, 2018).

## Conclusion

The above-summarized estimations largely confirm the links in our framework. Understanding the relationships among these components is crucial to comprehending the mechanisms through which higher educational mobility can be achieved. Our framework focuses on macro-factors, unlike many models that include individual and family characteristics, such as Becker and Tomes's (1979; 1986) model and Solon's (2004) model. The standard model for intergenerational mobility in education extends Becker and Tomes' model, where parents invest in their children's future within their financial constraints and based on their children's endowments. However, our model's merit lies in its inclusion of multiple layers and paths linking per capita GDP to educational mobility. This framework elucidates the macro-level mechanisms for improving educational mobility and has relevant policy implications, explaining disparities in educational mobility among countries with similar economic conditions.

For public policy, understanding the relationship between educational mobility and other social indicators requires a more defined framework and prolonged observations for the outcomes to appear. In such a framework, decision-making units are collective entities, e.g., countries. Two immediate implications are:

A. Is there a sustainable optimal level of educational mobility in a given social-economic context? This involves the judgment of desirability, but empirical study can explore such a question. Suitability requires incentives, which leads to
B. What are the proper roles of individuals' incentives and stakeholders in society? This is the key to understanding how higher educational mobility impacts social outcomes. A better framework needs to integrate these two points in future studies.

Suppose we see education attainment not only just as a means to higher income but also as an achievement for individuals' aspirations and well-being. In that case, educational mobility should be promoted as long as it does not hinder the economy and is not against the individuals' will. For individuals, the non-pecuniary

benefits of education, including improved well-being, social mobility, and personal fulfillment, can be substantial, even if not counted as monetary returns in an economic sense (Oreopoulos and Salvanes, 2011). A society is a collection of individuals with specific needs and social arrangements for these needs. It is possible to calculate an optimal level of educational mobility for the sake of economic development. However, defining such an optimal level depends on the political approach chosen, for example, the utilitarian approach that benefits most individuals or the Rawlsian (Rawls, 1971) approach to benefit the least advantaged. Thus, the level of educational mobility and the way to achieve it remain important areas for further study.

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## Author's Contributions

**Lida Fan:** Involved in designing this study, collecting and statistically analyzing the data, and writing the manuscript.

**Meiying Zheng:** Involved in collecting and organizing the data sets.

**Rong Luo:** Involved in the use of statistical analysis.

**Alena Auchynnikava:** Provided support for the content related to transitional countries.

## Ethics

The authors affirm that this article adheres to proper scientific procedures and is free from any unethical practices.

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