

Blunch, Niels-Hugo; Hammer, Jeffrey S.

Working Paper

The Last of the Lost Generations? Formal and Non-Formal Education in Ghana during Times of Economic Decline and Recovery

GLO Discussion Paper, No. 208

Provided in Cooperation with:

Global Labor Organization (GLO)

Suggested Citation: Blunch, Niels-Hugo; Hammer, Jeffrey S. (2018) : The Last of the Lost Generations? Formal and Non-Formal Education in Ghana during Times of Economic Decline and Recovery, GLO Discussion Paper, No. 208, Global Labor Organization (GLO), Maastricht

This Version is available at:

<https://hdl.handle.net/10419/177888>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

The Last of the Lost Generations?

Formal and Non-Formal Education in Ghana during Times of Economic Decline and Recovery[†]

Niels-Hugo Blunch[†]
Economics Department
Washington and Lee University
Lexington, VA 24450, USA
blunchn@wlu.edu

Jeffrey S. Hammer
Woodrow Wilson School
Princeton University
Princeton, NJ 08544, USA
jhammer@princeton.edu

JEL Classification: I210, J240

Keywords: Human capital, formal and non-formal education, adult literacy programs, cohort analysis, Ghana.

Abstract:

Using a cohort approach, this paper examines educational attainment in Ghana and its potential determinants considering both educational attainment in the formal education system and participation in non-formal education in the form of adult literacy programs. The results indicate an overall substitution between formal and non-formal education across the generations, with participation in adult literacy programs decreasing as the formal education system expanded its coverage across space and time in Ghana. Individuals who completed any formal education were also much less likely to participate in adult literacy programs, by about 10 percentage-points per year of formal education completed. Additionally, the generations subject to the declining education system during the 1970s were substantially disadvantaged, with the cohort that was roughly of primary school age at the time of the economic breakdown in 1983 and the first few years thereafter being the last of the disadvantaged cohorts—the “lost generations.” This is especially true for the particularly vulnerable group of individuals who never received any formal education, where the crisis cohort peaked in terms of adult literacy program participation relative to later (and earlier) cohorts, possibly in response to a decrease in the quality of the formal education system as well as increased competition from returning refugees. We perform a simple test for the declining quality of the formal education system in the 1970s and find evidence consistent with a decrease in the quality in the education system during the 1970s, followed by an increase in quality thereafter.

[†] We thank participants at the Population Association of America Annual Meeting (Washington, DC) and the Economic Development in Africa conference (Centre for the Study of African Economies, Oxford) for helpful comments and suggestions. The initial analysis for this paper was undertaken while Blunch was a Departmental Guest at Princeton University’s Economics Department; the hospitality and support of the Department is gratefully acknowledged. The data were kindly provided by the Ghana Statistical Service. The findings and interpretations, however, are those of the authors and should not be attributed to the Ghana Statistical Service.

[†] Corresponding author.

1. Introduction

Education unarguably is at the heart of human and economic development and, as a result, has received widespread attention in previous research.¹ Yet, there are still issues related to the determinants of educational attainment that have only received limited attention and, therefore, are still poorly understood. One issue is the potential importance of alternative types of education to the traditional three-stage “primary-secondary-tertiary” system, where enrollment in primary education typically starts around the age of six, and secondary and tertiary then follows consecutively thereafter.

While that system has proven successful across the world in many contexts, it is only effective as long as pupils/students progress through the system. In particular, it largely has no role for somebody who dropped out of school as a child—or never attended school in the first place—and subsequently wants to return to school as an adult to learn basic skills, such as reading, writing, and performing basic written calculations. Adult literacy programs here may serve a crucial role, effectively allowing for these individuals to be “picked up” again later in life, in terms of learning these important life-skills—with all the positive impacts that will have on the livelihoods of themselves and their households.² Relatedly, there may be substitution between formal and non-formal education in an economy overall, so that as a larger and larger part of a given population attends the formal education system, there will be less and less demand for non-formal education.

Another issue is the effect of an economic crisis on different geographical areas or segments of the population and, relatedly, on educational attainment, including the possible asymmetries in the effects on different types of education—where some types may be more or less desirable from society’s point of view (as opposed to that of the individual, who is simply responding to the crisis as best as he or she can). For example, individuals growing up in a relatively poorer (or less developed area) or during times of crisis may be more prone to compensate for lack of formal education and skills with attending adult literacy programs later in life to a greater degree than individuals growing up either before or after the crisis. On the other hand, it is also possible that they get so “scarred” by the early childhood lack of resources or

¹ See Behrman (2010), Glewwe and Kremer (2006), and Orazem and King (2008) for extensive reviews of this literature for developing countries.

² See Blunch and Pörtner (2011) and Blunch (2014) for evidence on the relationship between adult literacy program participation and household expenditures and adult literacy program participation and child mortality, respectively.

effects of the crisis that they never obtain any skills. In turn, the lack of evidence is leaving policy makers with little information as to the impacts of and the responses to economic crisis and, therefore, to potential ways to address any adverse outcomes.

Using a cohort approach, pooling several nationally representative household surveys, this paper examines these issues for the case of Ghana. Ghana is exciting in this context, both since the country has a long-standing tradition for both traditional/formal education and for adult non-formal education in terms of adult literacy programs and since the country experienced a deterioration of the overall economy, including the formal education system during the 1970s, culminating with the overall economic breakdown of the Ghanaian economy in 1983.

We suggest that the cohorts subject to the declining economy and formal education system during the 1970s would be disadvantaged in terms of formal educational attainment relative to the generations coming both before and after, as well as hit harder from the effects of the other components of the overall economic breakdown (an economy wide drought, as well the return of about 1 million refugees from Nigeria). Specifically, we propose that the cohort that was roughly of primary school age at the time of the economic breakdown in 1983 and the first few years thereafter was the last of the “lost generations” in terms of human capital accumulation and other outcomes, though especially hard hit due to the crisis—with the period after 1983 being one of recovery, followed even by consistently positive social and economic development in Ghana in subsequent decades. Therefore, if considering adult literacy programs a (likely poorer) substitute for childhood education in the formal education system, one might expect this cohort—and, possibly, the cohort just before that—to peak (from trying to “catch up” in terms of human capital accumulation) in terms of adult literacy program participation relative to later (and possibly earlier) cohorts and similarly to have lower formal educational attainment relative to later (and possibly earlier) cohorts. That is, the cohort that were roughly of primary school age at the time of the economic breakdown in 1983 and the first few years thereafter as well as the cohort just before that would seem particularly susceptible to the potential effects of the eroding economy, including the formal education system, of the 1970s, culminating with the overall economic breakdown in 1983.³

³ So whenever we say “the” Crisis cohort subsequently, we mean the cohort that was roughly of primary school age at the time of the economic breakdown in 1983 and the first few years thereafter—although, again, the cohort immediately before that is still likely to be affected by the eroding economy, including the formal education system, of the 1970s.

The group of individuals with no formal education is a particularly vulnerable group in this context, and therefore should also be of particular concern for policy makers⁴—being likely more prone to be affected both by the overall crisis due to lacking coping mechanisms, as well as more likely to be affected by some of the specific components of the crisis. In this case, especially the influx of the roughly 1 million refugees (or return migrants) from Nigeria—many of which are likely to be unskilled and therefore in direct competition with resident unskilled Ghanaians in the labor market.

Additionally, one would expect to see the demand for adult literacy programs decrease across cohorts overall, as the formal educational attainment of the population as a whole increases thus necessitating less participation in adult literacy programs to acquire basic skills such as reading, writing, and basic written calculations ability.

Lastly, one might expect that people born in the Northern regions in Ghana (Northern, Upper East and Upper West) might be differentially affected by the Crisis, as well—since these regions are generally already poorer, with resulting low both quality and quantity of educational facilities.⁵ In particular, they might be affected in terms of formal educational attainment, so that that might drop below the already low levels (relatively to the Southern regions). As adults, they might again respond to the lower levels of childhood education by being more prone to engage in adult literacy program participation, to try to catch up—or they might be so scarred from their lack of resources and educational/learning stimulation as children, that they forego adult learning, as well.

Specifically, we explore the following seven research questions for the case of Ghana: (1) Is there evidence of direct substitution between formal and non-formal education overall—in particular, (i) have the more recent cohorts both completed more years of schooling and are also less likely to have participated in an adult literacy program than older cohorts and (ii) are individuals who completed any formal education less likely to participate in adult literacy programs—and if so, by how much?; (2) Relatedly, did the crisis cohort of eligible adult literacy program participants—that is, the particularly vulnerable group of individuals who had never completed any formal education—respond differently than other cohorts in terms of adult literacy program participation, possibly due to trying to mitigate their vulnerability from growing

⁴ Including issues related to public vs. private service delivery (Hammer, 2013).

⁵ One reason for this is the lower rainfall in the Northern regions in Ghana (van der Geest, 2011).

up during a time of crisis—including pressure from a deteriorating economy overall (as well as education system), an economic drought, and the return of refugees (likely themselves unskilled and therefore direct competitors to this particularly vulnerable group in the labor market)?; (3) Is there additional evidence of (more indirect) substitution between formal and non-formal education related to the access to formal and non-formal education in the community, so that access/exposure to formal educational facilities in the community increase formal educational attainment and similarly decrease the participation in adult literacy programs—and so that access/exposure to adult literacy programs in the community similarly increase the participation in adult literacy programs and similarly decrease formal educational attainment?; (4) Does geography matter for formal educational attainment and adult literacy program participation?—where the priors are that (i) individuals from the three most northern regions (Upper East, Upper West, and Northern) are less likely to have attended any formal education and for fewer years and either more (the Catching-Up Hypothesis) or less (the Discouragement/Scarring Hypothesis) likely to have participated in an adult literacy program relative to individuals from the capital region of Greater Accra (if not relative to all the seven most southern regions as a whole); and that (ii) there are differences in the importance of region of birth versus region of residence for formal educational attainment and adult literacy program participation, so that region of birth matters most, if not exclusively; (5) Is there evidence for intergenerational transmission of human capital—and does this transmission differ between formal education and adult literacy program participation? Here, we might expect that individuals with more educated parents also will have more formal education themselves and at the same time be less likely to attend adult literacy programs; (6) How do the previous results change if taking into account that interaction effects might exist—so that for example people born in the Northern regions may be more affected by the Crisis?; and (7) In addition to the evidence of formal educational attainment decreasing following the eroding quality of the formal education system in the 1970s (though not following the overall economic breakdown in 1983)⁶ in *nominal* terms, is there any evidence that formal educational attainment might also have decreased in *real* (i.e., quality-adjusted) terms?

The remainder of this paper is structured as follows. Section 2 presents the relevant parts of the Ghanaian context, including the education system and recent economic developments.

⁶ That is, for the cohort immediately prior to “the” Crisis cohort—which, again, is also likely to be affected by the eroding economy (including the formal education system) of the 1970s if not particularly by the overall economic breakdown in 1983, in terms of their formal (childhood) educational attainment.

This is followed by a presentation of the data and estimation issues in Section 3, while the results follow in Section 4. Finally, Section 5 concludes and discusses policy implications and future research.

2. Background: Recent Economic Developments and Formal and Non-Formal Education in Ghana⁷

The Ghanaian education system has origins far back in history, dating back at least to the European-style schools introduced by the arrival of the Portuguese in the fifteenth century. Later, the arrival of European Christian missionaries in the seventeenth century sparked large scale educational efforts in Ghana, including schools and agricultural stations. Koranic schools probably also came about during the seventeenth century (Naylor, 2000).

Historically, Ghana's education system was of good quality and enrollment rates were fairly high, at least for primary-school aged children. This can be seen from the increased attention towards education during the early years after gaining independence in 1957, most notably the Education Act of 1961, which declared primary education to be compulsory, and the Seven-Year Development Plan for 1963-1970, which had a strong focus on expanding the education system, including access and enrollment rates. By the late 1960s, the education system in Ghana consisted of six years of primary school, followed by four years of middle school, five years of secondary school and finally two years of so-called "sixth form", leading to A-level exams, which were required to enter university. The normal undergraduate program consisted of three years post-A levels, modeled after the British system. Entrance to secondary school, however, was based on examination results. Hence, children from the higher ranks of Ghanaian society could skip the four years of middle school altogether by attending elite private primary schools, which helped them pass the entry requirements for secondary school (Cobbe, 1991).

Following the expansion of the Ghanaian education system with the Seven-Year Development Plan for 1963-1970, the 1970s saw an erosion of the Ghanaian education system due to the decline of the overall Ghanaian economy culminating with the overall economic breakdown in 1983. Teachers were underpaid, resulting in lack of qualified teachers as well as

⁷ This section draws extensively on Blunch (2006) and Blunch and Pörtner (2005).

less time being devoted to teaching and preparation, since teachers had to take up second occupations to sustain their livelihoods. Nearly half of all primary school teachers were unqualified in 1982/83, with the numbers for middle school and secondary school teachers being roughly a third and a fifth, respectively (Cobbe, 1991). Practically the entire education budget was spent on salaries, leading to a general lack of textbooks, furniture, chalk, paper and other supplies, as well as to neglect of maintenance of schools and classrooms. To be sure, by the 1980s the value of education, especially below the secondary level, was diminishing (Cobbe, 1991).

In 1983, Ghana experienced an overall economic breakdown across all sectors, including the education sector Cobbe (1991). It was a drought year, causing severe food shortages, which were exacerbated by more than one million Ghanaian workers being expelled from Nigeria, effectively increasing the Ghanaian population by nearly 10 percent—with most of these workers being absorbed into agricultural work in rural areas (Shillington, 1992). In turn, this substantial influx of return-migrants can be expected to increase labor supply especially at the lower end of the skills distribution in the Ghanaian labor market. Real annual GDP per capita was at an all-time low of \$308 after several years decline, real GDP per capita had fallen more than 26 percent, inflation hit triple-digit numbers three times from the late 1970s to the mid 1980s, while the terms-of trade also deteriorated during the early 1980s (Blunch, 2006).

The Economic Recovery Program (ERP)—and later the Structural Adjustment Program (SAP)—initiated in 1983 in collaboration with the IMF and the World Bank and heavily funded by the international financial institutions and donors, achieved substantial improvements for the Ghanaian economy, including the education sector. Among the priorities were rehabilitation of the country's deteriorated ports, roads, and railway, as well as liberalization of input and produce marketing of most crops. Price controls and ceilings on interest rates in general were removed, as well. Major focus was also on increasing access to health services, water, and education.

In the decade following the overall economic breakdown and the introduction of the ERP, real GDP averaged an impressive 5 percent annually, leading to Ghana becoming a leading example of a successfully adjusting country. Indeed, the success of Ghana led Alderman (1994) to ask whether Ghana was “The Star Pupil” of Sub-Saharan African countries. The economic success continued into the 1990s though unevenly distributed geographically, with the three northern regions (Northern, Upper West and Upper East Ghana) even experiencing some

increases in poverty (Canagarajah and Pörtner, 2003). This economic success for the country as a whole has partly helped sustain the attention towards education inherent in the ERP to even more increased focus on education in the recent decades. For example, in 1987 the Education Sector Reform Program was established, aiming at improving the efficiency, quality and relevance of Ghanaian education. Part of the reform was an increase in the access to education and a shortening of the length of pre-university education from 17 to 12 years. The reform also included substantial change to educational finance, intended to make the system more equitable and sustainable from domestic resources. Additional reforms were outlined in “Ghana-Vision 2020” (GOG, 1995). Among specific goals were achievement of universal basic education and literacy in Ghana, increasing access to secondary and university education. The current education system consists of six years primary school, three years junior secondary school (JSS), and three years senior secondary school (SSS), followed by tertiary education. Ghana has several higher education institutions, including the University of Ghana at Legon, the University of Science and Technology, the University of Cape Coast, the University College of Winneba and the University of the North, all of which are public. Recently, privately run universities have emerged in Ghana, for example, Valley View University and Central University College. Additionally, Ghana has six polytechnic institutes, seven diploma awarding colleges and 38 teacher training colleges, as well as a number of private institutions offering computer and business studies (the latter having increased significantly since 1991, although exact numbers are not known) (EIU, 2001).

Attendance of primary and junior secondary schools (also denoted “basic education”) is mandatory and, in principle, free. However, in practice schools collect mandatory contributions from students to supplement the government subsidies (Canagarajah and Ye, 2001). While the main provision of basic education is public, there are quite a few private schools as well, especially at the primary and junior secondary levels (Canagarajah and Ye, 2001).

The curriculum at the primary level consists of English, Ghanaian Language and Culture, Mathematics, Environmental Studies, Religious/Moral Education, and, for the higher primary level, additionally Integrated Science (Science and Agricultural Science) and Physical Education (consisting of Music and Dance). The junior secondary curriculum consists of English, Ghanaian Language and Culture, Mathematics, Science, Agricultural Science, Pre-technical Skills (including Technical Drawing), Religious/Moral Education, Social Studies and French

(optional). Additionally, Music, Life Skills, and Physical Education are offered. However, these courses are not subject to external examination.

The education system is financed and managed by the government of Ghana (GOG) through two managerial offices, the Ministry of Education (MOE) and Ghana Education Services (GES). While the MOE primarily oversees budget allocation and education policies at a central level, the GES implements the budget and policies in a more decentralized manner, having branches at both the regional and the district level (Canagarajah and Ye, 2001).

While the formal education system has many similarities with the formal education system in most countries, non-formal education is quite distinct to Ghana, where adults have received special attention. This is reflected both from the fact that adult literacy programs have their own department directly under MOE—namely the Non-Formal Education Department (NFED)—as well as a long history in Ghana.⁸ They go back at least to the eighteenth century and were mainly conducted by religious institutions until after the Second World War. The first national literacy program was introduced in 1948 but collapsed in 1968 after the fall of the Kwame Nkrumah government in 1966. The reasons for this were two-fold. First, that it had become closely politically associated with the Nkrumah movement and, second, that the skills taught were often not considered relevant by participants.

In 1987 the Non-Formal Education Division (NFED) was established in the Ministry of Education to organize and co-ordinate adult literacy programs and other non-formal education at the national level. From the outset, the main target group was poor women in rural areas or, in the words of NFED itself, the main objective was “to make the poorest Ghanaians, especially those living in the rural communities, functionally literate with emphasis on women” (NFED, 1999). Subsequently, baseline studies were undertaken to ensure that the teaching would be of immediate use and relevance to the participants. Based on these studies, a pool of main themes were identified as important issues and concerns of communities to be addressed in adult literacy programs, covering issues as varied as nutrition, immunization, family planning, and traditional and modern farming.⁹ The themes can be broadly divided into three areas: social and health

⁸ For a more complete description of the history of adult literacy programs and their current function and curricula, see Blunch and Pörtner (2005), Appendix B, whereupon much of the following discussion is also based.

⁹ For the overall cycle of an adult literacy program in a given community, 28 main themes that were deemed particularly useful for that specific community were explicitly selected from among the entire pool of main themes.

issues,¹⁰ income-generation/occupational skills¹¹ and civic awareness.¹²

It takes about 21 months to complete the NFED course, with classes meeting two to three times a week, for a total of six hours per week. In most cases there are 20 to 30 participants per instructor/facilitator. Other providers of adult literacy programs include NGOs such as World Vision (Ghana), Action Aid (Ghana), the Hunger Project (Ghana), the Christian churches of various denominations, and Muslim communities. These programs are largely similar to the National Program; indeed, these providers frequently include similar health topics in their programs, and some even adopted the NFED primers directly for use in their own program (Blunch and Pörtner, 2005, Appendix B).¹³ It therefore seems plausible to interpret subsequent results in the context of the national NFED adult literacy course.

3. Data and Estimation Issues

The Ghana Living Standards Survey (GLSS) is a nationally representative multi-purpose cross-section¹⁴ household survey that has been collected periodically, starting in 1987/88. The first two rounds did not ask about adult literacy program participation, however, so the analysis here examines the three subsequent rounds—collected in 1991/92, 1998/99 and 2005/06. The household survey contains information on educational attainment, including formal education as well as non-formal education in the form of adult literacy program participation, as well as information on background variables such as age, gender, parental education, and region of birth and region of residence, which are also important factors in analyses of human capital processes. The community survey, which was only administered to rural areas, contains information on whether there is or has been a primary school, a secondary school, and/or an adult literacy program in the area and, if so, for how long. This latter information is integral to exploring the

¹⁰ Topics include family planning, teenage pregnancy, environmental hygiene, immunization, HIV/AIDS, safe motherhood and child care, drug abuse, traditional medicine, and safe drinking water.

¹¹ Topics include cocoa farming, maize cultivation, dry season farming, basket weaving, animal husbandry, bee-keeping, oil palm cultivation, borrowing money for work, hygienic way of preserving and selling fish, farm extension services, pottery, and soap making.

¹² Topics include taxation, bushfires, interstate succession law, child labor, chieftaincy, community empowerment, and expensive funerals.

¹³ For example, World Vision (Ghana) includes topics such as water and sanitation, family planning, HIV/AIDS, and immunization and the other NGOs include similar topics in their courses—some, again, even adopting the NFED primer directly into their programs.

¹⁴ While—as also suggested by a referee—it would be preferable to use difference-in-differences (DID) to estimate the impact of the crisis on educational outcomes, the nature of the data (cross-sectional rather than panel data) unfortunately does not allow this.

relationship between educational attainment and educational access/exposure—the estimation sample therefore is restricted to individuals from rural areas. The respondent in the survey is either the head of household or a knowledgeable adult member (household survey) and the community chief along with his elders and other knowledgeable people in the community (community survey).

Educational attainment, the dependent variable for the analysis here, contains two dimensions. Formal educational attainment is constructed from the education module based on information on the highest level completed, ranging from “never attended school” through “university.” We consider a measure of years of schooling, where these levels are converted into years of schooling (for example, primary school completion corresponds to six years of schooling), as well as two dummy variables (Ever attended school and Primary and above). The non-formal education measure, adult literacy course participation, is a binary measure based on information on whether an individual has ever attended an adult literacy course or not. It would have been preferable to know whether an adult had completed—rather than merely attended, possibly for less than the full duration—an adult literacy program but that information is unfortunately not available from the GLSS.

Moving to the explanatory variables, one of the main hypotheses explored here is the possibility of individuals being exposed to the eroding education system of the 1970s being particularly affected in terms of their human capital accumulation—with the cohort that would be roughly of primary school age in a “neighborhood” of the time of the economic breakdown in 1983 and the first few years thereafter possibly being the last of “The Lost Generations” in terms of their educational attainment. We suggest children born 191971-75 would belong to this (last) cohort, and then construct additional cohorts around this “Last/Crisis Cohort”—namely individuals born prior to 1951, 1951-55, 1956-60, 1961-65, 1966-70, 1976-80, 1981-85, and 1986-90.

Additional important explanatory variables include region of residence and region of birth, capturing—at least to some degree—current school quantity and school quality, as well as school quantity and school quality during childhood. While the place of residence is potentially important in affecting educational attainment through the access to educational facilities, we suggest that the region of birth is likely much more important than the region of current

residence since that more closely related with the timing of childhood schooling.¹⁵ We also consider more explicit measures of educational access, allowing for a total of four alternative measures of educational access: (1) current access to adult literacy programs, primary schools, and senior secondary schools in the area, which is measured by a set of dummy variables (one of access, zero otherwise); (2) access in 1970, the last year of the earlier mentioned Seven-Year Development Plan for Ghana (which, again, had a strong focus on expanding the Ghanaian education system in terms of access and enrollment), which can therefore also be interpreted as an “initial-condition,” education access-wise, going into the period of the deteriorating education system in the 1970s; (3) access at the relevant age of an individual (6 for primary school, 15 for secondary, and 12 for adult literacy programs¹⁶); and (4) age relevant exposure, measured in terms of years of age relevant exposure to these facilities in the area using the same cut-offs as in (3).

Further, as in many other countries in the developing world females also tend to receive less schooling than males in Ghana (Chao, 1999), thus calling for inclusion of a female dummy variable. To control for socioeconomic background as set of dummies for parental education is included, as well. Lastly, since the data from the three rounds of the GLSS used for the analysis here is pooled, survey fixed effects are also included.

Three analysis samples are examined here, namely—ordered by the amount of observations, from large to small: (1) individuals with information on formal educational attainment (as well as the previously discussed explanatory variables); (2) individuals with information on both formal educational attainment and adult literacy program participation (as well as the previously discussed explanatory variables); and (3) individuals with information on adult literacy program participation (as well as the previously discussed explanatory variables), who never went to (formal) school. All samples are of individuals 18 years and above from rural areas (where the questionnaire including educational access was administered). The age-restriction ensures that most of the individuals in the estimation sample has completed most of their formal education (or, for the last sample, to at least have had a chance to do so, age-wise)—certainly, at least, to have completed primary (if not secondary) education.¹⁷ Also, while as

¹⁵ Subsequently testing for the joint statistical significance of these two sets of variables confirm this, see below.

¹⁶ The latter may appear low but in practice adult literacy programs are also attended by youth or even older children (one of the authors (Blunch) has personally witnessed this on travels in rural Ghana).

¹⁷ Grade repetition is quite common in Ghana, especially in rural areas.

previously mentioned adult literacy programs in practice may be attended by youth and even younger children, restricting the sample for the analysis of non-formal educational attainment to individuals 18 years or older, as well, helps maintain consistency with the analysis of formal educational attainment. The reason for restricting the sample to individuals from rural areas is that the community questionnaire, which includes the information on access to schools and adult literacy programs in the community, was only administered in rural areas—although the information was not collected for all communities—thus leading to an initial estimation sample where this information is available of 23,695 individuals 18 years and above for the analysis of formal educational attainment (sample (1) above). In terms of the focus of this paper, it is not clear what “other education” is, so individuals who have completed “other education” are dropped from the sample. For the narrower research question on the response of low-skilled Ghanaians’ response to the crisis and prior deteriorating period (sample (3) above) we restrict the estimation sample to individuals who have never attended the formal education system. Relatedly, the official target group of adult literacy programs is individuals with no or only very little formal education—that is, the correct counterfactual to participation in adult literacy programs is not merely non-participation but rather non-participation coupled with being in the relevant target group of no-formal schooling completers. Additionally, restricting the sample for this analysis to individuals who have not attended the formal education system also helps address some potential issues related to irregularities in the data collection.¹⁸

After these considerations, and further drops due to missing observations on dependent or explanatory variables, we finally arrive at the final, effective estimation samples of 23,179 observations for the analysis of formal educational attainment determinants (sample (1) above); 21,559 observations for the analyses of substitution between formal and non-formal education and of non-formal educational participation determinants, where formal educational attainment is one of the main explanatory variables (sample (2) above), respectively; and 11,523 observations for the analysis of non-formal educational participation determinants for individuals who have never attended the formal education system (sample (3) above). Basic descriptive statistics for the three estimation samples are shown in Table A1 in the Appendix.

¹⁸ During the first eight months of the data collection of the 1991/92 round of the GLSS some enumerators only collected information on adult literacy program participation for individuals who had never attended school—thus leading to a drop in sample sizes between estimation samples (1) and (2) but *not* affecting sample (3).

4. Results

This section reviews the main results of this paper. This is centered on addressing each of the seven research questions from the Introduction in turn and is accomplished by a combination of descriptive analysis and reduced form estimates of formal educational attainment and adult literacy course participation determinants, along with an additional simple test of the degree to which the formal educational system experienced a decrease in overall quality in the 1970s as measured by the returns to education. While the emphasis in this discussion is on the results for birth cohort and access to educational institutions in the community, it should be noted that the estimations include a rich set of control variables, including demographic variables and region of birth and region of residence to control for geographical disparities in schooling access and quality (the full set of results can be seen in Tables A5-A12 in the Appendix).

The dependent variable for the education demand analysis is a binary measure for ever having attended (formal) school, for having completed primary or more, or for adult literacy program participation, and a continuous measure of years of formal schooling completed. The explanatory variables include the focal variables of birth cohort and education access and a set of additional controls as described in the previous section. Estimations are carried out using the linear probability model/OLS, estimating models separately for the formal and non-formal education measures, yielding a total of five main models to be estimated for the four alternative measures of education access (as discussed in the data and estimation issues section). So as to allow for arbitrary heteroskedasticity, the estimations are carried out using Huber-White standard errors (Huber, 1967; White, 1980). Additionally, so as to allow for the possibility that observations are correlated within communities the standard errors are also adjusted for within-cluster correlation (Wooldridge, 2010). Additional analyses to test for the declining formal education system in terms of the monetary returns of formal schooling are pursued as Mincer earnings regressions, for the pooled sample as well as by cohort. Since some of the results tables are rather large, the full results tables have been placed in the Appendix and the pertinent excerpts of these tables are then presented in the relevant sections below (except where they are too unwieldy—in which case we refer to the Appendix).

Research Question 1: *Is there evidence of direct substitution between formal and non-formal education overall—in particular, (i) have the more recent cohorts both completed more years of schooling and are also less likely to have participated in an adult literacy program than older cohorts overall; (ii) are individuals who completed any formal education less likely to participate in adult literacy programs—and if so, by how much, and (iii) is there evidence that the cohorts exposed to the deteriorating education system of the 1970s were particularly hard hit in terms of their human capital accumulation?*

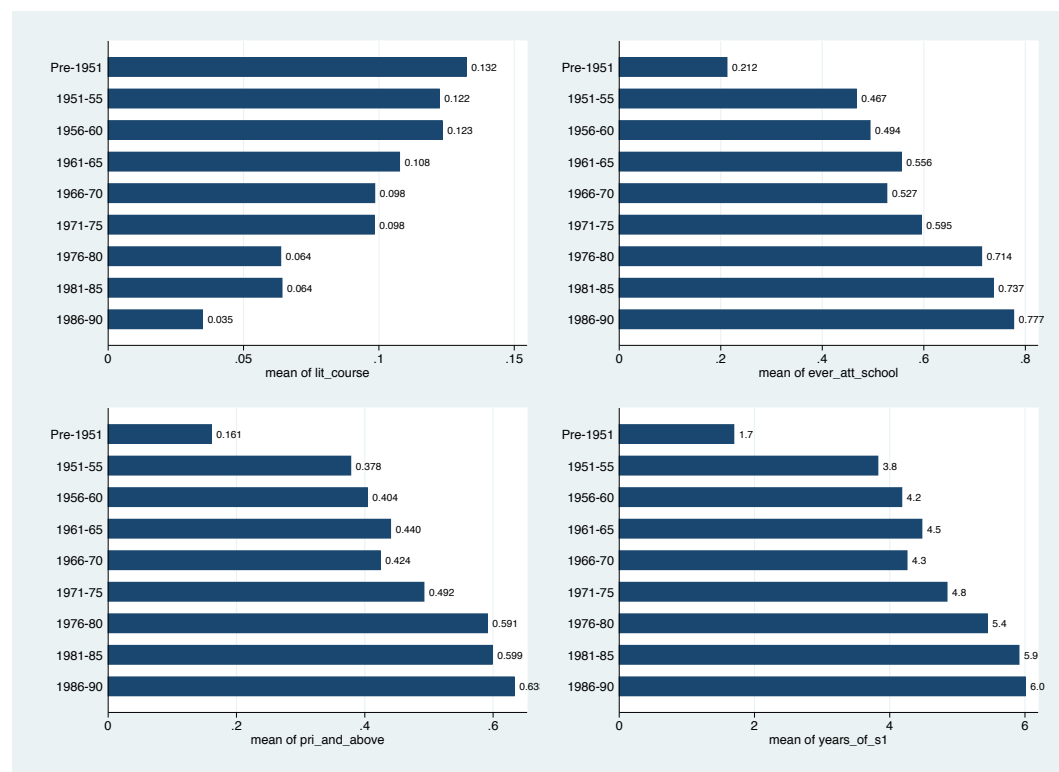
The means of formal educational attainment and adult literacy program participation across birth cohorts are presented in Figure 1. From the results in the figure there is a fairly steadily increasing trend across cohorts in ever attending school, as well as in formal educational attainment—both as measured in terms of primary school completion and as years of schooling completed. There is a bit of a dip, however, for the second-to-last (though not for the last) of the “Lost Generations,” consistent with the prediction that the individuals exposed to the deteriorating education system of the 1970s would be particularly hard hit in terms of their human capital accumulation.

This positive trend in formal educational attainment is associated with a similarly fairly steadily *decreasing* trend in adult literacy program participation across cohorts. In turn, this suggests that there has been a substantial degree of substitution between the formal and informal education system in Ghana in recent years in terms of overall education demand: as the formal education system has expanded—and more and more Ghanaians therefore have received formal education and the skills associated therewith—there has become less need for adult literacy programs to “pick up” Ghanaians who did not receive formal education as children and therefore need to obtain the associated skills as adults instead.¹⁹ Alternatively, one could view the 1971-74 cohort as the last of the “Lost Generations,” human capital-wise, following an initial period of adult literacy program participation consistently around 12-13 percent and with significant drops in participation thereafter—as both the quantity and the quality of the formal education system also starts improving again (the latter exemplified, among other initiatives, with the 1987

¹⁹ There might be concern whether this result is robust to the data anomaly in GLSS3 mentioned earlier, whereby during the first eight months of data collection only individuals who never attended the formal education system were asked about their adult literacy program participation. Exclusion of the individuals asked during the first eight months of the GLSS3, however leads to similar patterns (See Figure A1 in the Appendix (available upon request)).

Education Sector Reform).²⁰

Figure 1. Substitution Between Formal and Non-formal Education across Birth Cohorts



Notes: Calculations incorporate sampling weights. N = 21,559 observations.

Source: Ghana Living Standards Survey (Rounds 3-5: 1991/92, 1998/99, and 2005/06).

Additionally, from the results in Table 1 below, it can be seen that there is a strong substitution—both in statistical and substantive terms—between formal education and participation in adult literacy programs: if an individual has attended the formal education system as a child, that individual is about one percentage-point less likely to attend adult literacy programs as an adult per year of formal education completed. Also, the results from the descriptive analysis from Figure 1 holds up here, as well, even controlling for other factors—so that adult literacy program participation decreases substantially (and statistically significantly so) for the last three cohorts, at about minus 4 to 5 percentage-points for the cohorts born in 1976-80 and 1981-85, respectively, to about minus 6.6 to about 8 percentage points for the youngest cohort, born 1986-1990.

²⁰ See Blunch (2014) for a description of the main components of the Reform, as well as an analysis of the changing productivity of the different levels of education in terms of literacy and numeracy skills production.

Table 1. Years of Schooling and Birth Cohort Coefficients from Adult Literacy Program Participation Regressions Using Four Alternative Measures of Educational Access with Formal School Attendees Included in Estimation Sample (Linear Probability Model/OLS): Core Specification (No Interactions)

	<i>Current Access</i>	<i>Access in 1970</i>	<i>Access at Relevant Age (Binary)</i>	<i>Age Relevant Exposure (Years)</i>
Years of schooling	-0.009*** [0.001]	-0.010*** [0.001]	-0.009*** [0.001]	-0.010*** [0.001]
<i>Birth cohort:</i>				
1951-55	0.006 [0.011]	0.006 [0.011]	0.007 [0.011]	0.009 [0.011]
1956-60	0.008 [0.010]	0.009 [0.010]	0.01 [0.011]	0.012 [0.010]
1961-65	-0.004 [0.010]	-0.004 [0.010]	-0.003 [0.010]	0 [0.010]
1966-70	-0.017* [0.009]	-0.017* [0.009]	-0.016* [0.009]	-0.012 [0.010]
1971-75	-0.013 [0.009]	-0.012 [0.009]	-0.011 [0.009]	-0.006 [0.011]
1976-80	-0.050*** [0.010]	-0.048*** [0.009]	-0.048*** [0.011]	-0.040*** [0.011]
1981-85	-0.050*** [0.011]	-0.049*** [0.011]	-0.050*** [0.012]	-0.039*** [0.013]
1986-1990	-0.078*** [0.010]	-0.079*** [0.010]	-0.080*** [0.011]	-0.066*** [0.013]
R ²	0.037	0.032	0.032	0.033
N	21,559	21,559	21,559	21,559

Notes: This is an excerpt from Appendix Table A6, where the full results can be found. Calculations incorporate sampling weights. Robust Huber-White (Huber, 1967; White, 1980) standard errors, adjusted for within-cluster correlation/clustering (Wooldridge, 2010), in brackets under parameter estimates. ***: statistically significant at 1 percent; **: statistically significant at 5 percent; *: statistically significant at 10 percent. The reference category is “pre-1951” (birth cohort). The additional explanatory variables include a dummy variable for gender, region of birth, region of current residence, educational access/exposure, parental education, and survey fixed effects. *Source:* Ghana Living Standards Survey (Rounds 3-5: 1991/92, 1998/99, and 2005/06).

Turning to the results for formal educational attainment in Table 2, the descriptive results from Figure 1 again hold up fairly well, even when controlling for a host of other potentially important factors. Most importantly for our focus here, formal educational attainment again exhibits a positive trend across the cohorts, again flattening out somewhat towards the younger cohorts. Note that while years of schooling may seem to decrease for the youngest cohort, this is

simply due to this cohort not yet having completed their (entire) education. The ever attended school and primary completed measures, however, are not susceptible to this issue—and consistently show substantial improvements in human capital accumulation across the cohorts. The probability of ever having attended school, for example, is between 40 and 52 percentage-points higher for the youngest relative to the oldest (i.e., the reference) cohort—with fairly steadily increases across cohorts, indicating a fairly continuous increase in the coverage of the Ghanaian formal education system across the cohorts. Again the dip for the 1966-70 cohort is pronounced—so that even when controlling for other mediating factors, the individuals exposed to the deteriorating education system of the 1970s seems to have been particularly hard hit in terms of their human capital accumulation.

Summing up, the evidence suggests that has been substitution between formal and non-formal education in Ghana in recent years, so that more recent cohorts have both completed more years of schooling and are also less likely to have participated in an adult literacy program than older cohorts. Further, individuals who completed formal education are less likely to participate in adult literacy programs, by about 1 percentage-point per year of formal schooling. Lastly, individuals exposed to the deteriorating education system of the 1970s seem to have been particularly hard hit in terms of their human capital accumulation, though only for the second-to-last of the “Lost Generations.”

Table 2. Birth Cohort Coefficients from Formal Educational Attainment Regressions Using Four Alternative Measures of Educational Access (Linear Probability Model/OLS): Core Specification (No Interactions)

	<i>Current Access</i>			<i>Access in 1970</i>			<i>Access at Relevant Age (Binary)</i>			<i>Age Relevant Exposure (Years)</i>		
	<i>Ever attended</i>	<i>Primary and above</i>	<i>Years of schooling</i>	<i>Ever attended</i>	<i>Primary and above</i>	<i>Years of schooling</i>	<i>Ever attended</i>	<i>Primary and above</i>	<i>Years of schooling</i>	<i>Ever attended</i>	<i>Primary and above</i>	<i>Years of schooling</i>
1951-55	0.262*** [0.012]	0.234*** [0.012]	2.194*** [0.129]	0.266*** [0.013]	0.238*** [0.012]	2.235*** [0.129]	0.236*** [0.013]	0.206*** [0.012]	1.895*** [0.130]	0.273*** [0.013]	0.246*** [0.013]	2.339*** [0.133]
1956-60	0.312*** [0.011]	0.287*** [0.011]	2.785*** [0.134]	0.314*** [0.011]	0.288*** [0.011]	2.803*** [0.133]	0.268*** [0.012]	0.240*** [0.012]	2.288*** [0.134]	0.326*** [0.011]	0.303*** [0.012]	2.981*** [0.139]
1961-65	0.337*** [0.012]	0.287*** [0.011]	2.770*** [0.116]	0.340*** [0.012]	0.290*** [0.011]	2.806*** [0.116]	0.290*** [0.012]	0.236*** [0.011]	2.237*** [0.121]	0.357*** [0.014]	0.311*** [0.012]	3.053*** [0.127]
1966-70	0.320*** [0.011]	0.284*** [0.013]	2.598*** [0.128]	0.322*** [0.012]	0.287*** [0.013]	2.625*** [0.125]	0.269*** [0.012]	0.229*** [0.013]	2.016*** [0.131]	0.344*** [0.014]	0.314*** [0.014]	2.949*** [0.144]
1971-75	0.360*** [0.012]	0.319*** [0.013]	2.790*** [0.124]	0.363*** [0.012]	0.322*** [0.013]	2.821*** [0.124]	0.304*** [0.013]	0.259*** [0.013]	2.158*** [0.132]	0.390*** [0.016]	0.355*** [0.015]	3.215*** [0.148]
1976-80	0.391*** [0.013]	0.343*** [0.013]	2.617*** [0.131]	0.392*** [0.013]	0.346*** [0.013]	2.647*** [0.130]	0.324*** [0.015]	0.271*** [0.015]	1.864*** [0.149]	0.424*** [0.016]	0.384*** [0.015]	3.110*** [0.160]
1981-85	0.448*** [0.016]	0.384*** [0.018]	3.173*** [0.163]	0.449*** [0.016]	0.386*** [0.018]	3.191*** [0.164]	0.376*** [0.017]	0.305*** [0.019]	2.369*** [0.179]	0.485*** [0.019]	0.430*** [0.020]	3.713*** [0.192]
1986-1990	0.480*** [0.018]	0.406*** [0.018]	3.067*** [0.166]	0.483*** [0.018]	0.409*** [0.018]	3.104*** [0.164]	0.401*** [0.021]	0.316*** [0.021]	2.174*** [0.204]	0.523*** [0.020]	0.459*** [0.020]	3.692*** [0.189]
R ²	0.408	0.363	0.355	0.407	0.364	0.356	0.414	0.37	0.363	0.405	0.359	0.352
N	23,179	23,179	23,179	23,179	23,179	23,179	23,179	23,179	23,179	23,179	23,179	23,179

Notes: This is an excerpt from Appendix Table A5, where the full results can be found. Calculations incorporate sampling weights. Robust Huber-White (Huber, 1967; White, 1980) standard errors, adjusted for within-cluster correlation/clustering (Wooldridge, 2010), in brackets under parameter estimates. ***: statistically significant at 1 percent; **: statistically significant at 5 percent; *: statistically significant at 10 percent. The reference category is “pre-1951” (birth cohort). The additional explanatory variables include a dummy variable for gender, region of birth, region of current residence, educational access/exposure, parental education, and survey fixed effects.

Source: Ghana Living Standards Survey (Rounds 3-5: 1991/92, 1998/99, and 2005/06)

Research Question 2: *Did individuals from the last of the “Lost Generations” among eligible adult literacy program participants—that is, the particularly vulnerable group of individuals who had never completed any formal education—respond differently than other cohorts in terms of adult literacy program participation (possibly owing both to increased internal and external pressures)?*

As previously mentioned, there are reasons why the group of individuals who had never attended the formal education system—itsself the main target group of adult literacy programs in the first place—might respond differently to the Crisis than other Ghanaians. In particular, this group would seem to be a particular vulnerable group in the labor market due to their lack of skills. Therefore, if facing increased pressures from increased competing labor supply of similarly low skilled workers, they might find it particularly important to increase their skills to improve their labor market outcomes—with a strong contender for such increased competing low-skilled labor supply stemming from the influx of more than one million Ghanaian refugees from Nigeria in early 1983, amounting to an expansion of the population of almost 10 percent (Shillington, 1992)—many of whom likely unskilled (or at least low-skilled) laborers. As mentioned in the discussion of adult literacy programs in Ghana and their specific contents in Section 2 the scope for skills-upgrading from adult literacy program participation is potentially quite wide—involving literacy and numeracy skills, written calculation skills,²¹ and skills specifically related to income generating activities, as well as possible network effects.²²

Restricting the sample to Ghanaians who never attended the formal education system reveals that this group did in fact respond differently than Ghanaians overall—namely by attending adult literacy programs in greater numbers than both previous but especially subsequent cohorts (Figure 2). Indeed, while the experience for Ghanaians overall was one of an almost consistently decreasing trend in adult literacy program participation across cohorts (Figure 1), Ghanaians from the pre-Crisis and Crisis cohorts who never attended the formal education system as children participated in adult literacy programs in far greater numbers and at a far more steady level across cohorts than were the case for Ghanaians overall—even with an

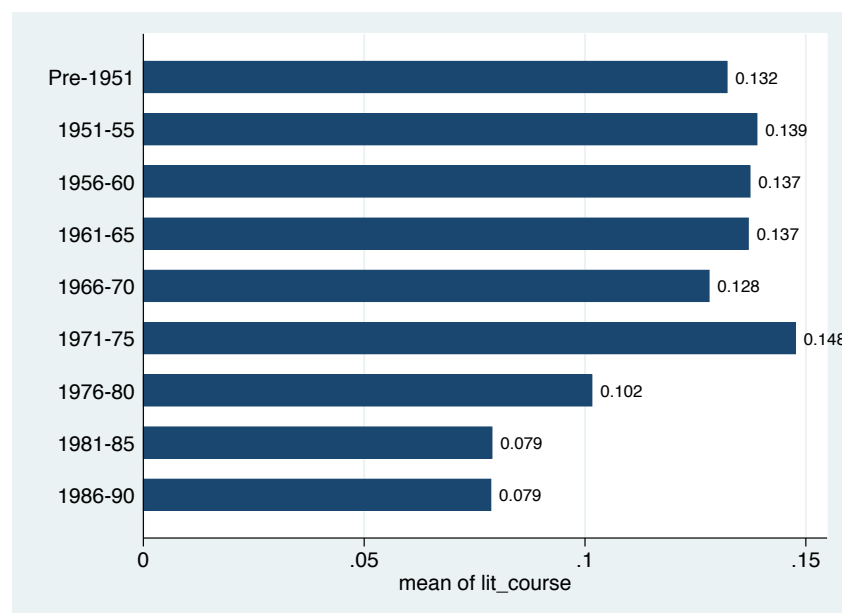
²¹ Though in practice adult literacy program participation frequently does not lead to literacy or numeracy proficiency both in Ghana (Blunch, 2006, 2008; Blunch and Pörtner, 2011) and elsewhere (Abadzi, 1994; Ortega and Rodríguez, 2008).

²² Anecdotal evidence for this observed during travels in rural Ghana (Blunch) include female participants getting together—outside of the actual program—to build an oven for baking bread and subsequently selling it in the market.

increase in the participation rates among the Crisis cohort, increasing from 12.8 percent among the pre-Crisis cohort to 14.8 percent among the Crisis cohort. From Table 3 below, this result holds when also including additional explanatory variables to the adult literacy program participation-cohort relationship: controlling for other factors, the Crisis cohort is between about 2.5 and about 4.0 percentage-points more likely to participate in an adult literacy program, relative to the oldest cohort. Also, adult literacy program participation is consistently less likely for subsequent cohorts (though not always statistically significantly so).²³

In turn, these results are consistent with this group proactively up-skilling themselves in response to the impact of the Crisis overall, though perhaps in particular in response to the increased competition in the lower end of the skills distribution in the labor market following the influx of competing labor from returning Ghanaians (de facto refugees) from Nigeria in early 1983.

Figure 2. Non-formal Education across Birth Cohorts: Individuals With No Formal Education



Notes: Calculations incorporate sampling weights. N = 11,523 observations.

Source: Ghana Living Standards Survey (Rounds 3-5: 1991/92, 1998/99, and 2005/06).

²³ Additionally, there are a few statistically significant, positive coefficients for some of the earlier cohorts, as well. These do not seem to detract from the overall storyline here, however.

Table 3. Birth Cohort Coefficients from Adult Literacy Program Participation Regressions Using Four Alternative Measures of Educational Access For Individuals Who Never Attended School (Linear Probability Model/OLS): Core Specification (No Interactions)

	<i>Current Access</i>	<i>Access in 1970</i>	<i>Access at Relevant Age (Binary)</i>	<i>Age Relevant Exposure (Years)</i>
1951-55	0.02 [0.014]	0.023 [0.014]	0.019 [0.014]	0.025* [0.014]
1956-60	0.023* [0.013]	0.024* [0.013]	0.019 [0.014]	0.028** [0.013]
1961-65	0.019 [0.015]	0.021 [0.015]	0.016 [0.016]	0.027* [0.015]
1966-70	0.007 [0.012]	0.009 [0.012]	0.003 [0.013]	0.016 [0.013]
1971-75	0.029* [0.015]	0.031** [0.015]	0.025* [0.015]	0.040** [0.016]
1976-80	-0.021 [0.018]	-0.019 [0.017]	-0.025 [0.020]	-0.009 [0.017]
1981-85	-0.038** [0.016]	-0.035** [0.017]	-0.040** [0.020]	-0.024 [0.018]
1986-1990	-0.037* [0.019]	-0.042** [0.020]	-0.047** [0.023]	-0.027 [0.021]
R ²	0.033	0.028	0.026	0.028
N	11,523	11,523	11,523	11,523

Notes: This is an excerpt from Appendix Table A6, where the full results can be found. Calculations incorporate sampling weights. Robust Huber-White (Huber, 1967; White, 1980) standard errors, adjusted for within-cluster correlation/clustering (Wooldridge, 2010), in brackets under parameter estimates. ***: statistically significant at 1 percent; **: statistically significant at 5 percent; *: statistically significant at 10 percent. The reference category is “pre-1951” (birth cohort). The additional explanatory variables include a dummy variable for gender, region of birth, region of current residence, educational access/exposure, parental education, and survey fixed effects.

Source: Ghana Living Standards Survey (Rounds 3-5: 1991/92, 1998/99, and 2005/06).

Research Question 3: *Is there additional evidence of (more indirect) substitution between formal and non-formal education related to the access to formal and non-formal education in the community?*

In addition to the substitution between formal and non-formal education in terms of overall education demand documented previously, it is possible that there is a more indirect substitution between formal and non-formal education coming through the access to educational

facilities in the local community. Our prior here is that the presence of formal educational facilities in the community increases formal educational attainment and similarly decrease the participation in adult literacy programs: children are more likely to attend formal education when there are schools present in the community and are therefore less likely to participate in adult literacy program as adults. Similarly, presence of adult literacy programs in the community is expected to increase the participation in adult literacy program—and possibly similarly decrease formal educational attainment.²⁴ Table 1 presents the results from formal educational attainment (Linear Probability Model/OLS) regressions using the explanatory variables discussed in Section 3, including four alternative measures of educational access in the local community (Current Access; Access in 1970; Access at Relevant Age (Binary), and Age Relevant Exposure (Years)).

Access to educational facilities in the community is seen to exert a strong independent relationship with formal educational attainment. Most consistently across all the four specifications of educational access, access to formal educational institutions in the community is strongly positively associated with formal educational attainment. For the specification using current access, for example, individuals who have access to a primary school in the community are about 6.4 percentage-points more likely to have ever attended school, almost 10 percentage-points more likely to have completed primary or higher, and have completed almost one year more formal education, on average.

Moving to the adult literacy program participation results, access to formal educational facilities in the community turns out to not be important—again supporting the conjecture of non-formal education being education of the last resort. Access to adult literacy programs in the community matters, though, with current access being associated with between a 5.1 and a 6.6 percentage-points higher probability of an individual attending an adult literacy program for the two different estimations sample, respectively. For the sample including formal education completers age relevant exposure to adult literacy programs in the community also matters both statistically and, to a lesser degree, substantively, at 0.2 percentage-points per year of exposure—so that 5 years of exposure to an adult literacy program in the community will increase the probability of participation in this program by 1 percentage-point.

²⁴ Though the amount of substitution probably is much less pronounced (if even existent) in the direction from presence of adult literacy programs to formal educational attainment than from the presence of formal educational facilities to adult literacy program participation.

Table 4. Education Access Coefficients from Formal Educational Attainment Regressions Using Four Alternative Measures of Educational Access with Formal School Attendees Included in Estimation Sample (Linear Probability Model/OLS): Core Specification (No Interactions)

	<i>Current Access</i>			<i>Access in 1970</i>			<i>Access at Relevant Age (Binary)</i>			<i>Age Relevant Exposure (Years)</i>		
	<i>Ever attended</i>	<i>Primary and above</i>	<i>Years of schooling</i>	<i>Ever attended</i>	<i>Primary and above</i>	<i>Years of schooling</i>	<i>Ever attended</i>	<i>Primary and above</i>	<i>Years of schooling</i>	<i>Ever attended</i>	<i>Primary and above</i>	<i>Years of schooling</i>
Adult literacy program	-0.007 [0.016]	-0.007 [0.012]	-0.039 [0.127]	-0.015 [0.057]	0.006 [0.064]	-0.244 [0.611]	0.013 [0.021]	0.023 [0.020]	0.087 [0.196]	0 [0.001]	0.001 [0.001]	0.006 [0.010]
Primary school	0.064*** [0.014]	0.095*** [0.013]	0.923*** [0.143]	0.083*** [0.015]	0.097*** [0.012]	1.016*** [0.133]	0.122*** [0.014]	0.128*** [0.011]	1.334*** [0.121]	0.002*** [0.000]	0.002*** [0.000]	0.021*** [0.004]
Secondary school	0.115*** [0.037]	0.087*** [0.019]	1.168*** [0.212]	0.073** [0.031]	0.090*** [0.026]	1.365*** [0.414]	0.063** [0.025]	0.088*** [0.023]	1.272*** [0.355]	0.004** [0.002]	0.003*** [0.001]	0.053*** [0.013]
R ²	0.408	0.363	0.355	0.407	0.364	0.356	0.414	0.37	0.363	0.405	0.359	0.352
N	23,179	23,179	23,179	23,179	23,179	23,179	23,179	23,179	23,179	23,179	23,179	23,179

Notes: This is an excerpt from Appendix Table A5, where the full results can be found. Calculations incorporate sampling weights. Robust Huber-White (Huber, 1967; White, 1980) standard errors, adjusted for within-cluster correlation/clustering (Wooldridge, 2010), in brackets under parameter estimates. ***: statistically significant at 1 percent; **: statistically significant at 5 percent; *: statistically significant at 10 percent. The additional explanatory variables include a dummy variable for gender, birth cohorts, region of birth, region of current residence, educational access/exposure, parental education, and survey fixed effects.

Source: Ghana Living Standards Survey (Rounds 3-5: 1991/92, 1998/99, and 2005/06).

Table 5. Education Access Coefficients from Adult Literacy Program Participation Regressions Using Four Alternative Measures of Educational Access with Formal School Attendees Included in Estimation Sample (Linear Probability Model/OLS): Core Specification (No Interactions)

	<i>Including formal education completers:</i>				<i>Individuals who never attended school:</i>			
	<i>Current Access</i>	<i>Access in 1970</i>	<i>Access at Relevant Age (Binary)</i>	<i>Age Relevant Exposure (Years)</i>	<i>Current Access</i>	<i>Access in 1970</i>	<i>Access at Relevant Age (Binary)</i>	<i>Age Relevant Exposure (Years)</i>
Adult literacy program	0.051*** [0.008]	0.001 [0.028]	0.006 [0.012]	0.002** [0.001]	0.064*** [0.011]	-0.019 [0.036]	-0.007 [0.027]	0.001 [0.001]
Primary school	-0.013 [0.012]	0.003 [0.010]	-0.005 [0.009]	0 [0.000]	-0.011 [0.015]	0.014 [0.014]	0.006 [0.014]	0.001 [0.000]
Secondary school	-0.009 [0.011]	0.029 [0.023]	-0.004 [0.014]	0 [0.001]	0.015 [0.018]	0.078* [0.041]	0.044 [0.052]	0.001 [0.001]
R ²	0.037	0.032	0.032	0.033	0.033	0.028	0.026	0.028
N	21,559	21,559	21,559	21,559	11,523	11,523	11,523	11,523

Notes: This is an excerpt from Appendix Table A6, where the full results can be found. Calculations incorporate sampling weights. Robust Huber-White (Huber, 1967; White, 1980) standard errors, adjusted for within-cluster correlation/clustering (Wooldridge, 2010), in brackets under parameter estimates. ***: statistically significant at 1 percent; **: statistically significant at 5 percent; *: statistically significant at 10 percent. The additional explanatory variables include a dummy variable for gender, birth cohorts, region of birth, region of current residence, educational access/exposure, parental education, and survey fixed effects.

Source: Ghana Living Standards Survey (Rounds 3-5: 1991/92, 1998/99, and 2005/06).

Research Question 4: *Does geography matter for formal educational attainment and adult literacy program participation? Here the priors are that (i) individuals from the three most northern regions (Upper East, Upper West, and Northern) are less likely to have attended any formal education and for fewer years and either more (the Catching-Up Hypothesis) or less (the Discouragement/ Scarring Hypothesis) likely to have participated in an adult literacy program relative to individuals from the capital region of Greater Accra (if not relative to all the seven most southern regions as a whole); and that (ii) there are differences in the importance of region of birth versus region of residence for formal educational attainment and adult literacy program participation, so that region of birth matters most, if not exclusively.*

The relationship between formal educational attainment and region of birth appears to be a strong one, with the three most northern regions (Upper East, Upper West, Northern) exhibiting far lower levels of formal educational attainment than the capital region of Accra (as well as all the other six regions) (Appendix Table A5). For example, individuals from the Northern region are about 28 to 30 percent less likely to have ever attended school and about 20 to 22 percent less likely to have completed primary school than individuals from the Greater Accra region. From Table A5, the relationship between formal educational attainment and region of residence is far weaker, both in substantive and statistical terms. In addition to the individual estimates and their statistical significance being far stronger for region of birth than for region of residence, this is further supported by the F-tests for joint statistical significance of the region of birth versus those of the region of current residence—where the statistical significance of region of birth as a whole once again appears far stronger than that of the region of current residence. In turn, this indicates that controlling for an individual’s current place of residence in studies of formal educational attainment and its determinants is not sufficient—the relevant spatial control is rather an individual’s place of birth.

Once again, this highlights the importance of educational access and quality—or “geographic initial conditions”—for formal educational attainment, since the geographic birth place will frequently be where an individual will undertake at least the initial part of one’s education (migration for educational purposes certainly will become potentially much more important at the higher levels, especially for tertiary education). To ensure that this is not a spurious result, we also examined the relationship between region of birth and region of current residence and found that while many live in the region where they were also born, there is also

some inter-regional movement (Appendix Tables A3 and A4). In turn, the existence of inter-regional migration lends support to being able to make a claim of region of birth being more important than region of current residence (had there been no inter-regional migration to speak of, disentangling the effect of region of birth versus region of current residence would not be possible in the first place).

Turning to adult literacy program participation, it again turns out that the relationship with region of birth is stronger—both in substantive and statistical terms—than that with region of current residence. The results again are consistent with our prior, this time that individuals from the three most northern regions (Upper East, Upper West, Northern) are more likely to have participated in an adult literacy program than individuals from the capital region of Accra—though this is far stronger for the sample of individuals who never went to school (Appendix Table A6, the four right-most columns). For example, individuals from the Northern region are up to about 6 to 7 percent more likely to have participated in an adult literacy program than individuals from the Greater Accra region. This is once again additionally supported by the F-tests for joint statistical significance of region of birth versus region of current residence (though again more pronounced for the sample of individuals who never went to school—i.e. the main target group of these programs). In turn, this again indicates that controlling for an individual's current place of residence in studies of educational attainment and its determinants is not sufficient—the relevant spatial control is rather an individual's place of birth.

Research Question 5: Is there evidence of intergenerational transmission of human capital—and does this transmission differ between formal education and adult literacy program participation?

From Table A5 in the Appendix there is a substantial degree of intergenerational transmission of human capital for formal education, with children of educated parents being more likely to have attended school, to have completed primary education, and to have completed more years of education—for both maternal and paternal education. For the most part, this transmission is higher the more formal education the parents have completed. For example, from the second column children of mothers with primary education are about 12 percentage-points more likely to complete primary education and have about one more year of schooling more than children of mothers with less than primary education—as compared to about 17 percentage-points more

likely to complete primary education and about 2.6 years of schooling more if mothers have completed middle/junior secondary. As a whole, parental education is highly statistically significant, with F-statistics mostly exceeding 50 (Table A5, in the Appendix).

The above contrasts starkly with the evidence (or lack thereof) of intergenerational transmission of human capital for adult literacy program participation in Table A6. As expected, the coefficients are mostly negative, indicating that when parents have completed formal education, their children are less likely to attend adult literacy programs (presumably because they, too, have completed formal education during their childhood—though these effects are both quite small in substantive term and also very imprecisely measure and therefore statistically insignificant. Taken as a whole, parental education is highly statistically insignificant, with F-statistics around one in all cases.

Research Question 6: *How do the previous results change if taking into account that interaction effects might exist—so that for example people born in the Northern regions may be more affected by the Crisis?*

Based on the previous results, indicating that region of residence was hardly significant (neither statistically nor substantively) so as to condense the results into a tractable amount we now examine interaction effects from models considering only region of birth as the relevant spatial control. We do this by further aggregating region of birth into two main groups, namely North (Northern, Upper Eastern, and Upper Western regions) and South (all the seven remaining regions). We also aggregate birth cohorts into only three cohorts, namely pre- (born prior to 1971), during (born between 1971 and 1975) and post- (born after 1975)—thereby focusing exclusively on the last of the “Lost Generations”. We then interact birth cohort with place of birth, as well as with access to educational facilities, and also interact place of birth with access to educational facilities (Tables A7-A10).

Testing first for the joint statistical significance of the interaction effects, it is clear that these are relevant as a whole, for both formal education and adult literacy program participation and all their individual specifications (Tables A9 and A10 in the Appendix). Considering next the overall average marginal effects for each explanatory variable for the formal educational attainment regressions from Table A7 some of the variables become more important when allowing for interaction effects in this more disaggregated model (with respect to birth cohort

and place of birth). For example, the total average marginal effect of being born in one of the three northern regions is associated with almost minus 40 percentage-point less probability of having ever attended school for the current access specification, where this was ranging between minus 28.5 and minus 32.4 percentage-points for the previous (i.e., non-interacted) specification. Having access to a secondary school in the local community also comes out stronger now—considering again the current access specification the probability of having ever attended school increases with 3 percentage points, to 14.5 percentage-points (from 11.5 percentage-points for the specification without interaction effects, in Table A5).

While the interacted specification takes away the “blip” in adult literacy program participation for the crisis-cohort for the sample of individuals who never attended school, from Table A8 this cohort remains “the last of the lost generations”: after this cohort, adult literacy program participation consistently went down, in favor of formal schooling. The North-South differential in adult literacy program participation from Table A6 now comes out clearer: instead of having the Northern, Upper East and Upper West as intermediate cases, in between Greater Accra (the reference region in that table) and the other regions, it now comes out very clearly how the three northern regions, as whole, have seen far lower adult literacy program participation than the rest of the country (at about minus four percentage-points for individuals who never attended school). In turn, this strongly supports the “Scarring Hypothesis” in the geographical dimension: if you didn’t go to school as a child, rather than making up for that when adult (through participation in adult literacy programs), you are actually less likely to make it up if growing up in a resource-poor area (such as the three northern regions, relative to the rest of Ghana).

Research Question 7: *In addition to the evidence of formal educational attainment decreasing following the eroding quality of the formal education system in the 1970s (as experienced by the 1966-70 cohort) though not following the overall economic breakdown in 1983 (as experienced by the 1971-75 cohort) in **nominal** terms, is there any evidence that formal educational attainment might also have decreased **in real** (i.e., **quality-adjusted**) terms following the eroding quality of the formal education system in the 1970s and the subsequent overall economic breakdown in 1983?*

At the face of it, then, while the pre-crisis cohort (born 1966-70) experienced a decrease

in educational attainment following the deteriorating education system of the 1970s, it appears that this was not the case for the second of the two crisis cohorts—the “last of the lost generations.” This disregards several potential issues, however. Most importantly, even if formal educational attainment appears to increase in nominal terms overall, this could mask a stagnant or even decreasing formal education stock, in quality-adjusted terms. That is, a year of education obtained during the times of the (declining, quality-wise) education system of the 1970s is not the same as one obtained either before or, especially, after (when the economy, including the quality of the formal education system really started to improve, after the overall breakdown in 1983 and the subsequent structural adjustment programs and improved economy)—in *quality* adjusted terms.

Also, it is possible that the decline in the quality of the formal education system led to an increase in demand for non-formal education—namely adult literacy programs—*above* what it would otherwise have been and an increase in the demand for formal education *below* what it would otherwise have been. This is somewhat confirmed by the results in Figure 1, with the fairly steep decrease in adult literacy program participation after the second crisis cohort—that is, after the quality of the *formal* education system is starting to improve, following the improvement of the economy in the years after the overall economic breakdown in 1983. Alternatively, one could view the crisis cohort as the last of the “Lost Generations,” human capital-wise, following a period of adult literacy program participation consistently around 12-13 percent of a cohort and with significant drops in participation thereafter—as the quality of the formal education system also starts improving again (exemplified, among other initiatives, with the 1987 Education Sector Reform). Again, these observations come out even clearer for the sample of individuals who never attended formal education, where the incidence of adult literacy program participation even peaks for the Crisis-cohort, and then drops by a third and then by a fifth (Figure 1, above). Similarly, it appears from Figure 1 that the increasing trend in formal educational attainment got dampened somewhat for the pre-crisis cohort (born 1966-70) and Crisis-cohort (born 1971-75), and then really picked up for the subsequent cohorts. Once again, these patterns hold when allowing for other factors acting as mediating factors in a multivariate analysis, as seen from Tables A5 and A6 in the Appendix.

In turn, while admittedly speculative and by no means providing definitive evidence, these findings nevertheless are consistent with the presence of at least some substitution between

formal and non-formal education for the 1966-70 and 1971-75 cohorts—possibly reflecting (if not caused by) the twin issues of the deteriorating education system in the 1970s culminating in the economic breakdown in 1983, and the increased focus on education (quantity and quality) in Ghana in the decades thereafter. Again, while this is potentially due to the declining quality of the formal education system in Ghana during the 1970s, it could also be due to the overall declining economy, with increased poverty and the associated lack of resources in many households to cover school uniforms and school fees.

Is there any way to try to disentangle these different explanations? One possible measure of the overall quality of formal schooling is its monetary return. Hence, a simple test of this would seem to be to estimate the returns to education across cohorts and then compare these to examine which cohort(s) experienced the relatively higher school quality (at least in terms of the monetary return) and whether any cohorts appear particularly disadvantaged. Table A11 in the Appendix shows the results from estimating simple Mincer earnings equations across birth cohorts.²⁵ From these results, the returns to schooling experience a steady increase from 4.3 percent for the first cohort up until and including the 1956-60 cohort—where the return is 5.6 percent per year of schooling—and then stays around that level for the next cohort, at 5.4 percent per year of schooling.²⁶ For the 1961-65 cohort the returns to schooling then are cut by more than a third, and then they dip with the last of the “Lost Generations,” at 3 percent. For the cohort thereafter the return to schooling then starts to recover, at almost 5 percent. To explore this further (and to also add statistical power to the analysis), we also ran pooled regressions including instead cohort dummies plus interactions with years of schooling for the two affected cohorts (columns 8 and 9 in Table A11 in the Appendix). Again the results support declining returns for years of schooling for the 1961-65 and 1971-75 cohorts, though more so for the latter—once again supporting this cohort being the last of the “Lost Generations,” leading up to the 1983 national economic breakdown (and subsequent recovery).

To explore interaction effects related to birth cohort and geographical area of birth, we also added interactions of these two variables to the simple specification (Appendix, Table

²⁵ Possibly due to the low number of observations the returns to schooling for the most recent cohorts were negative, though not statistically significant, so we focus on the first seven cohorts in the analysis here.

²⁶ This is in line with the findings in Canagarajah and Thomas (1997), who find average returns of about 4-6 percentage points per year of schooling across all adults.

A10).²⁷ From the table, individuals born in the North, who were also born in one of the two cohorts particularly affected by the declining education system of the 1970s were also harder hit in terms of their returns to that education—although this effect is only statistically significant for the 1966-70 cohort (column 9).

In turn, this simple test supports a conjecture of the *quality* of the formal education system deteriorating during the 1970s and then recovering thereafter (even as the *quantity* of formal education in terms of coverage of the formal education system in Ghana increased throughout). While the last of the “Lost Generations” was therefore hit once, though hit the hardest, in terms of the lower returns to schooling, the second-to-last of the “Lost Generations” was hit twice: first in terms of lower levels of formal educational attainment and second in terms of the returns to that education.

5. Conclusion

This paper examines whether there is any evidence of substitution between formal and non-formal education during times of economic decline and recovery for the case of Ghana exploring both direct and indirect possible pathways. The results reveal a substantial substitution between formal and non-formal education overall, with formal educational attainment increasing across the generations overall, while the participation in adult literacy programs has seen a similar decline across the generations overall. Additional evidence suggested that there was also indirect substitution through access to educational institutions in the area, so that increased access to either school or adult literacy programs would increase schooling and literacy program participation, respectively. The results also revealed that the individuals exposed to the declining education system of the 1970s were hit in terms of their human capital accumulation—the last of the “Lost Generations” once, in terms of their returns to formal schooling, while the cohort before that, born in 1966-70, was hit twice namely both in terms of their formal educational attainment and in terms of their returns to that education. Additionally, we found evidence that the last of the “Lost Generations”—born just prior to the economic breakdown of 1983—who had not attended the formal education system, used adult literacy program participation as a coping mechanism for the increased competition following the influx of the roughly one million

²⁷ Where the geographical area of birth is defined similar to the interaction models of educational attainment (i.e. “North” containing the Northern, Upper East and Upper West regions and “South” containing the seven remaining regions).

return migrants from Nigeria that same year (many of whom would likely be unskilled, as well).

These results, thus, at the outset may primarily seem to suggest that the quality of the formal education system should be a priority. However, in a population where many people are poor, the formal education system may not be an option especially in rural areas, where both the access to and quality of formal education frequently is poor. Instead, adult literacy programs may be a much more relevant alternative for the poor and people living in remote areas without access to formal education. Again, adult literacy programs are specifically targeted at youth and adults with only limited schooling and also, in addition to their primary focus on literacy and numeracy, typically incorporate health knowledge and income generating components. In turn, this indicates that these programs are potentially beneficial not only in terms of literacy and numeracy per se but also in terms of public health and income generation.²⁸ Hence, while—as shown in this paper—less and less Ghanaians fall through the cracks of childhood education in the formal education system, there is still a large number of young people and adults who have never gone to school or at least only for a limited duration, especially in rural areas and the three poorest regions in the northern part of Ghana. Adult literacy programs in Ghana, therefore, should still be interesting for policy makers as a vehicle to increase the basic skills stock of Ghanaians who have fallen through the cracks of the traditional education system both in terms of basic literacy and numeracy and in terms of health knowledge and income generation.

Indeed, based on the results obtained here (Appendix Table A7) it is possible—and useful, it would seem, for policy makers—to consider a more general profile of adult literacy program participants. First, despite the widespread gender gap in formal education—which is why adult literacy programs were also initially specifically targeted towards women, as also discussed in Section 2 (NFED, 1999), participants are still more likely to be male than female—at between about 3 and 7 percentage-points (Table A6 in the Appendix). This indicates that the targeting of programs have not been as originally intended—which is something policy makers would seem interested in changing in the future. Participants also tend to be older, so that the younger cohorts are much less likely to participate in adult literacy programs than the older cohorts (Table A6 in the Appendix), which is as intended: the Ghanaian formal education system has expanded substantially in recent years (though still not enough to truly provide “Education for All,” as intended), so that it is still the older generations that lack behind in terms of (formal)

²⁸ See Blunch (2013, 2017, 2018) and Blunch and Pörtner (2011).

educational attainment, thus having more need for adult literacy programs as their source of individual human capital development. As for the geographical variation, Ghanaians born outside of the capital region of Greater Accra are much more likely to participate in adult literacy programs. This reflects the geographical “catching up” due to lacking resources in the rest of Ghana relative to the Greater Accra region, related to differences in both the quantity and quality of the formal education system (only the former of which we are able to control for in the analysis, and only crudely so). While there does not seem to be too strong a relationship with parental education when profiling adult literacy program participants in more detail, we note that a lot of that effect has probably been accounted for by the other explanatory variables.

More research is needed, however, to shed light on some of the issues raised in this paper. It would, for example, also potentially be useful to examine how the crisis affected other educational outcomes such as attitudes towards education and the educational attainment of the children of those who grew up during the crisis. It might then be useful to extend these results to look at (even if only tentatively) the aggregate labor market implications. Given the extensive analysis already conducted in this study, however, we leave this as a topic for possible future research. Also, adult literacy programs have been offered for a long time, and across several continents and countries, so one particular interesting direction for further research is whether the results obtained here hold for other countries during times of a declining formal educational system and/or economic crisis.

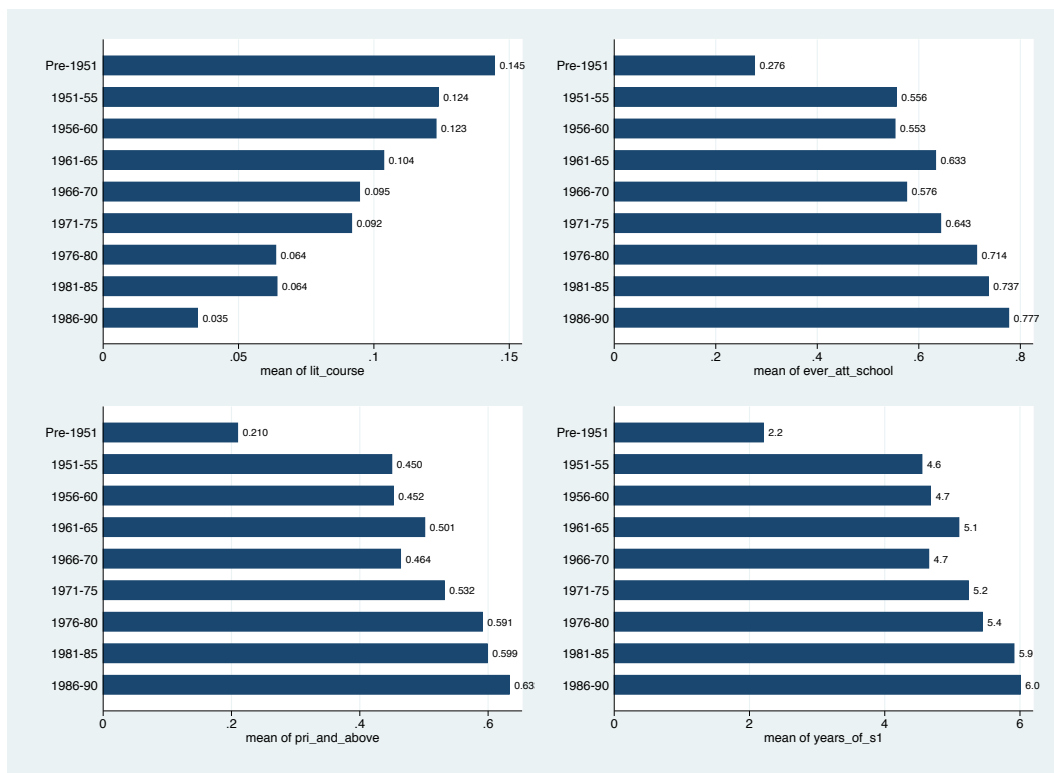
References:

- Abadzi, Helen (1994) "What We Know about Acquisition of Adult Literacy: Is There Hope?" World Bank Discussion Paper no. 245, World Bank, Washington, DC.
- Alderman, Harold (1994) "Ghana: Adjustment's Star Pupil?" in David E. Sahn (ed) *Adjusting to Policy Failure in African Economies*, Ithaca: Cornell University Press.
- Behrman, Jere R. (2010) "Investment in Education—Inputs and Incentives," in: Dani Rodrik and Mark R. Rosenzweig (Eds.) *Handbook of Development Economics*, Vol. 5, Amsterdam: Elsevier.
- Blunch, Niels-Hugo (2006) *Skills, Schooling and Household Well-Being in Ghana*, Unpublished PhD Dissertation, The George Washington University, Washington, DC.
- Blunch, Niels-Hugo (2008) "Maternal Literacy and Numeracy Skills and Child Health in Ghana," in Ernest Aryeetey and Ravi Kanbur (Eds.): *Economy of Ghana: Analytical Perspectives on Stability, Growth and Poverty*, Oxford: James Currey.
- Blunch, Niels-Hugo (2013) "Staying Alive: Adult Literacy Programs and Child Mortality in Rural Ghana," *World Development* 42(1): 114–126.
- Blunch, Niels-Hugo (2014) "Literacy and Numeracy Skills and Education Sector Reform: Evidence from Ghana," *Education Economics* 22(2): 209-235.
- Blunch, Niels-Hugo (2017) "Adult Literacy Programs in Developing Countries," *IZA World of Labor* 2017: 374.
<https://wol.iza.org/uploads/articles/374/pdfs/adult-literacy-programs-in-developing-countries.pdf?v=1>
- Blunch, Niels-Hugo (2018) "A Teenager in Love: Multidimensional Human Capital and Teenage Pregnancy in Ghana," *The Journal of Development Studies* 54(3): 557-573.
- Blunch, Niels-Hugo and Claus Pörtner (2005) "Literacy, Skills and Welfare: Effects of Participation in an Adult Literacy Program," University of Washington Economics Department Working Paper Series, UWEC-2005-23, University of Washington, Seattle.
- Blunch, Niels-Hugo and Claus C. Pörtner (2011) "Literacy, Skills, and Welfare: Effects of Participation in Adult Literacy Programs," *Economic Development and Cultural Change* 60(1): 17-66.
- Canagarajah, Sudharshan and Claus Pörtner (2003) "Evolution of Poverty and Welfare in Ghana in the 1990s: Achievements and Challenges," Africa Region Working Paper Series No. 61, Washington, D.C.: The World Bank.
- Canagarajah, Sudharshan and Saji Thomas (1997) "Ghana's Labor Market (1987-92)," Policy Research Working Paper No. 1752, Washington DC: World Bank.
- Canagarajah, Sudharshan and Xiao Ye (2001) "Public Health and Education Spending in Ghana in 1992-98," Policy Research Working Paper No. 2579, Washington DC: World Bank.
- Chao, Shiyen (1999) "Ghana: Gender Analysis and Policymaking for Development," World Bank Discussion Paper No. 403, Washington DC: World Bank.
- Cobbe, James (1991) "The Political Economy of Education Reform in Ghana," in Donald Rothchild (ed), *Ghana: The Political Economy of Recovery*, SAIS African Studies Library, Boulder: Lynne Rienner Publishers.
- EIU (2001) *Country Profiles: Ghana*, London: The Economist Intelligence Unit.

- Glewwe, Paul and Michael Kremer (2006) "Schools, Teachers, and Education Outcomes in Developing Countries," in: Eric A. Hanushek and Finis Welch (Eds.) *Handbook of the Economics of Education*, Volume 2 Amsterdam: Elsevier.
- GOG (1995) 'Ghana-Vision 2020 (The First Step 1996-2000)', Accra, Ghana: Government of Ghana.
- Hammer, Jeffrey (2013) "Balancing Market and Government Failure in Service Delivery," *Lahore Journal of Economics* 18:1-19.
- Huber, P. J. (1967) "The Behavior of Maximum Likelihood Estimates under Nonstandard Conditions," In: *Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability* Vol. 1, Berkeley, CA: University of California Press.
- Naylor, Rachel (2000) *Ghana: The Background, the Issues, the People*, Oxford: Oxfam GB.
- Orazem, Peter F. and Elizabeth M. King (2008) "Schooling in Developing Countries: The Roles of Supply, Demand and Government Policy," in: T. Paul Schultz and John Strauss (Eds.) *Handbook of Development Economics*, Vol. 4, Amsterdam: Elsevier.
- Ortega, Danile and Francisco Rodríguez (2008) "Freed from Illiteracy? A Closer Look at Venezuela's Misión Robinson Literacy Campaign," *Economic Development and Cultural Change* 57(1): 1-30.
- Shillington, Kevin (1992) *Ghana and the Rawlings Factor*, London and Basingstoke: Macmillan Education Ltd.
- White, H. (1980) "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity," *Econometrica* 48(4): 817-830.
- Wooldridge, J. M. (2010) *Econometric Analysis of Cross-section and Panel Data* (2nd ed.), Cambridge, Massachusetts: The MIT Press.

APPENDIX: Additional Figures & Descriptive Statistics Plus Full Set of Regression Results

Figure A1. Substitution Between Formal and Non-formal Education across Birth Cohorts (Sensitivity Analysis: Excluding Individuals Surveyed During the First 8 Months of the GLSS 3)



Notes: Calculations incorporate sampling weights. N = 19,310 observations.

Source: Ghana Living Standards Survey (Rounds 3-5: 1991/92, 1998/99, and 2005/06).

Table A1. Descriptive Statistics for Dependent and Explanatory Variables: Formal and Non-formal Education Analysis

	<i>Formal Educational Attainment Analysis:</i>		<i>Adult Literacy Program Participation Analysis:</i>			
			<i>Including formal education completers:</i>		<i>Individuals who never attended school, only:</i>	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Dependent variables:						
Ever attended school	0.526	0.009				
Primary and above	0.439	0.008				
Years of schooling	4.295	0.090				
Adult literacy program participation			0.104	0.004	0.130	0.006
Explanatory variables:						
Years of schooling			3.907	0.097		
Female	0.541	0.003	0.554	0.003	0.665	0.005
Born before 1951	0.270	0.005	0.277	0.005	0.427	0.009
1951-55	0.077	0.002	0.074	0.002	0.077	0.003
1956-60	0.100	0.002	0.096	0.002	0.095	0.003
1961-65	0.108	0.003	0.104	0.003	0.090	0.003
1966-70	0.125	0.003	0.119	0.003	0.110	0.003
1971-75	0.116	0.003	0.109	0.003	0.086	0.003
1976-80	0.107	0.003	0.116	0.003	0.065	0.003
1981-85	0.056	0.002	0.061	0.002	0.031	0.002
1986-1990	0.040	0.002	0.043	0.002	0.019	0.002
<i>Region of birth:</i>						
Western	0.086	0.010	0.084	0.011	0.061	0.008
Central	0.110	0.010	0.109	0.011	0.096	0.009
Greater-Accra	0.026	0.004	0.027	0.004	0.022	0.004
Eastern	0.142	0.013	0.139	0.014	0.093	0.010
Volta	0.126	0.012	0.126	0.012	0.100	0.010
Ashanti	0.141	0.010	0.136	0.011	0.080	0.007
Brong-Ahafo	0.083	0.010	0.078	0.010	0.063	0.007
Northern	0.133	0.015	0.142	0.016	0.227	0.023
Upper-East	0.083	0.010	0.088	0.010	0.147	0.017
Upper-West	0.055	0.009	0.057	0.010	0.090	0.014
Foreign country	0.013	0.001	0.014	0.001	0.021	0.002
<i>Region of residence:</i>						
Western	0.107	0.013	0.104	0.014	0.079	0.010
Central	0.107	0.012	0.105	0.012	0.092	0.010
Greater Accra	0.019	0.004	0.020	0.005	0.018	0.005

Eastern	0.154	0.016	0.153	0.017	0.114	0.014
Volta	0.114	0.013	0.113	0.014	0.089	0.012
Ashanti	0.148	0.013	0.144	0.013	0.094	0.009
Brong-Ahafo	0.099	0.014	0.095	0.014	0.087	0.011
Northern	0.130	0.016	0.139	0.017	0.220	0.024
Upper-East	0.074	0.010	0.079	0.011	0.131	0.018
Upper-West	0.047	0.010	0.049	0.011	0.076	0.015
<i>Definition of Education Access/Exposure:</i>						
<i>(i) Current Access</i>						
Adult literacy program	0.725	0.020	0.726	0.021	0.721	0.022
Primary school	0.828	0.015	0.818	0.016	0.801	0.019
Secondary school	0.097	0.014	0.095	0.015	0.062	0.009
<i>(ii) Access in 1970</i>						
Adult literacy program	0.018	0.006	0.019	0.007	0.019	0.007
Primary school	0.615	0.021	0.600	0.022	0.523	0.024
Secondary school	0.028	0.008	0.025	0.008	0.018	0.005
<i>(iii) Access at Relevant Age (Binary)</i>						
Adult literacy program	0.072	0.006	0.077	0.006	0.041	0.006
Primary school	0.509	0.016	0.493	0.017	0.330	0.015
Secondary school	0.034	0.007	0.032	0.007	0.010	0.003
<i>(iv) Age Relevant Exposure (Years)</i>						
Adult literacy program	4.752	0.221	5.048	0.238	4.778	0.276
Primary school	22.101	0.528	22.175	0.562	22.904	0.698
Secondary school	1.151	0.196	1.147	0.205	0.915	0.174
<i>Mother's education:</i>						
None	0.899	0.004	0.901	0.004	0.980	0.002
Primary	0.036	0.002	0.035	0.002	0.005	0.001
Middle/JSS	0.049	0.003	0.048	0.003	0.006	0.001
Secondary and above	0.005	0.001	0.005	0.001	0.003	0.001
Don't know	0.007	0.001	0.007	0.001	0.005	0.001
Missing information	0.003	0.000	0.003	0.000	0.002	0.000
<i>Father's education:</i>						
None	0.580	0.008	0.620	0.008	0.668	0.010
Primary	0.211	0.006	0.179	0.006	0.263	0.010
Middle/JSS	0.123	0.005	0.128	0.005	0.030	0.002
Secondary and above	0.051	0.003	0.036	0.002	0.026	0.003
Don't know	0.022	0.002	0.024	0.002	0.012	0.001
Missing information	0.001	0.000	0.001	0.000	0.001	0.000
<i>Survey dummies:</i>						
GLSS 3	0.243	0.007	0.181	0.007	0.297	0.011
GLSS 4	0.345	0.012	0.373	0.013	0.310	0.014
GLSS 5	0.413	0.010	0.447	0.011	0.393	0.013

N	23,179	21,559	11,523
---	--------	--------	--------

Notes: Calculations incorporate sampling weights and adjust for within-cluster correlation/clustering (Wooldridge, 2010).
Source: Ghana Living Standards Survey (Rounds 3-5: 1991/92, 1998/99, and 2005/06).

Table A2. Descriptive Statistics for Dependent and Explanatory Variables: Earnings Analysis

	Mean	Std. Dev.
Dependent variable:		
Ln (Earnings, annual)	14.338	0.031
Explanatory variables:		
Years of schooling	4.604	0.107
Female	0.459	0.006
<i>Birth cohorts:</i>		
Born before 1951	0.300	0.007
1951-55	0.096	0.003
1956-60	0.123	0.003
1961-65	0.129	0.004
1966-70	0.138	0.004
1971-75	0.098	0.003
1976-80	0.074	0.003
1981-85	0.034	0.002
1986-1990	0.010	0.001
<i>Region of birth:</i>		
North_birth	0.217	0.015
South_birth	0.783	0.015
<i>Region of residence:</i>		
North	0.195	0.016
South	0.805	0.016
<i>Survey dummies:</i>		
GLSS 3	0.251	0.008
GLSS 4	0.370	0.015
GLSS 5	0.379	0.012
N	13,159	

Notes: Calculations incorporate sampling weights and adjust for within-cluster correlation/clustering (Wooldridge, 2010).
Source: Ghana Living Standards Survey (Rounds 3-5: 1991/92, 1998/99, and 2005/06).

Table A3. Region of Birth and Region of Current Residence Transition Matrix: Formal Educational Attainment Sample

<i>Region of birth:</i>	<i>Region of residence:</i>										Total
	Western	Central	Greater Accra	Eastern	Volta	Ashanti	Brong- Ahafo	Northern	Upper East	Upper West	
Western	87.9	5.6	0.3	1.1	0.9	1.5	1.2	0.1	0.8	0.7	100.0
Central	6.4	82.1	0.4	3.5	2.3	4.3	0.9	0.1	0.1	0.1	100.0
Greater Accra	2.9	5.6	52.7	17.7	9.7	2.9	5.2	2.3	0.5	0.6	100.0
Eastern	3.7	3.2	1.1	56.9	29.3	4.2	1.3	0.3	0.0	0.0	100.0
Volta	1.6	1.5	1.4	42.6	45.8	2.2	2.3	2.8	0.0	0.0	100.0
Ashanti	3.3	1.7	0.2	1.3	0.9	85.1	4.6	1.1	0.9	1.0	100.0
Brong Ahafo	7.3	0.4	0.1	0.4	0.5	4.4	84.8	1.4	0.2	0.6	100.0
Northern	0.6	0.3	0.1	2.2	3.0	2.3	4.0	87.4	0.2	0.1	100.0
Upper East	2.3	0.2	0.2	1.8	0.4	3.4	5.2	1.4	85.0	0.4	100.0
Upper West	2.2	0.0	0.2	0.6	0.3	3.6	6.3	8.1	0.3	78.7	100.0
Foreign country	12.1	7.0	1.5	20.8	22.3	10.0	8.2	8.0	4.7	5.5	100.0

Notes: Calculations incorporate sampling weights.

Source: Ghana Living Standards Survey (Rounds 3-5: 1991/92, 1998/99, and 2005/06).

Table A4. Region of Birth and Region of Current Residence Transition Matrix: Adult Literacy Course Participation (Never Attended School) Sample

<i>Region of birth:</i>	<i>Region of residence:</i>										Total
	Western	Central	Greater Accra	Eastern	Volta	Ashanti	Brong- Ahafo	Northern	Upper East	Upper West	
Western	86.0	8.0	0.2	0.6	0.5	1.2	0.8	0.4	1.8	0.6	100.0
Central	6.3	81.1	0.5	4.4	2.0	4.9	0.7	0.0	0.1	0.0	100.0
Greater Accra	2.4	5.2	63.0	11.3	6.9	1.7	5.4	3.8	0.4	0.0	100.0
Eastern	4.6	3.3	1.0	55.7	28.8	4.3	1.6	0.8	0.0	0.0	100.0
Volta	1.1	1.5	1.4	41.3	45.2	2.4	2.1	5.0	0.0	0.0	100.0
Ashanti	2.2	1.5	0.4	1.0	1.1	83.5	5.3	2.0	1.6	1.3	100.0
Brong Ahafo	7.0	0.5	0.0	0.7	0.0	1.9	86.8	2.2	0.4	0.7	100.0
Northern	0.4	0.2	0.1	2.4	3.4	2.0	3.6	87.8	0.0	0.1	100.0
Upper East	1.9	0.2	0.2	1.8	0.4	3.1	4.8	1.3	86.3	0.2	100.0
Upper West	2.1	0.0	0.2	0.3	0.2	3.5	6.1	7.5	0.3	79.8	100.0
Foreign country	13.0	3.5	1.6	20.6	21.2	8.2	8.2	10.5	6.3	7.0	100.0

Notes: Calculations incorporate sampling weights.

Source: Ghana Living Standards Survey (Rounds 3-5: 1991/92, 1998/99, and 2005/06).

Table A5. Formal Educational Attainment Regression Results Using Four Alternative Measures of Educational Access (Linear Probability Model/OLS): Core Specification (No Interactions)

	<i>Current Access</i>			<i>Access in 1970</i>			<i>Access at Relevant Age (Binary)</i>			<i>Age Relevant Exposure (Years)</i>		
	<i>Ever attended</i>	<i>Primary and above</i>	<i>Years of schooling</i>	<i>Ever attended</i>	<i>Primary and above</i>	<i>Years of schooling</i>	<i>Ever attended</i>	<i>Primary and above</i>	<i>Years of schooling</i>	<i>Ever attended</i>	<i>Primary and above</i>	<i>Years of schooling</i>
Female	-0.246*** [0.006]	-0.260*** [0.007]	-2.892*** [0.073]	-0.246*** [0.006]	-0.260*** [0.007]	-2.890*** [0.073]	-0.246*** [0.006]	-0.259*** [0.007]	-2.882*** [0.073]	-0.247*** [0.006]	-0.261*** [0.007]	-2.906*** [0.074]
<i>Birth cohort:</i>												
1951-55	0.262*** [0.012]	0.234*** [0.012]	2.194*** [0.129]	0.266*** [0.013]	0.238*** [0.012]	2.235*** [0.129]	0.236*** [0.013]	0.206*** [0.012]	1.895*** [0.130]	0.273*** [0.013]	0.246*** [0.013]	2.339*** [0.133]
1956-60	0.312*** [0.011]	0.287*** [0.011]	2.785*** [0.134]	0.314*** [0.011]	0.288*** [0.011]	2.803*** [0.133]	0.268*** [0.012]	0.240*** [0.012]	2.288*** [0.134]	0.326*** [0.011]	0.303*** [0.012]	2.981*** [0.139]
1961-65	0.337*** [0.012]	0.287*** [0.011]	2.770*** [0.116]	0.340*** [0.012]	0.290*** [0.011]	2.806*** [0.116]	0.290*** [0.012]	0.236*** [0.011]	2.237*** [0.121]	0.357*** [0.014]	0.311*** [0.012]	3.053*** [0.127]
1966-70	0.320*** [0.011]	0.284*** [0.013]	2.598*** [0.128]	0.322*** [0.012]	0.287*** [0.013]	2.625*** [0.125]	0.269*** [0.012]	0.229*** [0.013]	2.016*** [0.131]	0.344*** [0.014]	0.314*** [0.014]	2.949*** [0.144]
1971-75	0.360*** [0.012]	0.319*** [0.013]	2.790*** [0.124]	0.363*** [0.012]	0.322*** [0.013]	2.821*** [0.124]	0.304*** [0.013]	0.259*** [0.013]	2.158*** [0.132]	0.390*** [0.016]	0.355*** [0.015]	3.215*** [0.148]
1976-80	0.391*** [0.013]	0.343*** [0.013]	2.617*** [0.131]	0.392*** [0.013]	0.346*** [0.013]	2.647*** [0.130]	0.324*** [0.015]	0.271*** [0.015]	1.864*** [0.149]	0.424*** [0.016]	0.384*** [0.015]	3.110*** [0.160]
1981-85	0.448*** [0.016]	0.384*** [0.018]	3.173*** [0.163]	0.449*** [0.016]	0.386*** [0.018]	3.191*** [0.164]	0.376*** [0.017]	0.305*** [0.019]	2.369*** [0.179]	0.485*** [0.019]	0.430*** [0.020]	3.713*** [0.192]
1986-1990	0.480*** [0.018]	0.406*** [0.018]	3.067*** [0.166]	0.483*** [0.018]	0.409*** [0.018]	3.104*** [0.164]	0.401*** [0.021]	0.316*** [0.021]	2.174*** [0.204]	0.523*** [0.020]	0.459*** [0.020]	3.692*** [0.189]
<i>Region of birth:</i>												
Western	0.022 [0.031]	0.091*** [0.034]	0.733** [0.373]	0.013 [0.031]	0.086** [0.034]	0.647* [0.379]	0.008 [0.030]	0.083** [0.034]	0.626* [0.363]	0.023 [0.031]	0.098*** [0.035]	0.763** [0.376]
Central	-0.017 [0.032]	0.033 [0.035]	0.204 [0.372]	-0.023 [0.032]	0.028 [0.035]	0.129 [0.376]	-0.02 [0.032]	0.031 [0.035]	0.168 [0.369]	-0.018 [0.032]	0.034 [0.035]	0.192 [0.374]
Eastern	0.073***	0.101***	0.903***	0.063**	0.092***	0.793**	0.072***	0.102***	0.897***	0.067**	0.097***	0.848**

	[0.025]	[0.032]	[0.333]	[0.027]	[0.032]	[0.342]	[0.026]	[0.032]	[0.332]	[0.026]	[0.032]	[0.340]
Volta	0.007	0.027	0.315	0.012	0.035	0.386	0.013	0.035	0.394	0.008	0.03	0.329
	[0.028]	[0.032]	[0.353]	[0.028]	[0.032]	[0.358]	[0.028]	[0.032]	[0.349]	[0.028]	[0.032]	[0.356]
Ashanti	0.083***	0.128***	1.250***	0.083***	0.129***	1.257***	0.081***	0.128***	1.252***	0.084***	0.131***	1.265***
	[0.029]	[0.033]	[0.359]	[0.030]	[0.033]	[0.363]	[0.029]	[0.032]	[0.351]	[0.030]	[0.033]	[0.360]
Brong-Ahafo	0.044	0.128***	1.142**	0.041	0.128***	1.127**	0.04	0.129***	1.143***	0.045	0.132***	1.170***
	[0.033]	[0.038]	[0.451]	[0.033]	[0.038]	[0.466]	[0.033]	[0.037]	[0.438]	[0.034]	[0.038]	[0.452]
Northern	-0.301***	-0.223***	-2.081***	-0.287***	-0.204***	-1.888***	-0.282***	-0.199***	-1.837***	-0.293***	-0.209***	-1.950***
	[0.041]	[0.040]	[0.453]	[0.041]	[0.038]	[0.447]	[0.040]	[0.037]	[0.429]	[0.041]	[0.040]	[0.449]
Upper East	-0.324***	-0.229***	-2.189***	-0.322***	-0.225***	-2.155***	-0.313***	-0.216***	-2.064***	-0.324***	-0.227***	-2.162***
	[0.040]	[0.043]	[0.441]	[0.040]	[0.043]	[0.445]	[0.040]	[0.042]	[0.439]	[0.040]	[0.043]	[0.441]
Upper West	-0.285***	-0.187***	-1.620***	-0.274***	-0.171***	-1.468***	-0.269***	-0.167***	-1.425***	-0.282***	-0.180***	-1.558***
	[0.046]	[0.043]	[0.485]	[0.049]	[0.045]	[0.509]	[0.050]	[0.044]	[0.495]	[0.048]	[0.044]	[0.495]
Foreign country	-0.245***	-0.189***	-1.906***	-0.241***	-0.182***	-1.844***	-0.240***	-0.182***	-1.839***	-0.245***	-0.187***	-1.885***
	[0.042]	[0.040]	[0.412]	[0.041]	[0.039]	[0.415]	[0.042]	[0.039]	[0.406]	[0.042]	[0.040]	[0.415]
<i>Region of residence:</i>												
Western	0.054	0.016	0.395	0.058	0.018	0.425	0.06	0.018	0.416	0.05	0.01	0.35
	[0.043]	[0.048]	[0.502]	[0.046]	[0.051]	[0.538]	[0.045]	[0.050]	[0.517]	[0.044]	[0.049]	[0.513]
Central	0.075	0.011	0.235	0.082*	0.018	0.342	0.075	0.009	0.233	0.075	0.007	0.231
	[0.046]	[0.051]	[0.519]	[0.049]	[0.053]	[0.551]	[0.048]	[0.052]	[0.537]	[0.047]	[0.051]	[0.529]
Eastern	0.06	0.048	0.601	0.058	0.045	0.581	0.049	0.034	0.459	0.056	0.041	0.554
	[0.041]	[0.048]	[0.498]	[0.045]	[0.051]	[0.536]	[0.044]	[0.049]	[0.515]	[0.043]	[0.048]	[0.510]
Volta	0.061	0.04	0.458	0.068	0.045	0.541	0.06	0.035	0.411	0.063	0.039	0.468
	[0.043]	[0.049]	[0.509]	[0.047]	[0.052]	[0.546]	[0.045]	[0.051]	[0.528]	[0.045]	[0.050]	[0.523]
Ashanti	0.056	0.02	0.268	0.056	0.015	0.224	0.057	0.016	0.221	0.057	0.02	0.269
	[0.043]	[0.048]	[0.498]	[0.046]	[0.051]	[0.539]	[0.045]	[0.050]	[0.521]	[0.044]	[0.049]	[0.514]
Brong-Ahafo	0.045	-0.006	0.031	0.041	-0.007	0.01	0.039	-0.01	-0.034	0.04	-0.011	-0.018
	[0.048]	[0.049]	[0.501]	[0.049]	[0.051]	[0.539]	[0.048]	[0.049]	[0.515]	[0.048]	[0.049]	[0.510]
Northern	-0.071	-0.094*	-0.763	-0.06	-0.082	-0.627	-0.064	-0.088*	-0.705	-0.07	-0.095*	-0.759
	[0.053]	[0.054]	[0.582]	[0.056]	[0.054]	[0.600]	[0.054]	[0.053]	[0.581]	[0.055]	[0.053]	[0.585]
Upper East	-0.009	-0.045	-0.205	-0.003	-0.037	-0.111	-0.009	-0.046	-0.213	-0.01	-0.047	-0.198

Upper West	[0.053] 0.012 [0.064]	[0.058] -0.032 [0.055]	[0.573] -0.308 [0.578]	[0.054] 0 [0.065]	[0.058] -0.047 [0.058]	[0.592] -0.47 [0.628]	[0.053] 0.002 [0.066]	[0.058] -0.047 [0.057]	[0.579] -0.448 [0.604]	[0.053] 0.007 [0.065]	[0.057] -0.04 [0.056]	[0.575] -0.366 [0.592]
<i>Educ. access/exposure:</i>												
Adult literacy program	-0.007 [0.016]	-0.007 [0.012]	-0.039 [0.127]	-0.015 [0.057]	0.006 [0.064]	-0.244 [0.611]	0.013 [0.021]	0.023 [0.020]	0.087 [0.196]	0 [0.001]	0.001 [0.001]	0.006 [0.010]
Primary school	0.064***	0.095***	0.923***	0.083***	0.097***	1.016***	0.122***	0.128***	1.334***	0.002***	0.002***	0.021***
Secondary school	[0.014] 0.115*** [0.037]	[0.013] 0.087*** [0.019]	[0.143] 1.168*** [0.212]	[0.015] 0.073** [0.031]	[0.012] 0.090*** [0.026]	[0.133] 1.365*** [0.414]	[0.014] 0.063** [0.025]	[0.011] 0.088*** [0.023]	[0.121] 1.272*** [0.355]	[0.000] 0.004** [0.002]	[0.000] 0.003*** [0.001]	[0.004] 0.053*** [0.013]
<i>Mother's education:</i>												
Primary	0.122*** [0.012]	0.121*** [0.018]	1.041*** [0.192]	0.124*** [0.012]	0.122*** [0.018]	1.058*** [0.190]	0.122*** [0.012]	0.120*** [0.018]	1.032*** [0.188]	0.129*** [0.013]	0.127*** [0.018]	1.121*** [0.188]
Middle/JSS	0.104*** [0.011]	0.168*** [0.014]	2.154*** [0.183]	0.107*** [0.012]	0.171*** [0.014]	2.192*** [0.187]	0.103*** [0.011]	0.166*** [0.014]	2.135*** [0.184]	0.113*** [0.012]	0.178*** [0.014]	2.258*** [0.185]
Secondary and above	0.072** [0.035]	0.100*** [0.031]	2.586*** [0.614]	0.074** [0.036]	0.101*** [0.032]	2.606*** [0.619]	0.073** [0.035]	0.101*** [0.033]	2.589*** [0.634]	0.076** [0.036]	0.103*** [0.032]	2.630*** [0.615]
Don't know	-0.031 [0.045]	-0.031 [0.044]	-0.323 [0.390]	-0.04 [0.044]	-0.04 [0.043]	-0.426 [0.378]	-0.039 [0.043]	-0.037 [0.043]	-0.394 [0.374]	-0.032 [0.043]	-0.033 [0.043]	-0.342 [0.380]
Missing information	0.011 [0.051]	-0.01 [0.054]	0.008 [0.709]	0.025 [0.054]	-0.001 [0.054]	0.168 [0.680]	0.025 [0.054]	0.002 [0.052]	0.152 [0.663]	0.021 [0.052]	0 [0.053]	0.101 [0.699]
<i>Father's education:</i>												
Primary	0.051*** [0.014]	0.036** [0.015]	0.558*** [0.163]	0.050*** [0.014]	0.034** [0.015]	0.539*** [0.162]	0.055*** [0.014]	0.038** [0.015]	0.589*** [0.163]	0.050*** [0.014]	0.035** [0.015]	0.548*** [0.163]
Middle/JSS	0.139*** [0.011]	0.144*** [0.012]	1.595*** [0.128]	0.137*** [0.010]	0.141*** [0.012]	1.557*** [0.127]	0.136*** [0.010]	0.139*** [0.012]	1.551*** [0.127]	0.143*** [0.010]	0.148*** [0.012]	1.630*** [0.129]
Secondary and above	0.164*** [0.017]	0.191*** [0.019]	2.268*** [0.211]	0.161*** [0.017]	0.187*** [0.019]	2.219*** [0.211]	0.159*** [0.017]	0.185*** [0.019]	2.203*** [0.210]	0.166*** [0.017]	0.194*** [0.019]	2.294*** [0.214]
Don't know	0.100*** [0.024]	0.013 [0.026]	0.138 [0.234]	0.102*** [0.023]	0.013 [0.026]	0.165 [0.232]	0.096*** [0.023]	0.008 [0.025]	0.095 [0.229]	0.101*** [0.024]	0.014 [0.026]	0.145 [0.234]
Missing information	0.112	0.028	0.006	0.094	0.014	-0.164	0.112	0.032	0.033	0.102	0.02	-0.093

	[0.088]	[0.117]	[0.834]	[0.092]	[0.117]	[0.833]	[0.089]	[0.111]	[0.786]	[0.088]	[0.119]	[0.845]
<i>Survey fixed effects:</i>												
GLSS 4	0.133***	0.022	0.612***	0.133***	0.021	0.621***	0.132***	0.019	0.598***	0.124***	0.008	0.457**
	[0.019]	[0.018]	[0.213]	[0.019]	[0.019]	[0.215]	[0.020]	[0.019]	[0.215]	[0.021]	[0.020]	[0.226]
GLSS 5	0.079***	-0.027	0.685***	0.080***	-0.026	0.707***	0.081***	-0.027	0.694***	0.055***	-0.059***	0.336*
	[0.016]	[0.017]	[0.194]	[0.016]	[0.017]	[0.193]	[0.016]	[0.017]	[0.191]	[0.017]	[0.018]	[0.202]
Constant	0.244***	0.232***	1.878***	0.245***	0.246***	1.998***	0.274***	0.285***	2.425***	0.259***	0.261***	2.089***
	[0.044]	[0.051]	[0.478]	[0.048]	[0.052]	[0.497]	[0.045]	[0.050]	[0.476]	[0.046]	[0.049]	[0.475]
<i>F-tests:</i>												
Region of birth	39.250	37.540	34.020	38.730	41.200	35.530	39.250	41.350	35.510	38.580	39.130	34.630
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Region of residence	2.102	2.303	1.825	1.957	2.368	1.803	2.007	2.394	1.837	1.956	2.382	1.845
	[0.027]	[0.015]	[0.061]	[0.042]	[0.012]	[0.064]	[0.036]	[0.011]	[0.059]	[0.042]	[0.012]	[0.057]
Parental education	50.430	63.740	52.640	53.990	61.330	49.610	51.170	56.220	48.520	61.240	70.850	55.770
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
R ²	0.408	0.363	0.355	0.407	0.364	0.356	0.414	0.37	0.363	0.405	0.359	0.352
N	23,179	23,179	23,179	23,179	23,179	23,179	23,179	23,179	23,179	23,179	23,179	23,179

Notes: Calculations incorporate sampling weights. Robust Huber-White (Huber, 1967; White, 1980) standard errors, adjusted for within-cluster correlation/clustering (Wooldridge, 2010), in brackets under parameter estimates; and p-values of robust F-test statistics under F-test statistics. *: statistically significant at 10 percent; **: statistically significant at 5 percent; ***: statistically significant at 1 percent. Reference categories are “pre-1951” (birth cohort); “Greater Accra” (region of birth/residence); “No education” (maternal/paternal education).
Source: Ghana Living Standards Survey (Rounds 3-5: 1991/92, 1998/99, and 2005/06).

Table A6. Adult Literacy Program Participation Regression Results from Alternative Samples and Alternative Measures of Educational Access (Linear Probability Model): Core Specification (No Interactions)

	<i>Including formal education completers:</i>				<i>Individuals who never attended school:</i>			
	<i>Current Access</i>	<i>Access in 1970</i>	<i>Access at Relevant Age (Binary)</i>	<i>Age Relevant Exposure (Years)</i>	<i>Current Access</i>	<i>Access in 1970</i>	<i>Access at Relevant Age (Binary)</i>	<i>Age Relevant Exposure (Years)</i>
Female	-0.028*** [0.006]	-0.029*** [0.006]	-0.029*** [0.006]	-0.029*** [0.006]	-0.068*** [0.009]	-0.069*** [0.009]	-0.068*** [0.009]	-0.070*** [0.009]
Years of schooling	-0.009*** [0.001]	-0.010*** [0.001]	-0.009*** [0.001]	-0.010*** [0.001]				
<i>Birth cohort:</i>								
1951-55	0.006 [0.011]	0.006 [0.011]	0.007 [0.011]	0.009 [0.011]	0.02 [0.014]	0.023 [0.014]	0.019 [0.014]	0.025* [0.014]
1956-60	0.008 [0.010]	0.009 [0.010]	0.01 [0.011]	0.012 [0.010]	0.023* [0.013]	0.024* [0.013]	0.019 [0.014]	0.028** [0.013]
1961-65	-0.004 [0.010]	-0.004 [0.010]	-0.003 [0.010]	0 [0.010]	0.019 [0.015]	0.021 [0.015]	0.016 [0.016]	0.027* [0.015]
1966-70	-0.017* [0.009]	-0.017* [0.009]	-0.016* [0.009]	-0.012 [0.010]	0.007 [0.012]	0.009 [0.012]	0.003 [0.013]	0.016 [0.013]
1971-75	-0.013 [0.009]	-0.012 [0.009]	-0.011 [0.009]	-0.006 [0.011]	0.029* [0.015]	0.031** [0.015]	0.025* [0.015]	0.040** [0.016]
1976-80	-0.050*** [0.010]	-0.048*** [0.009]	-0.048*** [0.011]	-0.040*** [0.011]	-0.021 [0.018]	-0.019 [0.017]	-0.025 [0.020]	-0.009 [0.017]
1981-85	-0.050*** [0.011]	-0.049*** [0.011]	-0.050*** [0.012]	-0.039*** [0.013]	-0.038** [0.016]	-0.035** [0.017]	-0.040** [0.020]	-0.024 [0.018]
1986-1990	-0.078*** [0.010]	-0.079*** [0.010]	-0.080*** [0.011]	-0.066*** [0.013]	-0.037* [0.019]	-0.042** [0.020]	-0.047** [0.023]	-0.027 [0.021]
<i>Region of birth:</i>								
Western	0.026 [0.026]	0.018 [0.027]	0.02 [0.027]	0.018 [0.027]	0.122*** [0.035]	0.106*** [0.034]	0.111*** [0.034]	0.108*** [0.034]

Central	0.044*	0.037	0.038	0.039*	0.121***	0.110***	0.112***	0.111***
	[0.023]	[0.023]	[0.023]	[0.023]	[0.027]	[0.026]	[0.026]	[0.026]
Eastern	0.051**	0.046**	0.045**	0.047**	0.127***	0.118***	0.119***	0.118***
	[0.021]	[0.020]	[0.020]	[0.020]	[0.026]	[0.025]	[0.025]	[0.025]
Volta	0.049**	0.048**	0.047**	0.047**	0.115***	0.113***	0.114***	0.112***
	[0.020]	[0.019]	[0.019]	[0.019]	[0.025]	[0.024]	[0.024]	[0.024]
Ashanti	0.055**	0.053**	0.053**	0.051**	0.148***	0.146***	0.149***	0.142***
	[0.024]	[0.025]	[0.025]	[0.025]	[0.030]	[0.030]	[0.030]	[0.030]
Brong-Ahafo	0.042	0.038	0.038	0.037	0.139***	0.138***	0.139***	0.135***
	[0.031]	[0.031]	[0.031]	[0.031]	[0.036]	[0.036]	[0.036]	[0.036]
Northern	0.016	0.009	0.009	0.01	0.069***	0.062**	0.062**	0.061**
	[0.030]	[0.031]	[0.031]	[0.030]	[0.026]	[0.025]	[0.025]	[0.025]
Upper East	0.039	0.037	0.036	0.039	0.073**	0.068*	0.068*	0.070**
	[0.031]	[0.032]	[0.032]	[0.031]	[0.036]	[0.036]	[0.035]	[0.036]
Upper West	0.062*	0.057	0.055	0.056	0.076*	0.069*	0.069*	0.067*
	[0.038]	[0.039]	[0.038]	[0.038]	[0.039]	[0.039]	[0.039]	[0.039]
Foreign country	-0.004	-0.008	-0.009	-0.007	0.053*	0.047*	0.047*	0.047*
	[0.027]	[0.027]	[0.027]	[0.027]	[0.028]	[0.027]	[0.028]	[0.027]
<i>Region of residence:</i>								
Western	0.008	0.009	0.008	0.009	0.012	0.011	0.007	0.011
	[0.037]	[0.036]	[0.036]	[0.037]	[0.042]	[0.039]	[0.040]	[0.040]
Central	-0.029	-0.025	-0.027	-0.03	-0.048	-0.047	-0.054	-0.054
	[0.037]	[0.035]	[0.035]	[0.035]	[0.039]	[0.035]	[0.036]	[0.036]
Eastern	-0.046	-0.044	-0.045	-0.046	-0.054	-0.059*	-0.063**	-0.060*
	[0.033]	[0.030]	[0.031]	[0.031]	[0.034]	[0.030]	[0.031]	[0.031]
Volta	-0.019	-0.016	-0.018	-0.017	0.001	0.005	-0.001	0.003
	[0.034]	[0.032]	[0.033]	[0.032]	[0.037]	[0.034]	[0.035]	[0.034]
Ashanti	-0.025	-0.033	-0.032	-0.031	-0.03	-0.042	-0.044	-0.042
	[0.036]	[0.034]	[0.035]	[0.035]	[0.039]	[0.035]	[0.037]	[0.036]
Brong-Ahafo	0.006	0.005	0.005	0.005	0.013	0.006	0.002	0.005
	[0.038]	[0.037]	[0.037]	[0.037]	[0.041]	[0.038]	[0.039]	[0.039]

Northern	-0.023 [0.043]	-0.024 [0.041]	-0.026 [0.041]	-0.027 [0.041]	-0.024 [0.039]	-0.028 [0.035]	-0.033 [0.036]	-0.03 [0.036]
Upper East	-0.044 [0.043]	-0.043 [0.043]	-0.045 [0.043]	-0.046 [0.043]	-0.025 [0.046]	-0.023 [0.044]	-0.029 [0.045]	-0.026 [0.045]
Upper West	-0.041 [0.053]	-0.035 [0.053]	-0.035 [0.052]	-0.036 [0.053]	0 [0.056]	0.002 [0.055]	0.001 [0.055]	0.005 [0.055]
<i>Educ. access/exposure:</i>								
Adult literacy program	0.051*** [0.008]	0.001 [0.028]	0.006 [0.012]	0.002** [0.001]	0.064*** [0.011]	-0.019 [0.036]	-0.007 [0.027]	0.001 [0.001]
Primary school	-0.013 [0.012]	0.003 [0.010]	-0.005 [0.009]	0 [0.000]	-0.011 [0.015]	0.014 [0.014]	0.006 [0.014]	0.001 [0.000]
Secondary school	-0.009 [0.011]	0.029 [0.023]	-0.004 [0.014]	0 [0.001]	0.015 [0.018]	0.078* [0.041]	0.044 [0.052]	0.001 [0.001]
<i>Mother's education:</i>								
Primary	0.007 [0.011]	0.006 [0.011]	0.006 [0.011]	0.006 [0.011]	-0.005 [0.046]	-0.005 [0.048]	-0.005 [0.047]	-0.003 [0.047]
Middle/JSS	-0.003 [0.009]	-0.001 [0.009]	-0.001 [0.009]	-0.002 [0.009]	-0.073 [0.057]	-0.067 [0.057]	-0.066 [0.057]	-0.066 [0.057]
Secondary and above	-0.003 [0.022]	-0.004 [0.023]	-0.005 [0.023]	-0.007 [0.023]	-0.045 [0.050]	-0.044 [0.050]	-0.047 [0.050]	-0.051 [0.052]
Don't know	-0.021 [0.027]	-0.024 [0.028]	-0.023 [0.028]	-0.025 [0.028]	-0.063 [0.043]	-0.075* [0.044]	-0.073* [0.044]	-0.074* [0.044]
Missing information	-0.052* [0.030]	-0.049* [0.029]	-0.049 [0.030]	-0.054* [0.030]	-0.06 [0.076]	-0.058 [0.073]	-0.057 [0.074]	-0.065 [0.076]
<i>Father's education:</i>								
Primary	-0.014 [0.011]	-0.013 [0.011]	-0.013 [0.011]	-0.013 [0.011]	-0.013 [0.030]	-0.014 [0.030]	-0.013 [0.031]	-0.011 [0.030]
Middle/JSS	-0.008 [0.006]	-0.01 [0.006]	-0.009 [0.006]	-0.009 [0.006]	0.009 [0.023]	0.008 [0.023]	0.011 [0.023]	0.011 [0.023]
Secondary and above	-0.003 [0.003]	-0.006 [0.006]	-0.005 [0.005]	-0.005 [0.005]	-0.008 [0.008]	-0.012 [0.012]	-0.012 [0.012]	-0.011 [0.011]

Don't know	[0.012] 0.038**	[0.012] 0.041**	[0.012] 0.041**	[0.012] 0.039**	[0.033] 0.068	[0.033] 0.077*	[0.033] 0.075*	[0.033] 0.074*
Missing information	[0.017] -0.027	[0.018] -0.019	[0.018] -0.02	[0.018] -0.02	[0.042] 0.015	[0.041] 0.027	[0.042] 0.031	[0.042] 0.03
	[0.047]	[0.046]	[0.046]	[0.046]	[0.109]	[0.106]	[0.107]	[0.107]
<i>Survey fixed effects:</i>								
GLSS 4	0.028* [0.015]	0.036** [0.016]	0.035** [0.015]	0.027* [0.016]	0.034 [0.034]	0.042 [0.034]	0.042 [0.035]	0.035 [0.034]
GLSS 5	0.042*** [0.014]	0.050*** [0.014]	0.048*** [0.014]	0.039** [0.015]	0.023 [0.031]	0.029 [0.032]	0.026 [0.032]	0.018 [0.032]
Constant	0.102*** [0.033]	0.125*** [0.030]	0.130*** [0.029]	0.118*** [0.030]	0.037 [0.043]	0.072* [0.040]	0.084** [0.038]	0.066 [0.040]
<i>F-tests:</i>								
Region of birth	1.721 [0.072]	1.739 [0.068]	1.725 [0.071]	1.724 [0.072]	5.759 [0.000]	5.643 [0.000]	5.894 [0.000]	5.575 [0.000]
Region of residence	1.524 [0.135]	1.536 [0.131]	1.551 [0.126]	1.613 [0.108]	1.273 [0.248]	1.499 [0.144]	1.522 [0.136]	1.539 [0.130]
Parental education	1.169 [0.308]	1.224 [0.272]	1.187 [0.296]	1.187 [0.296]	0.607 [0.809]	0.720 [0.706]	0.676 [0.748]	0.690 [0.735]
R ²	0.037	0.032	0.032	0.033	0.033	0.028	0.026	0.028
N	21,559	21,559	21,559	21,559	11,523	11,523	11,523	11,523

Notes: Calculations incorporate sampling weights. Robust Huber-White (Huber, 1967; White, 1980) standard errors, adjusted for within-cluster correlation/clustering (Wooldridge, 2010), in brackets under parameter estimates; and p-values of robust F-test statistics under F-test statistics. *: statistically significant at 10 percent; **: statistically significant at 5 percent; ***: statistically significant at 1 percent. Reference categories are “pre-1951” (birth cohort); “Greater Accra” (region of birth/residence); “No education” (maternal/paternal education).

Source: Ghana Living Standards Survey (Rounds 3-5: 1991/92, 1998/99, and 2005/06).

Table A7. Formal Educational Attainment Regression Results Using Four Alternative Measures of Educational Access (Linear Probability Model/OLS): Aggregating Regions and Cohorts and Adding Interactions (Aggregated/Total Average Marginal Effects, By Each Explanatory Variable)

	<i>Current Access</i>			<i>Access in 1970</i>			<i>Access at Relevant Age (Binary)</i>			<i>Age Relevant Exposure (Years)</i>		
	<i>Ever attended</i>	<i>Primary and above</i>	<i>Years of schooling</i>	<i>Ever attended</i>	<i>Primary and above</i>	<i>Years of schooling</i>	<i>Ever attended</i>	<i>Primary and above</i>	<i>Years of schooling</i>	<i>Ever attended</i>	<i>Primary and above</i>	<i>Years of schooling</i>
Female	-0.239*** [0.006]	-0.254*** [0.007]	-2.835*** [0.074]	-0.239*** [0.006]	-0.254*** [0.007]	-2.835*** [0.075]	-0.242*** [0.006]	-0.257*** [0.007]	-2.859*** [0.076]	-0.237*** [0.006]	-0.252*** [0.007]	-2.824*** [0.074]
Crisis cohort	0.162*** [0.010]	0.146*** [0.011]	1.150*** [0.106]	0.164*** [0.010]	0.148*** [0.011]	1.165*** [0.105]	0.132*** [0.011]	0.112*** [0.012]	0.782*** [0.114]	0.175*** [0.012]	0.172*** [0.014]	1.438*** [0.143]
Post-crisis cohort	0.207*** [0.010]	0.179*** [0.011]	1.049*** [0.113]	0.208*** [0.010]	0.181*** [0.011]	1.055*** [0.112]	0.168*** [0.011]	0.132*** [0.012]	0.642*** [0.120]	0.208*** [0.017]	0.221*** [0.018]	1.465*** [0.181]
North, birth	-0.392*** [0.017]	-0.355*** [0.012]	-3.281*** [0.118]	-0.380*** [0.024]	-0.340*** [0.014]	-3.110*** [0.142]	-0.368*** [0.024]	-0.332*** [0.014]	-3.033*** [0.140]	-0.395*** [0.023]	-0.357*** [0.014]	-3.290*** [0.135]
Adult literacy program	-0.01 [0.012]	-0.013 [0.011]	-0.087 [0.132]	-0.017 [0.038]	-0.004 [0.040]	-0.372 [0.355]	0.003 [0.033]	0.019 [0.028]	-0.002 [0.292]	0 [0.001]	0 [0.001]	-0.001 [0.010]
Primary school	0.061*** [0.014]	0.094*** [0.012]	0.897*** [0.140]	0.077*** [0.014]	0.095*** [0.012]	0.993*** [0.131]	0.183*** [0.014]	0.182*** [0.011]	1.809*** [0.118]	0 [0.000]	0.001* [0.000]	0.008* [0.004]
Secondary school	0.145*** [0.036]	0.096*** [0.020]	1.232*** [0.219]	0.090*** [0.033]	0.104*** [0.029]	1.395*** [0.411]	0.173*** [0.036]	0.163*** [0.033]	2.005*** [0.402]	0.007** [0.003]	0.005*** [0.002]	0.077*** [0.020]
<i>Mother's education:</i>												
Primary	0.166*** [0.013]	0.157*** [0.020]	1.410*** [0.201]	0.167*** [0.013]	0.157*** [0.020]	1.428*** [0.199]	0.154*** [0.013]	0.144*** [0.020]	1.292*** [0.199]	0.164*** [0.013]	0.158*** [0.019]	1.447*** [0.194]
Middle/JSS	0.141*** [0.011]	0.199*** [0.014]	2.494*** [0.188]	0.145*** [0.012]	0.200*** [0.015]	2.530*** [0.195]	0.131*** [0.011]	0.188*** [0.014]	2.399*** [0.191]	0.145*** [0.012]	0.203*** [0.014]	2.535*** [0.187]
Secondary and above	0.085** [0.035]	0.111*** [0.038]	2.739*** [0.674]	0.085** [0.037]	0.107*** [0.040]	2.693*** [0.688]	0.073** [0.037]	0.099** [0.042]	2.613*** [0.704]	0.087** [0.036]	0.110*** [0.037]	2.749*** [0.656]
Don't know	-0.041 [0.045]	-0.04 [0.046]	-0.414 [0.407]	-0.044 [0.044]	-0.046 [0.045]	-0.492 [0.392]	-0.045 [0.043]	-0.044 [0.045]	-0.463 [0.388]	-0.037 [0.044]	-0.038 [0.045]	-0.403 [0.397]
Missing information	0.084 [0.055]	0.051 [0.057]	0.621 [0.715]	0.096* [0.058]	0.059 [0.057]	0.779 [0.691]	0.083 [0.061]	0.045 [0.057]	0.636 [0.674]	0.091 [0.056]	0.056 [0.058]	0.67 [0.724]
<i>Father's education:</i>												
Primary	0.050*** [0.015]	0.035** [0.016]	0.593*** [0.173]	0.047*** [0.016]	0.032** [0.016]	0.567*** [0.172]	0.057*** [0.015]	0.040** [0.016]	0.653*** [0.169]	0.045*** [0.016]	0.031* [0.016]	0.545*** [0.179]
Middle/JSS	0.184*** [0.011]	0.181*** [0.013]	1.990*** [0.134]	0.181*** [0.011]	0.176*** [0.013]	1.942*** [0.133]	0.164*** [0.011]	0.161*** [0.013]	1.797*** [0.136]	0.186*** [0.011]	0.185*** [0.013]	2.017*** [0.137]
Secondary and above	0.199*** [0.021]	0.216*** [0.022]	2.530*** [0.237]	0.196*** [0.021]	0.212*** [0.023]	2.481*** [0.239]	0.178*** [0.020]	0.195*** [0.022]	2.318*** [0.232]	0.199*** [0.020]	0.219*** [0.022]	2.555*** [0.238]
Don't know	0.144***	0.052*	0.548**	0.143***	0.051*	0.555**	0.123***	0.031	0.352	0.148***	0.055*	0.571**

Missing information	[0.025] 0.154 [0.094]	[0.027] 0.068 [0.119]	[0.242] 0.415 [0.835]	[0.025] 0.143 [0.100]	[0.027] 0.06 [0.121]	[0.240] 0.301 [0.853]	[0.023] 0.141 [0.089]	[0.026] 0.059 [0.110]	[0.231] 0.302 [0.766]	[0.026] 0.152 [0.096]	[0.028] 0.069 [0.122]	[0.250] 0.442 [0.857]
<i>Survey fixed effects:</i>												
GLSS 4	0.148*** [0.019]	0.037* [0.019]	0.784*** [0.221]	0.146*** [0.020]	0.032 [0.020]	0.765*** [0.222]	0.141*** [0.021]	0.026 [0.020]	0.704*** [0.220]	0.148*** [0.020]	0.032 [0.021]	0.724*** [0.239]
GLSS 5	0.117*** [0.017]	0.005 [0.018]	1.007*** [0.200]	0.112*** [0.017]	0 [0.018]	0.984*** [0.199]	0.112*** [0.017]	-0.003 [0.018]	0.949*** [0.195]	0.102*** [0.018]	-0.017 [0.019]	0.769*** [0.214]
R ²												
N	23179	23179	23179	23179	23179	23179	23179	23179	23179	23179	23179	23179

Notes: Calculations incorporate sampling weights. Robust Huber-White (Huber, 1967; White, 1980) standard errors, adjusted for within-cluster correlation/clustering (Wooldridge, 2010), in brackets under parameter estimates; and p-values of robust F-test statistics under F-test statistics. *: statistically significant at 10 percent; **: statistically significant at 5 percent; ***: statistically significant at 1 percent. Reference categories are “pre-1971” (birth cohort); “Southern regions” (region of birth/residence); “No education” (maternal/paternal education).

Source: Ghana Living Standards Survey (Rounds 3-5: 1991/92, 1998/99, and 2005/06).

Table A8. Adult Literacy Program Participation Regression Results from Alternative Samples and Alternative Measures of Educational Access (Linear Probability Model): Aggregating Regions and Birth Cohorts and Adding Interactions (Aggregated/Total Average Marginal Effects, By Each Explanatory Variable)

	<i>Including formal education completers:</i>				<i>Individuals who never attended school:</i>			
	<i>Current Access</i>	<i>Access in 1970</i>	<i>Access at Relevant Age (Binary)</i>	<i>Age Relevant Exposure (Years)</i>	<i>Current Access</i>	<i>Access in 1970</i>	<i>Access at Relevant Age (Binary)</i>	<i>Age Relevant Exposure (Years)</i>
Female	-0.028*** [0.005]	-0.030*** [0.005]	-0.029*** [0.005]	-0.029*** [0.005]	-0.065*** [0.008]	-0.066*** [0.008]	-0.066*** [0.008]	-0.065*** [0.008]
Years of schooling	-0.009*** [0.001]	-0.010*** [0.001]	-0.009*** [0.001]	-0.009*** [0.001]				
Crisis cohort	-0.012 [0.007]	-0.012* [0.007]	-0.012 [0.008]	-0.018** [0.009]	0.01 [0.014]	0.012 [0.014]	0.004 [0.015]	-0.003 [0.019]
Post-crisis cohort	-0.055*** [0.006]	-0.056*** [0.006]	-0.050*** [0.008]	-0.055*** [0.010]	-0.061*** [0.012]	-0.064*** [0.012]	-0.045*** [0.014]	-0.080*** [0.020]
North, birth	-0.018* [0.010]	-0.018 [0.012]	-0.017 [0.012]	-0.021* [0.012]	-0.041*** [0.012]	-0.038*** [0.013]	-0.040*** [0.013]	-0.041*** [0.013]
Adult literacy program	0.051*** [0.008]	-0.009 [0.025]	0.001 [0.025]	0.002** [0.001]	0.067*** [0.011]	-0.024 [0.028]	-0.03 [0.045]	0.002* [0.001]
Primary school	-0.012 [0.012]	0.004 [0.010]	-0.007 [0.009]	0 [0.000]	-0.009 [0.015]	0.013 [0.014]	0.014 [0.014]	0 [0.000]
Secondary school	-0.009 [0.010]	0.032 [0.021]	0.007 [0.017]	0 [0.001]	0.007 [0.018]	0.091** [0.037]	0.054 [0.043]	0.002 [0.002]
<i>Mother's education:</i>								
Primary	0.012 [0.011]	0.011 [0.011]	0.011 [0.011]	0.012 [0.011]	0.013 [0.046]	0.011 [0.048]	0.009 [0.048]	0.012 [0.047]
Middle/JSS	0.002 [0.009]	0.004 [0.008]	0.004 [0.008]	0.002 [0.009]	-0.056 [0.052]	-0.05 [0.054]	-0.055 [0.052]	-0.05 [0.053]
Secondary and above	0.003 [0.022]	-0.001 [0.023]	0 [0.023]	-0.002 [0.023]	-0.042 [0.049]	-0.046 [0.052]	-0.042 [0.050]	-0.049 [0.051]
Don't know	-0.028 [0.028]	-0.032 [0.028]	-0.031 [0.028]	-0.032 [0.028]	-0.085* [0.044]	-0.090** [0.044]	-0.089** [0.045]	-0.091** [0.045]

Missing information	-0.053*	-0.052*	-0.050*	-0.054*	-0.048	-0.046	-0.041	-0.057
	[0.030]	[0.028]	[0.028]	[0.030]	[0.077]	[0.072]	[0.069]	[0.076]
<i>Father's education:</i>								
Primary	-0.008	-0.006	-0.007	-0.006	-0.004	-0.006	-0.004	-0.005
	[0.011]	[0.011]	[0.011]	[0.011]	[0.031]	[0.032]	[0.032]	[0.032]
Middle/JSS	-0.003	-0.003	-0.001	-0.003	0.029	0.023	0.028	0.029
	[0.007]	[0.006]	[0.007]	[0.006]	[0.024]	[0.023]	[0.023]	[0.023]
Secondary and above	-0.003	-0.003	-0.002	-0.004	-0.017	-0.02	-0.016	-0.02
	[0.012]	[0.012]	[0.012]	[0.012]	[0.034]	[0.035]	[0.035]	[0.035]
Don't know	0.045**	0.047***	0.048***	0.046**	0.086**	0.094**	0.090**	0.089**
	[0.018]	[0.018]	[0.018]	[0.018]	[0.042]	[0.042]	[0.043]	[0.043]
Missing information	-0.027	-0.023	-0.022	-0.019	0.034	0.045	0.052	0.058
	[0.047]	[0.048]	[0.048]	[0.047]	[0.109]	[0.109]	[0.109]	[0.107]
<i>Survey fixed effects:</i>								
GLSS 4	0.033**	0.040**	0.040**	0.032**	0.042	0.048	0.05	0.041
	[0.015]	[0.016]	[0.016]	[0.016]	[0.034]	[0.036]	[0.036]	[0.036]
GLSS 5	0.044***	0.051***	0.049***	0.041***	0.03	0.033	0.032	0.023
	[0.014]	[0.015]	[0.014]	[0.015]	[0.032]	[0.034]	[0.033]	[0.034]
R ²								
N	21559	21559	21559	21559	11523	11523	11523	11523

Notes: Calculations incorporate sampling weights. Robust Huber-White (Huber, 1967; White, 1980) standard errors, adjusted for within-cluster correlation/clustering (Wooldridge, 2010), in brackets under parameter estimates; and p-values of robust F-test statistics under F-test statistics. *: statistically significant at 10 percent; **: statistically significant at 5 percent; ***: statistically significant at 1 percent. Reference categories are “pre-1971” (birth cohort); “Southern regions” (region of birth/residence); “No education” (maternal/paternal education).

Source: Ghana Living Standards Survey (Rounds 3-5: 1991/92, 1998/99, and 2005/06).

Table A9. Formal Educational Attainment Regression Results Using Four Alternative Measures of Educational Access (Linear Probability Model/OLS): Aggregating Regions and Cohorts and Adding Interactions (Dis-aggregated Average Marginal Effects from Table 3, Explicitly Including All Interaction Variables)

	<i>Current Access</i>			<i>Access in 1970</i>			<i>Access at Relevant Age (Binary)</i>			<i>Age Relevant Exposure (Years)</i>		
	<i>Ever attended</i>	<i>Primary and above</i>	<i>Years of schooling</i>	<i>Ever attended</i>	<i>Primary and above</i>	<i>Years of schooling</i>	<i>Ever attended</i>	<i>Primary and above</i>	<i>Years of schooling</i>	<i>Ever attended</i>	<i>Primary and above</i>	<i>Years of schooling</i>
Female	-0.239***	-0.254***	-2.835***	-0.239***	-0.254***	-2.835***	-0.242***	-0.257***	-2.859***	-0.237***	-0.252***	-2.824***
	[0.006]	[0.007]	[0.074]	[0.006]	[0.007]	[0.075]	[0.006]	[0.007]	[0.076]	[0.006]	[0.007]	[0.074]
Crisis cohort	0.155***	0.106***	0.920***	0.172***	0.140***	0.975***	0.237***	0.183***	1.380***	0.096***	0.078***	0.469*
	[0.032]	[0.032]	[0.302]	[0.022]	[0.024]	[0.214]	[0.023]	[0.025]	[0.228]	[0.027]	[0.027]	[0.253]
Post-crisis cohort	0.208***	0.146***	0.887***	0.200***	0.154***	0.880***	0.273***	0.201***	1.364***	0.120***	0.076***	-0.02
	[0.027]	[0.027]	[0.285]	[0.019]	[0.017]	[0.181]	[0.020]	[0.018]	[0.175]	[0.024]	[0.023]	[0.244]
North, birth	-0.462***	-0.374***	-3.647***	-0.417***	-0.341***	-3.283***	-0.350***	-0.293***	-2.839***	-0.517***	-0.441***	-4.107***
	[0.025]	[0.021]	[0.228]	[0.016]	[0.014]	[0.160]	[0.013]	[0.011]	[0.116]	[0.022]	[0.019]	[0.208]
Crisis cohort X North, birth	-0.081***	-0.069***	-0.346	-0.077***	-0.064**	-0.266	-0.126***	-0.091***	-0.544**	-0.023	-0.027	0.014
	[0.022]	[0.024]	[0.247]	[0.024]	[0.027]	[0.264]	[0.024]	[0.028]	[0.270]	[0.026]	[0.028]	[0.270]
Post-crisis cohort X North, birth	0.054**	0.034	0.825***	0.047*	0.041*	0.823***	-0.051	-0.024	0.158	0.109***	0.078***	1.188***
	[0.022]	[0.021]	[0.212]	[0.024]	[0.021]	[0.217]	[0.033]	[0.024]	[0.253]	[0.026]	[0.024]	[0.246]
Adult literacy program	-0.024	-0.029*	-0.237	-0.063**	-0.057*	-0.760***	-0.053	-0.023	-0.439	0	0	-0.003
	[0.016]	[0.016]	[0.178]	[0.031]	[0.034]	[0.245]	[0.041]	[0.034]	[0.334]	[0.001]	[0.001]	[0.012]
Primary school	0.059***	0.092***	0.948***	0.062***	0.087***	0.947***	0.242***	0.236***	2.351***	-0.003***	-0.002***	-0.012**
	[0.020]	[0.018]	[0.206]	[0.016]	[0.016]	[0.175]	[0.014]	[0.013]	[0.144]	[0.000]	[0.000]	[0.005]
Secondary school	0.073***	0.060***	0.990***	0.082**	0.099**	1.578***	0.139***	0.156***	2.239***	0.003**	0.002*	0.047***
	[0.020]	[0.023]	[0.268]	[0.041]	[0.039]	[0.538]	[0.053]	[0.049]	[0.622]	[0.001]	[0.001]	[0.014]
Crisis cohort X Adult literacy program	-0.008	-0.016	-0.235	0.121	0.114	0.678	0.059	0.054	0.45	-0.004**	-0.005**	-0.047**
	[0.020]	[0.023]	[0.220]	[0.084]	[0.090]	[0.750]	[0.042]	[0.046]	[0.419]	[0.002]	[0.002]	[0.022]
Post-crisis cohort X Adult literacy program	0.032	0.024	0.18	0.047	0.017	-0.328	0.061	0.028	0.388	0	-0.001	0.017
	[0.023]	[0.025]	[0.243]	[0.065]	[0.091]	[0.476]	[0.046]	[0.039]	[0.415]	[0.002]	[0.002]	[0.022]
Crisis cohort X Primary school	0.043	0.082**	0.585*	0.018	0.038	0.392*	-0.138***	-0.092***	-0.888***	0.005***	0.006***	0.051***
	[0.033]	[0.032]	[0.300]	[0.023]	[0.025]	[0.232]	[0.023]	[0.026]	[0.245]	[0.001]	[0.001]	[0.014]
Post-crisis cohort X Primary school	-0.043	0.008	-0.209	-0.007	0.025	-0.035	-0.181***	-0.120***	-1.471***	0.003*	0.006***	0.046***
	[0.027]	[0.024]	[0.250]	[0.021]	[0.021]	[0.206]	[0.026]	[0.022]	[0.216]	[0.001]	[0.001]	[0.012]
Crisis cohort X Secondary school	-0.015	0.012	0.094	-0.02	-0.001	0.306	-0.121***	-0.104*	-0.946	0.002	0.002	0.049
	[0.027]	[0.040]	[0.344]	[0.042]	[0.050]	[0.538]	[0.044]	[0.055]	[0.624]	[0.003]	[0.005]	[0.050]
Post-crisis cohort X Secondary school	-0.037	-0.006	-0.203	-0.065	-0.014	-0.756	-0.108*	-0.086	-1.349**	0.001	0.004	0.05
	[0.030]	[0.037]	[0.368]	[0.059]	[0.060]	[0.576]	[0.061]	[0.055]	[0.622]	[0.004]	[0.004]	[0.045]
North, birth X Adult literacy program	0.031	0.048**	0.520**	0.083	0.133	1.383	0.138***	0.112**	1.126**	0	0.003*	0.017
	[0.029]	[0.023]	[0.262]	[0.103]	[0.091]	[1.031]	[0.052]	[0.044]	[0.447]	[0.002]	[0.002]	[0.018]
North, birth X Primary school	0.02	-0.034	-0.284	0.053	-0.005	0.029	-0.024	-0.072***	-0.518**	0.004***	0.002***	0.020***
	[0.030]	[0.023]	[0.252]	[0.042]	[0.026]	[0.266]	[0.045]	[0.025]	[0.255]	[0.001]	[0.001]	[0.007]
North, birth X Secondary school	0.298**	0.131**	1.001	0.088	0.029	-0.24	0.257***	0.133*	0.556	0.016	0.008	0.053

	[0.117]	[0.064]	[0.615]	[0.107]	[0.091]	[1.104]	[0.086]	[0.077]	[0.858]	[0.010]	[0.005]	[0.048]
<i>Mother's education:</i>												
Primary	0.166***	0.157***	1.410***	0.167***	0.157***	1.428***	0.154***	0.144***	1.292***	0.164***	0.158***	1.447***
	[0.013]	[0.020]	[0.201]	[0.013]	[0.020]	[0.199]	[0.013]	[0.020]	[0.199]	[0.013]	[0.019]	[0.194]
Middle/JSS	0.141***	0.199***	2.494***	0.145***	0.200***	2.530***	0.131***	0.188***	2.399***	0.145***	0.203***	2.535***
	[0.011]	[0.014]	[0.188]	[0.012]	[0.015]	[0.195]	[0.011]	[0.014]	[0.191]	[0.012]	[0.014]	[0.187]
Secondary and above	0.085**	0.111***	2.739***	0.085**	0.107***	2.693***	0.073**	0.099**	2.613***	0.087**	0.110***	2.749***
	[0.035]	[0.038]	[0.674]	[0.037]	[0.040]	[0.688]	[0.037]	[0.042]	[0.704]	[0.036]	[0.037]	[0.656]
Don't know	-0.041	-0.04	-0.414	-0.044	-0.046	-0.492	-0.045	-0.044	-0.463	-0.037	-0.038	-0.403
	[0.045]	[0.046]	[0.407]	[0.044]	[0.045]	[0.392]	[0.043]	[0.045]	[0.388]	[0.044]	[0.045]	[0.397]
Missing information	0.084	0.051	0.621	0.096*	0.059	0.779	0.083	0.045	0.636	0.091	0.056	0.67
	[0.055]	[0.057]	[0.715]	[0.058]	[0.057]	[0.691]	[0.061]	[0.057]	[0.674]	[0.056]	[0.058]	[0.724]
<i>Father's education:</i>												
Primary	0.050***	0.035**	0.593***	0.047***	0.032**	0.567***	0.057***	0.040**	0.653***	0.045***	0.031*	0.545***
	[0.015]	[0.016]	[0.173]	[0.016]	[0.016]	[0.172]	[0.015]	[0.016]	[0.169]	[0.016]	[0.016]	[0.179]
Middle/JSS	0.184***	0.181***	1.990***	0.181***	0.176***	1.942***	0.164***	0.161***	1.797***	0.186***	0.185***	2.017***
	[0.011]	[0.013]	[0.134]	[0.011]	[0.013]	[0.133]	[0.011]	[0.013]	[0.136]	[0.011]	[0.013]	[0.137]
Secondary and above	0.199***	0.216***	2.530***	0.196***	0.212***	2.481***	0.178***	0.195***	2.318***	0.199***	0.219***	2.555***
	[0.021]	[0.022]	[0.237]	[0.021]	[0.023]	[0.239]	[0.020]	[0.022]	[0.232]	[0.020]	[0.022]	[0.238]
Don't know	0.144***	0.052*	0.548**	0.143***	0.051*	0.555**	0.123***	0.031	0.352	0.148***	0.055*	0.571**
	[0.025]	[0.027]	[0.242]	[0.025]	[0.027]	[0.240]	[0.023]	[0.026]	[0.231]	[0.026]	[0.028]	[0.250]
Missing information	0.154	0.068	0.415	0.143	0.06	0.301	0.141	0.059	0.302	0.152	0.069	0.442
	[0.094]	[0.119]	[0.835]	[0.100]	[0.121]	[0.853]	[0.089]	[0.110]	[0.766]	[0.096]	[0.122]	[0.857]
<i>Survey fixed effects:</i>												
GLSS 4	0.148***	0.037*	0.784***	0.146***	0.032	0.765***	0.141***	0.026	0.704***	0.148***	0.032	0.724***
	[0.019]	[0.019]	[0.221]	[0.020]	[0.020]	[0.222]	[0.021]	[0.020]	[0.220]	[0.020]	[0.021]	[0.239]
GLSS 5	0.117***	0.005	1.007***	0.112***	0	0.984***	0.112***	-0.003	0.949***	0.102***	-0.017	0.769***
	[0.017]	[0.018]	[0.200]	[0.017]	[0.018]	[0.199]	[0.017]	[0.018]	[0.195]	[0.018]	[0.019]	[0.214]
Constant	0.506***	0.487***	4.322***	0.505***	0.492***	4.391***	0.434***	0.441***	3.942***	0.622***	0.605***	5.464***
	[0.026]	[0.025]	[0.266]	[0.021]	[0.021]	[0.221]	[0.019]	[0.019]	[0.202]	[0.024]	[0.023]	[0.237]
<i>F-test:</i>												
All interactions:	5.028	4.16	4.074	3.877	2.458	2.884	12.67	7.171	8.289	5.5	6.638	4.691
	[0.000]	[0.000]	[0.000]	[0.000]	[0.005]	[0.001]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
R ²	0.339	0.302	0.3	0.334	0.303	0.302	0.369	0.332	0.331	0.336	0.298	0.296
N	23179	23179	23179	23179	23179	23179	23179	23179	23179	23179	23179	23179

Notes: Calculations incorporate sampling weights. Robust Huber-White (Huber, 1967; White, 1980) standard errors, adjusted for within-cluster correlation/clustering (Wooldridge, 2010), in brackets under parameter estimates; and p-values of robust F-test statistics under F-test statistics. *: statistically significant at 10 percent; **: statistically significant at 5 percent; ***: statistically significant at 1 percent.

Reference categories are “pre-1971” (birth cohort); “Southern regions” (region of birth/residence); “No education” (maternal/paternal education).

Source: Ghana Living Standards Survey (Rounds 3-5: 1991/92, 1998/99, and 2005/06).

Table A10. Adult Literacy Program Participation Regression Results from Alternative Samples and Alternative Measures of Educational Access (Linear Probability Model): Aggregating Regions and Birth Cohorts and Adding Interactions (Dis-aggregated Average Marginal Effects from Table 4, Explicitly Including All the Interaction Variables)

	<i>Including formal education completers:</i>				<i>Individuals who never attended school:</i>			
	<i>Current Access</i>	<i>Access in 1970</i>	<i>Access at Relevant Age (Binary)</i>	<i>Age Relevant Exposure (Years)</i>	<i>Current Access</i>	<i>Access in 1970</i>	<i>Access at Relevant Age (Binary)</i>	<i>Age Relevant Exposure (Years)</i>
Female	-0.028*** [0.005]	-0.030*** [0.005]	-0.029*** [0.005]	-0.029*** [0.005]	-0.065*** [0.008]	-0.066*** [0.008]	-0.066*** [0.008]	-0.065*** [0.008]
Years of schooling	-0.009*** [0.001]	-0.010*** [0.001]	-0.009*** [0.001]	-0.009*** [0.001]				
Crisis cohort	-0.025 [0.021]	-0.021 [0.014]	-0.030** [0.014]	-0.02 [0.017]	-0.072** [0.035]	-0.045 [0.028]	-0.045 [0.029]	-0.019 [0.031]
Post-crisis cohort	-0.045*** [0.017]	-0.053*** [0.011]	-0.051*** [0.012]	-0.063*** [0.013]	-0.050* [0.029]	-0.074*** [0.021]	-0.051** [0.025]	-0.065*** [0.025]
North, birth	-0.068*** [0.023]	-0.043*** [0.016]	-0.053*** [0.013]	-0.035* [0.018]	-0.059** [0.027]	-0.058*** [0.018]	-0.073*** [0.013]	-0.047** [0.021]
Crisis cohort X North, birth	0.089*** [0.017]	0.079*** [0.019]	0.076*** [0.018]	0.073*** [0.018]	0.121*** [0.026]	0.110*** [0.029]	0.103*** [0.029]	0.093*** [0.028]
Post-crisis cohort X North, birth	0.076*** [0.016]	0.067*** [0.015]	0.058*** [0.021]	0.066*** [0.017]	0.111*** [0.020]	0.095*** [0.020]	0.077*** [0.026]	0.097*** [0.021]
Adult literacy program	0.042*** [0.011]	0.006 [0.035]	-0.005 [0.034]	0.001 [0.001]	0.053*** [0.017]	-0.039 [0.040]	-0.053 [0.045]	0.001 [0.001]
Primary school	-0.003 [0.017]	0.014 [0.012]	-0.007 [0.009]	0 [0.000]	0.012 [0.022]	0.022 [0.017]	0.004 [0.013]	0.001 [0.000]
Secondary school	-0.007 [0.014]	0.034 [0.028]	0.004 [0.022]	0 [0.001]	0.017 [0.024]	0.088* [0.052]	0.072 [0.084]	0.001 [0.001]
Crisis cohort X Adult literacy program	0.013 [0.015]	-0.028 [0.034]	0.011 [0.034]	0.003** [0.001]	0.068*** [0.026]	-0.037 [0.077]	0.029 [0.067]	0.005* [0.002]
Post-crisis cohort X Adult literacy program	-0.028** [0.013]	-0.089** [0.040]	0 [0.038]	0.001 [0.001]	-0.029 [0.023]	-0.108* [0.055]	0.047 [0.070]	0.001 [0.002]
Crisis cohort X Primary school	-0.024 [0.021]	-0.024 [0.016]	-0.009 [0.016]	-0.002* [0.001]	-0.032 [0.033]	0.003 [0.031]	-0.005 [0.029]	-0.002 [0.002]
Post-crisis cohort X Primary school	-0.015 [0.016]	-0.034*** [0.012]	-0.032** [0.016]	-0.001 [0.001]	-0.051* [0.026]	-0.068*** [0.022]	-0.095*** [0.032]	-0.003** [0.001]
Crisis cohort X Secondary school	-0.013 [0.017]	0.006 [0.038]	0.008 [0.026]	-0.002 [0.002]	0.032 [0.054]	0.228 [0.160]	0.086 [0.090]	0.004 [0.006]
Post-crisis cohort X Secondary school	0.006 [0.015]	-0.009 [0.034]	-0.001 [0.019]	0 [0.002]	-0.012 [0.051]	0.191 [0.117]	-0.029 [0.068]	0.006 [0.009]

North, birth X Adult literacy program	0.048*** [0.018]	0.026 [0.056]	0.014 [0.029]	0.002 [0.002]	0.025 [0.022]	0.066 [0.058]	0.031 [0.048]	0.001 [0.002]
North, birth X Primary school	-0.013 [0.023]	0.001 [0.023]	0.027 [0.025]	-0.001 [0.001]	-0.026 [0.028]	-0.002 [0.027]	0.045 [0.028]	-0.001 [0.001]
North, birth X Secondary school	-0.007 [0.020]	-0.002 [0.044]	0.01 [0.041]	-0.001 [0.003]	-0.026 [0.034]	-0.084 [0.068]	-0.046 [0.091]	0 [0.002]
<i>Mother's education:</i>								
Primary	0.012 [0.011]	0.011 [0.011]	0.011 [0.011]	0.012 [0.011]	0.013 [0.046]	0.011 [0.048]	0.009 [0.048]	0.012 [0.047]
Middle/JSS	0.002 [0.009]	0.004 [0.008]	0.004 [0.008]	0.002 [0.009]	-0.056 [0.052]	-0.05 [0.054]	-0.055 [0.052]	-0.05 [0.053]
Secondary and above	0.003 [0.022]	-0.001 [0.023]	0 [0.023]	-0.002 [0.023]	-0.042 [0.049]	-0.046 [0.052]	-0.042 [0.050]	-0.049 [0.051]
Don't know	-0.028 [0.028]	-0.032 [0.028]	-0.031 [0.028]	-0.032 [0.028]	-0.085* [0.044]	-0.090** [0.044]	-0.089** [0.045]	-0.091** [0.045]
Missing information	-0.053* [0.030]	-0.052* [0.028]	-0.050* [0.028]	-0.054* [0.030]	-0.048 [0.077]	-0.046 [0.072]	-0.041 [0.069]	-0.057 [0.076]
<i>Father's education:</i>								
Primary	-0.008 [0.011]	-0.006 [0.011]	-0.007 [0.011]	-0.006 [0.011]	-0.004 [0.031]	-0.006 [0.032]	-0.004 [0.032]	-0.005 [0.032]
Middle/JSS	-0.003 [0.007]	-0.003 [0.006]	-0.001 [0.007]	-0.003 [0.006]	0.029 [0.024]	0.023 [0.023]	0.028 [0.023]	0.029 [0.023]
Secondary and above	-0.003 [0.012]	-0.003 [0.012]	-0.002 [0.012]	-0.004 [0.012]	-0.017 [0.034]	-0.02 [0.035]	-0.016 [0.035]	-0.02 [0.035]
Don't know	0.045** [0.018]	0.047*** [0.018]	0.048*** [0.018]	0.046** [0.018]	0.086** [0.042]	0.094** [0.042]	0.090** [0.043]	0.089** [0.043]
Missing information	-0.027 [0.047]	-0.023 [0.048]	-0.022 [0.048]	-0.019 [0.047]	0.034 [0.109]	0.045 [0.109]	0.052 [0.109]	0.058 [0.107]
<i>Survey fixed effects:</i>								
GLSS 4	0.033** [0.015]	0.040** [0.016]	0.040** [0.016]	0.032** [0.016]	0.042 [0.034]	0.048 [0.036]	0.05 [0.036]	0.041 [0.036]
GLSS 5	0.044*** [0.014]	0.051*** [0.015]	0.049*** [0.014]	0.041*** [0.015]	0.03 [0.032]	0.033 [0.034]	0.032 [0.033]	0.023 [0.034]
Constant	0.123*** [0.020]	0.137*** [0.018]	0.150*** [0.015]	0.135*** [0.018]	0.130*** [0.038]	0.164*** [0.037]	0.177*** [0.035]	0.161*** [0.037]
<i>F-test:</i>								
All interactions:	7.765 [0.000]	5.538 [0.000]	4.009 [0.000]	4.896 [0.000]	6.396 [0.000]	7.912 [0.000]	4.864 [0.000]	4.491 [0.000]
R ²	0.038	0.031	0.031	0.032	0.03	0.024	0.024	0.023
N	21559	21559	21559	21559	11523	11523	11523	11523

Notes: Calculations incorporate sampling weights. Robust Huber-White (Huber, 1967; White, 1980) standard errors, adjusted for within-cluster correlation/clustering (Wooldridge, 2010), in brackets under parameter estimates; and p-values of robust F-test statistics under F-test statistics. *: statistically significant at 10 percent; **: statistically significant at 5 percent; ***: statistically significant at 1 percent. Reference categories are “pre-1971” (birth cohort); “Southern regions” (region of birth/residence); “No education” (maternal/paternal education).

Source: Ghana Living Standards Survey (Rounds 3-5: 1991/92, 1998/99, and 2005/06).

Table A11. Mincer Earnings Regression Results across Birth Cohorts and Full Sample (OLS): Core Specification

	<i>Across Birth Cohorts:</i>							<i>Full sample:</i>	
	<i>Pre-1951</i>	<i>1951-55</i>	<i>1956-60</i>	<i>1961-65</i>	<i>1966-70</i>	<i>1971-75</i>	<i>1976-80</i>	Only 1971-75 cohort dummy + interaction	Adding 1966-70 cohort dummy + interaction
<i>(1) Core specification:</i>									
Years of schooling	0.043*** [0.006]	0.047*** [0.008]	0.056*** [0.006]	0.054*** [0.007]	0.034*** [0.009]	0.030*** [0.010]	0.047*** [0.011]	0.045*** [0.004]	0.048*** [0.004]
1966-70 cohort									0.052 [0.051]
1966-70 cohort X Years of schooling									-0.015* [0.008]
1971-75 cohort								-0.081 [0.064]	-0.074 [0.065]
1971-75 cohort X Years of schooling								-0.019** [0.009]	-0.022** [0.010]
Female	-0.651*** [0.046]	-0.554*** [0.077]	-0.377*** [0.074]	-0.343*** [0.065]	-0.292*** [0.075]	-0.361*** [0.082]	-0.472*** [0.083]	-0.471*** [0.032]	-0.471*** [0.032]
North, birth	0.083 [0.113]	0.119 [0.195]	-0.147 [0.218]	0.007 [0.160]	-0.136 [0.134]	-0.034 [0.218]	0.1 [0.186]	0.024 [0.082]	0.022 [0.082]
North, residence	-0.330** [0.128]	-0.433** [0.212]	0.123 [0.245]	-0.174 [0.165]	-0.227 [0.154]	-0.293 [0.223]	-0.408* [0.213]	-0.253** [0.109]	-0.254** [0.109]
GLSS 4	-0.251*** [0.080]	-0.258*** [0.098]	-0.126 [0.103]	0.011 [0.099]	0.033 [0.110]	0.278** [0.136]	-0.911*** [0.128]	-0.171** [0.069]	-0.171** [0.070]
GLSS 5	0.267*** [0.077]	0.354*** [0.099]	0.425*** [0.090]	0.587*** [0.091]	0.730*** [0.101]	1.148*** [0.122]		0.440*** [0.061]	0.438*** [0.060]
Constant	14.433*** [0.061]	14.508*** [0.090]	14.296*** [0.089]	14.096*** [0.089]	14.087*** [0.109]	13.642*** [0.130]	14.683*** [0.124]	14.305*** [0.052]	14.300*** [0.051]
R ²	0.151	0.187	0.15	0.152	0.126	0.176	0.202	0.144	0.144
N	4,049	1,234	1,588	1,629	1,754	1,314	991	13,159	13,159

Notes: Calculations incorporate sampling weights. Robust Huber-White (Huber, 1967; White, 1980) standard errors, adjusted for within-cluster correlation/clustering (Wooldridge, 2010), in brackets under parameter estimates. *: statistically significant at 10 percent; **: statistically significant at 5 percent; ***: statistically significant at 1 percent. Reference region is “Southern regions.”

Source: Ghana Living Standards Survey (Rounds 3-5: 1991/92, 1998/99, and 2005/06).

Table A12. Mincer Earnings Regression Results across Birth Cohorts and Full Sample (OLS): Adding Region and Birth Cohort Interactions

<i>Across Birth Cohorts:</i>								<i>Full sample:</i>	
	<i>Pre-1951</i>	<i>1951-55</i>	<i>1956-60</i>	<i>1961-65</i>	<i>1966-70</i>	<i>1971-75</i>	<i>1976-80</i>	Only 1971-75 cohort dummy + interaction	Adding 1966-70 cohort dummy + interaction
Years of schooling	0.043*** [0.006]	0.047*** [0.008]	0.056*** [0.006]	0.054*** [0.007]	0.034*** [0.009]	0.030*** [0.010]	0.047*** [0.011]	0.045*** [0.004]	0.048*** [0.004]
1971-75 cohort								-0.061 [0.076]	-0.046 [0.077]
1971-75 cohort X Years of schooling								-0.021** [0.010]	-0.024** [0.010]
1966-70 cohort									0.128* [0.068]
1966-70 cohort X Years of schooling									-0.022** [0.009]
Female	-0.651*** [0.046]	-0.554*** [0.077]	-0.377*** [0.074]	-0.343*** [0.065]	-0.292*** [0.075]	-0.361*** [0.082]	-0.472*** [0.083]	-0.471*** [0.032]	-0.470*** [0.032]
North, birth	0.083 [0.113]	0.119 [0.195]	-0.147 [0.218]	0.007 [0.160]	-0.136 [0.134]	-0.034 [0.218]	0.1 [0.186]	0.028 [0.083]	0.055 [0.083]
North, residence	-0.330** [0.128]	-0.433** [0.212]	0.123 [0.245]	-0.174 [0.165]	-0.227 [0.154]	-0.293 [0.223]	-0.408* [0.213]	-0.253** [0.109]	-0.253** [0.109]
North, birth X 1971-75 cohort								-0.051 [0.111]	-0.076 [0.110]
North, birth X 1966-70 cohort									-0.198*** [0.075]
GLSS 4	-0.251*** [0.080]	-0.258*** [0.098]	-0.126 [0.103]	0.011 [0.099]	0.033 [0.110]	0.278** [0.136]	-0.911*** [0.128]	-0.171** [0.069]	-0.171** [0.070]
GLSS 5	0.267*** [0.077]	0.354*** [0.099]	0.425*** [0.090]	0.587*** [0.091]	0.730*** [0.101]	1.148*** [0.122]		0.441*** [0.061]	0.438*** [0.060]
Constant	14.433*** [0.061]	14.508*** [0.090]	14.296*** [0.089]	14.096*** [0.089]	14.087*** [0.109]	13.642*** [0.130]	14.683*** [0.124]	14.303*** [0.052]	14.289*** [0.052]
R ²	0.151	0.187	0.15	0.152	0.126	0.176	0.202	0.144	0.145
N	4,049	1,234	1,588	1,629	1,754	1,314	991	13,159	13,159

Notes: Calculations incorporate sampling weights. Robust Huber-White (Huber, 1967; White, 1980) standard errors, adjusted for within-cluster correlation/clustering (Wooldridge, 2010), in brackets under parameter estimates. *: statistically significant at 10 percent; **: statistically significant at 5 percent; ***: statistically significant at 1 percent. Reference region is “Southern regions.”

Source: Ghana Living Standards Survey (Rounds 3-5: 1991/92, 1998/99, and 2005/06).