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Article (Accepted Version)

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December 20, 2019

Declarations of interest: none
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Acknowledgements: This project was commissioned under the Complementary Basic Education (CBE) Programme, funded by DFID and USAID and managed by the Management Unit (MU) at Crown Agents, in partnership with the Ministry of Education and Ghana Education Service. Additional funding on the research component was provided by DFID via by the Education Development Trust, project number: 249756-185112. The authors are grateful for the support received from RTI International, JEAVCO and PAB Development Consultants and IMC Worldwide.

Highlights

- Research assesses learning in complementary education and school transition in Ghana
- Initial low learning is shown to be associated with subsequent low performance
- Boys are more likely than girls to escape the trap of low performance
- Greater support for most marginalised is needed in complementary and formal schools

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Abstract:

This study examines the link between initial school performance on subsequent learning for marginalised children in the Complementary Basic Education programme in Northern Ghana. Specifically, we focus on whether initial low performance of girls and boys differentially affects learning trajectories. Drawing on longitudinal data, we find a significant association between initial and subsequent low performance as students transit into formal education, even after taking account of other potential factors. Boys are more likely than girls to improve from low attainment as they move into formal school. As such, girls are at particular risk of maintaining low levels of learning, and therefore warrant greater support within both complementary and mainstream schooling contexts.

Keywords: Gender, Low attainment, Complementary Education, Primary Schooling; Out of School, Ghana

1. Introduction

The link between initial and subsequent learning has been established in high-income countries. Far less is known about how early learning levels change in low-income settings especially for children from disadvantaged backgrounds. Given that many children are not even learning the most foundational skills of literacy and numeracy, understanding these learning achievement trajectories in such contexts is vital if we are to understand how educational interventions are to address this problem successfully.

Some disadvantaged children in low-resource countries who are unable to access primary schooling or drop out early access alternative provision and use it to (re-)enter the formal system. One such example is the Complementary Basic Education Programme (CBE) in Ghana which, like other alternative provisions, has been found to raise learning outcomes, *on average*, and even to enable children participating in these programmes to surpass their peers once joining formal school (Akyeampong et al., 2019). The question remains whether learners from disadvantaged backgrounds, including those who start at low levels of learning and, amongst them, girls, who join the CBE programme equally benefit from the learning gains of this programme, including and after transition into formal school.

This paper focuses on whether low-performing disadvantaged children remain low performing after experiencing the CBE programme, as well as after they have transitioned into formal school. We further investigate trajectories by gender, to see whether girls or boys are more likely to remain as low performers.

The dataset used for the analysis includes 519 children (52% female) aged 9-10 years who enrolled in Ghana's CBE programme in the 2016/2017 academic year and then transitioned into formal school during 2017/18 academic year. Using transition matrices and logit regression modelling, we examine both the unconditional and conditional relationship of CBE students' initial and subsequent achievement in numeracy across three time periods: 1) the end of the CBE; 2) the start of formal school; and, 3) the end of the first year of formal school.

Our results show evidence of persistence in low achievement over time, even after controlling for socioeconomic and demographic factors. Notably, gender differences in this pattern emerged. We find that males are less likely to remain low performers by the end of the first

year of formal schooling. Overall, our findings align with previous studies in high-income countries which highlight the persistence of low attainment over time. Our study highlights the need for support of low-performing girls in particular, who struggle with their learning within complementary education programmes and during the transition to formal schools. It further identifies the limitations of a one size fits all approach to the learning needs of all low achievers in low-income country settings

2. Literature Review

In this section, we situate our analysis of Ghana's CBE programme in the wider literature on the link between initial and later attainment, how student background is found to affect learning trajectories, followed by an overview of the Ghanaian context in particular.

2.1 Association between initial and later achievement

The link between initial and subsequent academic performance has been well established in higher income contexts (Arnold & Doctoroff, 2003; Crawford, Tindal, & Steiber, 2001; Duncan et al., 2007; Entwisle, et al., 2003; Herbers et al., 2012; Luster & McAdoo, 1996; Siegler et al., 2012). Using data drawn from large-scale longitudinal studies from the United States, Great Britain and Canada, for example, Duncan et al. (2007) found that early attainment at ages 5-6 predicts achievement at age 18. Arnold and Doctoroff's (2003) review of research on the academic trajectories of low socio-economic status (SES) children from birth through the first years of elementary school within the US showed that children who experience difficulty with reading in the early years are less likely to engage in reading related activities, therefore falling further behind their peers. In another study in the US, Crawford et al. (2001) identify that poor early reading skills can impact later numeracy achievement, for example, as many maths tasks, such as worded problems, require well developed verbal skills.

Although much of the evidence examining the link between initial and subsequent achievement in centred in high-income countries, some studies also show that early learning levels are a powerful determinant of future academic success in low and lower middle-income countries. In Peru, for example, longitudinal data have demonstrated that vocabulary skills at age 5 are positively correlated with skills in reading and mathematics seven years on (Young Lives, 2016). In Andhra Pradesh, India, evidence has further revealed that early learning (at age 8) is a strong predictor of learning during adolescence (ages 12 and 15), and also of higher

education access at age 19. This influence remains important even after controlling for children's background characteristics gender, school attendance, parental education, and poverty status (Rose et al., n.d).

2.2 The impact of disadvantage on learning trajectories

Children who face disadvantage due to their home and personal background, such as related to poverty and gender, are likely to encounter a number of difficulties that may impact their learning trajectory. Socioeconomic disadvantage has been shown to have a negative influence on children's education outcomes and trajectories in both high and low-income countries (Abukari & Laser, 2013; Arnold & Doctoroff, 2003; Burchinal et al., 2008; Janus & Duku, 2007; Gutman et al., 2003; Larson et al., 2015; Rose et al., nd).

Evidence within high-income country contexts has shown that low socio-economic status (SES) children can progress at comparable rates as higher SES children in school. However, the initial gap in performance remains, thus preserving prior discrepancies in performance overtime (Entwistle et al., 2005). Other research, based on Canada's National Longitudinal Study of Children, suggests that the achievement gap between low SES and high SES children can widen with age (Caro et al., 2009). Those at the lowest end of the poverty spectrum, including children who experience homelessness and residential instability, are at particular risk of remaining at critically low levels of attainment throughout school, as shown by Herbers et al.'s (2013) study conducted within the US. This pattern is also typically found within Southern countries and has been linked with issues concerned with educational access, gender and parental schooling (Alcott & Rose, 2016; Ilie & Rose, 2016). Alcott & Rose's (2016) study found, for example, that household wealth and parental education in rural India drive sizeable gaps in learning which increase over the school trajectory. Their study further showed that gender gaps widen overtime among the poorest.

2.3 The context of Ghana

Over the past two decades, Ghana has made impressive strides towards increasing primary school enrolment and narrowing the gender gap. Ghana, like many other low- and lower-middle income countries, however, still faces challenges in access to quality education for children from disadvantaged backgrounds. In a recent assessment, over four-fifths of children at the end of the second year of schooling within selected regions in the country were found to be unable to read any familiar word such as "the" and "cat" (World Development Report,

2018). In addition, girls have been found to be more likely than boys to drop out of primary school because they had to do household chores, a family member was sick or were unable to pay school fees (Wolf et al., 2016). Within Ghana, sex discrimination within school favouring males in still prevalent (Abukari & Laser, 2013). In a study conducted in the rural central region of Ghana, for example, teachers named more than twice as many males than females, when asked to name their top five students (Lambert et al., 2012).

Socio-economic inequalities also continue to detrimentally impact educational experiences and outcomes within Ghana. Around 40% of Ghana's poorest children (compared with 17% of the richest) are out of school with those in the Northern region faring worst both in terms of access as well as achievement (UNESCO, 2014). The three northern regions, Northern, Upper East and Upper West, have the highest poverty headcount ratio (proportion of the population below the poverty line), across Ghana, surpassing the national average by substantial margins. These regions also suffer from poor quality education with staff retention, distance to schools, inadequate infrastructure and student drop out constituting enduring challenges (UNDP, 2018).

2.4 Ghana's Complementary Basic Education

In many Southern contexts, such as Ghana, complementary education programmes have been introduced to enable disadvantaged, out of school children, an opportunity to achieve foundational skills in literacy and numeracy, offering a second chance to enter the formal school system. These programmes are typically community-led initiatives which provide around a year of accelerated, targeted instruction in basic literacy and numeracy (Ngware et al. 2018). The Government of Ghana, with the support of donors, has been implementing policies and interventions in recent years aimed at improving the quality of education provision and increase gender equity in both school enrolment and achievement, particularly within poorer regions of the country (See Education Sector Plan 2010-2020, Ministry of Education, 2012). The CBE programme is an example of this. With the support of donors (notably DFID and USAID) to a number of implementing partners, the CBE programme has provided over 250, 000 out of school children between the ages of 8-14 access to quality education by adopting flexible and contextualised learning approaches that enable them to transition into the formal school system (DFID Ghana, 2018; UNICEF, 2015).

The Ghanaian CBE programme provides nine months of accelerated learning in basic literacy and numeracy in eleven mother tongue languages for children generally aged between 8-14 years, with classes are set up in remote and deprived areas. Following completion of the CBE programme, children transition into nearby primary schools at a grade level compatible with their achievement at the end of the programme (UNICEF, 2015). In Ghana and other African countries, complementary basic education approaches have been found to be an effective model for producing learning gains within shorter timeframes than formal government schools (e.g. Abreh & Wilmot, 2018; Akyeampong et al., 2019; Jere, 2012; Nicholson, 2007). As previously highlighted, however, less is understood about how the lowest performing children who enter such initiatives fare overtime, and if early assessments of children's learning are predictive of later success.

2.5 Factors associated with learning amongst disadvantaged children in Ghana

A number of factors have been linked to academic achievement and progression in low- and lower-middle income settings. These include, for example, being female, particularly in rural and remote areas where factors such as teacher and family attitudes towards girls' education, feelings of insecurity, early marriage and pregnancy can affect their achievement (Abukari & Laser, 2013; Camfed, 2012). In addition, having parents who have little or no schooling, as is the case for many rural Ghanaian children, can also influence poor educational performance due to economic strains that can inhibit children's ability to learn (Adamu-Issah et al., 2007; Abukari & Laser, 2013; Nicholas-Omoregbe, 2010).

Negative associations have been identified between family size and educational outcomes in the Kumasi Metropolitan district of the Ashanti region in Ghana. The findings indicate that children from large families mostly enrol late in school, perform poorly and leave school early. This is found to be due to parental financial problems, lack of parental attention and poor health compared with children from small families (Azumah, Adjei & Nachinaab, 2017). Absenteeism and child labour are further factors that have been negatively associated with educational outcomes and school engagement in Ghana, particularly in socio-economically deprived regions in the north (Afful-Broni & Sekyi, 2014; Hamenoo et al., 2018).

Having parents who are interested and involved in their child's education, especially for female students, has been found to be positively associated with learning (Abukari & Laser, 2013). A positive association between academic attainment and learning in a child's mother

tongue language has also been identified (e.g. Ball, 2011; Carter et al., forthcoming; Tackie-Ofosu at al., 2015).

Given their focus on the most disadvantaged, children in complementary education programmes often face particular challenges. In the CBE programme in Ghana, for example, the majority of children are above the official primary school age, have illiterate parents, and themselves have minimal or no experience of schooling (Akyeampong et al., 2019; Casely-Hayford et al., 2017). This means that a number of children assessed on entry to the CBE programme demonstrate critically low levels of performance in literacy and numeracy. For those low-performing children who do manage to make the transition to formal schools following completion of CBE, additional difficulties often arise, including the need to travel long distances to school, lack of family learning support, lack of individualized teacher support, learning in new languages of instruction and adjustments to the formal school environment (Akyeampong et al., 2007; Akyeampong et al., 2018; Casely-Hayford et al., 2017).

Girls may face further challenges during this transition related to socio-cultural norms in some communities that restrict their opportunities for educational engagement (Casely-Hayford et al., 2017). Qualitative evidence has also revealed that low-performing CBE girls particularly struggle with the transition to formal school, both cognitively (in their learning) and affectively (in their learner identity) (Akyeampong et al., 2019).

2.6 Study objective

In light of gaps in the existing literature, this study aims to investigate the relationship between initial low performance and subsequent learning within the context of Ghana. It focuses on learning trajectories of disadvantaged children in the CBE programme, and their transition into formal schools. Given that one of the aims of the CBE programme is to tackle potential disadvantage associated with gender, this study further investigates whether gender differences exist between the trajectories of initial low performers.

The analysis begins by examining descriptively whether students initially identified as low-performing males and females maintain their position overtime through tracking their trend in performance relative to that of the overall cohort. Drawing upon Feinstein's (2013) methodology, this first stage further examines the mobility of low-performing students

through the inclusion of transition matrices that show extreme movement patterns from the bottom and top quartiles of performance and vice versa, as a potential indicator of stability or change. The second stage looks retrospectively at the relative influence of initial attainment on low achievement at the end of the CBE one-year cycle, the beginning and end of the first year of formal school. This analysis also takes account of other potential predictors of achievement drawing on factors identified in previous research discussed above.

The following research questions inform the study:

1. To what extent does initial low performance influence CBE students' learning trajectories, including in the transition into formal schooling, including once other factors are taken into account?
2. To what extent does initial low performance differentially influence male and female learning trajectories, including once other factors are taken into account?

3. Methodology

3.1 Sample and participants

This article draws on data collected for a study that tracked a cohort of CBE students over the year of CBE, as well as one year following their transition into formal schooling. Four waves of learning assessment (local language literacy and numeracy) were collected at the beginning and end of each academic year, together with survey data providing information on background characteristics of the students. In total, 2,360 CBE children were originally selected from an approximate total of 40,000 in the 2016/2017 academic year. A stratified random sampling approach was used, which provided proportional representation of the sample by implementing partners (IP) within the CBE programme, language taught, region, district, CBE centre and gender. For each of the 10 different IPs involved, the targeted sample size was determined based on the number of students each was responsible for as a proportion of the total student population. Following this, regions were represented based on their proportions of students, after which districts were selected, taking language into account. The aim was not to achieve equal representation of each of the 11 languages taught within CBE, but rather to ensure that in the selection of the IPs, regions, and districts, none were left unrepresented. Finally, on the basis of an average of 25 students per centre, the number of centres for each district was determined and randomly selected for the study. At each selected

centre, all students present at school on the day(s) of assessment were assessed and selected for the study.

From this original sample, 1,166 children were identified for which learning data were available across waves. Over time, sample attrition occurred due to discontinuation of schooling following the CBE programme, dropout from formal school, migration and absence from school at the time of data collection (irregular attendance is high due to seasonality and household chores). In the first wave of data collection, students' self-reported ages ranged from 6 to 14 years with the average student in the sample being 10.1 years old. In order to account for the confounding factor of age on initial and subsequent achievement, this study restricted its sample to children aged 9 and 10. From this, 519 were included in the study to assess trends in learning. Kolmogorov-Smirnov tests were conducted to check for equality of score distributions for these ages for relevant assessments, all revealing insignificant results and thus establishing the comparability of performance for students aged 9-10 (Table 1). We are mindful of the relatively small dataset. As such, we also undertook the analysis with the larger sample that included a wider age range, and found that similar results to those presented below still hold.

Table 1: Equality of Score Distributions for CBE students Ages 9 and 10

Attrition bias could affect our results in that if attrition is higher for low-performing children, then our sample could contain more high achieving children. Using the same dataset, Carter et. al. (forthcoming) identify children from the original sample who were unavailable at each round of data collection, focusing on the proportion of children who were classified as non-performers in overall local language literacy and numeracy tasks at the start of the CBE programme, i.e. children who could not answer a single item on any of the literacy and numeracy subtask assessments, as well as the percentages of male/female students. With respect to achievement differences, children who were unavailable at each round of data showed significantly higher proportions of zero scores in overall local literacy compared with children who were available. For numeracy, lower but nonetheless significant zero score proportional differences were also observed. This provided evidence that our sample contained children who were more likely to be higher performers. The implication of these findings is that initial low-performing children, who constitute the focus of the paper, show stronger tendencies to discontinue their education compared with initial higher performing

children. As such, conclusions drawn from our study may represent an underestimation of the persistence in low performance over time. Even so, if we our results demonstrate some persistence, then the situation for low performers in the population is likely to be much worse than the one estimated here.

3.2 Regression to the mean

Within this study, we are cognisant of issues related to regression to the mean, namely a statistical phenomenon that occurs when data are drawn from repeated measures taken from the same participants(s). As explained by Jerrim & Vignoles (2013, p. 890), due to random error, children who achieve a relatively low or high mark on an initial assessment are more likely to attain a less extreme score on later assessments. Their initial result, for example, may have been due to the 'luck' the student had at the time the assessment was administered (i.e. random error), rather than their genuine potential. In order to address this, we draw upon Jerrim and Vignole's (2013) approach through tracking performance on different measures (numeracy assessments) to what is used to identify initial low and high performance (local language literacy assessments). In drawing upon this method as well as applications in more recent research (e.g. Crawford, Macmillan & Vignoles, 2017), test scores taken from two different assessments (local language literacy and numeracy) at the same time point are used in this study. Local language literacy assessment data are used to categorise children as 'low performing', while the numeracy assessment is used as the baseline observation from which changes in performance are determined. As explained by Crawford, Macmillan and Vignoles (2017, p. 94), defining initial performance using a different assessment, measured at the same time point, will go some way to reducing any effect of regression to the mean by minimising the correlation (and hence measurement error) between the initial categorisation and first observed achievement measure.

3.3 Definition of low performance

Previous studies have adopted different approaches to defining and measuring low achievement. These have included, for instance, applying percentile thresholds based on children's assessment scores or ranked positions, relative to the distribution of participants of interest (e.g. Feinstein, 2003; Loveless et al., 2008), as well as set score cut offs or grades dependent upon age, learning level and contextual expectations (e.g. Crawford et al., 2014).

For our analysis, low performance is defined as those children within the sample performing in the bottom quartile (i.e. 25th percentile of overall scores) in local language literacy at the start of the CBE programme. For the second stage of analysis, which investigates whether additional factors influenced the relationship between initial and subsequent low performance, low performers are defined as those students achieving scores in bottom quartiles (25th) in numeracy at each subsequent timeframe investigated in the study (at the end of CBE, the beginning of formal school and the end of the first year of formal school).

Our decision to base thresholds for low performance on the lower quartiles of assessment results, as opposed to set cut offs, was informed by the non-normal distributions of scores at the time periods in question, as well as previous approaches that have been applied in defining and tracking performance through assessments overtime (e.g. Feinstein, 2003). Tracking performance through numeracy provided a more robust measure of achievement over time, compared to local language literacy, due to challenges that many CBE children face with having to change local language of instruction, and hence language of assessment, upon placement into formal school. In addition, basing initial low performance on students' local language literacy is consistent with previous studies, which identify this as a significant predictor of future academic success in both developing and developed country contexts (see Arnold & Doctoroff, 2003; Crawford et al., 2001; Cueto et al., 2016; Entwisle et al., 2003; Herbers et al., 2012; Young Lives, 2016).

3.4 Learner assessments

For the key variables of interest (i.e. initial and subsequent low performance), data on learning were collected via learning assessments for the four rounds of data collection. These were adaptations of the Early Grade Reading Assessment (EGRA) for local language and Early Grade Mathematics Assessment (EGMA) for numeracy. In terms of language, students were tested in either Asante Twi, Dagaare, Dagbani, Ewe, Gonja or Kasem on subtasks comprising letter sound identification, phonemic awareness, reading comprehension, reading fluency, familiar word identification, word writing and creative writing. EGMA was designed to provide information about basic mathematics competencies—those competencies which should typically be mastered in the very early grades, and without which pupils will struggle, or potentially drop out in later years of schooling. This was also administered in students' local language and included subtask assessments on number identification, number discrimination, identifying missing numbers as well as mechanical and worded problems

involving addition, subtraction, multiplication and division.[1]

To maximise the information available regarding students' learning performance while reducing the number of dependent variables, scores from each subtask of the literacy and numeracy assessments were combined by principal component analysis. This method has the benefit of combining subtask results into a single score which is representative of overall performance for literacy and numeracy. It is also easier to understand and use in subsequent analysis than the full set of test scores. Cronbach's alphas for all overall scores used in the present study were between 0.92 and 0.94, therefore providing strong evidence of internal consistency (UNESCO Institute for Statistics, 2016).

3.5 Child Background Survey

In addition to learning assessments, a child background survey was administrated to CBE children at all four stages of data collection. The child survey collected information related to participants' demographics, family status, household economic situation, school, language backgrounds, work history, and personal opinions about school and learning. It was designed to permit the analysis of patterns of differences in performance linked to the students' background and in particular, this information was key to investigating whether confounding variables impacted learning outcomes for low and high performing students in their transition to formal school.

3.6 Analytical Approach

A two-stage quantitative approach to analysis was used in this study. Stage 1 involved examining descriptively initial low-performing CBE students' progress in numeracy assessments over four time frames, namely: beginning of CBE; end of CBE; start of formal school; end of the first year of formal school.[2] Due to the skew of score distributions and minor differences between the subtask constitution of instruments used in the first and second year of data collection, the median (as opposed to mean) achievement level of students

[1] Due to the need to tailor assessments to the specific purposes of the programme, assessments used during CBE contained a few minor differences between the standard EGMA design used for assessments of students' learning in formal school (data rounds 3 & 4). These included differences in the numbers of items in each subtask as well as the subtask constitution of the instrument.

[2] It is important to acknowledge the limited time frame of the trajectories examined. Typically, studies investigating associations between initial and later achievement involve more extensive time periods with wider intervals between data points. However, given our interest in the CBE programme, which is only over one year, and transition into primary school, the time scale under investigation is of relevance to our study.

identified as low performers at each of the four time frames was used as the measure of progress and compared against that of the overall sample of students used within the study.

To provide further insight into the trajectories of initial low achievers, this study adopts Feinstein's (2003) technique of transition matrices to better understand and clarify the relationship between initial and subsequent performance. As explained by Feinstein, given fluctuations in scores over time periods and ages, it is often not clear that movements to adjacent cells are indicative of genuine mobility. Perhaps more revealing are movements from the bottom to top quartiles, or vice versa. Following this approach, our analysis examines extreme movement patterns of initial low-performing children.

The second stage of the analysis focused on establishing the statistical significance of the influence of initial low performance on CBE students' learning trajectories, including by gender. Logistic regression was used to estimate the models, taking account of other potential factors. This is presented in three steps: the first examines the association between initial low performance and subsequent achievement for the overall sample, after accounting for the relative impact of school-level and demographic variables that have been found to influence learning. Within this stage, gender is also accounted for, but it is not specifically considered in relation to differences between male and female initial low performers. For this, we examine separate male and female models in steps 2 and 3 respectively. This is undertaken in order to identify whether girls and boys are both as likely to remain low performers, even taking into account other factors. The logistic regression model applied in each of these stages is represented through the following equation

$$logit(p_{it}) = \log\left(\frac{p_{it}}{1-p_{it}}\right) = \beta_0 + \beta_1 x_1 + \gamma \boldsymbol{X}_{it} + e_{it}$$

where the binary outcome variable Y indicates 1 for low performance; the probability of being low performing for child i in time t is $p_{it} = P(Y = 1)$; x_1 is a binary explanatory variable with 1 indicating initial low performance; and the matrix $\boldsymbol{X}_{it}$ contains school level and demographic characteristics for which we control. The logistic regression of Y on x_1 and $\boldsymbol{X}_{it}$ estimates parameter values for β_0, β_1 and γ using maximum likelihood method. Parameter values within all models are displayed as odds ratios. These represent the odds (or likelihood) of being a low performer given a one-unit increase in the explanatory variable.

As with Stage 1, we address issues related to regression to the mean by tracking attainment through a different measure as that used to determine initial low performance (Crawford et al., 2017; Jerrim & Vignoles, 2014). In other words, our binary outcome variable within these models - whether a child is a low performer - was based upon the numeracy assessment result at the time period in question. Our key explanatory variable - whether a child was an initial low performer- was based upon the local language literacy assessment at the start of the CBE programme. Our control variables representing both school and household factors include having access to mother-tongue instruction in the classroom, grade of placement at formal school, having access to home learning support, household size, absenteeism, engaging in work outside of home and prior school experience to CBE. In addition, relative wealth position (as incorporated through a wealth index constructed using Principal Component Analysis, following Filmer and Pritchett's (2001)) methodology is incorporated as a control.[3]

Table 2 provides descriptive information for key variables of interest for our overall sample as outlined above, as well as for the initial low-performing sub-sample which constitute the core interest of our paper.

Table 2: Descriptive statistics for the sample

4. Results

4.1 Examining trajectories of low-performing male and female CBE students

Figure 1 shows the median level of achievement in numeracy for initial low-performing students across four time periods spanning from the beginning of CBE to the end of the first year of formal school. The trajectories demonstrate that both male and female low-performing students largely maintained their relative position below and above the cohort's median level of achievement across examined time frames. Figure 1 demonstrates that at the end of the CBE programme and start of formal school, low performers maintained median scores well below the overall sample, with modest differences observed between male and female trajectories. By the end of formal school, both male and female students demonstrated a strong

[3] The wealth index is based on data derived from the Child Background Questionnaire. Responses to the household economic questions were used to create an index as a proxy for socio-economic status. Following Filmer & Pricthett's (2001) methodology, this was achieved through using tetrachoric correlations for all binary variables and then split into quartiles by district.

increase of 50.1 and 42.3 percentage points respectively, a finding that revealed many low-performing students, and particularly boys, were able to shift from their initially weak attainment position overtime.

Figure 1: Numeracy scores for initial low-performing CBE students by gender

In order to shed further light on the relationship between initial and subsequent learning of CBE children and areas of greatest mobility, extreme movement patterns of initial low-performing children are further examined through the application of transition matrices (Table 3). Results show that 51% of girls and 47% of boys who were low performers at the start of CBE were still in the bottom quartile in numeracy by the end of the programme. By contrast, only 4.9% female and 6.7% male students had entered the top quartile. While trends remained relatively stable for female low-performing students overtime, greater mobility was observed for males. At the end of the first year of formal school for example, only 32% of initial low-performing males were still in this category. For females, however, 47% remained in the lowest quartile. Moreover, 18% of initially low-performing males shifted to the highest quartile within this time period compared to only 9% of low-performing females. This again suggested a weaker relationship between initial and subsequent low attainment for males, compared to females who appear to be more likely to be trapped in low performance.

The analysis so far suggests that initial low-performing boys and girls differ in their ability to progress from their relatively weak initial positions. The next step in our analysis is to determine the statistical significance of these observed patterns to see whether these are maintained after accounting for the influence of other factors found to affect learning achievement within the Ghanaian and other related contexts.

Table 3: Transition matrices for initial low-performing male and female CBE students

4.2 Establishing the significance of the influence of initial low performance of CBE students' learning trajectories

Table 4 presents results from three binary logit models that specify the probability that a CBE graduate is a low performer in numeracy at the end of CBE, beginning of the first year of formal school and end of the first year of formal school. These models are applied to the full

sample as well as male and female sub-samples. The coefficients in this model are displayed as odds ratios. These represent the odds (or likelihood) of being a low achiever given a one-unit increase in the explanatory variable. Numbers greater than 1 demonstrate increased odds of being in school, whereas numbers less than 1 show decreased odds. A coefficient of exactly 1 means there was no difference in the odds for that variable.

Table 4: Logistic regression model estimates of low performance

In examining the association between initial and subsequent achievement for the overall sample, low performance in numeracy was strongly predicted by initial performance across all three time periods examined. For example, at the end of CBE, Model 1 revealed that students whose achievement was in the bottom quartile at the start of CBE were 5 times more likely to remain in that quartile, after controlling for additional explanatory factors. Compared to the end of CBE, odds ratios at both the start and end of the first year of formal school were lower: at the start and end of the first year of formal school, initial low performers were 3.1 and 2.5 times more likely to remain low performers in numeracy, respectively.

In investigating gender differences in the likelihood to remain low performers, initial achievement was found to predict significantly subsequent achievement at the end of CBE and beginning of formal school for both boys and girls. At both these time points, however, girls showed higher odds to remain low performers compared with boys. At the end of CBE and start of formal school, girls, for example, were 6.1 and 5.3 times more likely to remain low performers respectively, compared to boys who were 4.0 and 2.3 times more likely. By the end of the first year of formal school, initial achievement significantly predicted later performance for girls who were found to be 3.3 times more likely to remain low performers. However, initial achievement was not significant in predicting performance for boys at this stage.

Overall, this analysis reveals that the relationship between initial and subsequent achievement observed in the first stage of our analysis holds after controlling for a range of additional explanatory factors. Similarly, trends related to male and female low performers remained largely in line with the analysis presented above. Low- performing males remained less affected by their initial low achievement than their female counterparts score in numeracy, as evidenced by a lower likelihood at the end of CBE and start of formal school, as well as by an

insignificant association at the end of the first year of formal school. Whilst small sample sizes might affect significance levels, findings nonetheless support low-performing male CBE's students' greater capacity to shift from their initial performance levels, relative to females, overtime. Unlike initial performance, the majority of school-level and socio-demographic variables for which we controlled were not found to significantly predict low performance across time frames. While this also could be partly explained by small sample sizes, it further suggests that initial low performance is the most powerful and consistent determinant of subsequent attainment of all variables examined in our analysis.

5. Discussion

The purpose of this study was to examine the extent to which initial low performance influences children's learning trajectories within the CBE programme and into their transition to formal school in Northern Ghana. Given CBE's emphasis on gender equity (Akyeampong et al., 2019; Casely-Hayford et al., 2017), a further aim was to determine if differences exist between initial low-performing male and female students' achievement overtime, and, whether such differences prevail after accounting for a range of confounding factors that have been found to influence learning.

Overall, this study provided empirical support for the link between initial and subsequent low performance, thus aligning with previous research, particularly in high-income country contexts, as reviewed above. Given the intention of the CBE programme to pay particular attention to those who are initial low performers, this suggests that further measures are likely to be needed to support them. It is important to reinforce the uniqueness of the cohort of children in question. As noted, CBE learners, for example, typically enter the programme overage and with extremely limited, and in most cases, no experience of schooling. As such, those who are low performing are amongst the most marginalised and, as such, most difficult to reach.

With respect to CBE students who enter the formal system, we find some evidence that boys are more likely to break out of their initial low performance, suggesting the CBE programme may offer benefits to these students. This is consistent with observations of CBE classes that revealed teachers gave more attention to low achieving boys than girls (Akyeampong et al., 2019). These observations also showed that low achievers in general rarely engage or

contribute to group work and as a result were not benefitting from learning activities as much as higher achievers. When they transitioned into formal schools this isolation in learning persisted. Evidence from classroom observations further highlighted that low-performing girls were the most marginalised from the instructional routines of formal schools and also showed social withdrawal in the classrooms (Akyeampong et al., 2019).

For girls, despite considerable efforts of the CBE programme to tackle barriers to their access and learning for those who would otherwise have been out of school, many remain trapped in low performance. This raises concerns that they may face increased likelihood of disengaging and dropping out of school over time.

Our findings suggest that girls from poor disadvantaged backgrounds are unable to overcome their learning barriers even with targeted classroom instructional practice. This is consistent with the global evidence that progress in the last two decades to improve access to quality education has not translated into improvements in learning for children from poor and marginalised communities (UNESCO, 2014; World Bank, 2018). Our study suggests that initially low-performing girls from poor backgrounds are particularly affected. Not only are trapped in low performance but, changing this may require more effort. According to Akmal & Pritchett (2019, p. 2), "even with complete equality in grade attainment and learning achievement, children from poor households would be far from the equity goal of universal numeracy and literacy …". These authors make it clear the difficult challenge ahead: "raising the learning of disadvantaged children to that of the privileged may still leave them well short of absolute learning levels needed for global equity" (p. 2). This raises the stakes for achieving SDG4 by 2030. Unless, the global effort shifts towards addressing the learning needs of disadvantaged children, particularly girls from poor backgrounds, achieving SDG4 will be highly unlikely.

Our study also raises questions for reforms to improve classroom instructional practice. The global evidence suggests that improving classroom instruction produces the greatest impact on learner achievement (Bashir et al., 2018; Filmer, Molina and Stacy, 2016). But, as our study suggests, this may not necessarily benefit all, especially if you are a girl from a disadvantaged background. The evidence from our study suggests that pedagogy which targets low achievers in general may actually work to the advantage of some (low achieving boys) but not all. It may be an indication that teachers are not particularly adept at identifying the learning

needs of ‘silently excluded’ poor disadvantaged girls, or even if they are able to, lack the commitment and ability to adopt inclusive pedagogies that address their specific learning needs. Unfortunately, many early grade primary teachers in low-income countries teach to the top of their class making it difficult to produce more equitable learning outcomes (Banerjee et. al., 2016; World Bank 2018). We should, as our study suggests, be equally concerned with teaching that fails to address the gender inequality gap in learning opportunities and outcomes.

One potential implication of this finding is the need for teacher training that focuses teachers’ attention on the learning needs of low achievers, and especially to support girls who struggle with their learning within both complementary education programmes as well as mainstream schooling contexts.

An important limitation of this study was the restricted time frame of the trajectories examined, which were over the period of two years in total. To fully understand the contribution of the CBE programme, and how this affects different groups of the population, follow up studies that continue to track learning trajectories and subsequent livelihood outcomes of CBE would be highly beneficial.

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Table 1: Equality of Score Distributions for CBE students Ages 9 and 10

Kolmogorov–Smirnov Results				
Assessment	**Time-Frame**	**Statistic**	**Degrees of Freedom**	**P-value**
Overall literacy	Start CBE	0.06	519	0.790
Overall numeracy	Start CBE	0.06	518	0.790
Overall numeracy	End CBE	0.13	474	0.125
Overall numeracy	Start Formal School	0.13	519	0.125
Overall numeracy	End of 1st Year in Formal School	0.07	519	0.627

Asterisks *, **, *** indicate statistical significance at 5, 1 and 0.1% level.
P-values adjusted for multiple comparisons using the Benjamini-Hochberg correction.

Table 2: Descriptive statistics for sample

Variables	**Full sample n=519**	**Initial Low performers n=133**
Female (%)	52.4	52.6
Age 10 (%)	55.7	50.4
Average Household size	8.3 (4.4)	8.2 (3.9)
Working outside of home (%)	44	48.1
Quartile Wealth index Low (%)	24.7	22.3
Mid-low (%)	22.7	18.9
Mid (%)	26.7	29.1
High (%)	25.9	29.1
Access to home learning support (%)	79.2	76.4
Prior school attendance (%)	21.6	20.3
Transition to Grade 4 and above (%)	53.9	31.5
Access to mother-tongue language of instruction at formal school (%)	59.2	55.6

*Standard deviations in parentheses

Table 3: Transition matrices for initial low-performing male and female CBE students

	Numeracy achievement (Female)		**Numeracy achievement (Male)**	
	Initial Low Performers	Initial High Performers	Initial Low Performers	Initial High Performers
End of CBE				
End of cycle low performer	50.85	4.92	47.37	6.67
End of cycle high performer	1.69	37.7	14.04	43.33
z-stat on difference	6.07***	-4.42***	3.86***	-4.64***
Start of formal school				
End of cycle low performer	45.71	10.45	46.03	12.9
End of cycle high performer	4.29	50.75	7.94	53.23
z-stat on difference	5.66***	-4.99***	4.82***	-4.77***
End of formal school (Yr1)				
End of cycle low performer	47.14	13.43	31.75	9.68
End of cycle high performer	8.57	46.27	17.46	41.94
z-stat on difference	5.09***	-4.09***	1.86	-4.10***

The final row for each panel reports the test statistic for cell proportion differences

Asterisks *, **, *** indicate statistical significance at 5, 1 and 0.1% level

Table 4: Logistic regression model estimates of end of cycle low performance

	(A) End of CBE			(B) Start of formal school			(C) End of formal school (Yr 1)		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Explanatory variables	Full model	Male	Female	Full model	Male	Female	Full model	Male	Female
Initial low performance	4.99***	4.03***	6.08***	3.14***	2.32*	5.33***	2.45***	1.62	3.25***
	(1.26)	(1.49)	(2.21)	(0.85)	(0.88)	(2.33)	(0.62)	(0.61)	(1.16)
Female	0.9			0.88			1.17		
	(0.22)			(0.21)			(0.28)		
Age	0.96	0.68	1.24	0.93	1.14	0.68	0.81	0.55	1.16
	(0.23)	(0.24)	(0.43)	(0.23)	(0.40)	(0.25)	(0.19)	(0.20)	(0.41)
Prior school experience	0.49*	0.44	0.58	0.34**	0.18**	0.55	0.81	0.96	0.72
	(0.14)	(0.19)	(0.26)	(0.13)	(0.11)	(0.26)	(0.24)	(0.41)	(0.32)
School non-attendance	1.12	1.1	1.14	1.34**	1.29	1.36	1.1	1.11	1.22
	(0.12)	(0.21)	(0.15)	(0.14)	(0.17)	(0.22)	(0.11)	(0.13)	(0.19)
Household size	0.98	1.01	0.95	0.98	0.97	0.98	1.01	1.03	0.99
	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)	(0.03)
Engagement in home learning	0.37***	0.29**	0.46	1.08	0.68	1.95	0.41**	0.41*	0.29**
	(0.11)	(0.11)	(0.21)	(0.32)	(0.27)	(1.07)	(0.11)	(0.16)	(0.12)
Undertaking work outside of home	1.36	1	1.88	0.52*	0.62	0.38*	1.22	1.21	1.25
	(0.34)	(0.35)	(0.71)	(0.14)	(0.24)	(0.16)	(0.29)	(0.41)	(0.42)
Mother-tongue access in formal school				0.63	0.69	0.45*	1.27	0.94	1.86
				(0.16)	(0.26)	(0.17)	(0.31)	(0.33)	(0.71)
Observations	473	227	246	478	230	248	478	230	248

Note: Robust Standard errors in parentheses. Coefficients for age, grade of placement at formal school and relative wealth status are included as control. Asterisks *, **, *** indicate statistical significance at 5, 1 and 0.1% level

Figure 1: Numeracy scores for initial low-performing CBE students by gender