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Does Government Spending on Education Increase Intergenerational Education Mobility?

The Case of Free Compulsory Basic Education in Ghana

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ABSTRACT

Does Government Spending on Education Increase Intergenerational Education Mobility?*

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This paper examines whether Ghana's education reforms have increased intergenerational education mobility. Using the newly constructed Ghana Education and Labour Series—a harmonized dataset combining multiple rounds of the Ghana Living Standards Survey—we track intergenerational education mobility trends for cohorts born between 1958 and 1992. Utilizing bottom-half mobility, a measure of the expected educational rank of children born to fathers in the bottom half of the education distribution, we find that, despite substantial gains in educational attainment across cohorts, mobility has remained largely unchanged. We estimate causal effects of the 1996 Free Compulsory Universal Basic Education policy using regional and cohort variation in exposure. The reform substantially increased years of schooling, particularly for women and those born in northern regions, but had only a modest effect on intergenerational mobility. These findings suggest that while free and compulsory education expanded access, structural inequalities continue to limit equal opportunities.

JEL Classification:

I24, J62, O15, C21

Keywords:

Intergenerational educational mobility, free compulsory junior secondary education, policy reform, rank-based mobility measures

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1 Introduction

Since independence, Ghana has implemented a series of education policy reforms with a focus on improving quality and expanding equity in access (Ministry of Education 2019). Major reforms include a reduction in the duration of pre-tertiary education in 1987, Free Compulsory Universal Basic Education (FCUBE) in 1996—which included free junior high school (JHS)—and, most recently, free senior high school (SHS) in 2017.

These policies have the potential to alter the distributional patterns of educational opportunity and attainment across the population. However, it is not guaranteed that they will enhance the educational mobility prospects of children born to less-educated parents. Even when overall educational attainment rises, children from such backgrounds may continue to occupy the lower tiers of the distribution, particularly if those who disproportionately benefit are the children of well-educated parents, thereby reinforcing existing advantages.

Consequently, whether intergenerational persistence in educational attainment declines alongside overall improvements in education levels is an empirical question. Existing studies of intergenerational educational mobility (IEM) in Ghana have largely been part of cross-country analyses, limiting their ability to capture country-specific trends and responses to domestic policy reforms.

We make a two-fold contribution in this regard. First, we contribute to the IEM literature in Ghana by employing rank-based measures of mobility, specifically 'bottom-half mobility', that are comparable across time, space, and groups (Asher et al. 2024). Bottom-half mobility, which is the expected rank of a child born to a parent in the bottom half of the education distribution, is also a particularly useful measure in contexts where a large share of parents have education levels that are bottom-coded (e.g., no education). As we show, this is the case in Ghana and is often the case in developing country settings. This measure also allows us to isolate the intergenerational persistence of education from 1) increasing levels of education attainment in the population over time and 2) economic growth and inequality.

Additionally, Ghana is an ideal case for studying how education, geography, and gender interact to shape IEM. Ghana exhibits a long-standing North-South divide, rooted in colonial and post-independence policies that prioritized infrastructure and education investment in the south, while leaving the Northern regions relatively underdeveloped (Kambala 2023). Economic growth and urbanization have also been spatially uneven, and large parts of the country remain reliant on subsistence agriculture and informal work (Ghana Statistical Service 2023). Moreover, gender norms and structural constraints, especially in rural and northern areas, continue to limit the educational and occupational opportunities available to women, contributing to persistent gender gaps (e.g., in wages, Boadi 2023). These inequalities continue to shape access to opportunity and patterns of mobility, making our study of IEM in Ghana, disaggregated at these levels, particularly interesting and relevant.

Second, we exploit cohort and regional variation in Ghana's introduction of free JHS under the 1996 FCUBE policy to assess the impact of this education reform on educational attainment and IEM. While free education policies have been widely adopted across sub-Saharan Africa, their implications for IEM remain under-explored. To date, we find only one study focused on Kenya (Shimada 2024) that has foregrounded the relationship between the introduction of free education policies and intergenerational mobility, highlighting the novelty and relevance of our contribution in the Ghanaian context. Both contributions use our Ghana Education and Labour Series (GELS), a stacked and harmonized dataset of all rounds of the nationally representative Ghana Living Standards Surveys (GLSS), allowing us to trace mobility trends for cohorts born from independence (1957) to 1994.

We find that despite substantial improvements in overall education levels over recent decades, upward IEM in Ghana has remained remarkably stable for children born since independence. This implies that, although educational expansion has raised average attainment across the population, it has not significantly increased the likelihood of upward mobility for children from less-educated backgrounds. That said, regional patterns of mobility have shifted. Upward mobility increased for individuals born in the Northern regions and declined for those born in the Coastal and Central regions. The component of our study analysing the impact of free JHS suggests that part of this convergence in regional mobility patterns appears to have been driven by this policy.

In the following section, we briefly summarize Ghana's key education policy reforms and motivate our efforts to measure IEM by visually presenting evidence of educational expansion. Next, we outline our contribution to existing literature on IEM (and IEM in Ghana specifically), as well as the literature on school fee abolition in Africa (Section 3). Thereafter, we discuss our data (Section 4), followed by our methods and sample construction (Section 5) for both components of our analysis. Our results on bottom-half mobility follow thereafter (Section 6.1), and lastly, we turn to examine the role of free JHS on IEM (Section 6.2). We conclude in Section 7.

2 Education reforms and resulting expansion

Ghana has implemented several education policy reforms over the years, with stated goals of increasing access to and improving quality of education. Table 1 summarizes some of the major changes, indicating which birth cohorts were likely to be first affected under the assumptions of entering primary school at age 6 and no grade repetition.

Table 1: Education policies and reforms in Ghana

Policy/reform	Description	Year introduced	Cohort 1st exposed
Accelerated Development Plan (ADP)	**Free** primary education/universal primary education (UPE)	1951	1945
New Educational Reform Programme (NERP)	Reduction in **duration**: 7 years senior secondary to 3 years SHS	1987	1972
New Educational Reform Programme (NERP)	Reduction in **duration**: 4 years middle school to 3 years JHS	1987	1975
Free Compulsory Universal Basic Education (FCUBE)	Extension of free primary to **free** JHS (& compulsory)	1996	1985
Free Compulsory Universal Basic Education (FCUBE)	Entirety of basic education free and compulsory	1996	1990
Free Senior High School	**Free** SHS	2017	2002

Source: Information compiled from Bank (2004) and Stenzel et al. (2024)

In 1951, Ghana introduced the Accelerated Development Plan (ADP) for education. The ADP made primary education free for all children and expanded pre-tertiary education through a massive increase in the construction of primary and middle schools (Boahen and Yamauchi 2018).

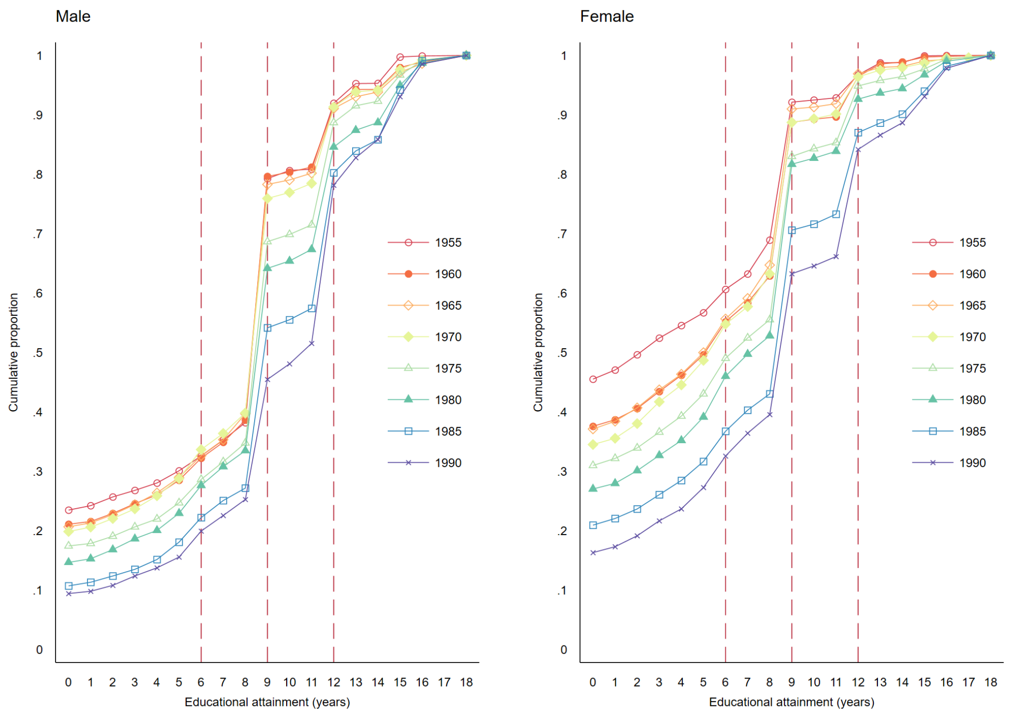
The New Educational Reform Programme (NERP) was introduced in 1987. This reform focused on restructuring the entire pre-tertiary education system and improving access through the provision of infrastructure, whilst making the curriculum more relevant to social and economic needs (Asare Danso 2017; Boahen et al. 2021). The reform reduced the duration of pre-tertiary education from 17 to 12 years.

In 1996, Free Compulsory Universal Basic Education (FCUBE) was introduced. This meant that free primary education (grades 1–6) was extended to include JHS (grades 7–9). Basic education (primary and JHS) was also made compulsory. The (unachieved) goal was that universal enrolment in basic education would be achieved by 2005 (Akyeampong 2009).[1] The country, further, made SHS free in 2017, which eliminated fees for all students enrolling in public senior high schools.

To contextualize our study and motivate our efforts to measure IEM, we consider two illustrations of education expansion in Ghana. Figure 1 presents cumulative distribution functions (CDFs) of years of education for five-year birth cohorts by gender. Vertical lines are drawn at nine years of completed education (JHS) and 12 years (SHS). The pattern of the CDFs reiterates that each cohort has been attaining higher average education than the cohort preceding it. The share of women with six years of education or less (i.e. completed primary or less; first vertical line) fell from just above 50% for the 1955–59 cohort to roughly 30% for the 1990–94 cohort.

[1] Akyeampong (2009) provides a more detailed discussion of these reforms.

Figure 1: Rising educational attainment: CDFs by gender and birth cohort (ages 25–54)



Note: Vertical lines drawn at six years of completed education (primary), nine years (JHS or lower secondary), and 12 years (SHS or upper secondary).
Source: Own calculations using GLSS 1–3, 5–7 (survey weighted), PHC 2010, 2021.

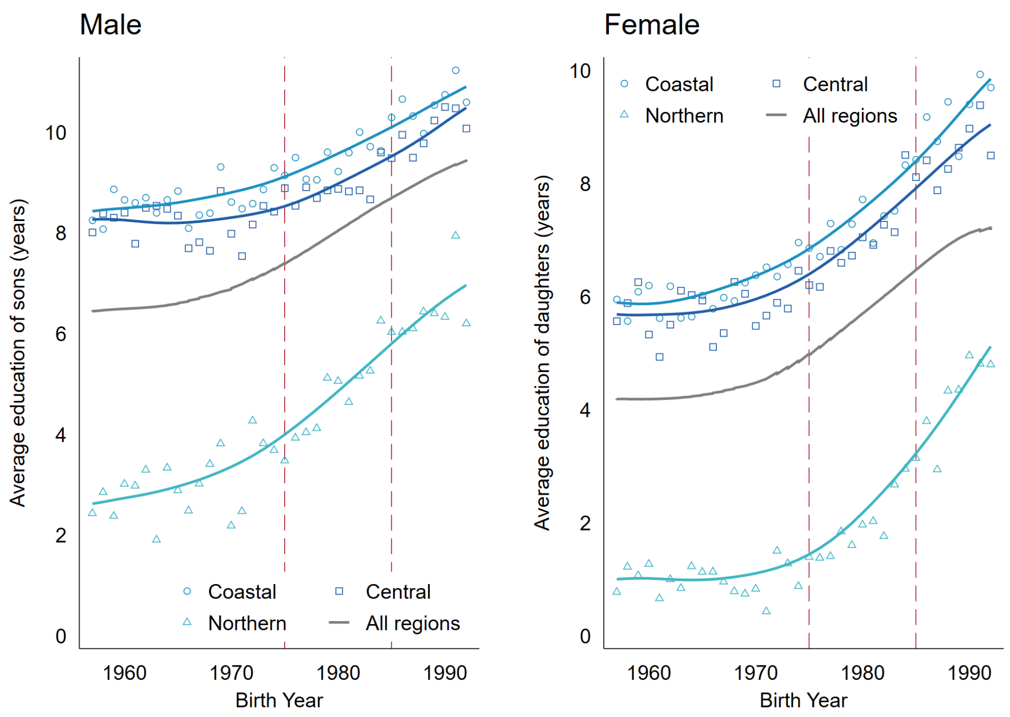
If primary school enrolment age was strictly enforced, those born in 1990 would have been the first cohort to start school with free and compulsory education from grade 1 to grade 9, while those born in 1985 would have been the first cohort to have access to free JHS (even though this was not an option when they started grade 1). However, delayed enrolment (see e.g., Boahen et al. 2021), stop-outs, and repetition means that learners from earlier cohorts would likely have been affected, too. The substantial attainment shift for both genders between the 1980–84 and 1990–94 cohorts could be a lagged effect of the NERP or reflect increased attainment following FCUBE, particularly the expansion to free JHS. It is notable that the attainment shift for the female 1975–79 cohort (at lower years of education) was greater than the corresponding shift for men, suggesting that the NERP may have been important in encouraging female educational attainment (as found in Boahen et al. 2021).

Figure 2 illustrates how educational attainment differs dramatically in level and trend across regions. Attainment levels are similar in Coastal and Central regions, but children born in Northern regions have substantially fewer years of education.

Differences across gender by region are also apparent. Notably, all groups have seen increases in education, but the rate of growth has been faster for females overall and for males in Northern regions. The gender gap has thus decreased from 2.11 to 1.37 between the older and younger cohorts overall in the Northern region. The Coastal-Northern female gap decreased from 5.18 to 4.9, with a larger change in the Coastal-Northern gap evident for males (5.82 to 4.4).

The education policy context, increases in educational attainment, and regional and gender differences presented in this section motivate our aim to understand whether substantial gains in education have translated into changes in relative socioeconomic status.

Figure 2: Average education of daughters and sons by birth year and region of birth



Note: Vertical lines drawn at the 1975 and 1985 birth cohorts, i.e. those likely to be affected by the NERP and free JHS under FCUBE, respectively.
Source: Own calculations using GLSS 1–7 (survey weighted)

3 Literature

A growing body of research examines IEM in developing countries, seeking to understand how family, community, and education systems shape equality of opportunity and the persistence of disadvantage. Yet, despite widespread adoption of free education policies across sub-Saharan Africa, very little is known about whether such reforms have weakened the intergenerational transmission of education. This paper contributes to filling this gap by directly linking a major policy reform—the introduction of free and compulsory JHS under Ghana's 1996 FCUBE policy—to IEM outcomes. In doing so, we connect two strands of literature that are rarely integrated: studies measuring IEM in developing countries and those evaluating the impact of large-scale education policy reforms.

Five prominent studies have included Ghana in their analysis of IEM—Van Der Weide et al. (2024), Azomahou and Yitbarek (2021), Alesina et al. (2021), Razzu and Wambile (2022), and Razzu and Wambile (2025)—all as part of broader cross-country analyses of nations. The most comprehensive of these is Van Der Weide et al. (2024), who compile a global IEM database for 153 countries covering 97% of the world's population and 86% of developing countries (although they do not provide individual country estimates). This builds on earlier studies that increasingly broadened the scope of analyses to include more countries. For example, Azomahou and Yitbarek (2021) analyse IEM across nine African countries,[2] Alesina et al. (2021) across 27, and Razzu and Wambile (2022) across 34. More recently, Razzu and Wambile (2025) extend the IEM concept to three-generation mobility, although their study is for six African countries only. Using a range of mobility measures, these studies reveal that substantial cross- and within-country variation exists.

For instance, Azomahou and Yitbarek (2021) find that the African countries in their data—with the exception of Comoros and Rwanda—have greater IEM than Latin American countries but lower mobility than Eastern and Western Europe countries and the United States. In their analysis, Ghana's mobility as measured by a one-correlation coefficient is estimated to be 0.55, aligning with Van Der Weide et al. (2024)'s aggregated estimate for the 1980s cohorts in the developing countries. Razzu and Wambile (2022) further show that within African countries, historical context matters with former British colonies, including Ghana, tending to exhibit higher levels of mobility than former French or Portuguese colonies. Alesina et al. (2021) exploit census data to construct district-level measures of upward and downward mobility, highlighting large regional disparities associated with colonial-era investments in education and infrastructure. They show that Ghana's aggregate upward mobility level (0.57)—measured by the share of children born to parents without education who attain some schooling—is above the regional mean but ranges from a low of 0.18 to a high of 0.8 across districts within Ghana, typically lowest in the North and highest in the Central districts.

Finally, Razzu and Wambile (2025) find that intergenerational effects can persist beyond two generations, though grandparents' influence is generally weaker than that of parents and most pronounced when co-resident. Ghana's persistence between grandparent and child education levels once again falls in the mid-range of the countries analysed at 0.18 for daughters and 0.12 for sons.

[2] They combine their findings with those from Azam and Bhatt (2015); Ranasinghe (2015); and Hertz et al. (2008), allowing them to rank 52 countries worldwide.

Building on this literature, our study contributes new evidence on the dynamics of IEM in a setting that has undergone multiple large-scale education reforms. We employ a rank-based measure of mobility—Asher et al. (2024)'s bottom-half mobility—which is comparable across time and space and less sensitive to changes in the overall education distribution than many absolute measures. This approach enables a clearer assessment of whether children from less-educated backgrounds are improving their relative position within the education hierarchy, a key concern in countries with large state investment in education and experiencing rapid educational expansion.

Our work also connects to the broader literature on education policy and equality of opportunity, particularly to research evaluating the impact of school fee abolition on educational outcomes in low- and middle-income countries (see reviews by Snilstveit et al. (2016); Evans and Popova (2016); Evans and Mendez Acosta (2021); Crawfurd and Ali (2022)). Empirical studies have examined short- and medium-term effects on attainment (see Stenzel et al. (2024) and Duflo et al. (2024) for Ghana), with some exploring longer-run effects on fertility or labour market outcomes (see Boahen and Yamauchi (2018) and Duflo et al. (2024) for Ghana). However, evidence on how such reforms affect intergenerational mobility, specifically the extent to which they break the link between parental and child education, has not been explored in a developing country context.

To our knowledge, ours is the first study to assess the direct impact of a free education policy on IEM in an African context. The closest related paper is Shimada (2024), who examines intergenerational mobility in Kenya before and after the introduction of free primary education. Shimada (2024) compares mobility levels in cohorts exposed to the reform versus those not exposed. He does not directly link the policy reform to IEM outcomes, however, rather shifting focus to earnings when evaluating the policy. Moreover, his study differs from ours on several important respects. First, the reform he examines—free primary education—targeted the early stage of schooling, whereas we analyse the introduction of free and compulsory JHS (lower secondary), building on a system where primary education had been (in theory) free since independence. Second, Shimada (2024)'s estimation sample is limited to respondents who are co-resident with parents, likely biasing estimates of IEM; to mitigate this, he restricts his analysis to respondents aged 18–30. By contrast, we utilize data that record parental education for both resident and non-resident parents, allowing us to construct a more complete intergenerational linkage and to include a much wider range of ages. Finally, our use of a rank-based absolute mobility measure distinguishes our approach from Shimada (2024)'s relative mobility decomposition. Our measure abstracts from structural shifts in the overall education distribution and provides a direct, distributionally interpretable estimate of the effect of the free JHS reform on the upward mobility of children from less-educated families.

The closest contribution to ours is made by Karlson and Landersø (2025) in a study of Denmark. They examine the 1958 abolition of a dual education system in Denmark using a difference-in-differences framework and show that the reform increased educational attainment, test scores, and income rank, with the inclusion of the income rank measure providing a direct assessment of the policy's impact on a distributional outcome. We therefore contribute to this emerging body of research assessing the direct impact of education policy reforms on intergenerational mobility.

In summary, our study contributes to two strands of literature: (i) the measurement and interpretation of intergenerational mobility in developing countries and (ii) the causal evaluation of major education policy reforms and their implications for equality of opportunity. By linking rank-based IEM measures to quasi-experimental variation in exposure to the Free Compulsory Universal Basic Education (FCUBE) reform, we provide novel evidence on how large-scale fee abolition policies influence the intergenerational transmission of educational advantage—an issue of broad relevance to development and human capital policy globally.

4 Data and key variables

This study uses data from our GELS,[3] a stacked series of nationally representative household survey and census data for our analysis. For the analysis of IEM trends, we leverage the component of GELS that harmonized rounds of the GLSS, which is a nationally representative cross-sectional survey that collects detailed information on a variety of topics, including demographics, individuals' education, and their parents' education. GELS contains information from seven GLSS rounds (1987/88, 1988/89, 1991/92, 1998/99, 2005/06, 2012/13, and 2016/17) that are available in the public domain. We stack these surveys to create a high-frequency, harmonized database of information on education and other variables spanning 1987–2017. This synthesis exercise is important both for identifying changes and inconsistencies in sampling and measurement over time. To date, studies on IEM in Ghana have been based on GLSS rounds 6 and/or 7 alone (Alesina et al. 2021; Azomahou and Yitbarek 2021; Razzu and Wambile 2022).

Table 2 shows the datasets in which we have been able to harmonize key variables required for our analysis, namely parental education and region of birth. Importantly, parents' education level is available for both co-resident and non-co-resident parents in the GLSSs, meaning we can observe parent-child links even when parents and children live in different households.

GELS includes a harmonized years of education variable that accounts for changes in the structure of education over time (specifically the shift from 17 to 12 years). We utilize this vari-

[3] More details on this series can be found in Whitelaw and Branson (2025).

able in Figures 1 and 2 and in the impact section but in some parts of the analysis use categorical education variables defined as 1) no education or less than completed primary, 2) completed primary, 3) completed JHS, 4) completed SHS, and 5) tertiary. Additionally, for children, we can separate the bottom education category into no education and primary education.[4]

Region of birth is also available in all of the GLSS datasets, allowing us to measure changes in mobility by region. We group regions into three aggregate categories—Coastal, Central, and Northern. We include the Western, Central, Greater Accra, and Eastern sub-regions in the Coastal grouping; Volta, Ashanti, and Brong Ahafo in the Central grouping; and Northern, Upper East, and Upper West sub-regions in the Northern grouping.

Table 2: Source datasets for harmonization

Survey	**Survey year**	Education (years)	Parental education	Region of birth
GLSS 1	1987–88	Harmonized	Harmonized	Harmonized
GLSS 2	1988–89	Harmonized	Harmonized	Harmonized
GLSS 3	1991–92	Harmonized	Harmonized	Harmonized
GLSS 4	1998–99	-	-	Harmonized
GLSS 5	2005–06	Harmonized	Harmonized	Harmonized
GLSS 6	2012–13	Harmonized	Harmonized	Harmonized
GLSS 7	2016–17	Harmonized	Harmonized	Harmonized

Source: Original data files downloaded from https://www.statsghana.gov.gh/gssdatadownloadspage.php

5 Methods

5.1 Measuring IEM

Absolute and rank measures of intergenerational mobility (Chetty et al. 2014) have become popular in the literature as they can isolate intergenerational mobility from economic growth and inequality changes. However, these measures typically require linked parent-child income measures, which are not available in Ghana (and many other developing countries), and even when available, they may nevertheless be difficult to ascribe to individuals in multi-generational households with joint production (Asher et al. 2024).[5] Thus, researchers have typically relied on education information. Rank-based measures are useful in this context, since although most children obtain more education than their parents, this in itself does not tell us whether this increased attainment has improved their relative position in society and equalized access to opportunities. They are also particularly useful in contexts of high inequality, as they anchor mobility in the distributional structure of both generations.

[4] We were not able to compute a years-of-education variable or parental education using GLSS 4 because the questions were not detailed enough.

[5] Additionally, education is likely to be measured more accurately and not vary as substantially over the life cycle (Asher et al. 2024).

A problem is that education is reported in discrete bins with many respondents reporting the same level of education. Additionally, these bins can be very large, especially in societies where many people have not formally participated in education. This makes it hard to construct rank measures from educational attainment. Asher et al. (2024) present a solution to this challenge: their bottom-half mobility measure. This is the expected rank of a child born to a parent in the bottom half of the education distribution. If there is no mobility, the expected percentile rank of children born to fathers in the bottom 50% would be 25; values above and below this reflect upward and downward mobility, respectively.

To overcome the issue of bottom-censoring in education measures, Asher et al. (2024) recast this problem as an interval censoring problem, such that the binned education data reflect a continuous (but unobserved) latent rank distribution. They note that tools from the partial identification literature can then be used to put bounds on the parent-child rank cumulative education function (CEF) (see also Novosad et al. 2022).

The bottom-half mobility measure has a very similar interpretation to absolute upward mobility[6] (Chetty et al. 2014), but it is appealing in that it can be tightly bounded even in contexts with severe interval censoring. A limitation, however, is that by averaging results in the bottom half of the distribution, bottom-half mobility may conceal changes within the bottom half.

5.1.1 The bottom-half mobility measure

Formally, bottom-half mobility is defined as the expected outcome of a child born to a parent or parents in the bottom half of the parental education distribution, defined as

$$\mu_0^{50} = \mathbb{E}[y \mid x \in [0, 50]],$$

for child rank y and parent rank x.

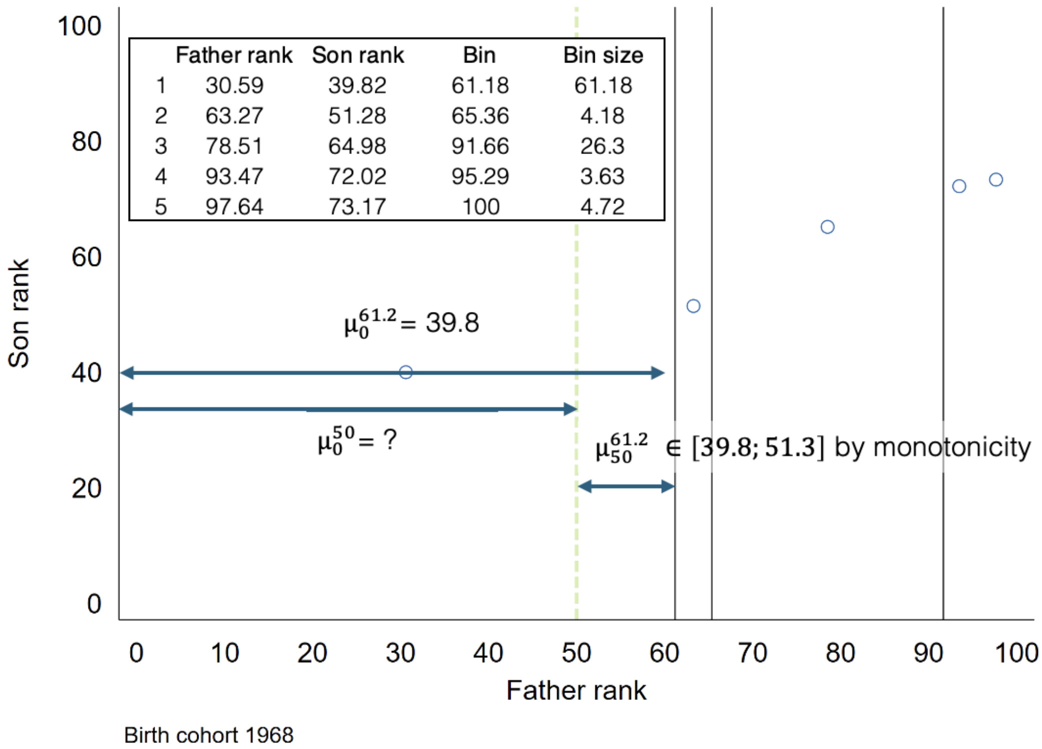
Figure 3 provides a graphical example that we use to outline the logic behind the calculation of μ_0^{50} for the 1968–72 birth cohort in Ghana. Notice that discrete values of the CEF can be point estimated within ranges that correspond to bin boundaries in the data. That is, for fathers in the lowest bin (1) of the education distribution, the bin has rank boundaries 0 and 61.2 (61.2% of fathers fall into this bottom category). $\mu_0^{61.2}$ is precisely equal to the expected child outcome in that rank bin (here, 39.8). One can then solve iteratively for the lower bound of μ_0^{50}, knowing that $\mu_{50}^{61.2} \in [39.8,\ 51.3]$ by the assumption of monotonicity.[7] In our case, this assumption means that higher parental rank necessarily correlates with higher child rank or, put differently,

[6] The expected outcome of a child born to the median parent in the bottom half of the parental education distribution.

[7] Asher et al. (2024) motivate this assumption but state that it is not strictly necessary, elaborating in their online appendix.

having a parent in a higher ranked position will not result in the child's rank being worse off than if they were in a lower ranked position. Intuitively, this aligns with higher education being associated with better outcomes and is illustrated, at least across the median bin points, in the data in Figure 3.

Figure 3: Calculating μ_0^{50} for the 1968–72 cohort



Note: Vertical lines drawn at bin rank boundaries.
Source: Own compilation using GLSS 1–7.

The intuition behind these bounds is that child rank in an arbitrary rank range is a weighted mean of known and partially identified values (Novosad et al. 2022). For example, take the case of $\mu_0^{50} = 37$. We can check whether the weighted mean for $\mu_{50}^{61.2}$ will meet the monotonicity assumption:

$$\mu_{50}^{61.2} < \mu_{61.2}^{65.35}$$

$$\mu_{50}^{61.2} < 51.3$$

$$\mu_{50}^{61.2} < \frac{[\mu_0^{61.2} \cdot 61.2 - \mu_0^{50} \cdot 50]}{61.2 - 50},$$

where the denominator reflects the number of percentiles between the 50th and the lowest bin boundary. This equates to:

$$\frac{[\mu_0^{61.2} \cdot 61.2 - \mu_0^{50} \cdot 50]}{61.2 - 50} = \frac{[(39.818 \cdot 65) - (37 \cdot 50)]}{11.818} = 52.419$$

We therefore reject that $\mu_0^{50} = 37$, as monotonicity is violated. Solving iteratively, we can therefore obtain that mean son's rank $\mu_0^{50} \in [37.254, 39.818]$. In general, the bounds on μ_a^b will be tightest when a and b are close to actual rank bin boundaries and when the slope of the CEF is small.

5.1.2 Sample and summary statistics

We pool the GLSS surveys and in each survey restrict our sample to those between 25 and 64 years of age. Bottom coding of mothers' education is very severe and results in large bounds. We therefore measure mobility from fathers to their sons and daughters. The lower age limit of 25 years ensures that our respondents have completed their education. We limit the upper age to 64 years to reduce the potential of selection bias due to ageing. That is, longevity and education are positively correlated, and including older respondents could result in a downwardly biased estimate of the intergenerational regression coefficient (Hertz 2008).

Trends in IEM are based on five-year birth cohorts born between 1958 and 1992. The five-year intervals provide adequate observations for each group, while still being short enough to generate a sufficient number of coefficient estimates, allowing us to track the trend of intergenerational mobility over time.[8] We present information nationally and by region of birth, broadly grouped into Coastal, Central, and Northern regions.

Key to our measurement of bottom-half mobility is the size of the bins of fathers' education, especially the delineation of the bottom 50% of fathers from those with higher levels of education. As discussed above, this will influence the accuracy with which we can bound our bottom-half mobility estimates. Table 3 presents sample and bin sizes by fathers' education level for sons and daughters for birth cohorts from 1958–62 and 1988–92.

Table 3: Fathers' education bin sizes by child birth cohort

	Child	Region	1958	1963	1968	1973	1978	1983	1988
None/some primary	D	All	72.33	68.65	63.42	58.21	55.14	48.83	47.82
Compl primary	D	All	2.97	2.61	3.21	4.15	3.59	3.75	4.82
Junior sec.	D	All	19.44	21.38	24.47	27.7	31.45	34.68	34.47
Senior sec.	D	All	2.79	3.81	3.82	4.64	3.75	5.09	5.15
Tertiary	D	All	2.46	3.55	5.09	5.3	6.06	7.65	7.75
Observations	D	All	4,774	4,699	4,312	4,885	5,116	4,878	2,582
None/some primary	S	All	72.63	67.79	61.18	58.45	50.3	43.53	43.97
Compl primary	S	All	3.39	3.17	4.17	3.73	4.29	5.64	4.66
Junior sec.	S	All	17.01	21.52	26.3	26.49	33.6	36.84	38.65
Senior sec.	S	All	3.4	3.69	3.62	5.26	4.45	6.03	6.6
Tertiary	S	All	3.56	3.84	4.72	6.07	7.35	7.96	6.13
Observations	S	All	3,785	3,791	3,539	4,035	4,219	3,856	2,229

Note: D = daughters and S = sons.
Source: Own calculations using pooled GELS, respondents with fathers' education.

[8] We avoid problems relating to age heaping at years ending in 0 or 5 by using this approach: five-year cohorts are defined from digits 2 and 8.

The table highlights that fathers' education levels were extremely low in Ghana but have improved substantially over time—almost three-quarters of those born in 1958–62 had fathers with zero or incomplete primary education. This decreases to just less than 50% for those born in 1988–92, with much of the increase seen in the share with JHS (from one-fifth to one-third). Although the share of children with fathers with tertiary education remains below 8% for all cohorts, the share in this group has seen a rapid increase. For example, only 2.5% of daughters born in 1958–62 have fathers with tertiary education. This increases to 7.75% for daughters born in 1988–92, overtaking the share of fathers with completed senior secondary education (5.15% in the 1988–92 cohort). This suggests that when these fathers were at school, expanding access to education resulted in fathers either stopping after completing JHS or continuing through to tertiary education.

Fathers' education levels vary substantially across our regional groupings (see Appendix Table A1). Among daughters in the older cohorts, the share of fathers with zero or less than primary is 64%, 68%, and 96% in Coastal, Central, and Northern regions, respectively. While children born in all regions show an increase in their father's education levels over time, there was much more change for children born in Coastal and Central regions such that the gap between Coastal and Northern regions in the share of daughters born to fathers with less than primary, which was 32 percentage points in the 1958–62 cohort, grew to 72 (27% in Coastal versus 89% in Northern) percentage points in the 1988–92 cohort.

It is worth noting the potential measurement error in these parental education variables. One might expect the distribution of weighted observations across fathers' education levels to be similar for sons and daughters born within the same cohort. While they are typically similar, there are some differences. Overall, sons tend to report higher levels of education for their fathers than do daughters. Measurement error in education has been raised as a difficulty in estimating intergenerational persistence using correlation coefficients or beta estimates (Van Der Weide et al. 2024). However, recall that bottom-half mobility requires only that parents (in our case, fathers) be accurately assigned to either the bottom or top half of the education distribution. Therefore, differences between daughters' and sons' reporting of their fathers' education would only bias our estimates if these discrepancies were large enough to shift fathers across the median threshold.

Moreover, although sampling design ensures that respondents within a survey born in a specific year are representative of their birth cohort, here we are grouping respondents across survey years. Expecting that the parents of these respondents are representative of all parents in that cohort would therefore be a strong assumption. It is thus not necessarily the case that the distribution of fathers' education should be identical across sons and daughters within a cohort—these are not the same fathers, and gendered sample composition (e.g., by region or survival) could contribute to observed differences.

5.2 Impact of free JHS on educational outcomes

The next component of our study examines whether the implementation of free JHS had any effect on IEM as measured by bottom-half mobility. To do this, we use a difference-in-differences (DiD) approach, which relies on differential exposure to free JHS based on birth cohort and district (Lucas and Mbiti 2012; Brudevold-Newman 2021).

Following Brudevold-Newman (2021), we define a continuous treatment intensity measure $I_k = (1 - transitionrate_k)$, which reflects the maximum by which district-level transitions from primary school to JHS could increase. Thus, the intensity measure is higher for regions with low pre-programme transition rates, where the free JHS policy had greater scope to induce students to attend junior secondary school. We use this continuous treatment intensity in the following regression specification:

$$S_{ijk} = \alpha_0 + \beta_1 \left(\mathbf{I}_k * \mathbf{JHS}_j \right) + \delta_{ijk} + \eta_k + \gamma_j + \varepsilon_{ijk} \tag{1}$$

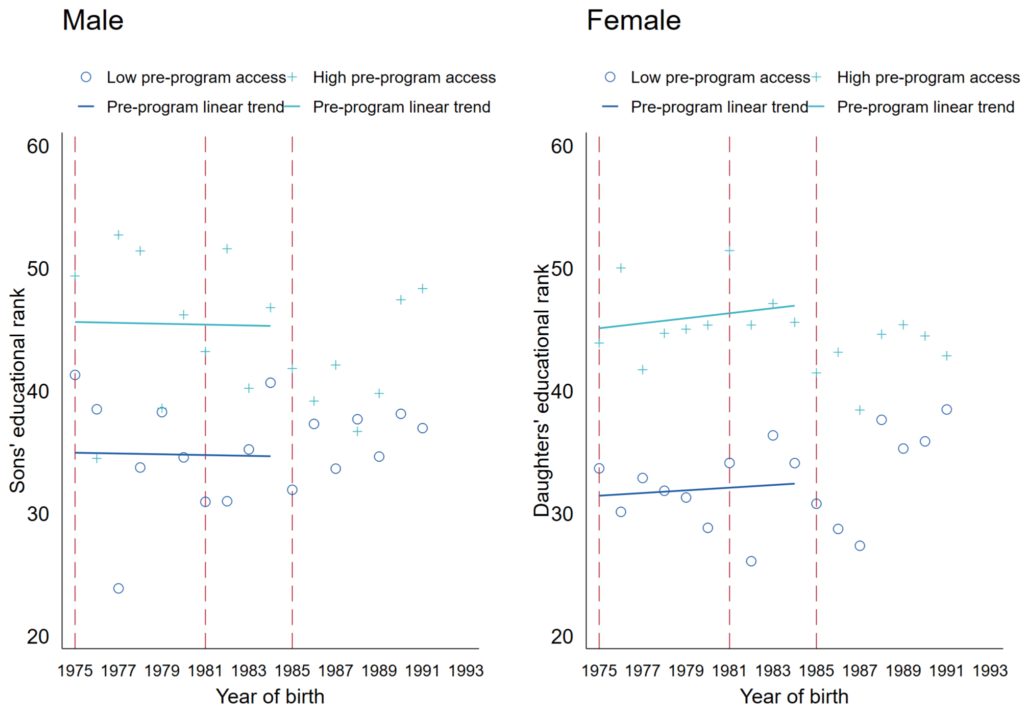
where I_k is the treatment intensity for district k, JHS_j is a dummy variable equal to one for individuals born in cohorts exposed by the free JHS policy, δ_{ijk} reflects time-invariant or persistent individual characteristics (gender, ethnicity, and religion), and η_k and γ_j represent region of birth (Coastal, Central, Northern) and cohort fixed effects (two-year groupings),[9] respectively. We cluster errors at the district level to account for possible serial correlation within school markets over time. The interaction coefficient, β_1, is the estimate of the effect of the policy change on outcome S (education, labour market, household expenditure rank, and IEM measures, as listed in Table 4).

There are two main assumptions underlying this approach. First, selection bias (treatment intensity) should be attributable to unchanging characteristics of the district. In assessing the validity of this assumption, we note that if capacity constraints at the secondary school level are binding, then the ratio of primary school graduates to secondary school spots determines the transition rate. That is, without large changes in either the number of primary school graduates or junior secondary school capacity, the transition rate is likely to be serially correlated over time. Indeed, the data suggest that this assumption is likely to hold: the correlation between the district treatment intensity calculated using cohorts enrolled six versus 16 years prior to treatment is 0.93, suggesting that within-district transition rates were highly persistent in the 16 years prior to the FCUBE policy change. Thus, estimates from our choice of a six-year window likely reflect persistent characteristics of the districts.

[9] The regressions for labour market outcomes include a quadratic in age to account for non-linearities in age.

The second assumption is that the trend in outcomes in high- and low-transition rate districts would have persisted in a similar fashion absent the policy change. While this is fundamentally untestable, Figure 4 demonstrates common pre-programme trends in child rank by low versus high (classified as those above versus below the median) pre-programme transition rate districts going back eight years, suggesting that differences across regions in primary to JHS transition rates are due to structural rather than transitory factors. If these assumptions are satisfied, the fixed effects absorb these structural region and cohort differences yielding a consistent measure of impact.[10]

Figure 4: Child rank by birth cohort and pre-policy transition rates



Note: Vertical lines drawn at the 1975, 1981, and 1985 birth cohorts. Cohorts born from 1981 may be partially exposed due to delayed school entry, grade repetition, and stop-outs.
Source: Own compilation using GELS.

Furthermore, our method identifies the differential effect of the policy for individuals in high- versus low-intensity districts, while the free JHS policy would have affected students nationwide. To the extent that the programme also affected outcomes in low-intensity districts, our approach will underestimate the total impacts of the programme by differencing out these changes.

Finally, because our intergenerational mobility measure is constructed directly from educational attainment, we can estimate the policy's impact on IEM without needing additional assumptions. For outcomes not based on education (e.g., child's expenditure rank, type of work),

[10] Figure A1 in the Appendix shows pre-trends for years of education as an outcome variable. Similar figures for the other outcomes measured are available on request.

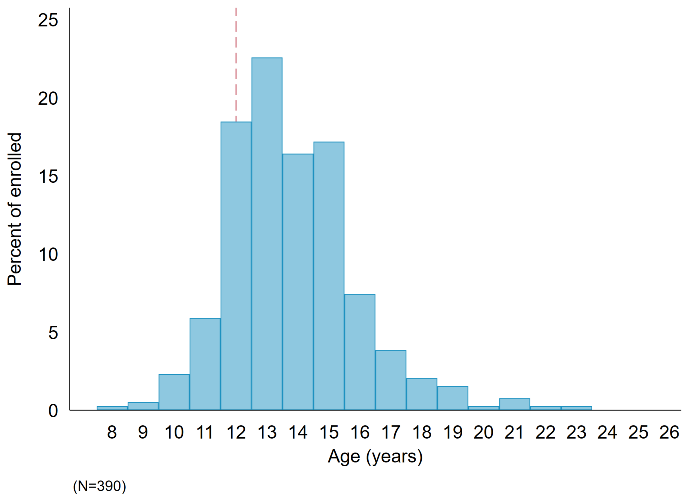
our estimates reflect the total effect of the programme, which may include both the direct impact of improved education and other indirect or spillover effects. To isolate the specific effect of education on these outcomes would require an instrumental variables approach.

5.2.1 Sample and identification

We consider those exposed to the policy to be born in 1985 or after. In other words, we assume that children born from 1985 onward would have the potential to be treated by the policy. This assumes that children start school at age six and progress without repetition or stop-outs. We assess the sensitivity of our results to shifting the exposure to children born from 1980 to allow for delayed school entry, repetition, and stop-outs in Section 6.3.

Our control cohorts are those born between 1975 and 1981. Cohorts born from 1975 are likely to have enrolled during the 12-year pre-tertiary system, whereas cohorts born before 1975 were likely educated under the 17-year system (again, this relies on the assumption of entering first grade on time). Figure 5 assesses this assumption using the dataset closest to the pre-policy period (1992 GLSS 3). The figure shows the age distribution of those who have completed at most sixth grade and were enrolled in the past 12 months. Using a strict cut-off, children should be 12 when entering JHS, but we see that some are indeed older—up to 15 years—suggesting delayed entry, repetition, and stop-outs. We therefore assess the impact of excluding birth cohorts 1982–84 in Section 6.3 given that they may have been partially exposed.

Figure 5: Age distribution of those who have completed sixth grade and enrolled in the past 12 months



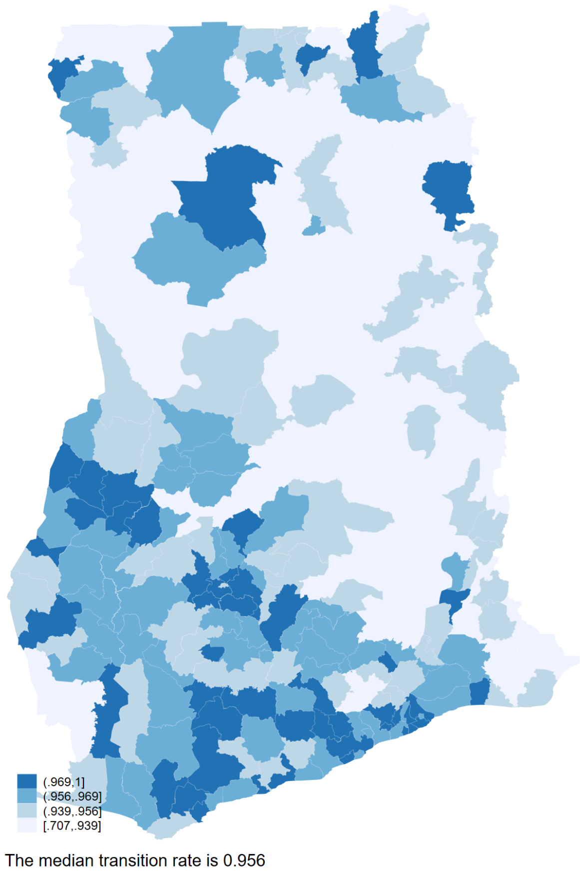
Source: Own compilation using GLSS 3.

The transition rate is calculated within district as the share of students transitioning from primary to junior secondary in the period prior to the introduction of the free JHS reform (we use the control cohorts: 1975–81). The transition rate is calculated as the number of adults from these cohorts with at least some JHS (i.e. grade 7+) divided by the number of adults with primary school or more (i.e. grade 6+).

The 2010 Population and Housing Census (PHC) data give us the best approximation with which we can calculate district-level estimates of the transition rate. Figure 6 shows these transition rates. The way the transition rate is computed, i.e. with only those who have completed primary in the denominator, means that the median transition rate is high at 95.6%. The distribution of transition rates is shown in Figure A2 in the Appendix.

Given how we define the exposed versus control cohorts and the need for both parental education and district-level intensity, only the 2017 GLSS 7 dataset meets our requirements. We are not able to map the 2010 PHC districts to the 2013 GLSS 6. Unfortunately, in the 2010 PHC, there is no information collected on district of birth, meaning we rely on current district. Approximately 50% of the cohorts we consider have moved from their place of birth. This could bias our results if those with higher IEM are more likely to move.

Figure 6: Primary to JHS transition rates by district, pre-FCUBE policy



Note: N=216.
Source: Own compilation using 2010 PHC.

We summarize our outcome variables in Table 4. We present summary measures for two analysis samples: 1) all respondents between 25 and 64 with parental education, and 2) a sample of children born to a father in approximately the bottom half of the fathers' education distribution. Here, we restrict our sample as closely as possible to those with fathers in the bottom 50%. The trickiness arises because older cohorts have more than 50% of their fathers with no education (see Table 3).[11] We therefore approximate a sample of children from fathers in the bottom 50% by taking the lowest education bin in older cohorts and the lowest two bins in younger cohorts. This sample ($\approx 50\%$) has lower levels of education than the full sample, but average age and treatment intensity are similar.

Just under three-quarters of our full sample has completed primary or more, but the share who have completed JHS falls to below two-thirds, with less than one-third having completed SHS. As expected, the mean rank of children in the full sample is 50.

Table 4: GLSS 7 outcome variable charactersitics

	Obs	Mean	SD	Median	Min	Max
Full sample						
Age	11,661	32.46	4.98	32	25	44
Years of education	11,371	7.96	4.93	9	0	18
Completed primary or more	11,371	.72	.45	1	0	1
Some JSS	11,371	.67	.47	1	0	1
Completed JSS	11,371	.59	.49	1	0	1
Completed secondary	11,371	.3	.46	0	0	1
Child educational rank	11,371	50	28.21	48.63	7.51	95.55
Son's educational rank	5,167	50	28.12	52.64	4.97	94.33
Daughter's educational rank	6,204	50	28.15	56.1	9.77	97.44
Child can write in English	9,245	.57	.5	1	0	1
Child can read in English	9,245	.6	.49	1	0	1
Child had wage/salaried work	10,088	.33	.47	0	0	1
Child household expenditure rank	11,661	50.03	28.88	50.04	.01	100
District: intensity (one-transition rate)	11,414	.06	.04	.05	.03	.29
Bottom 50%						
Age	7,048	32.88	4.89	33	25	42
Years of education	6,864	5.68	4.9	6	0	18
Completed primary or more	6,864	.53	.5	1	0	1
Some JSS	6,864	.47	.5	0	0	1
Completed JSS	6,864	.4	.49	0	0	1
Completed secondary	6,864	.16	.37	0	0	1
Child educational rank	6,864	37.57	26.81	31.14	7.51	95.55
Son's educational rank	3,021	38.56	27.86	40.23	4.97	93.39
Daughter's educational rank	3,843	36.74	25.37	30.21	9.77	97.44
Child can write in English	5,413	.38	.49	0	0	1
Child can read in English	5,413	.41	.49	0	0	1
Child had wage/salaried work	6,194	.24	.42	0	0	1
Child household expenditure rank	7,048	39.8	28.04	35.55	.01	100
District: intensity (one-transition rate)	6,900	.07	.04	.06	.03	.29

Note: Sample is respondents born between 1975 and 1992 with fathers' education.
Source: Own calculations using GLSS 7.

Even under the assumptions described above, a threat to our identification is that the estimated impact may be due to other programmes or pre-programme trends that are correlated with treatment intensity. Appendix Table A2 shows sample characteristics by intensity, where we define low intensity as those with transition rates above the median (i.e. high pre-programme

[11] Given our focus on GLSS 7 specifically, we can separate the bottom category into fathers with no education and fathers with some primary education. This allows us to come close to identifying fathers in the bottom 50% across each birth cohort we use.

transition rate). Respondents in lower-intensity districts are more likely to be of Brong, Mole-Dagbani, or Ewe ethnicity; to be Christian; to have higher household per capita expenditure; and to live in urban areas compared to their counterparts in high treatment-intensity areas. We therefore include controls for religious and ethnic groups. Furthermore, in Section 6.3, we test for the robustness of our results to the inclusion of pre-programme district unemployment rates.

6 Results

In this section, we first discuss the results of our analysis of mobility trends, followed by a discussion of the results from the impact of free JHS on IEM. Lastly, in Section 6.3, we present results from robustness checks relating to the analysis.

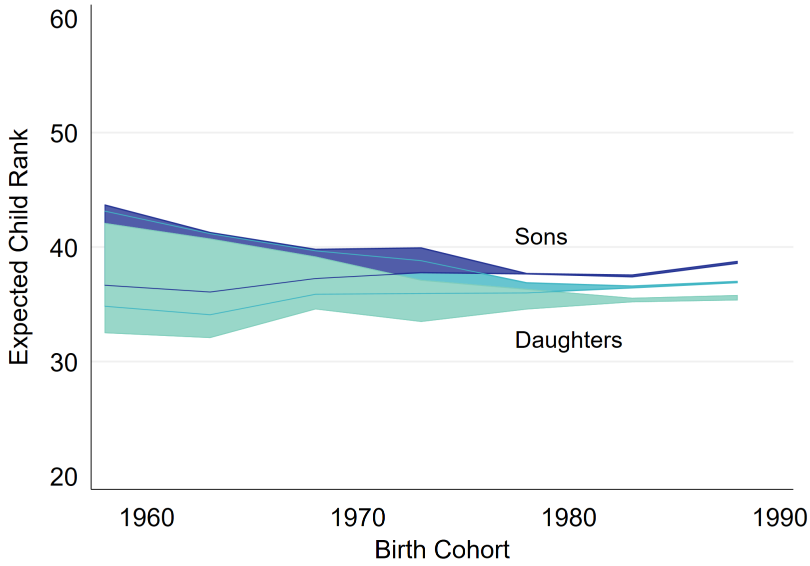
6.1 Intergenerational educational mobility

Trends in bottom-half mobility have remained remarkably flat over the analysis period for both men and women, as shown in Figure 7. Recall that in the absence of intergenerational mobility, bottom-half mobility would take a value of 25, while a complete one-generation shift out of the bottom half would yield a value of 50. Upward mobility for sons moved from [36.7, 43.7] for the 1958–62 birth cohort to [38.6, 38.8] for the 1988–92 cohort and from [32.5, 42.1] to [35.3, 35.8] for daughters over the same cohorts.

The mobility bounds for the earlier cohorts are wider, leaving open the possibility of either increases or decreases from earlier birth cohorts. However, decreases appear more likely, as the lower bound for the earlier cohorts aligns more closely with estimates for the younger cohorts. Bottom-half mobility can be bounded even in cohorts with severe interval censoring in the rank data, and bounds tend to tighten when a rank bin boundary lies close to the 50th percentile. As shown in Table 3, this occurs for the youngest three cohorts of sons and the last two cohorts of daughters.

When viewed in an international context, Ghana's levels of bottom-half mobility are comparable to those observed in other developing countries but notably stable across cohorts. Asher et al. (2024) find that in India, sons born in the 1950s had an expected rank of [36.6, 39.0], with a rank of [37.5, 37.9] for those born in the late 1980s. By contrast, Van Der Weide et al. (2024), grouping countries by development status and income level, report that bottom-half mobility in developing countries rose from 35 to 38—albeit using midpoints—over a similar period. The Ghana estimates fall squarely within this range but, unlike many developing countries, show little evidence of upward trend. Taken together, these patterns suggest that while Ghana's level of intergenerational mobility is typical of low- and middle-income settings, its persistence across cohorts contrasts with the modest convergence observed in the broader developing-country context. Specifically, Van Der Weide et al. (2024) show that bottom-half mobility in developed countries declined slightly, from 44 to 41, across cohorts born between 1950 and 1980, indicating gradual convergence between developed and developing country settings over time.

Figure 7: Expected child rank for those born to fathers in the bottom 50% of the education distribution

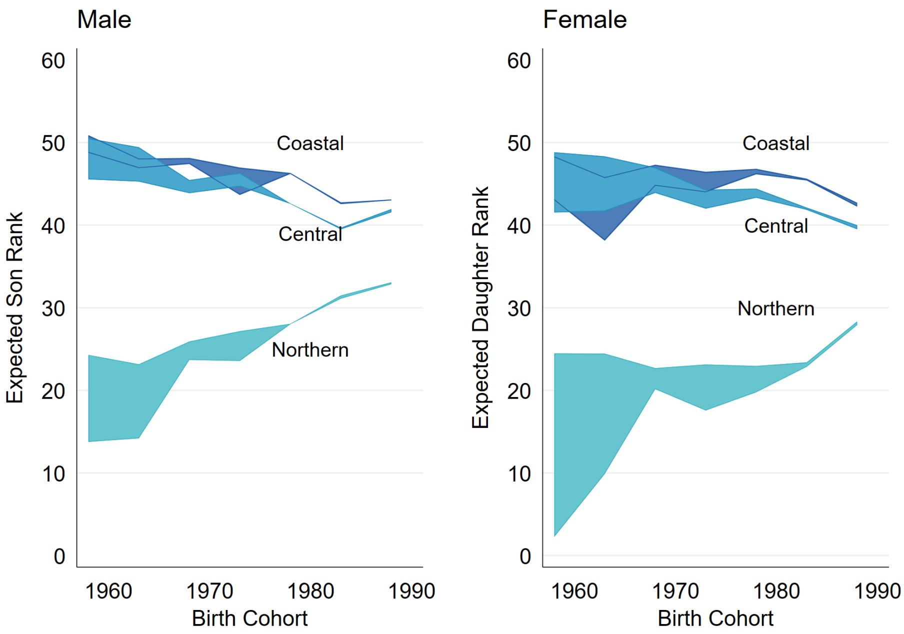


Source: Own compilation using GLSS 1–3, 5–7.

Next, we examine how upward mobility levels and trends differ by regions. Figure 8 presents bottom-half mobility grouped for respondents born in Coastal, Central, and Northern regions. The right-hand panel shows father-son pairs and the left-hand panel shows father-daughter pairs.

There are substantial differences in levels and trends across regions. Among sons born in the 1958–62 cohort in Coastal regions, the expected rank is [48.8, 50.8], compared to [45.5, 50.5] and [13.8, 24.3] for those born in the Central and Northern regions, respectively. Over time, upward mobility in the Northern region rises to [32.8, 33.1] among the 1988–92 cohort, while there are slight declines to [43.0, 43.1] and [41.6, 41.9] in the Coastal and Central regions. These changes close approximately two-thirds of the Northern–Coastal gap (from 30% to 10%) and the Northern–Central gap (from 29% to 8.8%) over time.

Figure 8: Expected child rank for those born to fathers in the bottom 50% of the education distribution, by region



Source: Own compilation using GLSS 1–3, 5–7.

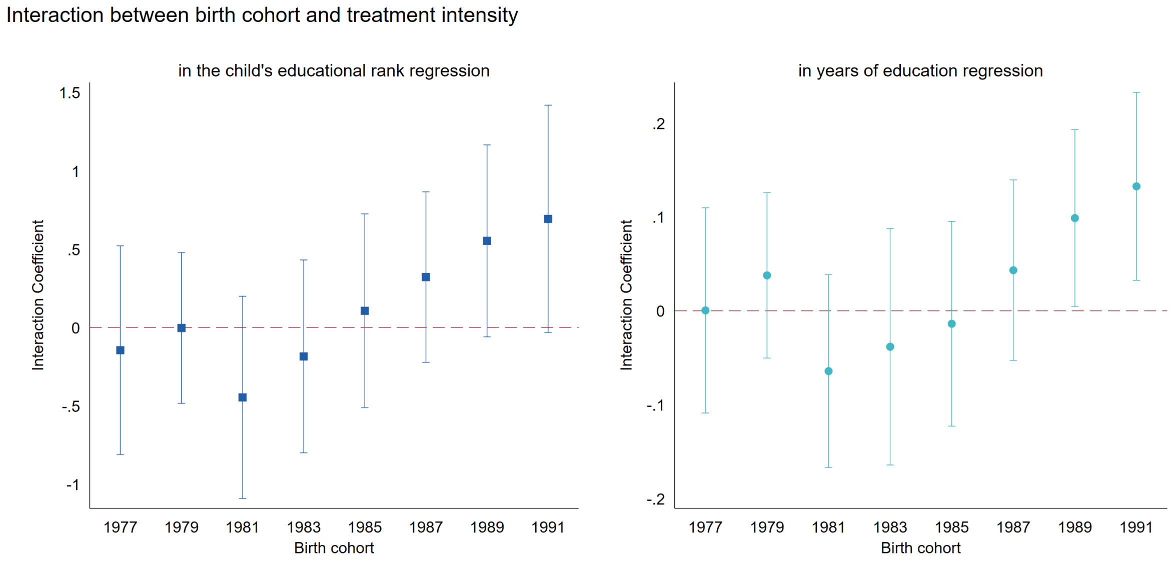
The trends suggest that children born in Northern regions in the earlier cohorts were unlikely to experience any mobility, but that sons born since the 1980s and daughters since the 1990s have had a greater likelihood of upward movement. In contrast, children born to low-educated parents in Coastal or Central regions were almost assured of moving out of the bottom half. While their expected ranks have fallen to 43 and 42, respectively, in the youngest cohort, these still indicate substantial upward mobility and highlight the persistent, albeit narrowing, North–South divide in educational attainment.

Upward mobility is slightly lower for daughters than for sons across all regions. Among daughters in Northern regions, upward mobility increases from [2.2, 24.5] to [27.9, 28.4], while it decreases from [43.1, 48.3] and [41.5, 48.8] to [42.8, 42.7] and [39.5, 40.0] in the Coastal and Central regions, respectively. Thus, women in the youngest cohorts have nearly equal chances of upward mobility to their male counterparts in the Coastal and Central regions but continue to lag behind in the Northern region ([27.9, 28.4] for females versus [32.8, 33.1] for males).

6.2 Free JHS as a driver of mobility trends

Next we explore whether free JHS has been a driver of the IEM trends illustrated above. We begin by motivating our identification strategy graphing the interaction effect between treatment intensity and birth cohort (relative to 1975) in Figure 9, for the sample born between 1975 and 1992. The panel on the left presents the interaction coefficients from a regression of child educational rank for those born to fathers in the bottom 50% of the education distribution, and the right-hand panel presents similar estimates from the regression of years of education for the full sample of children. The regressions control for religion, ethnicity, and region of birth fixed effects. Standard errors are clustered at the district level. The figures show that the intensity measure is correlated with gains in education rank and in years of education for children born in the 1985+ cohorts, while no measurable effect on educational rank or attainment is evidenced for cohorts who reached JHS school age before free JHS was implemented.

Figure 9: Interaction coefficients



Note: The regressions control for religion, ethnicity, and region of birth fixed effects. Standard errors are clustered at the district level. The interaction coefficients are relative to 1975.
Source: Own compilation using GLSS 7.

Our main specification (equation 1) is set up to estimate the impact of the policy change on the outcomes in Table 4. We additionally include interactions between the treated cohorts indicator, the intensity measure, and two key variables of interest: gender and region of birth. Average marginal effects (AMEs) resulting from treatment are presented for mean intensity values (see the intensity value column) in all tables. Table 5 presents the AMEs from the educational outcome measures, and Appendix Table A3 presents the AMEs for the labour market and socioeconomic outcomes. In both tables, the top panel presents estimates for the full sample, and the bottom panel presents estimates for the sample of children born to fathers in the bottom 50% of the education distribution. Table 6 presents our main outcomes of interest: potential shifts in rank position in the education, household expenditure, and wage distribution for those born to children in the bottom 50% of the distribution. Each column in each of the tables represents the associated AME for a specific group (e.g., the value in column Female represents the AME for females, while the value in column Coastal $\times$ female represents the AME for females born in Coastal regions).

Table 5: Average marginal effects for educational outcomes

Outcome	Obs	Mean	Intensity value	Overall	Female	Coastal	Central	Northern	Coastal X female	Central X female	Northern X female
Full sample				.	.	.	.	.	.	.	.
edu years	11,096	8	7.37	2.06***	2.34***	2.04***	1.83***	2.51***	2.33***	2.04***	2.87***
				(.25)	(.27)	(.33)	(.28)	(.35)	(.39)	(.32)	(.4)
At least primary	11,137	.71	7.37	.15***	.19***	.16***	.11***	.22***	.2***	.15***	.27***
				(.03)	(.03)	(.03)	(.03)	(.04)	(.04)	(.04)	(.04)
JHS	11,096	.6	7.37	.15***	.19***	.17***	.13***	.19***	.22***	.16***	.22***
				(.03)	(.03)	(.04)	(.03)	(.03)	(.05)	(.04)	(.03)
SHS	11,096	.3	7.37	.18***	.17***	.19***	.19***	.14***	.18***	.17***	.15***
				(.03)	(.02)	(.03)	(.03)	(.03)	(.04)	(.03)	(.03)
Read English	9,018	.6	7.26	.21***	.26***	.21***	.21***	.23***	.25***	.28***	.25***
				(.03)	(.03)	(.04)	(.03)	(.04)	(.04)	(.04)	(.04)
Write English	9,018	.57	7.26	.23***	.28***	.25***	.22***	.22***	.28***	.3***	.25***
				(.03)	(.03)	(.03)	(.03)	(.04)	(.04)	(.04)	(.04)
≈ Bottom 50%				.	.	.	.	.	.	.	.
Edu years	6,673	5.72	8.25	2.24***	2.41***	2.02***	2***	2.63***	2.11***	2.26***	2.76***
				(.34)	(.36)	(.55)	(.37)	(.37)	(.59)	(.42)	(.42)
At least primary	6,708	.52	8.25	.17***	.19***	.16**	.16***	.2***	.17*	.19***	.22***
				(.04)	(.05)	(.06)	(.05)	(.04)	(.08)	(.06)	(.04)
JHS	6,673	.4	8.25	.16***	.18***	.19***	.13***	.17***	.22***	.16***	.17***
				(.04)	(.04)	(.06)	(.04)	(.03)	(.07)	(.05)	(.03)
SHS	6,673	.17	8.25	.12***	.1***	.1*	.13***	.12***	.09*	.11***	.11***
				(.03)	(.02)	(.05)	(.03)	(.03)	(.04)	(.03)	(.03)
Read English	5,262	.41	8.25	.18***	.21***	.17**	.17***	.2***	.18*	.25***	.19***
				(.04)	(.05)	(.07)	(.05)	(.04)	(.08)	(.05)	(.04)
Write English	5,262	.38	8.25	.19***	.22***	.19***	.19***	.2***	.2*	.27***	.2***
				(.04)	(.05)	(.06)	(.05)	(.04)	(.08)	(.06)	(.04)

Note: Sample is respondents born between 1975 and 1992 with fathers' education. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Source: Own calculations using GLSS 7.

The introduction of JHS is found to have a positive impact on all education outcomes measured (Table 5). For example, the introduction of JHS increased total years of education by two years at the mean intensity level (7.37%) on a mean of eight years. This therefore represents a 25% increase in years of completed education. The effect is larger for females (2.34 years), for those in the Northern regions (2.51 years), and for females in the Northern regions specifically (2.87 years). Interestingly, the completed primary, JHS, and SHS AMEs are of a similar size (0.15, 0.15, and 0.18, respectively); however, given different means (0.71, 0.6, and 0.3, respectively), they represent different relative gains. The 0.18 SHS AME represents a 60% increase in SHS completion compared to the JHS and primary AMEs of 0.15 that represent a 25% and 20% increase in JHS and primary completion, respectively. The AMEs for females are larger at the primary and JHS level than those in the overall column but similar at the SHS level. This distinction is even further differentiated for females born in Northern regions—here the Northern AMEs are 0.22, 0.19, and 0.14 for females versus 0.27, 0.22, and 0.15 for primary, JHS, and SHS versus, respectively.

Next, we examine the impact of free JHS on ability to read and write English, our best measure of learning itself. Note that here the AME reflects the total effect of the policy on English abilities. These could result from schooling directly or as a result of other effects (e.g., someone with higher education may engage in a job that requires English usage, thus improving their

English abilities). The AMEs on English reading and writing ability are large and quite similar across sub-groups, representing about a 33% increase in abilities on a mean of around 60%.

The bottom panel presents similar estimates for the bottom 50% sample. The educational AMEs are typically slightly larger in size than for the full sample and represent changes of lower means, thus representing much larger relative increases. For example, the total years of education AME is 2.24 on a mean of 5.7, thus representing a 40% increase, while in the full sample the AME represented a 25% increase. Similarly, the policy is estimated to increase primary, JHS, and SHS by 33%, 40%, and 70% in the bottom 50% sample compared to 20%, 25%, and 60% in the full sample.

Appendix Table A3 extends the analysis to examine whether the policy influenced household expenditure and labour market outcomes. Here, the impact on socioeconomic improvements is more mixed. First, we find limited significance of improvements in household per capita expenditure (although the AMEs are positive in all but the Central X female column). The one exception is the AME for females born in Northern regions. Here, the AME is large—GSH659 on a mean of around GHS4,000—and it is statistically significant at the 10% significance level, representing a 17% increase per capita household expenditure. Household expenditure AMEs are also larger in the bottom 50% sample and significant in the Coastal, Northern, and Female x Northern.

Labour market outcomes show an increase in the propensity for skilled and agricultural work, offset by a decline in being not economically active. There is also a significant decline in other intermediate skilled occupations (excluding agriculture) for females, and specifically females born in Coastal regions. There are no significant effects on working in elementary occupations or in levels of unemployment. The share in wage employment is also shown to be affected—increasing especially for females and specifically females born in Coastal regions.

Unlike for the educational outcomes, the AMEs for the bottom 50% are similar (in a relative sense) to the full sample for most of the labour market outcomes. An exception is the large AME on Not Economically Active (NEA) for females born in Coastal regions. Furthermore, there are no significant changes for the propensity to be in wage work.

We have therefore shown that the introduction of the JHS is associated with some important improvements in education and labour market outcomes, with possibly larger impacts for those born to fathers in the bottom 50%. Our direct interest, however, is whether the policy has led to a shift in the distribution of outcomes. Table 6 provides AME estimates for three rank measures—child's educational rank, child's wage rank, and child's per capita household expenditure rank. Most of the AMEs are small in size and insignificant. The exceptions are the education and expenditure rank AMEs for those in the Northern regions and for females in the Northern regions. In both these exceptions, the AMEs are similar in size—representing a 4.5 point increase for those born in Northern regions, and a five point increase for females born in Northern regions. Given the average rank of 37.75 (39.98) for education (expenditure) ranks, this represents, for example, a 14% (13%) increase in rank for females born in Northern regions.

Table 6: Average marginal effects for rank outcomes

Outcome	Obs	Mean	Intensity value	Overall	Female	Coastal	Central	Northern	Coastal X female	Central X female	Northern X female
child_ed_rank	6,673	37.75	8.25	1.44	2.49	.1	-.52	4.33*	.96	.83	5.24*
				(2.01)	(2.15)	(3.13)	(2.19)	(2.14)	(3.31)	(2.49)	(2.33)
child_wage_rank	909	44.97	7.04	1.58	5.24	-.73	5.04	–1.73	4.38	6.97	3.29
				(6.09)	(7.58)	(6.58)	(7.12)	(7.07)	(8.51)	(10.53)	(9.79)
child_pc_hh_rank	6,708	39.98	8.25	1.64	.81	.73	-.66	4.59*	–3.28	-.59	5.14*
				(2.24)	(2.27)	(2.9)	(2.56)	(2.37)	(3.63)	(2.61)	(2.57)

Note: Sample is respondents born between 1975 and 1992 born to fathers in the bottom 50% of the education distribution. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Source: Own calculations using GLSS 7.

Thus, although the policy is associated with large educational gains and some important shifts in the composition of work, it has had a limited impact on the distribution of outcomes. Respondents in the North, specifically women, have however improved their educational and expenditure ranking, suggesting that the circumstances of those in most need was positively impacted.

6.3 Robustness checks

In this section, we assess the robustness of our results from Section 6.2 to potential threats to our identification strategy and to other empirical estimation choices. Results are shown in Appendix Tables A4–A12.

First, we assess potential treats from other differential trends by district. If areas with higher unemployment, for example, were exposed to other targeted poverty alleviation programmes, we may conflate the impact of introduction of free JHS with these interventions. To address this concern, we interact 2010 district-level unemployment rates (from the Ghana Population and Housing Census 2010) with birth cohort dummies. The results for our education and rank outcomes are presented in Tables A4 and A6. An interesting pattern emerges—the education results for the full sample are strengthened with the AMEs increasing in size and significance, while the results for the bottom 50% sample are muted. A similar pattern is evident for the labour market outcome—the results in the bottom 50% are more muted although the size of the AMEs do not increase in the full sample as they did for the educational outcomes. Table A6 shows, however, that none of the rank outcomes are statistically significant. These results suggest that while the results of the impact of the policy introduction on overall education outcomes is positive, the results are less robust for the lower half of the distribution, and we cannot confirm the hypothesis that the improved educational rank of females, and females born in Northern regions, is attributable to the introduction of free JHS.

Second, we attempt a placebo test. Here we are constrained by the fact that those born before 1975 were likely educated under the 17 years of education system that changed to 12 years from 1987. Therefore, we do not want to include these earlier birth cohorts as the change in the number of years of education has been shown to impact outcomes (Boahen et al. 2021). We therefore restrict our sample to those born between 1975 and 1981—the group that would not have been exposed to any policy changes—and arbitrarily define a treatment group as those born between 1978 and 1981. The results of these estimates are found in Tables A7–A9.[12] The sizes of the education outcome AMEs are small (sometimes even reversed) and most are not significant, providing some assurance that our estimates are not likely to be driven by existing trends over time. Similar assurance is provided for the labour market and rank outcomes, with many of the AMEs negative in value and almost all statistically insignificant.

Lastly, given the potential exposure of children born between 1982 and 1984 to the free JHS policy—a result of delayed school starting age, grade repetition, and stop-outs—we exclude these cohorts from the analysis. The results of this updated specification are found in Tables A10–A12. The substantive findings from Section 6.2 are replicated, with the size of the AMEs in many cases increased.

7 Conclusion

Empirically, we present several previously unknown facts about upward mobility in Ghana. Despite substantial improvements in overall education levels over recent decades, upward mobility for children born to fathers in the bottom half of the education distribution has remained remarkably stable across cohorts. A son born to a father in the bottom half of the education distribution can expect to reach the 38th percentile, while a daughter can expect to reach the 35th percentile. These figures suggest that although educational expansion has raised average educational attainment across the population (i.e. absolute mobility), it has not substantially improved individuals' relative positions in the education distribution (i.e. rank mobility).

This stability likely reflects the persistence of structural inequalities in educational quality, geographic disparities, and access to post-basic education. Expansion in enrolment has benefited a broader segment of the population, but much of the gain has occurred within rather than across socioeconomic groups. In other words, while more children complete schooling than in the past, those from better-educated families continue to secure the most advantageous educational and labour market outcomes, limiting the potential for relative mobility to rise.

[12] Given the smaller sample sizes, some of the labour market outcomes for the bottom 50% sample did not converge. We therefore present the results for the full sample only.

Regional patterns of mobility, however, have shifted for cohorts born between 1958 and 1992. Bottom-half mobility increased for individuals born in the Northern regions, rising from approximately the 19th to the 33rd percentile for sons and from the 13th to the 28th percentile for daughters. In contrast, bottom-half mobility declined in the Coastal and Central regions, with sons' expected percentiles falling from 49 to 43 and from 48 to 41, respectively, and daughters' from 46 to 43 (Coastal) and from 46 to 41 (Central). There is no evidence that these gains have come at the expense of individuals born in Coastal or Central areas in absolute terms, as their top-half rankings remain relatively stable (not shown).

When viewed in a broader international context, Ghana's levels of bottom-half mobility are broadly comparable to those observed in other developing countries but possibly more stable. Asher et al. (2024) find that in India, sons born in the 1950s had an expected rank of 36.6–39.0, compared to 37.5–37.9 for those born in the late 1980s. Similarly, Van Der Weide et al. (2024) report that bottom-half mobility in developing countries rose modestly, from 35 to 38 (using midpoints), over a similar period. Our estimates for Ghana fall squarely within this range but, unlike the group trend for developing countries (Van Der Weide et al. 2024), show little evidence of an upward trend. Taken together, these patterns suggest that while Ghana's level of IEM as measured by bottom half mobility is typical of low- and middle-income settings, its persistence across cohorts contrasts with the modest convergence observed internationally.

Our analysis of the introduction of free JHS (with the FCUBE policy) suggests that part of the observed regional convergence—around four percentile improvement overall and five points for females—could be attributed to this reform extending free and compulsory education to the JHS level. The policy appears to have especially benefited children in the Northern regions, where historical disadvantage was greatest. This convergence implies a reshuffling of opportunities within the bottom half of the education distribution, rather than a broad-based rise in upward mobility. Children of more-educated fathers continue to hold an advantage, while progress among the least-educated families in the North has come alongside stagnation or mild decline among their counterparts in Central and Coastal regions.

In this sense, Ghana's experience provides the first direct evidence from an African context linking the expansion of free and compulsory education to IEM patterns. While comparable studies from the region are not available, research on the implementation of free primary and secondary schooling highlights similar challenges in translating expanded access into more equitable outcomes. Studies typically report large increases in enrolment but persistent inequalities in learning quality and progression beyond basic schooling, which may limit the potential for such reforms to raise intergenerational mobility (see Ajayi 2024 for a discussion of potential mechanisms why children from lower socioeconomic backgrounds may not fully realize the potential of their increased enrolment). This study on Ghana therefore extends this discussion by showing empirically how expansion can improve absolute attainment and narrow regional disparities yet leave rank mobility largely unchanged due to enduring differences in quality and returns.

Overall, our findings highlight both progress and constraint. The gains in absolute education levels and regional convergence, especially for women in the North, are encouraging and demonstrate that policy can shift opportunity structures. Yet, the stability of rank mobility underscores the persistence of deep-rooted inequalities that shape who benefits most from educational expansion. This suggests that future policy efforts would need to go beyond expanding access to address disparities in school quality, post-school transitions, and the broader structural factors that sustain intergenerational inequality.

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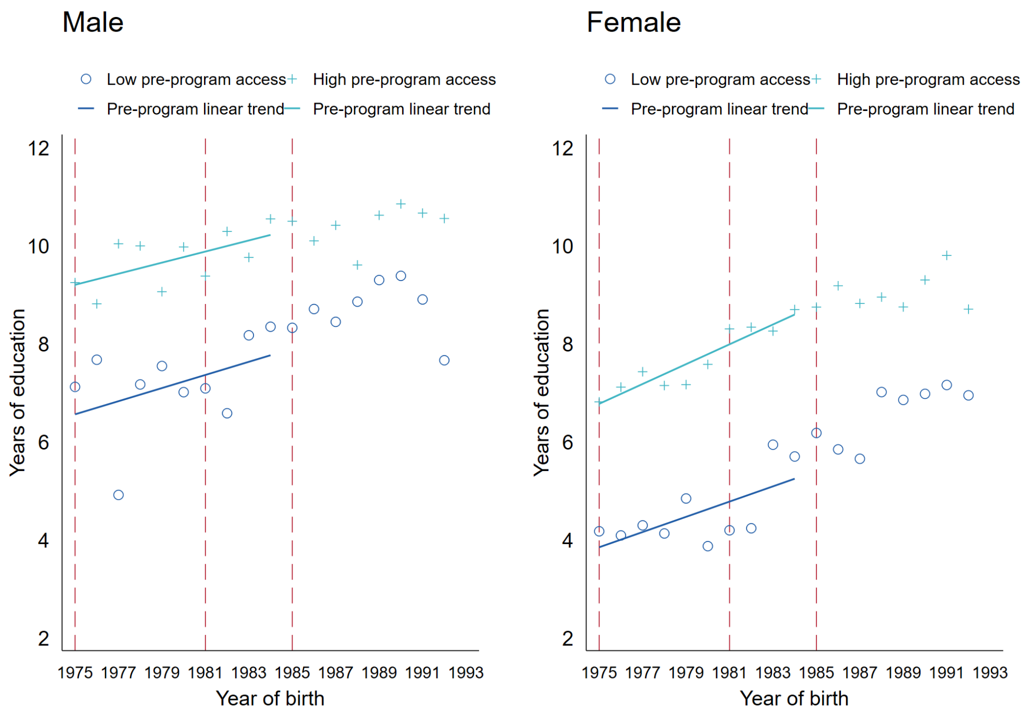
Appendix

Table A1: Father's education bin sizes by child birth cohort

	Child	Region	1958	1963	1968	1973	1978	1983	1988
None/some primary	D	Coast	64.17	57.71	50.88	43.88	40.08	33.54	26.75
Compl primary	D	Coast	3.13	2.5	3.64	4.8	4.09	4.43	5.68
Junior sec.	D	Coast	25.5	28.53	33.43	38.2	42.16	46.16	50.74
Senior sec.	D	Coast	3.93	6.18	5.21	6.33	4.57	6.54	7.26
Tertiary	D	Coast	3.27	5.09	6.84	6.79	9.1	9.33	9.57
Observations	D	Coast	1,792	1,755	1,605	1,662	1,667	1,637	817
None/some primary	S	Coast	63.24	55.53	48.04	44.12	34.96	26.55	25.54
Compl primary	S	Coast	3.54	3.98	5.91	3.61	4.95	5.37	5.83
Junior sec.	S	Coast	24.48	29.58	34.45	37.68	43.97	49.32	50.47
Senior sec.	S	Coast	4.04	5.51	4.53	7.2	6.25	8.57	10.17
Tertiary	S	Coast	4.7	5.4	7.06	7.4	9.87	10.19	7.97
Observations	S	Coast	1,458	1,420	1,252	1,351	1,427	1,390	718
None/some primary	D	Centr	68.48	67.74	58.84	51.27	46.11	41.38	44.72
Compl primary	D	Centr	4.18	3.8	4.29	5.74	4.93	4.74	6.12
Junior sec.	D	Centr	22.06	22.28	27.01	31.18	37.84	39.51	36.01
Senior sec.	D	Centr	2.89	2.69	3.98	5.41	4.79	6.06	5.57
Tertiary	D	Centr	2.39	3.5	5.89	6.41	6.33	8.31	7.57
Observations	D	Centr	1,673	1,571	1,312	1,520	1,620	1,518	793
None/some primary	S	Centr	70.8	66.68	56.33	50.91	42.36	39.3	39.17
Compl primary	S	Centr	4.78	3.69	4.38	5.84	5.49	7.61	4.83
Junior sec.	S	Centr	16.41	22.91	30.78	29.49	39.54	39.55	43.93
Senior sec.	S	Centr	4.14	3.08	4.1	6.08	4.67	5.74	6.29
Tertiary	S	Centr	3.87	3.65	4.41	7.68	7.95	7.79	5.78
Observations	S	Centr	1,337	1,292	1,116	1,292	1,313	1,141	642
None/some primary	D	North	96.17	94.51	96.34	95.81	93.36	89.33	88.87
Compl primary	D	North	.33	.61	.58	.39	.68	.84	1.08
Junior sec.	D	North	2.24	3.9	2.15	2.77	4.35	5.6	4.25
Senior sec.	D	North	.29	.7	.72	.27	.82	.78	.84
Tertiary	D	North	.97	.27	.21	.76	.79	3.46	4.95
Observations	D	North	1,309	1,373	1,395	1,703	1,829	1,723	972
None/some primary	S	North	95.95	95.1	95.24	93.34	90.74	86.75	86.92
Compl primary	S	North	.47	.58	.4	.79	1.17	2.61	2.15
Junior sec.	S	North	2.33	2.41	2.67	3.55	5.34	5.82	7.16
Senior sec.	S	North	.68	.96	1.03	.86	.89	1.24	.46
Tertiary	S	North	.57	.95	.66	1.46	1.85	3.58	3.31
Observations	S	North	990	1,079	1,171	1,392	1,479	1,325	869

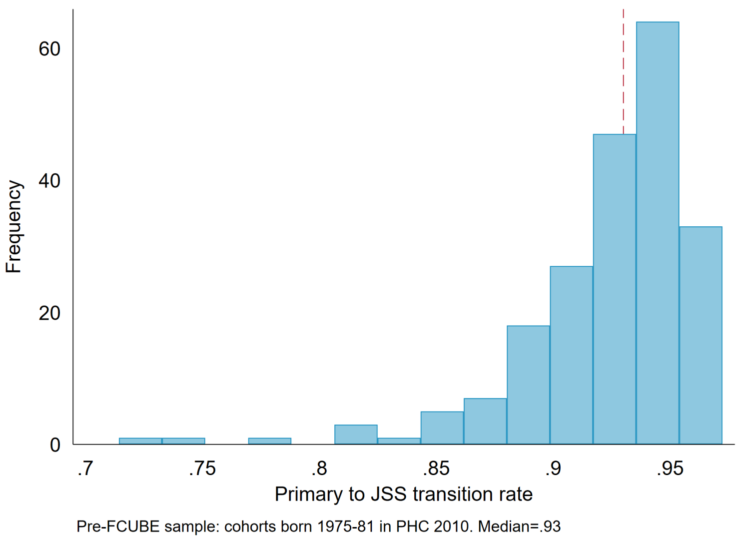
Note: D = daughters and S = sons.
Source: Own calculations using pooled GELS, respondents with fathers' education.

Figure A1: Years of education by birth cohort and pre-policy transition rates



Note: Vertical lines drawn at the 1975, 1981, and 1985 birth cohorts. Cohorts born from 1981 may be partially exposed due to delayed school entry, grade repetition, and stop-outs.
Source: Own compilation using GLSS 7 and PHC 2010.

Figure A2: Primary to JHS transition rates, pre-FCUBE policy



Note: N=210. Only 210 of the 216 districts match between GLSS 7 and the 2010 PHC. Hence, the median is different to the one presented in the map.
Source: Own compilation using 2010 PHC and GLSS 7.

Table A2: GLSS 7 sample charactersitics by intensity (one-transition rate)

	High intensity N	High intensity mean	Low intensity N	Low intensity mean	Standardized mean difference
Full sample					
Present characteristics:					
Age	7,066	32.4	4,595	32.52	-.02
Urban household	7,066	.37	4,595	.72	-.71
Household size	7,066	5.25	4,595	4.35	.29
Per capita household expenditure	7,066	2,874.55	4,595	5,044.94	-.44
Time invariant characteristics:					
Female	7,066	.54	4,595	.53	.02
Brong(Akan), Mole-Dagbani, Ewe	6,915	.73	4,541	.81	-.18
Ga-Dangme, Guan	6,915	.09	4,541	.12	-.09
Gurma, Grusi, Mande	6,915	.15	4,541	.06	.29
Other ethnic group	6,915	.02	4,541	.01	.09
Christian	7,066	.64	4,595	.81	-.39
Islamic	7,066	.25	4,595	.14	.28
Traditional, other, or no religion	7,066	.11	4,595	.04	.24
Coastal region of birth	6,912	.3	4,532	.51	-.43
Central region of birth	6,912	.41	4,532	.36	.1
Northern region of birth	6,912	.29	4,532	.13	.4
District: intensity (one-transition rate)	6,819	.09	4,595	.04	1.34
Region: intensity (one-transition rate)	7,066	.06	4,594	.05	.61
≈ Bottom 50%					
Present characteristics:					
Age	4,875	32.9	2,173	32.86	.01
Urban household	4,875	.32	2,173	.66	-.69
Household size	4,875	5.7	2,173	4.77	.27
Per capita household expenditure	4,875	2,279.14	2,173	4,101.21	-.38
Time invariant characteristics:					
Female	4,875	.56	2,173	.53	.06
Brong(Akan), Mole-Dagbani, Ewe	4,763	.67	2,143	.76	-.19
Ga-Dangme, Guan	4,763	.08	2,143	.1	-.05
Gurma, Grusi, Mande	4,763	.22	2,143	.13	.23
Other ethnic group	4,763	.03	2,143	.02	.07
Christian	4,875	.52	2,173	.65	-.28
Islamic	4,875	.35	2,173	.27	.16
Traditional, other, or no religion	4,875	.14	2,173	.07	.2
Coastal region of birth	4,755	.19	2,138	.38	-.42
Central region of birth	4,755	.38	2,138	.34	.08
Northern region of birth	4,755	.43	2,138	.28	.31
District: intensity (one-transition rate)	4,727	.1	2,173	.04	1.25
Region: intensity (one-transition rate)	4,875	.07	2,172	.06	.5

Note: Sample is respondents born between 1975 and 1992 with fathers' education.
Source: Own calculations using GLSS 7.

Table A3: Average marginal effects for expenditure and labour market outcomes

Outcome	Obs	Mean	Intensity value	Overall	Female	Coastal	Central	Northern	Coastal X female	Central X female	Northern X female
Full sample				.	.	.	.	.	.	.	.
pc_hh	11,137	3,983.4	7.37	234	188.91	337.98	52.82	354.8	145.37	– 23.45	659.13*
				(191.99)	(220.56)	(251.77)	(230.31)	(288.72)	(300.86)	(241.6)	(336.52)
Skilled occupations	11,095	.11	7.37	.05***	.06***	.07**	.05**	.02	.08***	.06***	.03*
				(.02)	(.02)	(.03)	(.02)	(.02)	(.03)	(.02)	(.01)
Interm-skill occ (excl agri)	11,095	.42	7.37	-.03	-.05*	-.04	-.02	-.01	-.08*	-.02	-.05
				(.03)	(.03)	(.03)	(.03)	(.03)	(.03)	(.04)	(.04)
Agriculture	11,095	.24	7.37	.04*	.05*	.06*	.01	.08**	.08**	.02	.07*
				(.02)	(.02)	(.03)	(.03)	(.03)	(.03)	(.03)	(.03)
Elementary occ	11,095	.04	7.37	0	0	0	0	0	.02	-.01	0
				(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Unemployed	11,095	.06	7.37	.01	.02	.01	.02	0	.02	.02	.01
				(.01)	(.01)	(.01)	(.01)	(.02)	(.01)	(.02)	(.02)
NEA	11,095	.13	7.37	-.04*	-.06***	-.04*	-.03	-.05*	-.07***	-.05*	-.06*
				(.02)	(.02)	(.02)	(.02)	(.03)	(.02)	(.03)	(.04)
wagewrk	9,845	.33	7.48	.05*	.07***	.07*	.06*	0	.1***	.06*	.03
				(.02)	(.02)	(.03)	(.03)	(.03)	(.03)	(.03)	(.03)
log_hrlywage	2,204	.71	6.16	-.04	.08	-.04	-.01	-.14	.1	.11	-.12
				(.11)	(.12)	(.11)	(.14)	(.14)	(.18)	(.16)	(.21)
≈ Bottom 50%				.	.	.	.	.	.	.	.
pc_hh	6,708	3,014.28	8.25	391.46	332.99	600.1*	102.82	531.05*	194.39	192.59	571.92*
				(240.35)	(273.39)	(355.74)	(252.29)	(306.55)	(387.33)	(285.1)	(289.51)
Skilled occupations	6,668	.05	8.25	.03*	.03**	.06**	.01	.02	.05**	.01	.03**
				(.01)	(.01)	(.02)	(.02)	(.02)	(.02)	(.01)	(.01)
Interm-skill occ (excl Agri)	6,668	.38	8.25	-.04	-.06	-.04	-.02	-.05	-.04	-.06	-.08*
				(.04)	(.04)	(.06)	(.05)	(.04)	(.07)	(.05)	(.04)
Agriculture	6,668	.34	8.25	.06*	.08*	.05	.05	.09**	.1	.06	.1**
				(.03)	(.04)	(.05)	(.04)	(.03)	(.07)	(.06)	(.03)
Elementary occ	6,527	.04	8.25	.01	.01	.01	.01	0	.04	0	.01
				(.01)	(.01)	(.02)	(.01)	(.01)	(.03)	(.02)	(.01)
Unemployed	6,668	.05	8.25	0	.01	.01	.01	-.01	.04	.01	0
				(.01)	(.01)	(.02)	(.01)	(.01)	(.03)	(.02)	(.02)
NEA	6,668	.13	8.25	-.04	-.05*	-.06*	-.02	-.03	-.12***	-.01	-.04
				(.02)	(.03)	(.03)	(.03)	(.03)	(.03)	(.04)	(.04)
wagewrk	6,024	.24	8.36	.02	.01	.05	0	0	.07	-.06*	.03
				(.03)	(.02)	(.05)	(.04)	(.03)	(.05)	(.03)	(.02)
log_hrlywage	909	.55	7.04	-.01	.14	-.08	.13	-.15	.07	.22	.08
				(.19)	(.23)	(.19)	(.27)	(.19)	(.31)	(.33)	(.32)

Note: Sample is respondents born between 1975 and 1992 with fathers' education.
Source: Own calculations using GLSS 7.

Table A4: Average marginal effects for educational outcomes

Outcome	Obs	Mean	Intensity value	Overall	Female	Coastal	Central	Northern	Coastal X female	Central X female	Northern X female
Full sample				.	.	.	.	.	.	.	.
Ed years	11,096	8	7.37	2.27***	2.57***	2.27***	2.04***	2.68***	2.65***	2.25***	3.01***
				(.48)	(.5)	(.54)	(.49)	(.5)	(.61)	(.52)	(.54)
At least primary	11,137	.71	7.37	.17***	.21***	.18***	.13**	.26***	.23***	.17**	.31***
				(.05)	(.06)	(.05)	(.05)	(.06)	(.07)	(.06)	(.06)
JHS	11,096	.6	7.37	.1*	.14*	.12*	.07	.14*	.17*	.1	.18***
				(.06)	(.06)	(.07)	(.06)	(.06)	(.08)	(.07)	(.06)
SHS	11,096	.3	7.37	.24***	.23***	.25***	.25***	.2***	.24***	.23***	.2***
				(.06)	(.05)	(.06)	(.06)	(.06)	(.06)	(.05)	(.05)
Read English	9,018	.6	7.26	.24***	.29***	.24***	.23***	.27***	.29***	.31***	.29***
				(.06)	(.07)	(.07)	(.06)	(.07)	(.08)	(.07)	(.06)
Write English	9,018	.57	7.26	.27***	.33***	.29***	.27***	.28***	.34***	.35***	.31***
				(.06)	(.07)	(.07)	(.07)	(.07)	(.08)	(.07)	(.06)
≈ Bottom 50%				.	.	.	.	.	.	.	.
Ed years	6,673	5.72	8.25	1.58*	1.77**	1.38*	1.36*	1.96**	1.58*	1.61*	2.08***
				(.68)	(.69)	(.81)	(.69)	(.7)	(.85)	(.7)	(.73)
At least primary	6,708	.52	8.25	.15*	.17*	.14	.14	.19**	.16	.17*	.21***
				(.08)	(.08)	(.09)	(.08)	(.08)	(.11)	(.09)	(.07)
JHS	6,673	.4	8.25	.1	.13*	.12	.06	.12*	.17	.1	.14**
				(.08)	(.07)	(.1)	(.09)	(.07)	(.11)	(.09)	(.05)
SHS	6,673	.17	8.25	.05	.06	.03	.06	.05	.06	.06	.07
				(.07)	(.04)	(.08)	(.07)	(.06)	(.06)	(.05)	(.04)
Read English	5,262	.41	8.25	.2*	.23***	.19*	.2*	.22***	.21*	.27***	.21***
				(.08)	(.08)	(.1)	(.09)	(.07)	(.11)	(.09)	(.06)
Write English	5,262	.38	8.25	.22**	.26***	.21*	.23*	.23***	.24*	.3***	.23***
				(.08)	(.08)	(.1)	(.1)	(.07)	(.11)	(.09)	(.07)

Note: Sample is respondents born between 1975 and 1992 with fathers' education. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Source: Own calculations using GLSS 7.

Table A5: Average marginal effects for expenditure and labour market outcomes

Outcome	Obs	Mean	Intensity value	Overall	Female	Coastal	Central	Northern	Coastal X female	Central X female	Northern X female
Full sample				.	.	.	.	.	.	.	.
pc_hh	11,137	3,983.4	7.37	102.22	79.33	210.02	–68.6	199.84	85.08	–137.75	464.29
				(378.65)	(371.96)	(389.23)	(453.82)	(370.85)	(434.12)	(390.04)	(399.6)
Skilled occup	11,095	.11	7.37	.05**	.06***	.06*	.05*	.01	.08***	.06***	.03*
				(.02)	(.02)	(.03)	(.02)	(.02)	(.03)	(.02)	(.02)
Interm skilled (excl agri)	11,095	.42	7.37	-.05*	-.07**	-.06*	-.04	-.03	-.08**	-.04	-.08*
				(.02)	(.03)	(.03)	(.03)	(.03)	(.03)	(.04)	(.04)
Agriculture	11,095	.24	7.37	.05***	.05***	.06**	.02	.08***	.05**	.03	.08***
				(.02)	(.02)	(.02)	(.02)	(.02)	(.02)	(.03)	(.03)
Elementary occ	11,095	.04	7.37	0	0	0	0	0	.02	-.01	0
				(.01)	(.01)	(.01)	(.01)	(.01)	(.02)	(.01)	(.01)
Unemployed	11,095	.06	7.37	.01	.02	.01	.02	0	.02	.02	.01
				(.01)	(.01)	(.01)	(.01)	(.02)	(.02)	(.02)	(.02)
NEA	11,095	.13	7.37	-.04*	-.06***	-.04*	-.03	-.05*	-.07***	-.05*	-.06
				(.02)	(.02)	(.02)	(.02)	(.03)	(.02)	(.03)	(.04)
wagewrk	9,845	.33	7.48	.04*	.07***	.06*	.05	0	.1***	.05	.03
				(.02)	(.02)	(.03)	(.03)	(.03)	(.03)	(.03)	(.03)
log_hrlywage	2,204	.71	6.16	-.04	.1	-.04	-.03	-.13	.13	.12	-.09
				(.1)	(.12)	(.11)	(.13)	(.14)	(.17)	(.16)	(.22)
≈ Bottom 50%				.	.	.	.	.	.	.	.
pc_hh	6,708	3,014.28	8.25	–41.09	–78.96	144.64	–292.71	77.58	–164.13	–200.87	103.15
				(405.81)	(383.6)	(439.29)	(497.92)	(380.33)	(508.35)	(363.08)	(384.14)
Skilled occup	6,668	.05	8.25	.03*	.03**	.06**	.01	.02	.06***	.01	.03**
				(.02)	(.01)	(.02)	(.02)	(.02)	(.02)	(.01)	(.01)
Interm skilled (excl agri)	6,668	.38	8.25	-.05	-.08*	-.05	-.05	-.06	-.04	-.09	-.1**
				(.04)	(.04)	(.05)	(.05)	(.04)	(.06)	(.05)	(.04)
Agriculture	6,668	.34	8.25	.06**	.08**	.06	.05	.08***	.06	.07	.1***
				(.03)	(.03)	(.04)	(.04)	(.03)	(.05)	(.05)	(.03)
Elementary occ	6,527	.04	8.25	0	.01	0	0	0	.03	-.01	0
				(.01)	(.01)	(.02)	(.01)	(.01)	(.03)	(.02)	(.01)
Unemployed	6,668	.05	8.25	0	.01	0	.01	-.01	.04	.01	0
				(.01)	(.01)	(.03)	(.01)	(.01)	(.03)	(.02)	(.02)
NEA	6,668	.13	8.25	-.03	-.04	-.06*	-.01	-.03	-.11***	0	-.03
				(.02)	(.03)	(.03)	(.02)	(.03)	(.03)	(.04)	(.04)
wagewrk	6,024	.24	8.36	.01	.01	.03	0	0	.07*	-.06*	.03
				(.03)	(.02)	(.05)	(.04)	(.03)	(.04)	(.03)	(.02)
log_hrlywage	909	.55	7.04	.03	.19	-.02	.18	-.17	.15	.29	.08
				(.16)	(.2)	(.17)	(.22)	(.18)	(.29)	(.3)	(.31)

Note: Sample is respondents born between 1975 and 1992 with fathers' education.
Source: Own calculations using GLSS 7.

Table A6: Average marginal effects for rank outcomes

Outcome	Obs	Mean	Intensity value	Overall	Female	Coastal	Central	Northern	Coastal X female	Central X female	Northern X female
child_ed_rank	6,673	37.75	8.25	–1.88	-.69	–3.13	–3.82	.94	–1.64	–2.51	1.8
				(4.01)	(4.12)	(4.7)	(4.05)	(4.08)	(4.94)	(4.23)	(4.17)
child_wage_rank	909	44.97	7.04	1.27	5.09	-.61	4.97	–2.84	3.92	7.21	2.86
				(13.26)	(14.3)	(13.17)	(13.9)	(13.66)	(14.12)	(16.81)	(14.94)
child_pc_hh_rank	6,708	39.98	8.25	–1.12	–1.65	–2.08	–3.36	1.81	–4.6	–3.32	2.13
				(3.93)	(3.92)	(4.45)	(4.07)	(3.92)	(4.91)	(3.91)	(3.99)

Note: Sample is respondents born between 1975 and 1992 born to fathers in the bottom 50% of the education distribution. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Source: Own calculations using GLSS 7.

Table A7: Average marginal placebo effects for educational outcomes

Outcome	Obs	Mean	Intensity value	Overall	Female	Coastal	Central	Northern	Coastal X female	Central X female	Northern X female
Full sample				.	.	.	.	.	.	.	.
Ed years	4,521	7.02	7.48	.16	.04	-.11	.16	.65	-.3	.3	.19
				(.31)	(.28)	(.45)	(.38)	(.42)	(.43)	(.38)	(.46)
At least primary	4,544	.64	7.48	.07*	.05	.01	.1*	.12***	-.04	.14**	.05
				(.04)	(.04)	(.05)	(.05)	(.04)	(.06)	(.05)	(.04)
JHS	4,521	.53	7.48	.02	.01	-.01	.04	.06*	-.04	.05	.03
				(.04)	(.04)	(.05)	(.05)	(.04)	(.06)	(.05)	(.04)
SHS	4,521	.22	7.48	-.04	-.01	-.03	-.07*	-.01	.01	-.03	.01
				(.03)	(.03)	(.05)	(.03)	(.04)	(.04)	(.03)	(.03)
Read English	3,757	.51	7.37	-.01	-.03	-.03	-.03	.05	-.08	-.01	.03
				(.05)	(.05)	(.06)	(.05)	(.05)	(.07)	(.06)	(.04)
Write English	3,757	.48	7.37	-.01	-.01	-.02	-.02	.04	-.06	.02	.04
				(.05)	(.04)	(.07)	(.05)	(.05)	(.07)	(.06)	(.04)
≈ Bottom 50%				.	.	.	.	.	.	.	.
Ed years	2,895	4.8	8.47	.35	.25	-.2	.28	.8*	-.08	.54	.21
				(.45)	(.45)	(.64)	(.62)	(.47)	(.71)	(.58)	(.48)
At least primary	2,913	.44	8.47	.06	.02	-.04	.09	.11**	-.1	.11	.02
				(.05)	(.05)	(.09)	(.08)	(.04)	(.11)	(.08)	(.04)
JHS	2,895	.34	8.47	.02	0	-.06	.05	.07*	-.11	.07	.01
				(.05)	(.04)	(.08)	(.07)	(.03)	(.07)	(.06)	(.02)
SHS	2,895	.11	8.47	-.05*	0	-.08*	-.08*	0	0	-.01	0
				(.03)	(.01)	(.04)	(.04)	(.03)	(.03)	(.02)	(.02)
Read English	2,308	.32	8.36	.01	-.01	-.06	.02	.06	-.12	.04	.01
				(.05)	(.05)	(.09)	(.07)	(.04)	(.11)	(.07)	(.03)
Write English	2,308	.29	8.36	0	-.01	-.09	.01	.05	-.12	.06	.02
				(.05)	(.05)	(.09)	(.07)	(.04)	(.11)	(.05)	(.03)

Note: Sample is respondents born 1975–81 with fathers' education. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Source: Own calculations using GLSS 7.

Table A8: Average marginal placebo effects for expenditure and labour market outcomes

Outcome	Obs	Mean	Intensity value	Overall	Female	Coastal	Central	Northern	Coastal X female	Central X female	Northern X female
Full sample				.	.	.	.	.	.	.	.
pc_hh	4,544	3,753.1	7.48	– 750.47	– 673.72	– 332.69	– 1251.26	– 613.16	– 707.09	– 887.82*	– 220.47
				(624.17)	(446.51)	(505.63)	(921.01)	(495.48)	(499.19)	(478.72)	(451.42)
Skilled occup	4,528	.1	7.48	-.04*	-.03*	-.05	-.07**	.02	-.05*	-.03	.02
				(.02)	(.02)	(.03)	(.03)	(.03)	(.02)	(.02)	(.02)
Interm skilled (excl agri)	4,528	.44	7.48	-.05	-.08*	-.04	-.04	-.09*	-.05	-.1	-.1*
				(.04)	(.05)	(.05)	(.05)	(.04)	(.07)	(.06)	(.05)
Agriculture	4,528	.29	7.48	.08*	.1*	.08	.06	.15**	.11	.05	.18***
				(.04)	(.05)	(.05)	(.05)	(.05)	(.07)	(.06)	(.06)
Elementary occ	4,447	.04	7.48	.02	.01	0	.01	.05*	-.01	.03	.04*
				(.01)	(.01)	(.02)	(.02)	(.02)	(.02)	(.02)	(.02)
Unemployed	4,528	.04	7.48	0	0	-.03	.02	0	-.03	.02	-.01
				(.02)	(.02)	(.02)	(.02)	(.02)	(.03)	(.03)	(.02)
NEA	4,528	.09	7.48	.03	.04	.05	.05*	-.02	.05	.07*	-.04
				(.03)	(.04)	(.03)	(.02)	(.04)	(.05)	(.03)	(.05)
wagewrk	4,170	.29	7.48	-.07*	-.06*	-.09*	-.07	-.03	-.08*	-.06	0
				(.04)	(.03)	(.05)	(.05)	(.04)	(.05)	(.04)	(.03)

Note: Sample is respondents born 1975–81 with fathers' education.
Source: Own calculations using GLSS 7.

Table A9: Average marginal placebo effects for rank outcomes

Outcome	Obs	Mean	Intensity value	Overall	Female	Coastal	Central	Northern	Coastal X female	Central X female	Northern X female
child_ed_rank	2,895	37.96	8.47	1.16	1.03	–2.65	1.03	4.03	–1.14	2.84	.79
				(2.38)	(2.37)	(3.48)	(3.46)	(2.47)	(3.77)	(3)	(2.64)
child_wage_rank	350	45.35	6.82	–5.13	–12.01	9.4	– 13.91*	–4.83	.96	–13.57	–23.35
				(6.78)	(10.55)	(9.75)	(7.07)	(9.18)	(13.14)	(13.96)	(18.95)
child_pc_hh_rank	2,913	39.78	8.47	–1.42	–2.76	–1.62	–3	.16	–2.72	–5.77	.12
				(2.5)	(2.66)	(3.48)	(3.16)	(2.61)	(3.57)	(3.88)	(2.38)

Note: Sample is respondents born 1975–81 to fathers in the bottom 50% of the education distribution. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Source: Own calculations using GLSS 7.

Table A10: Average marginal effects for educational outcomes

Outcome	Obs	Mean	Intensity value	Overall	Female	Coastal	Central	Northern	Coastal X female	Central X female	Northern X female
Full sample				.	.	.	.	.	.	.	.
Ed years	9,164	8.01	7.37	2.04***	2.4***	1.88***	1.82***	2.71***	2.25***	2.28***	2.87***
				(.24)	(.27)	(.35)	(.27)	(.35)	(.42)	(.33)	(.39)
At least primary	9,195	.71	7.37	.15***	.19***	.14***	.11***	.23***	.18***	.17***	.27***
				(.03)	(.03)	(.03)	(.03)	(.04)	(.04)	(.04)	(.04)
JHS	9,164	.6	7.37	.15***	.2***	.15***	.13***	.21***	.2***	.19***	.22***
				(.03)	(.03)	(.04)	(.03)	(.03)	(.06)	(.04)	(.04)
SHS	9,164	.31	7.37	.19***	.19***	.21***	.18***	.16***	.21***	.19***	.17***
				(.03)	(.03)	(.04)	(.03)	(.03)	(.04)	(.03)	(.03)
Read English	7,387	.61	7.26	.21***	.26***	.19***	.21***	.25***	.23***	.29***	.27***
				(.03)	(.03)	(.04)	(.03)	(.04)	(.05)	(.04)	(.04)
Write English	7,387	.58	7.26	.23***	.27***	.23***	.22***	.25***	.25***	.31***	.27***
				(.03)	(.03)	(.03)	(.03)	(.04)	(.05)	(.04)	(.04)
≈ Bottom 50%				.	.	.	.	.	.	.	.
Ed years	5,501	5.71	8.36	2.27***	2.48***	1.98***	2.05***	2.67***	2.14***	2.52***	2.67***
				(.34)	(.36)	(.56)	(.39)	(.38)	(.64)	(.42)	(.42)
At least primary	5,527	.52	8.36	.18***	.2***	.16*	.16***	.21***	.16*	.22***	.22***
				(.04)	(.05)	(.07)	(.05)	(.04)	(.09)	(.06)	(.04)
JHS	5,501	.4	8.36	.16***	.2***	.18**	.13***	.18***	.23**	.2***	.18***
				(.04)	(.04)	(.07)	(.05)	(.04)	(.09)	(.05)	(.04)
SHS	5,501	.17	8.36	.13***	.13***	.14**	.13***	.13***	.14**	.12***	.11***
				(.03)	(.03)	(.05)	(.04)	(.03)	(.06)	(.04)	(.03)
Read English	4,313	.42	8.25	.18***	.21***	.14*	.18***	.21***	.15	.27***	.2***
				(.04)	(.05)	(.08)	(.05)	(.05)	(.1)	(.06)	(.04)
Write English	4,313	.39	8.25	.2***	.23***	.17*	.21***	.22***	.17	.29***	.21***
				(.05)	(.05)	(.07)	(.06)	(.04)	(.11)	(.06)	(.04)

Note: Sample is respondents born 1975–81 and 1985–92 with fathers' education. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Source: Own calculations using GLSS 7.

Table A11: Average marginal effects for expenditure and labour market outcomes

Outcome	Obs	Mean	Intensity value	Overall	Female	Coastal	Central	Northern	Coastal X female	Central X female	Northern X female
Full sample				.	.	.	.	.	.	.	.
pc_hh	9,195	3,989.68	7.37	215.84	209.71	282.53	40.22	388.2	150.16	–26.14	732.23*
				(197.81)	(239.42)	(275.09)	(245.32)	(314.18)	(322.57)	(273.2)	(346.92)
Skilled occup	9,161	.11	7.37	.09***	.1***	.11***	.09***	.06**	.11***	.1***	.06***
				(.02)	(.02)	(.03)	(.02)	(.02)	(.03)	(.02)	(.02)
Interm skilled (excl agri)	9,161	.41	7.37	-.07*	-.08*	-.09*	-.06	-.04	-.12**	-.06	-.07
				(.04)	(.04)	(.04)	(.04)	(.04)	(.04)	(.05)	(.04)
Agriculture	9,161	.24	7.37	.07*	.07*	.09**	.03	.1*	.1**	.02	.11*
				(.03)	(.03)	(.03)	(.03)	(.04)	(.04)	(.04)	(.05)
Elementary occ	9,013	.04	7.37	0	.01	0	.01	0	.02	-.01	0
				(.01)	(.01)	(.01)	(.01)	(.01)	(.02)	(.01)	(.01)
Unemployed	9,161	.06	7.37	.01	.01	.01	.03	0	.01	.02	.01
				(.02)	(.02)	(.02)	(.02)	(.02)	(.02)	(.02)	(.03)
NEA	9,161	.14	7.37	-.04	-.08**	-.04*	-.02	-.08*	-.09***	-.06	-.1*
				(.03)	(.03)	(.02)	(.03)	(.04)	(.03)	(.04)	(.05)
wagewrk	8,106	.33	7.48	.09**	.11***	.11**	.08*	.04	.14***	.1***	.06*
				(.03)	(.03)	(.04)	(.04)	(.04)	(.04)	(.03)	(.03)
log_hrlywage	1,810	.67	6.27	.19	.32*	.17	.23	.13	.4*	.35*	-.03
				(.13)	(.15)	(.15)	(.14)	(.17)	(.2)	(.2)	(.31)
≈ Bottom 50%				.	.	.	.	.	.	.	.
pc_hh	5,527	3,002.05	8.36	363.13	391.88	492.47	56.29	557.27	137.89	298.79	653.9*
				(257.18)	(322.37)	(423.98)	(246.04)	(367.67)	(424.11)	(350.97)	(330.89)
Skilled occup	5,495	.05	8.36	.05**	.05***	.1***	.02	.05*	.11**	.02	.05***
				(.02)	(.02)	(.04)	(.02)	(.02)	(.04)	(.02)	(.01)
Interm skilled (excl agri)	5,495	.37	8.36	-.07	-.09*	-.08	-.04	-.08*	-.1	-.06	-.11**
				(.05)	(.05)	(.07)	(.06)	(.05)	(.08)	(.06)	(.05)
Agriculture	5,495	.35	8.36	.08*	.1*	.08	.05	.11**	.14	.04	.13**
				(.04)	(.05)	(.06)	(.06)	(.05)	(.08)	(.07)	(.05)
Elementary occ	5,384	.04	8.36	0	.01	0	.01	0	.03	0	.01
				(.02)	(.02)	(.03)	(.02)	(.02)	(.03)	(.02)	(.02)
Unemployed	5,495	.05	8.36	.01	.02	.01	.03	0	.05	.01	0
				(.02)	(.02)	(.03)	(.03)	(.02)	(.04)	(.03)	(.02)
NEA	5,495	.14	8.36	-.03	-.06	-.04	-.02	-.04	-.11***	-.02	-.06
				(.03)	(.04)	(.03)	(.03)	(.04)	(.03)	(.05)	(.05)
wagewrk	4,957	.23	8.36	.05	.05*	.1*	.03	.04	.13**	-.02	.05*
				(.04)	(.03)	(.06)	(.05)	(.04)	(.05)	(.04)	(.03)
log_hrlywage	735	.52	7.15	.23	.33	.1	.38	.15	.4	.39	.15
				(.22)	(.3)	(.28)	(.25)	(.21)	(.38)	(.41)	(.47)

Note: Sample is respondents born 1975–81 and 1985–92 with fathers' education.
Source: Own calculations using GLSS 7.

Table A12: Average marginal effects for rank outcomes

Outcome	Obs	Mean	Intensity value	Overall	Female	Coastal	Central	Northern	Coastal X female	Central X female	Northern X female
child_ed_rank	5,501	37.6	8.36	1.73	3.1	-.06	-.41	4.93*	1	2.36	5.23*
				(2)	(2.11)	(3.22)	(2.29)	(2.17)	(3.55)	(2.49)	(2.29)
child_wage_rank	735	44.98	7.15	.35	3.89	–2.36	3.11	–1.57	8.61	4.11	–1.82
				(6.12)	(8.12)	(6.65)	(7.35)	(7.11)	(9.61)	(12.09)	(12.33)
child_pc_hh_rank	5,527	39.71	8.36	1.28	.75	-.84	-.92	4.78*	–4.85	-.62	5.89*
				(2.17)	(2.24)	(3.13)	(2.46)	(2.29)	(3.72)	(2.77)	(2.49)

Note: Sample is respondents born 1975–81 and 1985–92 to fathers' in the bottom 50% of the education distribution. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Source: Own calculations using GLSS 7.