Is there an early gender gap in Ghanaian children development? Evidence from 3-4 years old boys and girls

Bago, Jean-Louis and Souratié, Wamadini M. and Ouédraogo, Ernest and Lompo, Miaba Louise and Ouédraogo, Moussa and Perrault, Nicolas

Laval University, University Ouaga 2, Anadolu University

August 2019

Is there an early gender gap in Ghanaian children development? Evidence from 3-4 years old boys and girls

Jean-Louis Bago
Laval University, Department of Economics, Canada
Email: jean-louis.bago.1@ulaval.ca

Wamadini dite Minata Souratié
University Ouaga 2, Department of Economics, Burkina Faso
Email: souratieminata@yahoo.fr

Ernest Ouédraogo
University Ouaga 2, Department of Economics, Burkina Faso
Email: ernestouedra@yahoo.fr

Miaba Louise Lompo
Laval University, Department of Information and Communication, Canada
Email: miaba-louise.lompo.1@ulaval.ca

Moussa Ouédraogo
Anadolu University, Department of Economics, Turkey
Email: moussaouedraogo@anadolu.edu.tr

Nicolas Perrault
Laval University, Department of Economics, Canada
Email: nicolas.perrault@ulaval.ca

Abstract

Using data from the 2011 round of the Ghana Multiple Indicator Cluster Survey (MICS), we investigate the presence of an early gender gap in child development among children 3-4-year-old. Based on that survey, we built multidimensional indexes of child development that account for children's ability to read, count, recognize numbers, interact with peers and others, follow rules and be independent for their health outcomes and for their physical skills. This allowed us to estimate the gender gap while controlling for factors affecting child development. Using this approach, we found overall no evidence of gender difference in children's child development. One index suggests that being female is associated with higher children development. This result is robust to several specifications and sensitivity tests. We also found that a mother's education, a father's involvement and the fact of living in an urban area, all increase child development both for boys and for girls. In terms of policy, these findings indicate that the educational gender gap in Ghana most likely reflects unequal access to schooling opportunities between boys and girls.

Keywords: gender gap, child development, Ghana

---

1. Introduction

The presence of a persisting educational gender gap in developing countries continues to raise the question of whether an early gender gap exists between boys and girls in child development (Ertem et al., 2018). The literature highlights the importance of child development in academic achievement, educational attainment and late life outcomes (Batty et al., 2007; Koenen et al., 2009; Bornstein et al., 2013; Hofer and Clouston, 2014; Vandivere et al., 2015). Vandivere et al. (2015) find that children who already have a head start in acquiring skills before entering school are more likely to experience later academic success, attain higher levels of education, and secure better employment than their peers. Several driving factors have been explored to explain the educational gender gap, including the economically disadvantaged geographic areas (McAvoy and Purdy, 2013), the traditional value patterns (Dagne, 1994; Jensen and Thornton, 2003; Tanye, 2008; Kristof, 2009), poverty (King and Hill, 1993), child labour and domestic work (Bendera and Mboya 1999, Mulama, 2010). In a study in Sub-Saharan Africa, Ombati and Ombati (2012) find that political instability, poverty, negative cultural values, female genital mutilation, early marriage, teenage pregnancy, and sexual harassment are the leading contributors to gender gap in educational attainment in these countries.

In order to explain the educational gender gap, more recent studies begin to focus on early gender gap in child development. Surprisingly, a large body of these studies find evidence that girls outperform boys in this early childhood stage (Kent and Pitsia 2018). Using intelligence tests, some studies such as Palejwala and Fine (2015), Doyle and McNamara (2011) and Masnjak (2017) find that girls have scored higher in overall measures of early cognitive abilities and socioemotional development. Isaacs (2012) in the United-States, Von Stumm and Plomin (2015) and Ring et al. (2016) in Ireland also find significant early gender gap in child development in favour of girls. Another study by Toivainen, Papageorgiou, Tosto and Kovas (2017) find that young girls have significantly stronger abilities in verbal and nonverbal abilities than boys at ages 2, 3 and 4. Using micro-level data from Demographic and Health Surveys (DHS) of 38 developing countries, including Ghana, Grant and Behrman (2010) find that girls who have attended school have equal or significantly better schooling progress. Hence, Grant and Behrman (2010) argue that the gender differences in education achievement reflects unequal access to schooling opportunities among male and female children rather than early child development. In contrast, some studies

find that boys demonstrate higher development and this, in several domains of child development. For example, Palejwala and Fine (2015) find evidence that boys have stronger visual processing than young girls. Other studies also find that boys display higher spatial ability skills (Merrill et al., 2016) and physical abilities (Masnjak, 2017).

Our paper contributes to this literature by estimating the early gender gap in child development in Ghana. The main challenge in estimating the early gender gap is that child development, as multidimensional concept, is difficult to measure (McCoy et al., 2016). According to Kent and Pitsia (2018), child development describes how socially, physically, and intellectually ready children are to start formal schooling. It includes physical well-being, social and emotional development, learning skills, literacy and cognition and general knowledge (Bronfenbrenner and Morris, 1998). This scarcity of child development measures has led some researchers to use proxies such as poverty, mortality, stunting, and low birth weight to evaluate children's well-being and child development (Grantham-McGregor et al., 2007; Black et al., 2017). Although proxies like poverty, mortality and stunting are correlated with child development, these indicators do not include many developmental outcomes such as children skills or social and cognitive development (Camilli et al., 2010; Black et al., 2017). Other authors rely on children's performance on standardized tests of intelligence to measure child development (Zigler and Trickett, 1978; Haskins, 1989; Tomporowski et al., 2008; Russo et al., 2019; Tavassolie and Winsler, 2019). Unfortunately, these tests are highly subject to criticisms as well. According to McClelland (1973) and Locurto (1991) using developmental measures from IQ and other standardized test measures may be misleading since a child may perform poorly in tests of mathematics but perform exceptionally well in a sport. McClelland (1973) and Barrett and Depinet (1991) confirmed that multidimensional qualification indicators (including social, physical, learning and literacy measures), rather than IQ, should be the primary measure of child development.

In this paper, we exploit data from the 2011 round of Ghana Multiple Indicator Cluster Surveys (MICS)[1] to build an index of child development. This index focuses on children's ability to read, count, recognize numbers, interact with peers and others, their health, their physical skills

[1] MICS is the only nationally representative micro-level dataset, that addresses child development in developing countries including Ghana up-to-now. The 2011 round is the latest available wave of MICS in Ghana.

as well as their ability to follow rules and to be independent. We built two indexes of child development. The first one is built as an unweighted sum of the child score at each item/question. For the second index, we use a principal component analysis approach to extract a weighted index for child development based on all the information available to us.

Our results indicate that, overall, there is no evidence of early gender gap in terms of child development between boys and girls in Ghana. One index even indicates that being female is associate with higher children development. This result is consistent previous studies (Palejwala and Fine, 2015 ; Doyle and McNamara, 2011; Masnjak, 2017). Grant and Behrman (2010) and Ombati and Ombati (2012) also find that the gender differences in educational achievement in Sub-Saharan Africa is actually a result of unequal access to schooling opportunities and of later factors including social, political and economic factors which affects male and female children differently.

The rest of this paper is structured as follows. Section 2 discussed evidence on gender differences in educational achievement. Section 3 presents our data. The identification strategy is presented in Section 4 while Section 5 reports and discusses the results. Section 6 presents sensitivity analyses and section 7 concludes the paper.

2. Educational gender gap in Ghana

Ghana is one of the most successful Sub-Saharan African country in terms of rate of school enrolment with around 92% of children aged 6–14 years who are enrolled in either kindergarten, primary school or junior high school, far ahead of average Sub-Saharan rates (UNICEF, 2017). For example, in 2018, the net school enrollment rate was 37% in Liberia, 37% in Congo Democratic Republic, 61% in Mali, 64% in Nigeria and 74% in Senegal (UNESCO, 2018).

Early in the year 2000, the revolutionary government of Ghana has indicated that girls' education remained a priority in order to reduce the educational gender gap and to achieve the Millennium Development Goals. In fact, according to the Ministry of Education and the Girls' Education Unit, Ghana (2012) although there is virtual gender parity in enrolment at primary and junior high school, girls' educational attainment continues to lag behind boys in Ghana. A study by Nguyen and Wodon, (2014) find that the national gender ratio for completion of senior high school is

around two girls for every three boys. The studies find that girls are especially more vulnerable to drop out, especially due to early marriage, and teenage pregnancy and are disadvantaged by being over-aged. In addition, girls who live in rural areas, and girls who live in poor households are less likely to enroll in school compared to boys under the same conditions (Nguyen and Wodon, 2014). Over the years, Ghana has launched several education policies such as the Education Sector Plan 2000-2015, the Fast Track Initiative in 2003-2004, the National Early Childhood Care and Development policy (ECCD) in 2004, the Education Sector Plan 2010-2020, the Education strategic plan 2018-2030, with the aims to expand education and reduce gender gaps in access to schooling and improving education quality (UNICEF, 2017, Ghana Ministry of Education, 2018). These initiatives include nutrition and school feeding programs, abolishing school fees, free school uniforms, free textbook programs and providing grants and cash transfers to girls and under privileged preschool aged children (Wolf et al., 2019). However, despite the government's efforts, a recent study by McCoy et al. (2016) found that around 32.6% of Ghanaian preschool-age children (3 and 4 years old) still do not meet child development indicator thresholds. From this study, very little is known about the profile of these children who do not meet child development, especially the existence or non-existence of a gender gap in child development among the 3-4-year-old children in Ghana.

2. Data, Key Variables and Descriptive Statistics

2.1. Data source

We use data from the 2011 round of Ghana's Multiple Indicator Cluster Survey (MICS). The MICS is a nationally representative cross-sectional household-based survey collected by the Ghana Statistical Service (GSS) with the financial and technical support of international institutions such as UNICEF, USAID, UNFPA, the Japanese Government, ICF/MACRO, the Ministry of Health/National Malaria Control Program, and the Navrongo Health Research Centre (Ghana Statistical Service, 2011). The MICS used standardized questionnaires to provide up-to-date information and key indicators about children and mothers/caretakers. Our database contains information about 3-4-years-old children's characteristics such as gender, weight,

height, mother's education, father's involvement in the child home education[1], their area and their region of residence.

3.2. Measuring Child development

We used the children's questionnaire to construct our main outcome variables such as child development indicators. We focused on 10 items/questions contained in the children's questionnaire of the MICS data to construct the MECD index. This index addresses child development in the domains of literacy, social, physical and learning skills. These items are read as follows: first and foremost, the child's mother/caretaker were asked: (1) Can your child identify at least ten letters of the alphabet? (2) Can your child read at least four simple, popular words? (3) Does your child know his name and recognizes the symbols of all numbers from 1-10? These first three questions are related to a child's literacy. A positive answer to an item implies that the child is developmentally on track according to this specific ability. Secondly, the child's mother/caretaker were also asked: (4) Does the child get along well with other children? (5) Does the child usually kick, bite or hit other children or adults? These questions address the social development of a child. A positive answer to question (4) and a negative answer to question (5) implies that the child is developmentally on track for each item. Thirdly, the child's mother/caretaker were asked the following questions regarding their children's physical and health development: (7) Is the child able to pick up a small object with 2 fingers? (8) Is the child sometimes too sick to play? A positive answer to question (7) and a negative answer to question (8) implies that the child is developmentally on track for each item. Finally, the child's mother/caretaker were asked the following questions regarding children's ability to learn easy tasks and be independent: (9) Does the child follow simple directions? (10) Is the child able to do something independently? A positive answer to both questions implies that the child is developmentally on track for each item.

Based of the response to these ten questions, we created a dummy variable sr_{ij} equal to one if the child i is developmentally on track with the corresponding item and 0 otherwise for each item j. We built our first child development index denoted $sr1$ as the total of items where the child is developmentally on track such as:

[1] Since the MICS focuses on children and their mothers/caretakers, it does not include father's education, but it contains some questions about the father's involvement in the child's education at home.

$$sr1_i = \sum_{j=1}^{10} sr_{ij} \qquad (1)$$

Note that *Index*1 is then a count variable taking values between 0 and 10 ($sr1_i \in \{0,1,2,3,4,5,6,7,8,9,10\}$). Using a multidimensional indicator allows us to have a more complete measure of child development. However, while constructing the first child development *sr1*, we implicitly assume that all the items (such as reading, counting, recognizing numbers, being alone with others, the physical and health abilities…) have equal weights in a child's development.

In order to relax this assumption, we built a second child development index denoted *sr2* using the Principal Component Analysis (PCA) method. The PCA approach is a data reduction technique that is used to extract the most relevant information from a large set of variables into a smaller set of variables called components using the following linear combination of original items:

$$sr2_i = \sum_{j=1}^{10} w_j sr_{ij} \qquad (2)$$

where w_j is the optimal weight of item j which is determined by the PCA method. The PCA technique constructs a new index variable as the best linear combination of the original variables so that the variance along the new variable is maximized and thus, contains the most information. The different combinations are ranked by relevance. The first principal component denoted by PC1 is the best synthetic index that combines or condenses, in a single variable the consistent information originally dispersed over the 10 items about child development. We also predict the second component denoted by PC2 for robustness analysis.

3.2.1. Descriptive Statistics

The summary of descriptive statistics on male and female children characteristics are presented in Table (1). We find that, on average male and female children are respectively 3.49 years old and 3.47 years old. We find that in terms of weight children are on average 14.35 kilograms for males and 13.91 kilograms for females. The same difference appears in terms of height where male children are on average approximately 0.65 centimeters taller than female children. We also find that fathers are more involved in their male children's home education

than when the child is a female. As far as mother's education is concerned, we find that almost half of mothers/caretakers have less than a primary education while around 36 % of male children and 37% of female children have a primary education.

Table 1: *Descriptive statistics*

	Male					Female				
VARIABLES	N	mean	sd	min	max	N	mean	sd	min	max
Child's age	1,467	3.486	0.500	3	4	1,444	3.469	0.499	3	4
Child's weight (kilograms)	1,467	14.35	2.007	5.800	22.20	1,444	13.91	2.072	6.100	30
Child's height (centimeters)	1,464	96.62	6.481	67.50	118	1,440	95.94	6.280	70.40	119.4
Child development index 1	1,467	5.211	1.560	0	10	1,444	5.181	1.612	0	10
Father involve in child's education at home	1,467	0.288	0.453	0	1	1,444	0.267	0.443	0	1
Mother's education level										
Less than primary	1,467	0.585	0.493	0	1	1,444	0.562	0.496	0	1
Primary	1,467	0.358	0.480	0	1	1,444	0.370	0.483	0	1
Secondary and more	1,467	0.0573	0.232	0	1	1,444	0.0672	0.250	0	1
Area of residence										
Rural	1,467	0.713	0.453	0	1	1,444	0.720	0.449	0	1
Urban	1,467	0.287	0.453	0	1	1,444	0.280	0.449	0	1
Region of residence										
Western	1,467	0.0545	0.227	0	1	1,444	0.0492	0.216	0	1
Central	1,467	0.132	0.338	0	1	1,444	0.132	0.339	0	1
Greater Accra	1,467	0.0552	0.228	0	1	1,444	0.0506	0.219	0	1
Volta	1,467	0.0607	0.239	0	1	1,444	0.0568	0.232	0	1
Eastern	1,467	0.0348	0.183	0	1	1,444	0.0492	0.216	0	1
Asante	1,467	0.0532	0.224	0	1	1,444	0.0609	0.239	0	1
Brong Ahafo	1,467	0.0525	0.223	0	1	1,444	0.0519	0.222	0	1
Northern	1,467	0.284	0.451	0	1	1,444	0.272	0.445	0	1
Upper-East	1,467	0.139	0.346	0	1	1,444	0.152	0.359	0	1
Upper-West	1,467	0.135	0.342	0	1	1,444	0.125	0.330	0	1

4. Identification strategy

4.1. Estimates Using Unweighted Index for Child development

Recall that the unweighted child development index denoted *sr1* is a count variable. In order to estimate gender differences in child development, we use a Poisson regression which is

appropriate for count data analysis. The conditional average of the Poisson model for child i, denotes λ_i reads as follows:

$$\lambda_i = \beta_0 + \beta_1 Gender_i + \beta_3 X_i + \epsilon_i \tag{2}$$

where $Gender_i$ is a dummy variable and equals 1 if the child is a girl and 0 if the child is a boy. X_i is a vector of control covariates including child's age, child's gender, health indicator measured by child's weight (in kilograms) and height (in centimeters), mother's/caretaker's level of education, father's participation in child's home education, the area of residence (rural or urban) and the region of residence. ϵ_i is a zero-mean error term capturing the unobservable factors affecting child development.

The likelihood function is:

$$P(SR1 = sr1_i | Gender_i, X_i) = \frac{e^{-\lambda_i} \lambda_i^{sr1_i}}{sr1_i!} \tag{3}$$

Since the coefficients from the Poisson estimation are difficult to interpreted, we also estimate the marginal effects in order to quantify the gender gap in child development.

4.2. Estimation Using Weighted Indexes for Child development

Since the second measure of child development is a continuous variable, we estimate the following equation:

$$sr2_i = \gamma_0 + \gamma_1 Gender_i + \gamma_3 X_i + \eta_i \tag{4}$$

Where X_i includes the same variables as in Equation (2). The parameter γ_1 captures the gender differences in terms of child development after controlling for the child's characteristics. *sr2* is the weighted index of child development measured by the first component pc1 estimated from the Principal Components Analysis. For sensibility analysis, we also use the second component *pc2* as a dependent variable to estimate the gender gap in child development.

5. Empirical Results

5.1. Estimates Using Unweighted Indexes for Child development

Table (1) reports the estimates of Equation (2). As suggested by Croft et al., (2018), our estimations are weighted and stratified by region to control for the unequal probability of

households to be selected for the interview during the survey and for the regional heterogeneity in Ghana.

In Model (i), we estimate the effect of gender on children's child development index while controlling for children's age, weight and height. The results suggest that gender has no significant effect on child development. In contrast, age and height have a positive impact on child development.

In Model (ii), we add mother's education as a control variable. Here, we also find that gender is not associated with a child's child development. Yet, we find that a mother's education has a positive impact on children's child development.

In Model (iii), we control for a father's involvement in a child's home education. Again, we find no evidence of gender differences. Results also indicate that children whose father provides home education (like reading, playing games, etc.) have higher child development in contrast to children whose father does not participate in their home education at all.

Finally, in Model (iv) we control for regional fixed effects. Overall, results confirm that being a female has no effect on child development. Instead, the factors that affect child development are a child's age, a child's height, a mother's education, a father's involvement in a child's home education and living in an urban area.

Table 2: *Estimated average partial effects on child development using unweighted index*

VARIABLES	**Model (1)**		**Model (2)**		**Model (3)**		**Model (4)**	
	coef	dydx	coef	dydx	coef	dydx	coef	dydx
Gender(1 if female)	-0.00755	-0.0408	-0.0141	-0.0761	-0.0142	-0.0769	-0.00860	-0.0464
	(0.0185)	(0.100)	(0.0182)	(0.0983)	(0.0178)	(0.0959)	(0.0176)	(0.0950)
child's age	0.0443**	0.239**	0.0623***	0.336***	0.0636***	0.343***	0.0695***	0.375***
	(0.0205)	(0.111)	(0.0191)	(0.103)	(0.0187)	(0.101)	(0.0188)	(0.101)
Child's weight	-0.00501	-0.0271	-0.00578	-0.0312	-0.00612	-0.0330	-0.00484	-0.0261
	(0.00647)	(0.0350)	(0.00649)	(0.0351)	(0.00648)	(0.0351)	(0.00613)	(0.0331)
Child's height	0.0116***	0.0627***	0.00909***	0.0490***	0.00873***	0.0471***	0.00792***	0.0428***
	(0.00225)	(0.0124)	(0.00216)	(0.0118)	(0.00216)	(0.0118)	(0.00216)	(0.0117)
Primary			0.0978***	0.512***	0.0963***	0.504***	0.0754***	0.397***
			(0.0159)	(0.0835)	(0.0158)	(0.0832)	(0.0184)	(0.0953)

At least econdary			0.228***	1.275***	0.225***	1.260***	0.191***	1.063***
			(0.0264)	(0.159)	(0.0274)	(0.165)	(0.0251)	(0.143)
Father involve					0.0484***	0.261***	0.0450***	0.243***
					(0.0140)	(0.0747)	(0.0147)	(0.0786)
Urban							0.0726***	0.392***
							(0.0177)	(0.0962)
Central							0.0820***	0.463***
							(0.0248)	(0.139)
Greater Accra							0.00596	0.0324
							(0.0261)	(0.142)
Volta							-0.00194	-0.0105
							(0.0262)	(0.141)
Eastern							-0.0989	-0.510
							(0.0689)	(0.340)
Asante							0.0175	0.0954
							(0.0252)	(0.137)
Brong Ahafo							-0.0488	-0.258
							(0.0299)	(0.157)
Northern							0.00850	0.0462
							(0.0229)	(0.124)
Upper-East							-0.0234	-0.125
							(0.0256)	(0.137)
Upper-West							-0.0288	-0.153
							(0.0236)	(0.126)
Constant	0.478***		0.596***		0.617***		0.641***	
	(0.153)		(0.146)		(0.144)		(0.147)	
Observations	2,656	2,597	2,656	2,597	2,656	2,597	2,656	2,597
F-statistic	44.24		50.72		49.72		24.99	
Prob > F	0.0000		0.0000		0.0000		0.0000	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5.2. Estimates Using Weighted Indexes for Child development

Table (3) reports the estimates of Equation (4) using the first component (pc1) and the second component (pc2). In Model (1), we include the same variables as Model (i). The results indicate that being a female has a positive effect on child development (when we use the first component) but this effect is significant only at a threshold of 10%. This effect is not significant at a 5% threshold. Using the second component, we find no difference in child development due to gender. After controlling for a mother's education in Model (2) and a father's involvement in Model (3), the results indicate that gender has no effect on child development using both components while a mother's education and a father's involvement have a positive impact on children's child development. Finally, after controlling for the area of residence and the region of residence, there is a small positive effect from being a female on child development, but this effect is only significant at a 10% threshold. Gender has no effect when we used the second component as a child development index.

Table 3: *Estimated average partial effects on child development using unweighted index*

	Model (1)		**Model (2)**		**Model (3)**		**Model (4)**	
VARIABLES	pc1	pc2	pc1	pc2	pc1	pc2	pc1	pc2
Gender (1 if female)	0.204*	0.00104	0.154	0.00655	0.153	0.00637	0.182*	0.0542
	(0.108)	(0.0757)	(0.101)	(0.0765)	(0.0978)	(0.0767)	(0.0979)	(0.0764)
Child's age	0.311**	-0.0349	0.439***	-0.0559	0.447***	-0.0545	0.489***	-0.0529
	(0.122)	(0.0769)	(0.111)	(0.0760)	(0.108)	(0.0765)	(0.107)	(0.0673)
Child's weight	0.00278	0.0416	-0.00325	0.0428	-0.00596	0.0423	-8.12e-05	0.0535**
	(0.0357)	(0.0264)	(0.0287)	(0.0277)	(0.0277)	(0.0276)	(0.0268)	(0.0254)
Child's height	0.0769***	-0.0140	0.0594***	-0.0106	0.0570***	-0.0110	0.0519***	-0.00815
	(0.0124)	(0.00875)	(0.0105)	(0.00922)	(0.0104)	(0.00923)	(0.0105)	(0.00916)
Mother's education								
Less than primary			0.615***	-0.235***	0.604***	-0.237***	0.533***	-0.0831
			(0.0665)	(0.0778)	(0.0639)	(0.0775)	(0.0885)	(0.0736)
At least secondary			1.704***	-0.275**	1.684***	-0.279***	1.476***	-0.0725
			(0.175)	(0.108)	(0.179)	(0.106)	(0.154)	(0.105)
Father involves					0.358***	0.0623	0.341***	0.0512

					(0.0759)	(0.0773)	(0.0766)	(0.0657)
Area of residence								
Urban							0.489***	-0.0890
							(0.0745)	(0.0708)
Region of residence								
Central							0.160	-0.658***
							(0.138)	(0.107)
Greater Accra							-0.143	-0.757***
							(0.154)	(0.204)
Volta							-0.714***	-0.711***
							(0.166)	(0.183)
Eastern							-0.535*	-1.461***
							(0.297)	(0.232)
Asante							-0.208*	-0.468***
							(0.108)	(0.119)
Brong Ahafo							-0.379***	-0.407***
							(0.121)	(0.153)
Northern							-0.0168	-0.366***
							(0.107)	(0.118)
Upper-East							-0.180*	-0.295**
							(0.101)	(0.128)
Upper-West							-0.394***	-0.747***
							(0.105)	(0.129)
Constant	-8.439***	0.806	-7.583***	0.683	-7.435***	0.709	-7.120***	0.757
	(0.738)	(0.680)	(0.659)	(0.706)	(0.651)	(0.711)	(0.671)	(0.728)
Observations	2,656	2,656	2,656	2,656	2,656	2,656	2,656	2,656
R-squared	0.144	0.003	0.238	0.012	0.249	0.012	0.295	0.104

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

6. Sensibility Analysis

(i) Is there an heterogenous gender gap related to a child's area of residence?

In order to test for this heterogeneity, we estimate the gender gap in child development for children living in rural areas and those living in urban areas separately. The results are presented in Table (5). We find no evidence of gender differences in both rural and urban residences when using both of our weighted and unweighted indicators of child development.

Table 5: *Robustness check: Estimated gender gap by area of residence (rural verus urban)*

	Children living in rural area			**Children living in urban area**		
VARIABLES	Index1	pc1	pc2	Index1	pc1	pc2
Gender (1 if female)	-0.0163	0.120	-0.0215	0.000284	0.240	0.131
	(0.0178)	(0.0990)	(0.0787)	(0.0250)	(0.174)	(0.131)
Child's age	0.0157	0.182	-0.0526	0.123***	0.884***	-0.0521
	(0.0180)	(0.112)	(0.0966)	(0.0364)	(0.195)	(0.101)
Child's weight (kilograms)	-0.00479	-0.0364	0.0116	-0.00415	0.0462	0.0974**
	(0.00704)	(0.0314)	(0.0338)	(0.0103)	(0.0385)	(0.0391)
Child's height (centimeters)	0.0106***	0.0653***	0.0112	0.00523	0.0332*	-0.0306*
	(0.00289)	(0.0119)	(0.0100)	(0.00350)	(0.0189)	(0.0173)
Mother's education level						
Primary	0.0774***	0.504***	-0.0127	0.0605**	0.518***	-0.189
	(0.0191)	(0.0838)	(0.0955)	(0.0301)	(0.144)	(0.119)
At least secondary	0.167***	1.199***	0.218	0.193***	1.555***	-0.210*
	(0.0467)	(0.218)	(0.207)	(0.0347)	(0.162)	(0.113)
Father involve	0.0597***	0.421***	0.0823	0.0243	0.229*	0.00254
	(0.0164)	(0.0877)	(0.0870)	(0.0265)	(0.136)	(0.104)
Region of residence						
Central	0.115***	0.353***	-0.674***	0.0381	-0.115	-0.673***
	(0.0298)	(0.124)	(0.113)	(0.0459)	(0.270)	(0.178)
Greater Accra	-0.0377	-0.200	-0.754***	-0.00458	-0.293	-0.821***
	(0.0405)	(0.214)	(0.177)	(0.0406)	(0.237)	(0.249)
Volta	0.0144	-0.529***	-0.715***	-0.0274	-0.953***	-0.762**

	(0.0319)	(0.160)	(0.188)	(0.0414)	(0.260)	(0.343)
Eastern	-0.128*	-0.327	-1.570***	-0.0829	-0.894**	-1.422***
	(0.0767)	(0.247)	(0.243)	(0.0841)	(0.417)	(0.363)
Asante	0.0546	-0.0395	-0.430***	-0.0439	-0.520**	-0.585***
	(0.0333)	(0.101)	(0.140)	(0.0466)	(0.247)	(0.192)
Brong Ahafo	-0.0438	-0.338**	-0.310*	-0.0695	-0.495*	-0.605***
	(0.0394)	(0.130)	(0.165)	(0.0529)	(0.249)	(0.197)
Northern	0.0258	0.0397	-0.255**	-0.0214	-0.106	-0.549***
	(0.0296)	(0.112)	(0.122)	(0.0420)	(0.254)	(0.186)
Upper-East	-0.0167	-0.161*	-0.177	-0.0138	-0.0497	-0.589***
	(0.0302)	(0.0914)	(0.130)	(0.0418)	(0.276)	(0.197)
Upper-West	-0.0438	-0.377***	-0.577***	0.0541	-0.202	-1.279***
	(0.0285)	(0.101)	(0.130)	(0.0609)	(0.333)	(0.254)
Constant	0.560***	-6.898***	-0.565	0.813***	-6.660***	2.369*
	(0.188)	(0.671)	(0.577)	(0.242)	(1.370)	(1.375)
Observations	1,892	1,892	1,892	764	764	764
R-squared		0.222	0.119		0.285	0.094

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

(ii) Is there an heterogenous gender gap related to a child's household income?

The second source of heterogeneity that we tested is a family's wealth. As in Bago and Lompo (2019), we use the household wealth index to divide our sample analysis into two sub-samples: the poor and the wealthier. Subsequently, we estimated the gender gap in child development for children from poor households and those from wealthier households separately. The results in Table (4) indicate that gender has no effect on children's child development for both poor and rich households.

Table 4: *Robustness check: Estimated gender gape by household's income (poor versus rich)*

	Children living in poor housholds			**Children living in rich housholds**		
VARIABLES	Index1	pc1	pc2	Index1	pc1	pc2
Gender (1 if female)	-0.0319	0.0333	0.108	-0.0227	0.214	-0.0837

	(0.0226)	(0.0875)	(0.0759)	(0.0359)	(0.239)	(0.131)
Child's age	0.0267	0.315***	0.0619	0.0995**	0.681***	-0.171
	(0.0217)	(0.113)	(0.106)	(0.0405)	(0.225)	(0.117)
Child's weight (kilograms)	-0.00962	-0.0233	0.0117	0.00226	0.0771	0.0389
	(0.00756)	(0.0312)	(0.0344)	(0.00970)	(0.0573)	(0.0499)
Child's height (centimeters)	0.00982***	0.0426***	0.0122	0.00380	0.0360	-0.0176
	(0.00281)	(0.0106)	(0.0112)	(0.00384)	(0.0252)	(0.0221)
Mother's education level						
Primary	0.0375	0.267***	0.0339	0.130***	0.757***	-0.0791
	(0.0226)	(0.0729)	(0.123)	(0.0447)	(0.260)	(0.199)
At least secondary	0.117	0.908**	0.166	0.234***	1.580***	-0.0429
	(0.0775)	(0.435)	(0.373)	(0.0457)	(0.257)	(0.191)
Father involve	0.0528**	0.287***	0.0991	0.0171	0.198	-0.0454
	(0.0225)	(0.0892)	(0.0849)	(0.0308)	(0.165)	(0.0892)
Area of residence						
Urban	0.0697**	0.591***	0.102	0.0270	0.141	-0.0463
	(0.0300)	(0.130)	(0.128)	(0.0408)	(0.177)	(0.124)
Region of residence						
Central	0.102**	0.334*	-0.682***	0.0373	-0.249	-0.554***
	(0.0425)	(0.176)	(0.125)	(0.0334)	(0.241)	(0.183)
Greater	0.0307	-0.174	-1.153***	-0.0243	-0.365	-0.541**
	(0.0776)	(0.320)	(0.192)	(0.0339)	(0.231)	(0.237)
Volta	-0.0265	-0.732***	-0.774***	0.0523	-0.694*	-0.556
	(0.0518)	(0.150)	(0.203)	(0.0715)	(0.389)	(0.378)
Eastern	-0.135	-0.428	-1.326***	-0.104	-0.741	-1.311***
	(0.104)	(0.355)	(0.181)	(0.0627)	(0.473)	(0.374)
Asante	0.0214	-0.320	-0.787***	-0.0329	-0.420*	-0.253
	(0.0542)	(0.293)	(0.163)	(0.0426)	(0.227)	(0.173)
Brong Ahafo	-0.0707	-0.480***	-0.433**	-0.0273	-0.119	-0.702***
	(0.0440)	(0.150)	(0.180)	(0.0719)	(0.327)	(0.224)
Northern	-0.0112	-0.138	-0.325**	0.0697	0.591	-0.697***
	(0.0375)	(0.147)	(0.136)	(0.0499)	(0.363)	(0.197)
Upper-East	-0.0484	-0.256*	-0.327**	0.107***	0.836**	-0.502**
	(0.0370)	(0.134)	(0.135)	(0.0303)	(0.364)	(0.205)

Upper-West	-0.0751**	-0.461***	-0.685***	0.0720	-0.193	-1.139***
	(0.0351)	(0.147)	(0.137)	(0.0627)	(0.312)	(0.245)
Constant	0.705***	-5.186***	-1.038	0.882***	-6.927***	2.254
	(0.176)	(0.598)	(0.662)	(0.255)	(1.754)	(1.696)
Observations	1,732	1,732	1,732	498	498	498
R-squared		0.175	0.093		0.241	0.097

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

7. Conclusion

We provide new evidence that there is no early gender gap in terms of child development among children 3-4 years old in Ghana. We take advantage of micro-level data from the 2011 round of Ghana's Multiple Index Cluster Survey (MICS). Our strategy consists first, in building child development indexes that account for children's ability to read, count, recognize numbers, interact with peers and other people, taking into consideration the child's health, physical skills as well as the child's ability to follow rules and be independent. Subsequently, we estimate the gender gap in terms of child development using several specifications. Results indicate that gender has no significant impact on children's school readiness. In contrast, we find that mother's education, father's involvement in the child home education and living in urban area have a positive effect on children's school readiness. This result is consistent with Grant and Behrman (2010) and Ombati and Ombati (2012) who find that the gender gap in later education outcomes in developing countries reflect the unequal access to schooling opportunities between male and female children. This paper contains some limitations. First, the questions for child development are limited. A larger set of questions on child development will be needed to measure the existence of a gender gap precisely. Second, the results are obtained in the context of Ghana and therefore we do not argue that these results are generalizable in other countries.

References

Appiah- Kubi, K. (2003), "Education inequality in Ghana", MIMAP – Ghana Research Report No. 001, July

Bago, J. L., & Lompo, M. L. (2019). Exploring the linkage between exposure to mass media and HIV awareness among adolescents in Uganda. Sexual & Reproductive Healthcare, 21, 1-8.

Barrett, G. V. and R. L. Depinet (1991). A reconsideration of testing for competence rather than for intelligence. *American Psychologist 46*(10), 1012.

Black, M. M., S. P. Walker, L. C. Fernald, C. T. Andersen, A. M. DiGirolamo, C. Lu, D. C. McCoy, G. Fink, Y. R. Shawar, J. Shiffman, et al. (2017). Early childhood development coming of age: science through the life course. *The Lancet 389*(10064), 77–90.

Bronfenbrenner, U. and P. Morris (1998). The ecology of developmental processes. In *Theorectical models of human development*, pp. 993–1028. Wiley.

Camilli, G., S. Vargas, S. Ryan, and W. S. Barnett (2010). Meta-analysis of the effects of early education interventions on cognitive and social development. *Teachers college record 112*(3), 579–620.

Coulombe, H. and Wodon, Q. (2007), "*Poverty livelihoods and access to basic services in Ghana*", Ghana CEM: Meeting the Challenge of Accelerated and Shared Growth,

Croft, T. N., M. J. M. Aileen, K. A. Courtney, and et al. (2018). Guide to dhs statistics. *Rockville, Maryland, USA: ICF*.

Ghana Ministry of Education and the Girls' Education Unit, (2012), What Works in Girls' Education in Ghana: A critical review of the Ghanaian and international literature. *Ghana Education Service*.

Ghana Ministry of Education,2018, The Education Strategic Plan 2018-2030, available online https://www.globalpartnership.org/sites/default/files/2019-05-education-strategic-plan-2018-2030.pdf

Ghana Statistical Service, G. (2011). Ghana multiple indicator cluster survey with an enhanced malaria module and biomarker. *Final Report*.

Grant, M. J. and J. R. Behrman (2010). Gender gaps in educational attainment in less developed countries. *Population and Development Review 36*(1), 71–89.

Grantham-McGregor, S., Y. B. Cheung, S. Cueto, P. Glewwe, L. Richter, B. Strupp, I. C. D. S. Group, et al. (2007). Developmental potential in the first 5 years for children in developing countries. *The lancet 369*(9555), 60–70.

Haskins, R. (1989). Beyond metaphor: The efficacy of early childhood education. *American Psychologist 44*(2), 274.

King, E. M. and A. D. Mason (2001). Engendering development through gender equality in rights resources and voice. summary.

Locurto, C. (1991). Beyond iq in preschool programs? *Intelligence 15*(3), 295–312.

Nguyen, M. C., & Wodon, Q. (2014), Analysing the gender gap in education attainment: A simple framework with application to Ghana. Journal of International Development, 26(1), 59-76.

McClelland, D. C. (1973). Testing for competence rather than for" intelligence.". *American psychologist 28*(1), 1.

McCoy, D. C., M. M. Black, B. Daelmans, and T. Dua (2016). Measuring development in children from birth to age 3 at population level. *The Hague, The Netherlands: Bernard van Leer Foundation*, 34–9.

Russo, J. M., A. P. Williford, A. J. Markowitz, V. E. Vitiello, and D. Bassok (2019). Examining the validity of a widely-used school readiness assessment: Implications for teachers and early childhood programs. *Early Childhood Research Quarterly 48*, 14–25.

Tavassolie, T. and A. Winsler (2019). Predictors of mandatory 3rd grade retention from high-stakes test performance for low-income, ethnically diverse children. *Early Childhood Research Quarterly 48*, 62–74.

Tomporowski, P. D., C. L. Davis, P. H. Miller, and J. A. Naglieri (2008). Exercise and children's intelligence, cognition, and academic achievement. *Educational psychology review 20*(2), 111.

UNICEF (2017) Annual Report 2017, Ghana

UNICEF (2008). Basic education and gender equality.

Wils, A. and A. Goujon (1998). Diffusion of education in six world regions, 1960-90. *Population and Development Review*, 357–368.

Wolf, S., J. L. Aber, J. R. Behrman, and E. Tsinigo (2019). Experimental impacts of the "quality preschool for ghana" interventions on teacher professional well-being, classroom quality, and children's school readiness. *Journal of Research on Educational Effectiveness 12*(1), 10–37.

Zigler, E. and P. K. Trickett (1978). Iq, social competence, and evaluation of early childhood intervention programs. *American Psychologist 33*(9), 789.