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UNDERSTANDING THE RELATIONSHIP BETWEEN CONSUMPTION INEQUALITY, INEQUALITY OF OPPORTUNITY, AND EDUCATION OUTCOMES IN GHANA

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Understanding the relationship between consumption inequality, inequality of opportunity and education outcomes in Ghana

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Abstract
There have been calls for a shift in policy focus towards economic inequality given that it can potentially generate social instability and be harmful to economic growth in the long run. The current study examines the contribution of inequality of opportunity in consumption inequality, schooling and learning outcomes. Through mediation analysis, the paper aims to isolate the mechanism through which consumption inequality affects education outcomes in Ghana. Using a two-wave nationally representative panel data, the study finds that the contribution of unfair inequality (which is inequality driven by factors beyond the control of individuals) to total consumption inequality in Ghana is not trivial. We find that inequality of opportunity accounts for about 8.1 per cent of total consumption inequality in Ghana. Place of birth, the locality of residence and parental education and the presence of parents within the household contribute significantly to inequality of opportunity. While consumption inequality negatively affects learning outcomes, its impact flows entirely through inequality of opportunity. Policymakers are required to be more deliberate in the distribution of social infrastructure and other economic resources across the country so as not to concentrate resources in particular areas thus leading to the neglect of other parts of the country. Policies that ensure access to education in the current generation are encouraged to minimize unfair inequality in the future.

Keywords
Inequality of opportunity; consumption inequality; education outcomes; random effects; panel data

JEL Classifications
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Introduction

Worldwide, questions have been raised regarding whether or not inequality is objectionable. The part of inequality that is attributed to effort and luck is usually perceived to be innocuous. However, inequality that is associated with unequal opportunities is regarded to be unfair and undesirable. Sen and Hawthorne (1985) suggest that inequality in outcomes depends largely on individuals' choices and effort. As such, they argued that emphasis should be placed on developing capabilities and factors that drive people's effort. In sharp contrast, however, Roemer (1998) made a clear distinction between tolerable and undesirable forms of inequality. His seminal work which popularised the concept of inequality of opportunity (IOP) posed a critical question of whether all forms of inequality are detrimental. This important question stimulated the current debate on the sources of inequality and has spawned several studies in this area of research. Although Roemer (1998) recognised individual effort as a key determinant of economic outcomes, he argued that the individual's circumstances such as family background and other factors, which are often exogenous and beyond the individual's control, play a significant role in determining whether he or she progresses economically or not.

In developing countries such as Ghana, children with identical capabilities and effort may reach different outcomes based on different opportunities, and this may be influenced by predetermined conditions for which the children cannot be held accountable. These conditions include family characteristics, location of birth or residence as well as the educational level of their parents. This kind of inequality, created as a result of unequal opportunities, emanating from differences in circumstances beyond the control of individuals, and which does not reflect the individual's efforts as described above, is what the literature describes as inequality in opportunities. The differences in outcomes created by inequality in opportunities, according to the World Bank (2006) is considered unfair and unjust in many societies. Following this nomenclature, we will in this study refer to the undesirable inequalities, driven by unequal opportunities beyond the control of individuals, as 'unfair inequality'. Indeed, studies such as Ferreira et al. (2014) and Marrero and Rodriguez (2013) have called for a policy shift to focus on inequalities in opportunities given that this can potentially be harmful to economic growth in the long run and generate social instability. The strong correlation between inequities in opportunities and intergenerational persistence of inequality and mobility as noted by Pirarino (2015), Chetty et al (2017), Narayan et al (2018), Aiyar and Ebeke (2019) and Busolo et al (2020), has made it even more pertinent for studies to focus on this line of research. Such research will enhance our understanding of the main drivers of economic inequalities in different contexts, and will better inform policymakers on the most efficient ways to deal with

the high levels of poverty and inequality that characterise most countries in the developing world.

The recent literature on the inequality of opportunity provides evidence on the main drivers of unfair inequality in varied contexts. In Europe, studies by Checchi et al (2016) and Brzezinski (2020) find that circumstances such as parental education, father's occupation and area of birth contribute significantly to unfair inequality.

Similarly, the Latin American evidence as shown by Fereira and Gignoux (2011) point to factors such as gender, ethnicity, parental education and father's occupation as being important. Also, father's education and occupation, caste, and religion are significant drivers of inequality of opportunity in India as noted by Singh (2011). Piraino (2015) and Belhaj-Hassine (2012) further highlight race and gender as additional circumstances in South Africa and Egypt. In eleven sub-Saharan African countries: Comoros, the Democratic Republic of Congo, Ghana, Guinea, Madagascar, Malawi, Niger, Nigeria, Rwanda, Tanzania, and Uganda, Brunori et al (2016) note that while there are some differences in the drivers of inequality of opportunity, ethnicity is the most dominant driver in the Congo while for other countries the most important driver of inequality of opportunity is the place of birth of individuals. For almost all countries considered, parental education plays an important role.

Although these different exogenous circumstances influence inequality of opportunity and therefore income inequality, inequality in education is regarded as a common denominator that can be used to explain the growing gap in income levels (Petcu, 2014; Abdelbaki, 2012). This assertion is deeply rooted in the neo-classical human capital model of determining wages by Schultz (1961) and Becker (1964) which suggests that inequalities in income are borne out of inequalities in investment in human capital, particularly in education. According to Borjas (2013), education is often used as a signal for productivity which commands higher levels of wages. The productivity-signalling effect of education is even more critical in developing countries in sub-Saharan Africa where the labour markets are characterised by an excess supply of educated labour relative to its demand as explained by Petcu (2014).

Despite the consensus about the theoretical basis for the positive relationship between inequality in education and income inequality, evidence from the empirical literature tells a different story. Findings appear to be mixed. Relying on the world inequality database for both developed and developing countries Keller (2010) finds that while primary and secondary education reduces inequality globally, tertiary level education leads to an increase in income inequality, particularly for developing countries. Similarly, Dao (2013) found a positive relationship between inequality in education and income inequality using data from nineteen developing countries and emerging

countries from sub-Saharan and northern Africa. Foldvari and Leewuen (2011) and Checchi (2004), found no significant association between income inequality and educational inequality using data from Organisation for Economic Cooperation and Development (OECD) countries and other regions, including sub-Saharan Africa, North Africa and the Middle East, South America. Petcu (2014) finds a positive relationship for developped countries but a negative relationship for developing countries using macro-level data. Moreover, most of the studies on such inequalities of opportunities have primarily focused on developed countries, and in particular, OECD countries as observed by Foldvari and Leewuen, (2011) or Latin American countries as seen in (Bourginon et al., 2007).

Concerning the relationship between economic inequality and education outcomes, recent studies have found evidence that gaps in educational attainment are strongly associated with income distribution. Reardon (2011) provide evidence that suggests that economic inequality widens the educational achievement gap in the United States. Other studies such as Chiu (2010) who makes use of student-level data from the OECD's International Student Assessment, for both OECD and non-OECD countries, found that economic inequality reduces math achievement. A similar result is also found for the United States by Condron (2011). The empirical evidence on sub-Saharan African countries is however limited (see Brunori et al., 2015).

The present study, therefore adds to the literature as it probes further into the factors that influence inequality in education outcomes, beyond establishing that inequality in education is an important source of total economic inequality in a developing country context. The broad objective of the study is to investigate the contribution of inequality of opportunity in consumption inequality and inequality in education. Also, the study aims to examine the effect of economic inequality, measured using consumption expenditures on education outcomes. Beyond examining this relationship, the study explores the mechanism through which consumption inequality affects education outcomes. This current study is particularly important because a determination of the degree of importance of exogenous circumstances in explaining inequalities and channels of its effect may have different policy implications. Thus, a better understanding, based on empirical evidence on these relationships may have useful implications for policymakers in the sub-region.

Specifically, the study focuses on the inequality of education as engendered by inequality of opportunity. The following are the specific research questions to be addressed in the study.

a) What is the contribution of inequality of opportunity in explaining consumption inequality in Ghana over the two periods?
b) What are the exogenous circumstances that influence inequality in education outcomes in Ghana?

c) What is the contribution of inequality of opportunity in explaining inequality in education outcomes?
d) What is the effect of consumption inequality on education outcomes?
e) Does inequality of schooling opportunities mediate the effect of consumption inequality on schooling and learning outcomes at the individual level?

The remainder of the paper is structured as follows. Section 2 provides a brief context of inequality and the education sector in Ghana while section 3 describes the measures of inequality of opportunity and empirical estimations used in the paper. In section 4 we describe the data and provide some summary statistics. Chapters 5 discusses the results and findings of the study. Chapter six concludes the paper with a summary of the findings and some policy recommendations.

1. Inequality in Ghana

Although the incidence of poverty has declined significantly with economic progress between 2005 and 2017, the level of consumption inequality has increased with the Gini coefficient increasing from 0.406 in 2006 to about 0.416 in 2017 (Atta-Ankomah et al, forthcoming). However, the character of inequality has not been uniform throughout the country. Based on data from the three most recent Living Standard Surveys, 2005/2006, 2012/2013 and 2016/2017, while some regions, including Greater Accra, Ashanti and Central regions recorded declines in inequality others such as the five northern regions experienced high levels of inequality. Particularly for the northern part of the country, high poverty areas coincide with high inequality. Overall inequality in Ghana is largely influenced by within-regional differences relative to between-regional differences. However, between 2012/2013 and 2016/17, the contribution of between- region differences in inequality increased from 16 per cent to approximately 25 per cent in 2017 (Atta-Ankomah et al, forthcoming). It is also highlighted in the report (ibid) that regional differences does exist in access to social amenities with a bias against the rural communities and also the Northern part of the country. This, therefore, suggests that regional differences in opportunities may be contributing towards inequality in Ghana.

2. The Education System in Ghana

Since independence, the country's education sector has been subjected to a series of changes by successive governments in the quest to provide a suitable model that meets the needs of the country as well as the expectations of the citizens (Macbeath, 2010). In the current structure, schooling starts at the age of four years and it follows the eight-three-three-four system where an individual goes through eight years of primary or basic education, which comprises of two years of kindergarten and six years of elementary education, three years of junior high school and senior secondary school, and four years at the university level or tertiary level where students can pursue programs at the training colleges. The major stakeholders in the country's education sector, defined here as various organisations and units within the government and educational sector architecture responsible for the administration and management of the sector, mainly at the pre-tertiary level include the Ghana Education Service, the Ministry of Education as well as the West African Examination Council (WAEC), which conducts standardized examination for students at the junior and secondary high schools to transition to senior high schools and tertiary levels respectively. According to data from the UNESCO Institute of Statistics (UIS), net primary education enrolment rates have remained high, above 80 per cent from 2010 through to 2019. Particularly for 2019, the net enrolment rate was estimated at 86.2 per cent, increasing marginally from 84.5 per cent in 2018. The net enrolment rates for both male and female is similar to the national rate at 85.7 and 86.6 per cent respectively. What is striking, however, is the low secondary school and tertiary enrolment relative to basic education for the past decade. For the past five years, for instance, available data suggest that net enrolment rate for secondary education ranges from 52 per cent to 58 per cent while that for tertiary education remained between 15 and 16 per cent within the same period. The differences in secondary education enrolment rate for both male and female is negligible, although there is a significant gender difference in the tertiary enrolment, with the rate for males being approximately 18 per cent compared to female rates of about 14 per cent. Enrolment data from the fifth, sixth and seventh rounds of the Ghana Living Standard Surveys in 2005/2006, 2012/2013 and 2016/2017 highlight the regional and locational differences in basic and high school enrolment. For all levels, the three northern regions record the lowest rates while the southern regions, particularly in Greater- Accra, Ashanti, Central and Eastern regions recording the highest enrolment rates. Expectedly, urban schooling rates are significantly higher than rural enrolment rates at all levels of education.

The distribution of education resources follows a similar pattern as enrolment. MOE (2018) observes large regional and locational differences in teacher deployment. Similarly, Opoku-Asare and Siaw (2015) emphasise that schools in rural areas are characterized by less qualified teachers, fewer textbooks, poor infrastructure and poor learning environments compared to schools in the urban areas. Additionally, the authors note that

urban schools are better funded and monitored compared to rural schools. These differences, in effect, explain the large differences in education outcomes between rural and urban students.

Similarly, there are considerable differences in completion rates. Children from the lowest income quintile are significantly less likely to complete junior high school compared to children from the higher income quintiles. The free senior high school policy that was implemented since the beginning of 2017 is meant to provide children from poor households the opportunity to obtain senior high school education.

Results from the standardized examination conducted by the examining body in Ghana for the 2016/2017 academic year highlights wide variations in learning outcomes across regions and gender. Again, the five northern regions recorded the lowest performance compared to the Greater Accra Region where the capital of the country is situated and is characterized by a relatively enhanced learning infrastructure. The results also showed that learning outcomes were skewed against female students, particularly in the areas of mathematics, English language comprehension and science. Also, early reading assessments conducted both in 2012 and 2015 for primary two pupils showed that about half of the children who were tested could not recognize a single word that was given to them to read. A similar finding was noted for mathematics. Particularly, MOE (2018) highlights the gender disparity in both English and mathematics scores.

To bridge the regional gap in schooling and learning outcomes, various policies have been implemented starting with the Free Compulsory Basic Education (FCUBE) in 1996. To ensure the children from low-income households remain in school, education-related costs which served as a barrier to schooling were absorbed by the government under the capitation grant which commenced in 2005. In the same year, the government instituted the school feeding program which targeted economically marginalized regions, particularly in the northern regions which recorded the lowest enrolment and attendance (GSS, 2014). Other policies that have been implemented include free uniforms, textbooks and the distribution of sanitary towels to encourage female enrolment and attendance. The most recent policy, the free senior high school policy which commenced in 2017, was implemented to address the challenge of access to senior high school education, particularly for students in low-income countries.

3. Measuring Inequality of Opportunity and Empirical Estimations

3.1. Measuring Inequality of Opportunity

Inequality of opportunity represents the part of inequality that emanates from differences in the circumstances or factors that are beyond the control of individuals. Conceptually, inequality of opportunity distinguishes between individual's effort and exogenous circumstances that are often beyond the individual's control. As argued by Roemer (1993, 1998), inequality originating from the differences in individual's effort rather than opportunities at the individual's disposal is less objectionable. Inherent in the concept of inequality of opportunity is the idea of fairness. The concept is developed around the idea of fairness where inequalities resulting from circumstances are considered to be unfair and therefore, should be eliminated (Fleurbaey and Peragine, 2013).

In measuring inequality of opportunity, a growing empirical literature documents several studies, including Trannoy et al (2010), Li Donni et al (2011), Checchi and Peragine (2010). Although the literature acknowledges the multifaceted nature of the concept, two main perspectives on its measurement emerge – *ex-ante and ex-post* perspectives. In this literature Fleurbaey and Peragine, (2013) provide a detailed explanation of the two main perspectives and argue that although there is a seeming clash between the two perspectives, the main difference is the convenience of intuitive interpretation. The ex-post perspective considers individuals with the same effort but different circumstances while the ex-ante perspective focuses more on the subgroups of people with similar circumstances.

Following the ex-ante approach, Ferreira and Gignoux (2011) develop both parametric and non-parametric techniques to estimate the share of total inequality (in household consumption) due to differences in observable exogenous circumstances. In the current study we adopt the parametric approach by Ferreira and Gignoux (2011) in estimating the inequality of opportunity for Ghana.

In this parametric approach represented by Equation (1), the outcome for each group is obtained using predicted values from an OLS regression. In the specification below, the coefficient of C (circumstances or exogenous factors), φ captures both the direct effect of circumstances on the individual's outcome of interest and indirect effect of the individual's effort since the coefficient is likely correlated with the error term. Y_i represents the outcome of interest, which is household-level consumption inequality, schooling and learning outcomes in the current study.

$$Y_i = \alpha + \varphi C_i + \varepsilon \quad (1)$$

The successful implementation of the IOP index requires a set of circumstances that are known to be beyond the control of the individual. The current analysis relies on the parametric measure. This is because, in the data that is employed, the individual's outcome and circumstances are easily observed which makes the parametric estimation ideal. For sub-Saharan African countries, Brunori et al (2016) provide a list of circumstances for different countries. For Ghana, Brunori et al (2016) show that birth place and parental education are the main circumstances to be considered in measuring inequality of opportunity in the country. In the current study, in addition to the suggested circumstances, we include the gender of the individual.

To answer the first two research questions, which aims to estimate the contribution of inequality of opportunity in total consumption inequality, and determine the exogenous factors that drive inequality of opportunity in education outcomes in Ghana, the study implements the parametric measure of inequality of opportunity. Based on literature and particularly for Ghana, the circumstances used for the current study are the region of birth of an individual, parental education as well as the gender of the individual. In the next step, and following Wendelspiess and Soloaga (2014) we compute a decomposition of the inequality of opportunities by subgroups or circumstances using the Shapely decomposition method by Shorrocks (1982) which calculates the average marginal effect of each circumstance over all their possible permutations. These statistics provide the relative contribution of each circumstance to the total inequality of opportunity measure. The same approach is adopted to answer the third research question, which focuses on examining the contribution of inequality of opportunity in explaining inequality in education outcomes. We estimate a similar measure of inequality (at the individual level) using enrolment at the primary or junior high school (depending on the age of the individual), mathematics (arithmetic) scores and English language scores as the dependent variable, as done in Carvalho et al. (2012) and Tansel (2015). The inequality measure is then decomposed by the identified exogenous factors such as school type and region of residence.

3.2. Empirical Strategy

The fourth research question which addresses the effect of consumption inequality on education outcomes, we exploit the panel structure of the data by estimating a random-effects model in a logistic regression as shown in Equation (2). Given that the covariates change very slowly over the two-time periods, a fixed-effects model would not yield 'good' estimates and is therefore problematic in this case (see for instance Beck, 2001; Plumper and Troeger (2007). Equation (2) estimates the effect of household consumption inequality in explaining the variations in education outcomes in addition to a host of other relevant covariates.

$$Y_{it} = \alpha_i + \beta_1 X_{it} + \beta_2 EI_{ht} + \delta_i + \varepsilon_{it} \qquad (2)$$

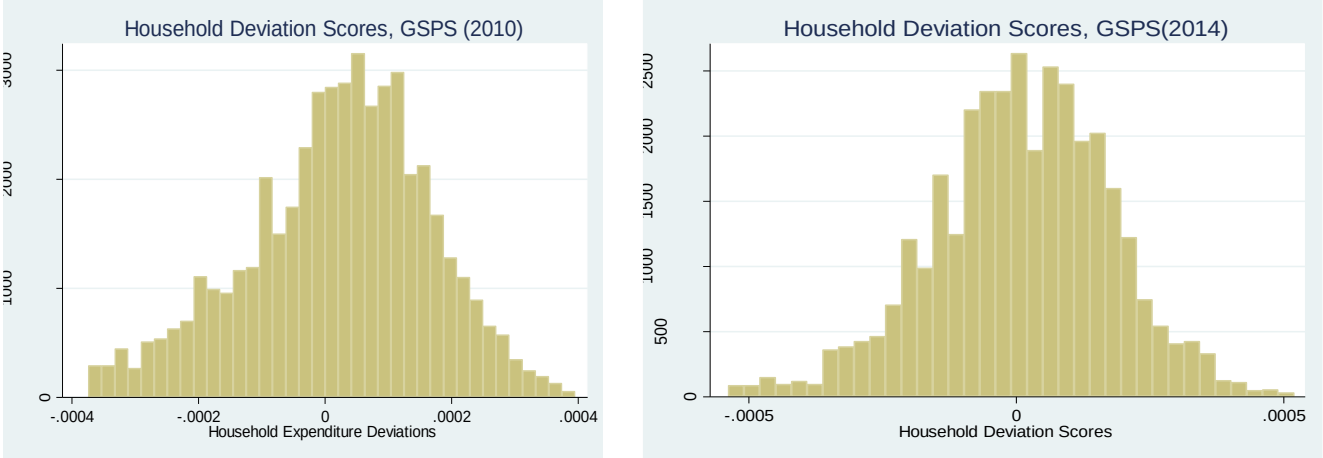
Where Y_{it} presents a dummy variable which takes on the value of one if individual *i* in period *t* obtains a test score that is at least above the mean test score (i.e. mean scores of mathematics and english tests). EI_{ht} represents household consumption inequality measures in period t. This variable is constructed from households' average adult equivalence consumption expenditures adjusted for inflation. Similar to the Thiel L index, deviations of household consumption expenditures from the population mean are estimated. Each household's measure of consumption inequality is expressed as a ratio of the population mean to the household's expenditure weighted by the number of households in the sample as shown in Equation 3

$$EI_h = \frac{1}{N} \log \frac{\bar{y}}{y_h} \qquad (3)$$

In the above, $\bar{y}$ represents the average population expenditure while y_h represents households' total expenditure). Household expenditure deviations for both waves are shown in Figure 1 below. Deviations closer to zero suggest expenditure levels similar to the average population expenditure. However, deviations, either above or below 0 suggest higher levels of inequality. To facilitate the interpretation of results, we first transform the household expenditure deviations scores by computing only absolute values as shown in Equation 4 A dummy variable is then constructed based on the absolute values of the household deviation scores where 1 represents a deviation from the line of equality (ie. values greater than zero) and 0 otherwise. This, therefore, becomes our measure of consumption inequality for the current study.

$$EI_h = \frac{1}{N} \left| \log \frac{\bar{y}}{y_h} \right| \qquad (4)$$

Figure 1: Household Expenditure Deviations in 2010 and 2014
Source: Authors' construct using Data from the Ghana Socio-economic panel survey (2010 and 2014)



X_i refers to other individual and household characteristics that are likely to affect schooling and learning outcomes. In the literature, a wide range of factors have been found to influence school enrolment. These include parental education (Iddrisu, 2014), the region of residence (Sackey, 2007), gender and age of the child, household size and whether or not the child is working (Iddrisu., et al 2017). Other important determinants of schooling enrolment include the poverty status of the child and the gender of the household head. In Ghana, however, Iddrisu (2014) finds no effect on household poverty status on enrolment, in view of the policies that have been implemented to encourage enrolment. Because of the regional differences in educational infrastructure (Opoku-Asare and Siaw, 2015), we control for the region of residence of children. Similarly, in determining learning outcomes, MOE (2018) note locality of residence, region of residence, school type (whether the child is enrolled in a private or public school), access to textbooks and wealth of the household as major determining factors. Also, Krafft and Alawode (2018) attribute parental education and the presence of both parents in the house as important determinants of learning outcomes. Guided by the literature, the study controls for child's age, gender, parental education, parental presence, household income, school type, access to textbooks, household size as well as the region and locality of residence Following Gamboa and Walternburg (2012) and Krafft and Alawode (2018) we identify exogenous variables as parental education, whether school attended is private or public, household size, the region of residence, and locality of residence. Children's effort exerted during studies and their general attitude towards learning are considered as effort indicators.

To examine whether or not inequality of opportunity in education mediates the effect of consumption inequality (ie. consumption inequality affects learning outcomes through inequality of opportunity in education) the study makes use of path analysis in the structural equation modelling framework developed by Bollen (1987;1989) to disentangle the direct and indirect effect from the total effect of consumption inequality. In the path analysis, the modelling technique allows for the coefficients of interest to be decomposed into direct and indirect effects. This mediation analysis, therefore, brings clarity to the nature of the relationship that exists between consumption inequality and inequality of learning outcomes and allows us to unpack the channels through which consumption inequality affects learning outcomes. To implement this, we consider the main circumstances that drive inequality of opportunity in education discussed earlier.

4. Data and Descriptive Statistics

The analysis makes use of the two waves of the Ghana Socio-Economic Panel Survey (GSPS) which was a collaborative effort between the Economic Growth Centre (EGC) at Yale University and the Institute of Statistical, Social and Economic Research (ISSER), at the University of Ghana. The panel data has two waves. The first wave of the data was collected on 5,009 households in 2010 and the second wave was collected in 2014. The second wave also has data on new households that had been formed from wave one households. These are called split-off households. In the second wave, although 5,484 households (old and split-off households) were searched, data was obtained only on 4,774 households. The survey adopted a two-stage stratified sample design where stratification was based on the administrative regions of Ghana. In the first stage of the sample design, 334 enumeration areas were sampled from a master sampling frame based on the 2000 Ghana Population and Housing Census. The clusters were randomly selected based on a simple random sampling technique. In the second stage, 15 households from the selected clusters were randomly selected from each enumeration area.

Using household and community questionnaires, detailed information was collected on demographic characteristics of households, education, health, employment, migration, land information, agricultural production inputs, livestock and household tools, non-farm enterprise, housing characteristics of household, financial assets, psychological measures, risk preference, social status and responsibilities.

This dataset is particularly unique for this current study as it contains important information on test scores for both mathematics (arithmetic) and English, which can be used as measures of education outcomes. To estimate the overall inequality of opportunity, the choice of the circumstances in guided existing studies such as Brunori et al (2016) who show that the relevant 'circumstances' to consider for inequality of opportunity in Ghana are the place of birth and parental education. In examining the inequality of opportunity of education, Krafft and Alawode (2018) and Aguereche (2012) show that household characteristics including parental education and household size, the presence of both parents within the household, and school environment are important characteristics that are beyond the control of individuals but play a critical role in determining the learning outcomes of children. In this study, therefore, the exogenous variables we consider for the estimation of inequality of opportunity in education are parental education, presence of both parents within the household, household size, the school type (i.e. whether the child attends a private or public school), and region of residence.

Table 1: Summary Statistics
Source: Authors' computations from the GSPS, 2010 and 2014

	2010		2014			
Variables	**Mean**	**SD**	**Mean**	**SD**	**Diff**	**t-stats**
Mathematics Test Scores	0.75	0.43	0.68	0.47	0.07***	7.24
English Test Scores	0.85	0.36	0.94	0.23	-0.10***	-14.19
Consumption Inequality	0.62	0.49	0.56	0.50	0.05***	4.72
Both parents present in the house	0.60	0.49	0.66	0.48	-0.05***	-4.98
Child is Male	0.51	0.49	0.54	0.499	0.02**	2.18
Household Size	6.30	2.69	5.98	2.55	0.32***	5.43
child attends public school	0.80	0.40	0.75	0.01	0.05***	4.78
Education level of father	0.14	0.01	0.17	0.38	-0.03**	-2.58
Education level of mother	0.05	0.01	0.06	0.01	-0.01	-1.22
Age of Child	9.83	3.13	9.82	3.11	0.01	-0.15
Education of child	0.92	0.01	0.84	0.01	0.09***	10.52
Child has access to all textbooks	0.40	0.49	0.46	0.50	0.06***	-4.32
Observations	**4169**		**3865**		**8034**	

We consider three measures of education outcomes as the dependent variables. The first measure, enrolment is captured as a dummy variable that takes on the value of 1 if the child is currently in school and 0 otherwise. The other outcomes are mathematics and English scores. These two variables are based on arithmetic and English tests administered to children within the ages of 5-15years in each wave. The tests entail basic tasks of answering basic arithmetic questions as well as English language comprehension. Mean scores for each test are computed and a dummy variable is constructed taking on the value of 1 if the child obtained at least the mean score for that particular test. As shown in Table 1, about three-quarters of the children in the sample obtained scores that are above the mean math score in the first wave in 2010. However, this proportion reduced significantly in the second wave to about 68 per cent. On the contrary, the proportion of children scoring above the mean English score increased significantly between 2010 and 2014. Household consumption deviations is used as a proxy for consumption inequality. As explained earlier, this variable is captured as a dummy variable which takes on the value of 1 if the absolute value of the consumption expenditure deviations is positive and 0 when the value is zero.

Access to learning materials and the school environment is critical to facilitate the learning process. The variables that serve as a proxy for the school and learning environment are school type and children's access to textbooks. We note that the majority of children in the sample (80 per cent in 2010 and 75 per cent in wave 2) attended public

schools. This is reflective of the percentages reported in MOE (2018). Also, in both waves, less than half of the children in the sample admitted having access to all the textbooks they require for effective learning. In larger households, resources may be spread thin among children and may consequently hamper their learning outcomes. Household size is included in the analysis with the average household size for both 2010 and 2014 being six people. As argued by Krafft and Alawode (2018), the presence of parents and parental education are both critical in ensuring better learning outcomes. Parental presence is constructed as a dummy variable taking on the value of 1 if it is reported that both parents are present within the household and 0 otherwise. Parental education is constructed as a categorical variable –no education, primary, secondary and tertiary. For ease of interpretation, we transform the parental education into a dummy variable taking on the value of 1 when the highest level of education attained is at least secondary school and 0 otherwise. Similarly, the education level of children is constructed as a dummy variable where the value is 1 if children have at least primary or basic education.

We also control for the age and gender of the child. The average age of children in the sample for 2010 and 2014 is about 10 years. To account for the regional differences in social and educational infrastructure we control for the region of residence.

5. Results and Discussion

We present results on the estimates for overall inequality of opportunity in consumption inequality for 2010 and 2014 together with its decomposition in Table 2. We note that the percentage of unfair inequality in Ghana increased from 4.3 per cent in 2010 to about 8.1 per cent in 2014. This value is consistent with the inequality of opportunity estimate obtained by Bruonori et al (2016). This is a big jump in unfair inequality, as it almost doubled over the four-year period. It is particularly worrisome given the continued investment in social policies such as the free maternal health policy, national health insurance, and school feeding programme among others. Although the values changed between the two waves, the major drivers of inequality of opportunity remained the same in both years. The decomposition suggests that parental education and region of birth were significant drivers of inequality of opportunity, similar to findings by Bruonori et al (2016) who used the Ghana Living Standard Survey VI data for their analysis.

Table 2: Inequality of Opportunity and Decomposition of Drivers
Source: Authors' computations from the GSPS, 2010 and 2014

Index and Circumstances	Wave 1 (2010)	Wave 2 (2014)
Inequality of Opportunity Index (IOP) (%)	4.3	8.1
Standard Error of Index	0.006	0.009
Shapely Decomposition		
Region of Birth	10.01	4.34
Father's Education	59.47	60.91
Mother's Education	29.43	31.98
Gender	1.09	2.78
N (Observations)	**6892**	**5811**

Ghana's level of inequality of opportunity is similar to that of Uganda, which is reported to have an index that ranges from 9 per cent to 11 per cent, according to Ferreira and Peragine (2015). We observe that Ghana's inequality of opportunity, as found in the current study, falls within the range of 4.5-11.3 per cent, as estimated by Ferreira and Peragine (2015) using sixth round of the Ghana Living Standard Survey. This range is however lower compared to the estimates for South Africa whose IOP values ranges from 16.9- 25 per cent. Situating this measure within the context of a current Gini coefficient of 42 per cent, we can interpret the 8.1 per cent as the share of inequality of opportunity in total inequality in Ghana (Table 2). This, therefore, represents the unfair inequality from the total inequality measure in Ghana. As more individual countries studies for West African region become available, a comparative analysis with Ghana's findings will prove a useful exercise.

Between 2010 and 2014, the decomposition of the opportunity measure by circumstances suggest that parental education and region of birth play a significant role in explaining the differences in inequality of opportunity in Ghana. Particularly, we observe that father's education contributed twice as much as the mother's education in both years. This could be due to the patriarchal nature of Ghana's society where fathers are the main decision-makers within households. Consistent with Bruonori et al (2016), gender does not contribute significantly relative to the other 'circumstances' in the analysis. This finding on the role of mother's and father's education can be interpreted to mean that providing education to the current generation may lead to a reduction in unfair inequality and the possibility of social mobility of the next generation as argued by Piraino (2015), for the South African context.

Inequality in education opportunity estimates for both 2010 and 2014 are presented in Table 3. For the three education outcomes considered, the percentage of unfair inequality for general enrolment in Ghana reduced from 15.2 per cent in 2010 to 6.5 per cent in 2014. Similarly, unfair inequality in English test outcomes reduced from 9.4 per cent in 2010 to 5.6 per cent in 2014. The overall reduction in unfair inequality between the two years could be as a result of the different interventions that have been implemented in the education sector to boost enrolment rates in the country. For instance, the gradual scale-up of the school feeding program across the ten[1] regions of Ghana since its pilot in 2005, the implementation of the free uniform policy by the government which commenced in 2010, and distribution of textbooks could explain the decline in the inequality of opportunity with respect to enrolment and perhaps for English test outcomes as well. Inequality of learning opportunity for mathematics remained the same at 14.5 per cent in 2014.

The decomposed shares of inequality of learning opportunity by the exogenous circumstances show the importance of parental presence, father's education, the locality of residence as well as school type in 2010. The contribution of parental presence in total inequality of opportunity ranged from 14.5 per cent for English, 31 per cent for mathematics scores and 50 per cent for enrolment. Other important exogenous circumstances that contribute to inequality of opportunity in learning outcomes are father's education which ranges from 16.9 per cent for enrolment and English test scores and 28.9 per cent for mathematics scores. Once we introduced school type as a circumstance for inequality in learning opportunity for mathematics and English language achievement, the influence of parental presence reduced significantly. These findings suggest that schooling environment and infrastructure, as proxied by whether the child attends a public school, contributes most to the inequality of learning opportunity. Relatively, gender does not appear to play a significant role in determining inequality of learning opportunity for all three education outcomes considered in 2010. In 2014, however, the influence of parents' presence

[1] The additional six regions were created only in 2019 while the GSPS data covered 10 regions in 2010 and 2014

was eliminated for inequality in enrolment opportunity as gender became the most significant contributor to inequality of opportunity in education, contributing almost half (48.7 per cent) of total inequality of schooling opportunity. It must be noted that the education initiatives discussed earlier do not require the presence of both parents for children to benefit. However, mother's education and father's education remain important drivers of inequality of schooling opportunity.

For mathematics scores, the estimates show father's education to be the most influential circumstance in explaining inequality of learning opportunity in 2014, followed by gender and mother's education. The contribution of school type reduced from 33.4 per cent to 8.8 per cent for mathematics scores over the two waves. In terms of the English language test scores however, its contribution increased significantly from 32.5 per cent in 2010 to 42.4 per cent in 2014. Also, we find that in 2010, the contribution of locality of residence in explainning unfair inequality in education outcomes was significant for both mathematics scores and English language test scores at 14 per cent and 12 per cent respectively. In 2014, however, its contribution had reduced to 8 per cent for mathematics and 5 per cent for English. Interestingly, the effect of father 's education declined very sharply from 29 per cent in 2010 to 3 per cent in 2014 for English tests while the reverse was true for mathematics test scores, where it doubled from 17 per cent in 2010 to 29 per cent in 2014.

Table 3: Inequality of Opportunity in Education and Decomposition of Drivers
Source: Authors' computations from the GSPS, 2010 and 2014

Index and Circumstances	*Wave 1 (2010)*	*Wave 2 (2014)*
	Enrolment	
Dissimilarity Index (%)	15.2	8.3
Standard Error of Index	0.013	0.021
Shapely Decomposition		
Gender	6.61	48.7
Parents' Presence	50.50	0.00
Household Size	8.19	9.05
Father's Education	16.89	31.24
Mother's Education	4.46	10.67
Region of Residence	13.29	0.34
N (Observations)	***7355***	***5811***
	Mathematics Test Scores	
Dissimilarity Index (%)	14.5	14.6
Standard Error of Index	0.05	0.06
Shapely Decomposition		
Gender	1.07	21.81
Parents' Presence	31.07	9.35
Household Size	0.48	1.97
Father's Education	16.82	38.42
Mother's Education	3.41	11.47
School Type	33.41	8.79
Locality of residence	13.67	8.18
N (Observations)	754	642
	English Test Scores	
Dissimilarity Indext (%)	9.4	5.6
Standard Error of Index	0.006	0.004
Shapely Decomposition		
Gender	0.95	5.25
Parents' Presence	14.95	33.27
Household Size	1.95	0.77
Father's Education	28.89	2.88
Mother's Education	8.78	10.79
School Type	32.47	42.36
Locality of residence	12.02	4.50
N (Observations)	***754***	***642***

In Tables 4 and 5, we provide the odd ratios to the logistic random effects specification which aims to answer research question three on the effect of inequality on schooling outcomes. In the specification in Table 4, the results suggest a negative effect of consumption inequality on the odds of a child being enrolled in school although the result is not

significant. Similarly, in Table 5, the effect is not statistically significant for both English and mathematics scores. Consistent with the results discussed earlier, the results show that both education of mother and father are important for schooling and learning outcomes. Other significant predictors of learning outcomes include the age of the child, gender of the child and locality of residence.

Table 4: Random Effects with a Logistic Regression
Source: Authors' computations from the GSPS, 2010 and 2014

	Enrolment	
	Odds Ratio	**t-stat**
household expenditure deviations	0.952	-0.34
child is male	1.852***	5.97
age of child	0.739***	-20.65
Child education (base: none)		
Primary school	3.556**	2.79
high school	4.012**	2.96
household size	1.05*	1.68
presence of both parents in the household	1.17	0.54
father's education (base: no education)		
primary	0.99	-0.00
secondary	1.49	1.32
tertiary	1.82*	1.72
mother's education (base: no education)		
primary	1.02	0.12
secondary	0.675	-1.04
tertiary	0.751	-0.49
Locality of residence (base: rural)	0.762*	-1.89
region of residence (base: western)		
central	1.695**	1.95
greater accra	1.696**	1.91
volta	1.462	1.46
eastern	1.14	0.56
ashanti	1.21	0.84
brong ahafo	1.14	0.48
northern	1.89**	2.14
upper east	2.42**	2.76
upper west	1.30	0.68
/lnsig2u	-13.961	.
sigma_u	0.001	.
rho	2.63e-07	.
N	**7971**	

Table 5: Random Effects with a Logistic Regression
Source: Authors' computations from the GSPS, 2010 and 2014

	English		Mathematics	
	Odds Ratio	t-stat	Odds Ratio	t-stat
household expenditure deviations	1.100	0.14	1.196	1.020
child is male	0.928	-0.450	0.946	-1.510
age of child	0.525**	-2.62	0.763***	-6.970
Child education (base: none)				
Primary school	0.082	-0.840	0.417***	-2.340
high school	1.525	0.110	2.930***	2.190
child attends a public school	0.145	-1.540	0.917	-0.400
child has access to all textbooks	1.987	1.020	1.106	0.620
household size	0.940	-0.200	1.003	0.100
presence of both parents in the household	1.722	0.670	1.017	0.08
father's education (base: no education)				
primary	0.032**	-2.190	2.687**	3.170
secondary	0.600	-0.180	3.241**	2.570
tertiary	0.072	-1.26	7.408***	4.030
mother's education (base: no education)				
primary	0.063**	-2.370	0.743	-0.970
secondary	0.175	-0.490	0.518	-1.380
tertiary	1.000		0.146**	-2.790
Locality (base: urban)	0.165*	-1.790	0.745	-1.58
region of residence (base: western)				
central	1.098	0.05	0.862	-0.370
greater accra	3.348	0.08	1.800	1.410
volta	66.636**	2.05	1.206	0.520
eastern	126.703**	2.190	1.321	0.840
ashanti	0.708	-0.26	1.490	1.170
brong ahafo	0.189	-0.840	0.919	-0.210
northern	1.117	0.06	1.815	1.310
upper east	1.000		3.633**	2.980
upper west	1.000		2.329**	1.950
/lnsig2u	3.831	.	-0.736	
sigma_u	6.791	.	0.692	
rho	0.933	.	0.127	
N	**1112**			**1222**

In the inequality of opportunity literature, recent studies, including Aiyar and Ebeke (2019) and Busolo et al (2020) allude to the possible mediating effect of inequality of opportunity on economic outcomes. Particularly, Aiyar and Ebeke (2019) argue that inequality of opportunity has the potential to mediate the impact of income inequality on economic growth. Based on these notions, we estimated a mediation analysis within the structural

equation modelling framework. In the current study to unpack the mechanism through which consumption inequality affects learning outcomes, we test whether inequality of learning opportunity mediates the effect of consumption inequality on learning outcomes through path analysis. The findings, as presented in Tables 6,7 and 8 show the decomposition of the total effect of consumption inequality into direct and indirect effects. For enrolment, mathematics and English scores we find that while the total effect of consumption inequality is not significant, the indirect effects (through the specified measures of inequality of opportunity) is negative and significant, suggesting a case of perfect mediation (Bollen, 1989). In the case of perfect or complete mediation, all the effects of consumption inequality on schooling and learning outcomes flow through unfair schooling and learning inequality. This finding suggests that the effect of consumption inequality on schooling and learning outcomes is entirely through inequality of education or schooling opportunity.

Table 6: Decomposition of Effects for Enrolment
Source: Authors' computations from the GSPS, 2010 and 2014

Direct Effects							
VARIABLES	Enrolment	Parents Present	Mother's Education	Father's Education	Locality	Gender	household Size
Parents present in the house	0.27*** (16.84)						
Mother's education	0.002 (0.11)						
Father's education	0.036** (3.32)						
Expenditure deviations	0.01 (0.97)	-0.10*** (-2.23)	-0.0*** (-8.50)	-0.06*** (-8.59)	0.30*** (27.96)	0.03** (2.41)	-1.01*** (-20.61)
Child's age	-0.011*** (-59.81)						
Child's gender	0.05*** (9.08)						
Household Size	0.01*** (3.46)						
Child's education level	0.160*** (4.27)						
Locality of residence	-0.03*** (-3.78)						
Indirect Effects							
VARIABLES	Enrolment	Parents Present	Mother's Education	Fathers' Education	Locality	Gender	household Size
Expenditure deviations	-0.02*** (-5.22)						
Parents present in the house							
Mother's education							
Father's education							
Locality of residence							
Gender of Child							
household size							

Total Effects							
VARIABLES	Enrolment	Parents Present	Mother's Education	Fathers' Education	Locality	Gender	House-hold Size
Parents present in the house	0.27** (16.84)						
Mother's education	0.02 (0.11)						
Father's education	0.04** (3.32)						
Expenditure deviations	-0.01 (-1.51)	-0.10*** (-2.23)	-0.0*** (-8.50)	-0.06*** (-8.59)	0.30*** (27.96)	0.03** (2.41)	-1.01*** (-20.61)
Child's age	-0.01*** (-59.81)						
Child's gender	0.06*** (9.08)						
Household Size	-0.004 (-1.00)						
Child's education level	-0.15** (-23.49)						
locality of residence	-0.03** (-3.78)						
var(e.enrolled)	0.077						
var(e.parents present)	0.041						
var(e.mother's education)	0.031						
var(e.locality)	0.225						
var(e.householdsize)	4.565						
var(e.gender of child)	0.250						
var(e.father's education)	0.094						
Observations	**7971**	**7971**	**7971**	7971	7971	7971	7971
Rsquared	**27.7**						

Table 7: Decomposition of Effects for Math Scores

Direct Effects								
VARIABLES	Math Scores	Parents Present	Mother's Education	Father's Education	Locality	Public School	Gender	House-hold Size
Parents present in the house	0.04 (1.39)							
Mother's education	-0.05 (-1.02)							
Father's education	0.10** (2.60)							
Expenditure deviations	-0.01 (0.55)	-0.10*** (-3.67)	-0.07*** (-4.77)	-0.16*** (-7.71)	0.36*** (13.61)	0.21*** (8.98)	0.03 (1.16)	-0.65 (-5.75)
Child's age	-0.05*** (-9.39)							
Child's gender	0.03 (0.99)							
Child's school is a public school	-0.02 (-0.66)							
Child has all textbooks	0.05* (1.75)							
Household Size	-0.001 (-0.06)							
Child's education level	0.160*** (4.27)							
Locality of residence	-0.05 (-1.61)							
Region of residence	0.01* (1.67)							
Indirect Effects								
VARIABLES	Math Scores	Parents Present	Mother's Education	Fathers' Education	Locality	Public School	Gender	household Size
Expenditure deviations	-0.04** (-2.78)							
Parents present in the house								
Mother's education								
Father's education								
Locality of residence								
School is a public school								
Gender of Child household size								

Total Effects								
VARIABLES	Math Scores	Parents Present	Mother's Education	Fathers' Education	Locality	Public School	Gender	House-hold Size
Parents present in the house	0.03 (1.37)							
Mother's education	0.01 (0.37							
Father's education	0.05* (1.93)							
Expenditure deviations	-0.02 (-1.04)	-0.10*** (-3.67)	-0.07*** (-4.77)	-0.16*** (-7.7)	0.36*** (13.61)	0.21*** (8.98)	0.03 (1.16)	-0.65 (-5.75)
Child's age	-0.02 (-5.75)							
Child's gender	0.01 (-1.54)							
Child's school is a public school	-0.37 (-1.54)							
Child has all textbooks	0.03 (1.45)							
Household Size	-0.004 (-1.00)							
Child's education level	0.06** (2.13)							
Region of residence	0.01** (2.22)							
var(e.mathscores)	0.196							
var(e.parents present)	0.208							
var(e.mother's education)	0.064							
var(e.locality)	0.212							
var(e.householdsize)	3.894							
var(e.school is public school)	0.164							
var(e.gender of child)	0.250							
var(e.father's education)	0.134							
Observations	**1222**	**1222**	**1222**					
Rsquared	**30.2**							

t statistics in parentheses* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8: Decomposition of Effects for English Scores

Direct Effects								
VARIABLES	English Scores	Parents Present	Mother's Education	Father's Education	Locality	Public School	Gender	House-hold Size
Parents present in the house	0.03 (1.39)							
Mother's education	0.01 (0.37)							
Father's education	0.05* (1.83)							
Expenditure deviations	-0.01 (-0.25)	-0.10*** (-3.67)	-0.07*** (-4.77)	-0.16*** (-7.71)	0.36*** (13.61)	0.21*** (8.98)	0.03 (1.16)	-0.65 (-5.75)
Child's age	-0.02*** (-5.75)							
Child's gender	0.01 (0.49)							
Child's school is a public school	-0.04 (-1.46)							
Child has all textbooks	0.03 (1.44)							
Household Size	-0.004 (-0.94)							
Child's education level	0.160*** (4.27)							
Locality of residence	-0.01 (-0.45)							
Region of residence	0.01* (1.67)							
Indirect Effects								
VARIABLES	English Scores	Parents Present	Mother's Education	Fathers' Education	Locality	Public School	Gender	household Size
Expenditure deviations	-0.02** (-2.03)							
Parents present in the house								
Mother's education								
Father's education								
Locality of residence								
School is a public public school								
Gender of Child								
household size								

Total Effects								
VARIABLES	English Scores	Parents Present	Mother's Education	Fathers' Education	Locality	Public School	Gender	household Size
Parents present in the house	0.03 (1.37)							
Mother's education	0.01 (0.37							
Father's education	0.05* (1.93)							
Expenditure deviations	-0.02 (-1.04)	-0.10*** (-3.67)	-0.07*** (-4.77)	-0.16*** (-7.7)	0.36*** (13.61)	0.21*** (8.98)	0.03 (1.16)	-0.65 (-5.75)
Child's age	-0.02 (-5.75)							
Child's gender	0.01 (-1.54)							
Child's school is a public school	-0.37 (-1.54)							
Child has all textbooks	0.03 (1.45)							
Household Size	-0.004 (-1.00)							
Child's education level	0.06** (2.13)							
Region of residence	0.01** (2.22)							
var(e.englisscores)	0.103							
var(e.parents present)	0.208							
var(e.mother's education)	0.064							
var(e.locality)	0.212							
var(e.householdsize)	3.894							
var(e.school is public school)	0.164							
var(e.gender of child)	0.250							
var(e.father's education)	0.134							
Observations	**1222**	**1222**	**1222**					
Rsquared	**27**							

t statistics in parentheses* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

6. Conclusions

With increased economic growth in the past few years, the issue of inequality lurks in most developing countries, including Ghana. To design appropriate policies to deal with rising inequalities, it is critical to fully appreciate the root causes of inequality. Using nationally representative panel data with two waves, the current study explores the share of inequality of opportunity in total inequality. Specifically, the study examines the contribution of inequality of opportunity in total consumption inequality in the Ghanaian context. Also, the study explores the extent to which inequality of learning opportunity contributes to inequality of learning outcomes. Other objectives of the study were to examine the effect of consumption inequality on learning outcomes as well as investigate the potential mechanism through which this effect is manifested.

The findings suggest that inequality of opportunity contributes significantly to total inequality. This means that a significant proportion of consumption inequality in Ghana is unfair. We note that by 2014, unfair inequality in Ghana was about 8.1 percent of total consumption inequality. This type of inequality is not based on individual effort or luck but rather on unequal opportunities that people have. The results show that the main drivers of inequality of opportunity in Ghana are the region of birth and the educational attainment of both mothers and fathers. The role of gender appears not to be significant in explaining inequality of opportunity in consumption inequality although its role is evident for learning outcomes. Similarly, the contribution of inequality of schooling opportunity is not trivial in the Ghanaian context. The primary sources of inequality of schooling opportunity include parental presence within the household, parental education, school type, gender and region of residence.

Results from the random effects and the mediation analysis suggest that while consumption inequality negatively affects schooling outcomes, its effect is completely through inequality of schooling opportunity.

Based on the findings from the study, we make the following policy recommendations. If policymakers aim to reduce unfair inequality in the future, there will be the need to focus on providing the opportunity for people to get an education today. Implementing policies that provide favourable conditions and which ensures that the general population has access to education has the potential to shape the opportunities the current generation present to their children for the future. In Ghana's context, the free senior high policy could serve this purpose and as such the policy should be reviewed to ensure it is sustainable and does not compromise on the quality of educational outcomes. This is particularly important given that many have raised concerns about the sustainability of the intervention in view of the fiscal effort required to pursue this policy and in the face of limited fiscal space that the government is presented with currently.

There is a need for policymakers to be more deliberate in the distribution of the national resources to ensure that equal opportunities are created for the entire population regardless of the part of the country one resides. This is based on the observed increase in the proportion of unfair inequality in addition to the heterogenous and unequal access to social infrastructure across rural-urban localities as well as, regions of the country. It is therefore imperative that a conscious policy effort is made to ensure that everyone has equal opportunity in the country.

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