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Does Female Education have a Bargaining Effect on Household Welfare? Evidence from Ghana and Uganda*

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Abstract

Female education and its potential to empower women in the development process have engaged the interest of policy makers and academics over the years. By employing individual level data from Ghana and Uganda, we analyze whether female education has a direct bargaining effect on six household welfare indicators: child labor and school enrollment; food expenditure and nutrition intake; female labor force participation and fertility rates. The empirical results indicate that both, the level of the wife and her husband's education, are significant determinants of household welfare. However, the wife's education has no larger effect than that of her husband's, and the relative bargaining position of the wife, at most, has negligible effects on the welfare indicators studied. Further robustness analysis largely confirms our findings. We conclude that, whilst female education has the potential to enhance household welfare, the effect does not necessarily work though enhanced bargaining power.

Keywords: Women Empowerment, Intra-household Bargaining, Household Welfare, Ghana, Uganda
JEL Codes: I2, J13, J16

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1. Introduction

The importance of women's empowerment in intra-household decision making and on household welfare has been an integral part of the development discourse (Grown, Gupta, & Kes, 2005; Malhotra & Schuler, 2005). The significance of the subject is also explicitly captured by the Millennium Development Goals and the Sustainable Development Goals. The Copenhagen Consensus Center (2015) estimates a net high benefit, in terms of US-Dollars, of women's empowerment; and the United Nation considers women's empowerment not only as an end in itself, but as a tool for achieving sustainable development (UNFPA, 1994; UNGA, 2015; Warth & Koparanova, 2012). This view has contributed to the formation of the World Bank's Gender Action Plan in 2006 which relates economic growth and women empowerment (Zuckerman, 2007).

Both policy makers and development practitioners are interested in finding effective ways to empower women to achieve the desired effects (Suguna, 2011; Sundaram, Sekar, & Subburaj, 2014). This is because women's empowerment may influence the allocation of resources including those resources that concern children (Doepke & Tertt, 2014; Hoddinott, Alderman, & Haddad, 1997; Thomas, 1990; Yusof & Duasa, 2010). Education is viewed as a potential tool for empowering women in developing countries (UNGEI, 2014) because it is argued to have a positive relationship with empowerment (McCracken, Unterhalter, Marquez, & Chelstowska, 2015). The positive association between women's education and household welfare, on the one hand, and the positive association between female empowerment and household welfare, on the other hand, suggest that women's education has two relevant pathways of improving household welfare: A *direct effect* and and *indirect effect* that is due to the empowerment factor.

We contribute to the literature on female empowerment by assessing the direct and the bargaining effects of education on multiple measures of household welfare in Ghana and Uganda.[1] In our empirical analysis, we measure female bargaining power as the relative years of schooling of the woman in relation to that of her husband. This measure and its variants have been extensively adopted in the literature (Doss, 2013; Handa, 1996; Imai, Annim, Kulkarni, & Gaiha, 2014; Thomas, 1994). The measure has, at least, three attractive features. First, the couple's education levels are unlikely to be the outcome of the household bargaining process since most people finish formal schooling before marriage. Hence, variations in their education can be deemed as exogenous of their current household decisions, particularly those related to children. Second, an educated woman has a better chance of achieving economic sustenance outside the marriage, which increases her bargaining power inside the marriage union.[2] Third, there is a comparatively reliable schooling data at the individual level in the two developing countries that we analyze.

The empirical analysis in this study evaluates how the levels of female and male education affect the household's welfare; and whether the bargaining power, induced by their educational differences, has any additional effects on the household and its members. We conduct this study for the two developing countries Uganda and Ghana

[1] We also provide review of theoretical discussions in an appendix to show that increases in women's empowerment do not necessarily lead to higher household welfare.

[2] Doss (2013) argues that any factor that affects the ability of the woman to survive out of the household arrangement is a good measure of her bargaining power.

as both countries have a free universal basic education policies with a certain emphasis on girls' education, making them particularly interesting cases. Moreover, the two countries have been politically and economically stable in recent years. They also have relatively comparable macroeconomic indicators including literacy rates, and we speculate that experiences regarding women's empowerment could be generalizable to other developing countries, particularly, in sub-Saharan Africa. We measure household welfare using six indicators in line witih the literature, namely, child labor and school enrollment (child's welfare); female labor participation and fertility rate (woman's welfare); and household food expenditure and nutrition intake (general household welfare) (see also Aromolaran, 2004; Breierova & Duflo, 2004; Glick & Sahn, 2000; Sackey, 2005; Thiele & Weiss, 2003).

Our results show that more years of schooling of the woman and man's have welfare-enhancing effects on the household, i.e. more education improves households welfare. However, the measure for the relative bargaining position of the woman has, at most, a marginally significant effect on all the welfare indicators studied. These findings are consistent across the two countries analyzed which helps us to exclude measurement errors and cultural differences as potential drivers for the results. We also employ instrumental variables to take account of potential endogeneity problems, and use an alternative measure of empowerment and a cultural indicator (ethnicity) in Ghana as a further robustness check. Moreover, we performed additional tests to see if the non-significance can be attributed to the omission of unobservable variables in our models. The robustness estimations and tests largely confirm the baseline finding regarding the relevance of bargaining power.

The remainder of the paper is organized as follows. Section 2 relates the paper to the existing literature on women's empowerment, intra-household bargaining, and economic development. We describe the data and how we measured the main variables in Section 3. Section 4 presents the empirical results and evaluates their robustness. Conclusion and policy implication are presented in Section 5.

2. Related Literature

This paper contributes to the literature on education, women's empowerment and welfare at the household level in developing countries (see e.g., Hl & King, 1993, 1995; Klasen, 2002) Women's empowerment and education are considered as key factors of economic progress (Doepke, Tertt, & Voena, 2012; Duflo, 2012)[3].

One way education can empower women is by increasing their productivity and labor force participation. However, the relationship between education and labor force participation depends on the impact of education on the reservation wage of women relative to the market wage rate (Becker, 1985; Lam & Duryea, 1999; Lincove, 2008; T. W. Schultz, 1960). If education rather increases the productivity of women at home than on the labor market, then the opportunity cost of working outside the home is

[3]Aguirre, Hoteit, Rupp, and Sabbagh (2012) suggest that the net impact on income levels of raising female labor participation ranges from 2 percent in Sweden to as high as 34 percent in Egypt. Other literature suggest negative impacts of female labor force participation on corruption (Swamy, Knack, Lee, & Azfar, 2001) which may, however, be moderated by culture (Debski, Jetter, M´osle, & Stadelmann, 2016)

higher; hence female labor force participation may not increase. Education may also have profound impact on female empowerment if it gives them access to resources and secured property rights. In sub-Sahara Africa, where agriculture is the primary source of livelihood for many women, the lack of secured property rights leads to under-utilization of farmlands belonging to women (Goldstein & Udry, 2008; Joireman, 2008; Udry, 1996). In parts of Ghana, where arable land belongs to the community head or chief, Goldstein and Udry (2008) note that women allow less fallowing period because of the fear of losing them.[4] We contribute this literature by explaining how education and a woman's bargaining power affect female labor force participation.

Studies have shown that women's education has a positive correlation with reduction in child labor, better school and health outcomes of children (Breierova & Duflo, 2004; Cygan-Rehm & Maeder, 2013; Glick & Sahn, 2000; Güneş, 2015; Imai et al., 2014). These findings suggest that the quality of the child's human capital will improve if the mother was better educated but Duflo (2012) suggests that it is possible that the observed correlation suffers from biases due to systematic differences between educated and uneducated women as well as and assortative mating. In particular, the observed effects can not be attributed to only the woman but may stem from both parents. Chou, Liu, Grossman, and Joyce (2010) found positive effect of both mother and father's education on child survival and Breierova and Duflo (2004) did not even find any effect of maternal education on child mortality. As our contribution to this strand of the literature, we jointly analyze education levels of both parents and the potential additional female empowerment effect at the same time.

Endogeneity between women's bargaining power and certain welfare indicators has been raised in the literature (Doss, 2013). The endogeneity comes from the bi-causal relationship between proxies of bargaining power like income or labor force participation and the respective welfare variables during the bargaining process. This makes it challenging to identify the bargaining effect for women. Some studies have used women's ownership of non-labor income such as remittance, pension benefits and interest on capital to proxy bargaining power (T. P. Schultz, 1990; Thomas, 1993). However, to the extent that the receipt of non-labor income could be the realization of past labor decisions makes these measures endogenous too (Doss, 2013). The identification issues, as well as the lack of suitable data on some of proxies, have led to the use of education and its correlates as a measure of women's bargaining power within the household (Güneş, 2015; Handa, 1996; Imai et al., 2014).

The use of education as measure of bargaining power is based on the following theoretical reasoning: there exists a positive relationship between education and women's participation in household decision making (Becker, Fonseca-Becker, & Schenck-Yglesias, 2006; Boateng et al., 2012; Gupta & Yesudian, 2006; Headey & Fan, 2008). Moreover, educated women have a better chance of meeting their livelihood needs outside of marriage, which makes them relatively more independent of their spouses. Therefore, education serves as a reliable indicator of the woman's bargaining power (Chiappori, 1997). This paper does not only use educational differences as a proxy for bargaining but proposes instrumental variable strategies to account for

[4]Goldstein and Udry (2008) also found that office holding women run lower risk of losing their lands than non-office holding women. Fortmann, Antinori, and Nabane (1997) observed for Zimbabwe that women invested less in tree planting because of unsecured property rights.

endogeneity issues. We also offer an alternative way of measuring bargaining power by focusing on the differences between matrilineal and patrilineal ethnic groups in Ghana. Thereby the article also contributes to the discussions on the approaches to empirically evaluate female bargaining power and it presents new alternatives.

3. Data and measurement

We empirically investigate the role of women's bargaining power and education on household welfare in Ghana and Uganda by using six different indicators of household welfare: child labor and school enrollment, household nutritional intake and expenditure on food, female labor force participation and fertility.

The fifth and sixth rounds of the Ghana Living Standards Survey (GLSS-6 and GLSS-5) and the Uganda National Panel Survey (UNPS) (2009/2010, 2010/2011 and 2011/2012) are the primary data sources. The two data sets are both nationally representative and they are collected in accordance with the Living Standards Measurement Survey of the World Bank. The surveys contain information on the social and economic background of individuals, their household, and their communities. Our choice of these data sets is informed primarily by their availability and the comparability of the variables of interest across the two countries.

Regarding the six welfare indicators, i.e. the dependent variables, (1) *child labor* is measured as a binary variable with outcomes 0 and 1. A child is assigned 1 if he or she had worked for pay, profit, family gain or produce anything for batter or family use when surveyed; otherwise, the value 0 is assigned. (2) *School enrollment* is measured for children between age 6 and 15 years. A child within this age range is considered enrolled if she has ever attended school. (3) The *fertility* of a woman is measured with the total number of births. (4) *Female labor force* is captured with a binary variable which takes a value of 1 if she is engaged in any economic activity outside domestic chores and household farm work, and 0 if otherwise. (5) *Household total expenditure on food* is used as a measure of food consumption. All these variables can be directly compared for the two countries and the time periods analyzed. Two different but closely related, variables are used to measure (6) *nutrition intake* for the respective countries. In the case of Ghana, we measure nutrient intake with dietary diversity while we use per capita caloric intake for Uganda. We measure household per capita caloric intake as the total calories consumed by the household divided by household size following the literature (Benson, Mugarurab, & Wandac, 2008).

Regarding our main independent variables of interest, the years of schooling is derived from the individuals highest grade completed which is the variable that is contained in the two data sets for both countries. We construct two variables, one for male and one for female education levels as our first two independent variables. To obtain the bargaining power proxy, we select a sub-sample of households where there is husband and at least one wife.[5] The bargaining measure is then derived as a ratio of the woman's years of schooling to the sum of her years of schooling and that of the husband, i.e. the higher a woman's education in comparison to her husband, the higher is her bargaining power.

[5]When the outcome variable is measured at the household level and there are more wives in the household, we used the education of the wife with the highest level of education to construct our measure for bargaining power. This is a conservative choice.

In the empirical analysis, we include a large array of relevant control variables including child's age and gender, household size, measures of household wealth, a dummy for whether the household is engaged in farming, distance to nearest school, an indicator variable for when both the man and woman have zero years of schooling. Descriptive statistics for these variables are presented in Table A3 in the appendix for Ghana and Uganda. Again, we take care that the variables employed are comparable for both countries. We also take account of regional and time-fixed effects in all the analyzes.

Empirical specification
We estimate a baseline model for each of the six welfare indicators using the following reduced form model:

$$y_{ij} = \alpha + \gamma_1 Bargain_i + \gamma_2 SchoolingWoman_i + \gamma_3 SchoolingMan_i + X'\beta + \epsilon_i, \quad (1)$$

where $j = 1, 2, ...6$ indexes the six welfare outcomes (school enrollment, child labor, female labor force participation, fertility, food expenditure, nutrition intake) studied and $i = 1, 2, 3...n$ is indexes the households in the study. Our main three coefficients of interest are γ_1, for the effect of a woman's bargaining power, γ_2, for the direct effect of a woman's education, and γ_3 for the effect of a man's education. As we include the education level of the woman and the man, γ_1 effectively captures the indirect effect of education through female empowerment. ϵ is the error term.

4. Results

4.1. Baseline results

The results of equation (1) for school enrollment and child labor (child welfare) are presented in Table 1. Table 2 presents results for female labor participation and fertility (female welfare), and the results of provides for nutrition intake and food expenditure (household welfare) are presented in Table 3. For every indicator, we present four specifications each for Ghana (columns 1-4) and Uganda (columns 5-8), respectively. Columns 1 and 5 shows the estimates of a simple regression with only the bargaining power measure and regional fixed effects as the only additional controls. In columns 2 and 6, only the levels of education of both the man and woman are entered for comparison. In specifications 3 and 7 we include both the levels as well as the bargaining index and finally the full models with additional controls and fixed effects are presented in columns 4 and 8. In Tables 1-3 we pool the various data sets from the various years for the respective countries. [6]

In Panel A of Table 1, we observe that the woman's relative bargaining position has no significant effect on the child's probability of school enrollment once the years of schooling of the mother and father are controlled. The years of schooling of both parents, however, have positive and statistically significant effects on the child's school enrollment. These

[6]The Ghana Living Standards Survey consists of repeated cross sections. The Uganda National Panel Survey allows us to present panel estimates with fixed-effects which we present in Table A1 in Appendix A. All our interpretation remain robust after the inclusion of individual fixed-effects. Tables A2, A4 and the Mean VIF of the models show that multicolinearity should not affect our findings.

effects are observed for both Ghana and Uganda. In Panel B, the effect of the mother's bargaining power on child labor also becomes insignificant when additional controls are included in the models. Columns 4 and 8 of Panels A and B in Table 1 show that when we include relevant control variables, only the years of schooling of the mother or father tend to remain statistically significant in explaining the child's enrollment and child labor. Higher female and male education, thus, tend to be associated with higher probability of school enrollment and a lower probability that children in Ghana and Uganda have to engage in child labor. However, we do not find evidence of a statistically significant effect of the woman's bargaining power once the level of education is included and when taking account of additional control variables. Moreover, we compare the magnitudes of the effects of the levels of education the woman and the man, but we fail to find evidence that the effect of the woman's education is higher than that of the man, i.e. the education of women does not have a higher effect on a child's welfare than that of men.

Table 1: Women's bargaining power and child welfare in Ghana and Uganda

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Ghana				Uganda			
	Panel A: Women's bargaining power and school enrollment (Marginal Effects)							
Woman's bargaining power	-0.043***		0.016	0.032	-0.038**		-0.022	-0.002
	(0.009)		(0.018)	(0.021)	(0.015)		(0.024)	(0.028)
Woman's sch. yrs.		0.008***	0.007***	0.004*		0.002*	0.004*	0.001
		(0.001)	(0.002)	(0.002)		(0.001)	(0.002)	(0.002)
Man's sch. yrs.		0.009***	0.010***	0.008***		0.008***	0.007***	0.002
		(0.001)	(0.001)	(0.001)		(0.001)	(0.002)	(0.002)
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	No	No	No	Yes	No	No	No	Yes
N	12716	12716	12716	12716	7265	7265	7265	7265
McFadd. R^2	0.193	0.251	0.251	0.276	0.009	0.026	0.026	0.272
Man -Woman		0.001	0.003	0.004		0.006	0.003	0.002
		[0.456]	[0.263]	[0.164]		[0.003]	[0.405]	[0.647]
Mean VIF				2.310				1.810
	Panel B: Women's bargaining power and child labor (Marginal Effects)							
Woman's bargaining power	0.028*		-0.062**	-0.026	-0.059***		0.028	0.036
	(0.016)		(0.030)	(0.029)	(0.023)		(0.041)	(0.036)
Woman's sch. yrs.		-0.007***	-0.003	-0.001		-0.011***	-0.013***	-0.006**
		(0.001)	(0.002)	(0.002)		(0.002)	(0.003)	(0.003)
Man's sch. yrs.		-0.011***	-0.014***	-0.011***		-0.003*	-0.001	0.001
		(0.001)	(0.002)	(0.002)		(0.002)	(0.003)	(0.002)
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	No	No	No	Yes	No	No	No	Yes
N	11779	11779	11779	11779	7410	7410	7410	7410
McFadd. R^2	0.063	0.085	0.085	0.177	0.006	0.012	0.012	0.221
Effect: Man-Woman		-0.004	-0.010	-0.010		0.008	0.012	0.007
		[0.029]	[0.004]	[0.002]		[0.005]	[0.038]	[0.165]
Mean VIF				2.120				1.760

Note: (#) Standard errors; [#] p-value; * $p < .1$, ** $p < 0.05$, *** $p < .01$. Man-Woman is the difference between man's years of schooling and that of the woman. The control variables in Panel A are child's age and gender; household size and a dummy for whether the household is engaged in farming and distance to nearest school (hours), an indicator variable for when both the man and woman have zero years of schooling; two dummies for whether the father or mother is engaged in any paid job; a measure of household wealth number of children between from to 17 years; set of dummies for region fixed effects, year and urban residence. The control variables in Panel B are child's age and gender, a dummy for school attendance; household size and a dummy for whether the household is engaged in farming and whether the child leaves with the father; two dummies for whether the father or mother is engaged in any paid job,an indicator variable for when both the man and woman have zero years of schooling; a measure of household wealth; set of dummies for region fixed effects, year and urban residence.

Table 2 presents the effect of women's bargaining power on her labor force participation and fertility rates in Panels A and B respectively. In columns 1 and 5 of Panel A, where we control for only region and time fixed effects, the woman's

bargaining power is only significant in explaining female labor force participation in Uganda. However, as observed in Table 1, this effect vanishes once the level of education of both woman and man is accounted for when additional control variables are included (see columns 3,4 for Ghana and 7,8 for Uganda). Panel B of Table 2 contains the Poisson estimates of the number of births of the woman. Even though columns 1 and 5 of Panel B show that higher bargaining power correlates with lower fertility levels, once we introduce the levels of education of the woman and man, we even find a positive coefficient for bargaining power in Ghana [7]. The respective coefficient for Uganda is statistically insignificant. The years of schooling of the woman and man, however, tend to reduce fertility. We interpret these results as being consistent with the view that formal education is relevant a predictor of female labor force participation and fertility rate. In Panel B the effect of the woman's education on fertility is statistically higher than that of the man in all cases. This means that issues concerning the woman's fertility is more affected by her education level than that of her husband, but this can only be attributed to the direct effect of education and not the indirect effect through relative bargaining power.

Table 3 presents results of the household's food expenditure in Panel A and nutrition intake in Panel B. Women's bargaining power is significant only in the simplest model for food expenditure in Uganda, i.e. bargaining power of women usually seems to have no statistically significant influence on these types of welfare variables. However, we observe that the years of schooling of the man and woman have significant effects, though not consistent in terms of the of the coefficient. For instance in the case of Ghana, we estimate negative effects of years of schooling on household food expenditure, but these effects are positive in the case of Uganda. In general the behavior of the bargaining variable is consistent with the observed patterns in Tables 1 and 2. On the difference between the effects of the years of schooling of the woman and the man, the estimates in both Panels of Table 3 show that the two level effects of education are not statistically significantly different from each other.

The results in Tables 1-3 suggests that the levels of education of both the women and men are relevant predictors of the six welfare indicators which we analyze in this paper. However, the effect of the proxy for the women's bargaining power on the indicators is not systematically and statistically significant when the levels of education of the woman and man are introduced. Thus, we find support for a direct effect of education of the woman and man but we find little evidence for an indirect effect through an increase in the bargaining power of women. It is also interesting to note that the results for the countries Ghana and Uganda are highly comparable regarding the statistically insignificant effect of a woman's bargaining power.

[7]The positive effect of bargaining power on fertility is possible because women who have higher bargaining power can use their bargaining position to attract transfer payment from their spouses/partners at the instance of child birth. Thus, giving birth to more children becomes a source of wealth appropriation for these woman (T. P. Schultz, 1990).

Table 2: Women's bargaining power and female welfare in Ghana and Uganda

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Ghana				Uganda			
	Panel A: Women's bargaining power and female labor force participation (Marginal Effects)							
Woman's bargaining power	-0.135		0.124	0.001	0.361		-1.113	-1.030
	(0.217)		(0.441)	(0.438)	(0.422)		(0.892)	(0.798)
Woman's sch. yrs.		0.011***	0.012***	0.007***		0.003	-0.002	-0.009*
		(0.001)	(0.002)	(0.002)		(0.003)	(0.005)	(0.005)
Man's sch. yrs.		0.007***	0.007***	0.005**		0.012***	0.018***	0.013**
		(0.001)	(0.003)	(0.003)		(0.003)	(0.006)	(0.006)
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	No	No	No	Yes	No	No	No	Yes
N	9283	9283	9283	9283	1956	1956	1956	1956
McFadd. R^2	0.053	0.069	0.072	0.105	0.027	0.034	0.034	0.090
Man-Woman		0.004	0.005	0.001		-0.008	-0.020	-0.023
		[0.061]	[0.308]	[0.755]		[0.122]	[0.061]	[0.023]
Mean VIF				2.230				2.050
	Panel B: Women's bargaining power and fertility - Poisson (Incident Rate Ratio)							
Woman's bargaining power	-1.653***		1.866***	1.601***	-3.350***		0.389	1.289**
	(0.284)		(0.544)	(0.418)	(0.433)		(0.737)	(0.569)
Woman's sch. yrs.		-0.035***	-0.045***	-0.030***		-0.047***	-0.049***	-0.033***
		(0.002)	(0.003)	(0.003)		(0.003)	(0.006)	(0.004)
Man's sch. yrs.		-0.011***	-0.003	-0.006**		-0.001	0.001	-0.001
		(0.002)	(0.003)	(0.002)		(0.003)	(0.005)	(0.004)
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	No	No	No	Yes	No	No	No	Yes
N	9133	9133	9133	9133	3208	3208	3208	3208
McFadd. R^2	0.011	0.035	0.035	0.156	0.015	0.015	0.033	0.173
Effect: Man-Woman		0.023	0.042	0.024		0.045	0.050	0.032
		[0.000]	[0.000]	[0.000]		[0.000]	[0.000]	[0.000]
Mean VIF				2.670				2.570

Note: (#) Standard errors; [#] p-value; * $p < .1$, ** $p < 0.05$, *** $p < .01$. Man-Woman is the difference between man's years of schooling and that of the woman. The control variables in the labor force model are age of the woman, dummy for a pregnant woman; number of household members who are 17 years, a dummy for a polygamous household, dummy for farm households, dummy for husband in a paid work, a measure of household wealth; set of dummies for region fixed effects, year and urban residence. The control variables in the fertility model are age of the woman; a measure of household wealth whether the woman or her husband used contraceptive, a dummy for a polygamous household, an indicator variable for when both the man and woman have zero years of schooling.; and the square term, age of the woman, number of males and female in the household, whether the woman has used contraceptive before, set of dummies for region fixed effects, year and urban residence.

Table 3: Bargaining power and household nutrition in Ghana and Uganda

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Ghana				Uganda			
	Panel A: Women's bargaining power and food expenditure							
Woman's bargaining power	0.156		-0.581	-0.253	1.048**		-0.582	-0.561
	(0.262)		(0.539)	(0.314)	(0.406)		(0.756)	(0.706)
Woman's sch. yrs.		0.018***	0.021***	-0.007***		0.036***	0.039***	0.023***
		(0.002)	(0.003)	(0.002)		(0.003)	(0.006)	(0.005)
Man sch. yrs.		0.016***	0.014***	-0.013***		0.031***	0.028***	0.009*
		(0.001)	(0.003)	(0.002)		(0.003)	(0.005)	(0.004)
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	No	No	No	Yes	No	No	No	Yes
N	10934	10934	10934	10934	4609	4609	4609	4609
R^2	0.517	0.537	0.537	0.839	0.098	0.185	0.185	0.330
Man-Woman		-0.001	-0.007	-0.006		-0.005	-0.011	-0.015
		[0.644]	[0.236]	[0.101]		[0.358]	[0.264]	[0.106]
Mean VIF				2.450				3.570
	Panel B: Women's bargaining power and household nutrition intake							
Woman's bargaining power	0.055		0.147	0.077	-0.795		-1.624	-0.463
	(0.046)		(0.095)	(0.091)	(0.477)		(0.894)	(0.885)
Woman's sch. yrs.		-0.001***	-0.002**	-0.000		0.005	0.015*	0.005
		(0.000)	(0.001)	(0.001)		(0.004)	(0.007)	(0.007)
Man sch. yrs.		-0.001***	-0.001	-0.000		0.015***	0.007	0.000
		(0.000)	(0.000)	(0.000)		(0.004)	(0.005)	(0.006)
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	No	No	No	Yes	No	No	No	Yes
N	11098	11098	11098	11098	4063	4063	4063	4063
R^2	0.801	0.803	0.803	0.823	0.110	0.117	0.118	0.161
Effect: Man-Woman		-0.000	0.001	0.000		0.010	-0.008	-0.005
		[0.331]	[0.326]	[0.934]		[0.121]	[0.466]	[0.672]
Mean VIF				3.590				4.180

Note: (#) Standard errors; [#] p-value; * $p < .1$, ** $p < 0.05$, *** $p < .01$. Man-Woman is the difference between man's years of schooling and that of the woman. The control variables in the per capita food expenditure model are: age of household head, a measure of household wealth, dummy for farm households, a dummy for a polygamous household, an indicator variable for when both the man and woman have zero years of schooling, set of dummies for region fixed effects, year and urban residence. The control variables in the nutrition model are: age of household head, household size, a measure of household wealth, dummy for farm households, a dummy for a polygamous household, an indicator variable for when both the man and woman have zero years of schooling, set of dummies for region fixed effects, year and urban residence

4.2. Robustness tests

Female lineage and bargaining power

The sensitivity of the above results is first tested by drawing on results of the anthropology literature. Women from matrilineal societies are more likely to be autonomous and empowered than their counterparts from patrilineal societies (Dyson & Moore, 1983). Traditional inheritance systems are still practiced in some African countries including Ghana (Kutsoati & Morck, 2014). Generally among the matrilineal tribes in Ghana children trace their blood lines from the mother, hence, a child is considered as the 'property of the woman'; whilst children in patrilineal societies 'belong' to their fathers.

As a robustness test for our bargaining measure, we explore the effect of variation in lineage and inheritance in Ghanaian societies on household welfare, i.e. instead of using differences in education between women and men, we use and indicator for female lineage. We expect women from matrilineal societies to have higher autonomy than those from patrilineal societies (Dyson & Moore, 1983). Table 4 contains the results of the effect of female lineage on the welfare outcomes for Ghana. Except for household food expenditure, there exists no statistically significant difference between household welfare outcomes of matrilineal and patrilineal women (and for food expenditure matrilineal households have, if anything, lower food expenditure). The results in Table 4 are highly consistent with those in Tables 1-3 with regards to the relative importance of the woman's bargaining power on the one hand and the levels of schooling of the man and woman on the other hand.[8] This suggests that our main results are not driven by the choice of bargaining measure.

Table 4: Female Lineage and household welfare in Ghana

	(1)	(2)	(3)	(4)	(5)	(6)
	Child Labour	School Enrollment	Fem. lab. Participation	No. of Children	Dietary Diversity	log Food Expenditure
Woman from a matrilineal society	0.021	0.209	0.088	0.023	0.002	-0.034***
	(0.074)	(0.163)	(0.064)	(0.014)	(0.002)	(0.010)
Woman's sch. yrs.	-0.017*	0.100***	0.023***	-0.022***	-0.000	-0.008***
	(0.008)	(0.019)	(0.007)	(0.001)	(0.000)	(0.001)
Man's sch.yrs.	-0.070***	0.106***	0.030***	-0.012***	-0.001**	-0.011***
	(0.008)	(0.015)	(0.006)	(0.001)	(0.000)	(0.001)
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes
N	11774	12716	9283	9133	11020	10860
R^2	0.183	0.275	0.105	0.156	0.823	0.838

Note: (#) Standard errors; [#] p-value; * $p < .1$, ** $p < 0.05$, *** $p < .01$. Woman from a matrilineal is an indicator variable = 1 if the woman is from one the matrilineal ethnic groups in Ghana and 0 if otherwise. The same controls in Tables 1-3 are used these estimations.

A further alternative for bargaining measure

We explicitly examine the likelihood that the lack of association between the bargaining proxy and the dependent variables is due to non-linearity of the relationship. To do this, the bargaining proxy is re-specified as a categorical variable of three

[8]Our results for fertility are also consistent with evidence for fertility by Harbison, Khaleque, and Robinson (1989), who argue that the considerable autonomy enjoyed by Garo women of Bangladesh plays a limited role in fertility decision of women of that tribe.

outcomes: (i) the woman has fewer years of schooling than man, (ii) the woman has more years of schooling than the man, and (iii) the woman and man have the same years of schooling. In Table 5, we compare the welfare outcomes of households where the women has higher years of schooling than the husband to those where the woman has fewer years of schooling. Again, the results are overall consistent with our main interpretation. In Panel A of Table 5, we find that, in Ghana, women who have had more years of schooling than their husbands tend to have fewer number of children, their households spend less on food, the children from these households are also less likely to engage in child labor. However, in the case of Uganda in Panel B, we fail to find any significant effect of the bargaining variable. In general, we do not find major differences between the result obtained from measuring bargaining power categorical variable in Table 5 and as a continuous variable Tables 1-3.

Table 5: Woman's bargaining power and household welfare – Categories of bargaining power

	(1)	(2)	(3)	(4)	(5)	(6)
	School Enrollment	Child Labour	Fem. lab. Participation	No. of Children	Dietary Diversity	log Food Expenditure
			Panel A:Ghana			
Woman's sch.> Man's sch.	-0.005	-0.050***	-0.013	-0.057**	0.003	-0.031*
	(0.015)	(0.018)	(0.023)	(0.024)	(0.005)	(0.017)
Woman's sch. = Man's sch.	-0.019	0.008	-0.010	-0.062***	-0.001	-0.024*
	(0.017)	(0.016)	(0.015)	(0.019)	(0.003)	(0.014)
Woman's sch. yrs.	0.007***	-0.001	0.006***	-0.017***	-0.000	-0.006***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.000)	(0.001)
Man's sch. yrs.	0.006***	-0.014***	0.006***	-0.016***	-0.001	-0.014***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.000)	(0.002)
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes
N	11940	12965	9282	9301	11095	11108
R^2	0.179	0.274	0.105	0.156	0.823	0.835
Man-Woman	-0.001	-0.013	-0.001	0.001	-0.000	-0.007
	[0.783]	[0.000]	[0.891]	[0.749]	[0.543]	[0.005]
			Panel B: Uganda			
Woman's sch.> Man's sch.	-0.019	0.003	-0.016	-0.023	0.051	0.035
	(0.013)	(0.019)	(0.039)	(0.033)	(0.043)	(0.034)
Woman's sch. = Man's sch.	-0.010	0.024	0.036	0.037	0.074**	0.015
	(0.012)	(0.017)	(0.030)	(0.027)	(0.037)	(0.031)
Woman's sch. yrs.	0.002	-0.006**	0.008*	-0.038***	-0.003	0.017***
	(0.002)	(0.002)	(0.005)	(0.004)	(0.006)	(0.004)
Man's sch. yrs.	0.001	-0.002	-0.005	-0.010**	0.007	0.014***
	(0.002)	(0.002)	(0.004)	(0.004)	(0.005)	(0.004)
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes
N	7265	7397	1956	3209	4063	4609
R^2	0.272	0.219	0.090	0.122	0.161	0.330
Man-Woman	-0.002	0.004	-0.013	0.028	0.010	-0.002
	[0.624]	[0.346]	[0.122]	[0.000]	[0.324]	[0.747]

Note: (#) Standard errors; [#] p-value; * $p < .1$, ** $p < 0.05$, *** $p < .01$. Man-Woman is the difference between man's years of schooling and that of the woman. The same controls in Tables 1-3 are used these estimations.

Instrumental variables estimations

As a further robustness test we take account of potential endogeneity between the years of schooling variables of women and men and the different outcome variables. The endogeneity is expected to emanate from measurement errors in the schooling variable as

well as omitted variables due to unobserved correlates.[9] We employ instrumental variables (IV) to tackle potential endogeneity. The identification process and the implementation IV requires the use of a valid instrumental variable that satisfy two conditions: (i) the instrument must correlate with our bargaining index, (ii) the instrument must fulfill the exclusion restriction. As generally known, finding instruments for individual education is challenging

Nevertheless, to obtain an likely instrument we proceed as follows: From the National Population Census of the respective countries, we calculate the average years of schooling of a cohort of individuals based on their region and year of birth. We then match each individual in our sample to the average years of schooling of their respective cohort in the census data. The average schooling variable is then used as an instrument for an individual's years of schooling. An instrument for the bargaining index is then derived by dividing the average years of school of the woman by the sum of the averages for the man and the women. The idea for the instrument is that people born within a certain year in a particular region are likely similar education, hence we expect the average years of schooling of a cohort to be correlated with the individual's level of schooling of women and men. At the same time, average education values should not directly affect individual household welfare but only through the channel of individual education which is instrumented. This type of instrument is not entirely new in the literature and our choice is inspired numerous existing studies (Breierova & Duflo, 2004; Chou et al., 2010; Correa, Jetter, & Agudelo, 2016; Fisman & Svensson, 2007; Winters & Winters, 2014). Identification of the coefficients of interest comes from the differences in the distribution of schools and their quality across the various regions and periods as well as changes in education policies over the years.

In Table 6, results of the IV estimates are presented where all educational variables and the bargaining measure is instrumented. These estimatesbagain show that the relative bargaining position has no significant effect on the selected indicators. In most cases the levels of education of women and men, however, to not exert a relevant influence either. Looking at the various diagnostic tests shows, that the instrumental variables to be weak. We we therefore exercise caution in interpreting the the IV estimates in Table 6.

Bias from unobservables

Finally we provide a test on potential bias from unobservables (Oster, 2013). This test relies on the movement of the coefficient with to draw conclusions on the possible bias that may arise due to the omission of unobservables. By successively including control variables with explanatory power in a model, the R^2 of the model is expected to increase, however, if the increase in R^2 leaves the coefficient unchanged, then it can be concluded that the inclusion of the unobservables will not significantly change the coefficient (Oster, 2013).[10] We use this to test that the observed coefficient is suffering from the unobserved characteristics. By examining the so called delta (δ) bound, we can determined how important the unobservables need to be, relative to the observables to reduce the estimated coefficient to zero if it was significant. A higher δ indicates that the unobservables must be high in relation to the observables, in order to make the estimated

[9] In the face of endogeneity, the bargaining index and the error term are no longer be assumed to be uncorrelated.

[10] Arnold, Freier, Pallauf, and Stadelmann (2015) and Birthal, Roy, and Negi (2015) provide a recent application.

Table 6: Woman's bargaining power and household welfare – Instrumental Variables Estimates (Linear Probabilities)

	(1) School Enrollment	(2) Child Labour	(3) Fem. lab. Participation	(4) No. of Children	(5) Dietary Diversity	(6) log Food Expenditure
			Panel A: Ghana			
Woman's bargaining power	1.423	-1.001	1.301	-16.697	-1.401	-0.390
	(1.059)	(2.036)	(2.315)	(12.129)	(1.730)	(3.211)
Woman's sch. yrs.	-0.100	0.034	-0.049	0.965	0.092	0.026
	(0.066)	(0.130)	(0.136)	(0.719)	(0.103)	(0.189)
Man's sch. yrs.	0.107*	-0.050	0.072	-1.161*	-0.078	-0.060
	(0.063)	(0.127)	(0.127)	(0.698)	(0.094)	(0.161)
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes
N	12366	11528	9017	8872	10792	10634
Under ID. LM Statistic	10.104	3.413	3.337	3.857	1.040	1.434
	[0.001]	[0.065]	[0.068]	[0.050]	[0.308]	[0.231]
Weak ID. F statistic	3.364	1.137	1.108	1.283	0.345	0.476
			Panel B: Uganda			
Woman's bargaining power	12.420	4.357	-61.749	-21.675	6.209	-0.561
	(12.356)	(3.528)	(482.330)	(19.989)	(4.173)	(2.120)
Woman's sch. yrs.	-0.988	-0.339	4.946	0.724	-0.486	0.065
	(0.978)	(0.286)	(38.540)	(1.544)	(0.299)	(0.151)
Man's sch. yrs.	0.837	0.291	-4.432	-1.420	0.460*	-0.011
	(0.798)	(0.229)	(34.427)	(1.423)	(0.276)	(0.143)
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed dummies	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes
N	5507	5539	1350	2220	3011	3255
Under ID. LM Statistic	1.108	1.913	0.016	1.733	3.858	3.654
	[0.293]	[0.167]	[0.898]	[0.188]	[0.050]	[0.056]
Weak ID. F statistic	0.364	0.629	0.005	0.557	1.253	1.190

Note: (#) Standard errors; [#] p-value; * $p < .1$, ** $p < 0.05$, *** $p < .01$. The same controls in Tables 1-3 are used these estimations.

coefficient insignificant, hence a larger δ is an indication of a robust coefficient since it is assumed the most important controls have already been added. Based on Oster (2014), the δ associated a coefficient of zero is calculated by the formula

$$\delta = \frac{\widetilde{\beta}(\widetilde{R^2} - \dot{R}^2)}{(\widetilde{\beta} - \dot{\beta})(R^2_{max} - \widetilde{R^2})}$$

,

where $\widetilde{\beta}$ is the coefficient from the full model, $\dot{\beta}$ the coefficient from the parsimonious model, $\widetilde{R^2}$ and R^2_{max} are the R^2 from the full model and the maximum obtainable R^2 if all possible control variables were to be included. $\dot{R}^2$ is the R^2 from the parsimonious model whilst δ is the coefficient of proportionality. It must be noted that since the test is appropriate for only linear models, linear probability models were run for cases where the dependent variable are dichotomous. Panels A and B of Table 7 presents the estimates for Ghana and Uganda. The results indicate that in most cases we need unobservables to have only minimal importance to reduce the coefficient of the bargaining measure to zero if it was significant. This results is not surprising as the bargaining power was shown to be mostly insignificant already in previous specifications. The results in Table 7 support the interpretation that female bargaining power has no statistically significant effect on the different indicators of household welfare for Ghana and Uganda.

Table 7: Proportional selection test (Delta bounding)

	(1) Child Labour	(2) School Enrollment	(3) Fem. lab. Participation	(4) No. of Children	(5) Dietary Diversity/ Caloric intake	(6) log Food Expend.
			Ghana			
$\dot{R^2}$	0.070	0.096	0.111	0.123	0.028	0.313
$\widetilde{R^2}$	0.170	0.174	0.142	0.490	0.823	0.839
$\dot{\beta}$	-0.055	-0.024	0.010	0.129	0.018	-0.389
$\widetilde{\beta}$	-0.028	0.043	0.003	0.468	0.008	-0.025
δ	0.132	-0.044	0.017	-0.879	3.305	0.228
			Uganda			
$\dot{R^2}$	0.056	0.097	0.068	0.123	0.020	0.311
$\widetilde{R^2}$	0.235	0.144	0.118	0.402	0.161	0.330
$\dot{\beta}$	-0.023	-0.029	0.047	0.129	-1.543	-0.413
$\widetilde{\beta}$	0.031	0.017	-0.109	0.091	-0.463	-0.056
δ	-0.148	-0.020	-0.023	1.360	0.111	0.006

5. Discussion and conclusion

Education often seen as a way to empower women and improve household welfare in developing countries. This is because education provides the skills necessary to directly engage in economic activities and participate in decision making. At the same time it is often argued that education increases women's relative bargaining position within the household. This argument has gained considerable policy relevance in many developing countries where female education and empowerment are now seen as important development ends. We provided empirical results by exploring six household welfare indicators in Ghana and Uganda and show that levels of education of women and men often matter for household welfare. Thus, education of women tends to affect household welfare directly. However, we do not find statistically relevant evidence of an education-induced bargaining effect on the indicators studied. That is, there is a direct effect of education of women and men but bargaining power, measured with differences in education yields no additional welfare effects for indicators of child labor, school enrollment, female labor force participation, fertility rates, food expenditure, and nutrition intake. An array of robustness checks are consistent with our interpretation of the empirical results. In many cases, we also find the effect of the woman's education not to be any different from that of the man. Thus, form a positive perspective, our findings confirm the traditional view on the importance of education in general. However, we do not find support that the welfare enhancing effect of education does not go beyond the direct effect of education, i.e. there does not seem to be an additional bargaining effect of female education on household welfare.

From a policy perspective, we note that our results lend support to the relevance of education of women and men in developing countries. Increasing education is associated with better household welfare as measured by our indicators. Specifically targeting women and increasing female education is a worthwhile endeavor because education in general

affects household welfare. At the same time, increasing the education of men tends yields similar positive effects.

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Appendix

A. Panel Models for Uganda

Table A1: Random and Fixed Effects Models for Uganda

	(1) Child Labour	(2) School Enrollment	(3) Fem. lab. Participation	(4) No. of Children	(5) Dietary Diversity	(6) log Food Expenditure
			Panel A: Random Effects			
Woman's bargaining power	0.346	-0.413	0.114	-0.630	-0.107	-0.061
	(0.282)	(0.617)	(0.074)	(0.544)	(0.990)	(0.071)
Woman's sch. yrs.	-0.061**	0.056	-0.029***	0.130**	0.004	0.023***
	(0.024)	(0.055)	(0.006)	(0.041)	(0.008)	(0.006)
Man's sch. yrs.	-0.000	0.047	0.000	-0.072*	0.008	0.008
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes
N	7441	7265	3208	3194	4063	4609
			Panel B: Fixed Effects			
Woman's bargaining power	-0.017	-3.181*	0.125	0.047	-1.031	-0.077
	(0.557)	(1.282)	(1.086)	(0.137)	(1.821)	(0.115)
Woman's sch. yrs.	0.031	0.265	0.182	0.001	0.012	0.014
	(0.055)	(0.163)	(0.115)	(0.014)	(0.016)	(0.010)
Man's sch. yrs.	0.057	-0.149	-0.010	0.001	-0.002	0.007
	(0.052)	(0.139)	(0.080)	(0.011)	(0.014)	(0.009)
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes
N	2417	718	919	2718	4063	4609

Note: (#) Standard errors; [#] p-value; * $p < .1$, ** $p < 0.05$, *** $p < .01$. The same controls in Tables 1-3 are used these estimations.

Table A2: Women's Bargaining Power and Household Welfare-Using Average schooling of man and woman

	School Enrollment	Child Labour	Fem. lab. Participation	No. of Children	Dietary Diversity	log Food Expenditure
			Panel A: Ghana			
Woman's bargaining power	0.007	0.050***	-0.012	-0.036*	0.008*	0.021
	(0.011)	(0.014)	(0.021)	(0.021)	(0.005)	(0.015)
Average schooling	0.013***	-0.014***	0.012***	-0.033***	-0.001***	-0.020***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.000)	(0.001)
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes
N	12716	11774	9283	9133	11095	10934
			Panel B: Uganda			
Woman's bargaining power	-0.013	-0.007	0.053	-0.183***	-0.014	0.038
	(0.014)	(0.020)	(0.041)	(0.037)	(0.048)	(0.038)
Average schooling	0.003**	-0.007***	0.002	-0.044***	0.005	0.030***
	(0.001)	(0.002)	(0.004)	(0.003)	(0.005)	(0.003)
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes
N	7265	7397	1956	3209	4063	4609

Note: (#) Standard errors; [#] p-value; * $p < .1$, ** $p < 0.05$, *** $p < .01$. Average schooling =Average years of schooling of man and woman. The same controls in Tables 1-3 are used these estimations.

Table A3: Summary Statistics of main variables

	Ghana			Uganda		
Variable definition	N	Mean	SD	N	Mean	SD
Bargaining power	10934	0.406	0.236	4609	0.399	0.248
Years of schooling of the man	10934	6.888	5.386	4609	6.204	3.774
Years of schooling of the woman	10934	4.737	4.806	4609	4.515	3.645
Both woman and man have no schooling	10934	0.244	0.430	4609	0.066	0.248
Household size	10934	5.220	2.278	4609	7.567	3.224
Number of children between 6 and 17 years	10934	1.624	1.522	4609	2.599	1.893
Number of males in household	10934	2.654	1.483	4609	3.773	2.024
Number of females in household	10934	2.566	1.439	4609	3.794	1.996
Age of household head	10934	45.14	14.13	4609	44.88	13.93
Polygamous households	10934	0.021	0.144	4609	0.032	0.176
Urban residence	10934	0.462	0.499	4609	0.189	0.392
Woman does paid work	10934	0.487	0.500	4609	0.284	0.451
Man does paid work	10934	0.732	0.443	4609	0.517	0.500
Hours from household to nearest school	8101	0.625	1.766	3547	37.03	27.19

Table A4: Correlation of the three independent variables in the different models for Ghana and Uganda

Model	Ghana			Uganda		
	Man-Woman	Man-Bargain	Woman-Bargain	Man-Woman	Man-Bargain	Woman-Bargain
School enrollment	0.617	-0.385	0.382	0.472	-0.298	0.679
Child labour	0.614	-0.384	0.385	0.632	-0.309	0.566
Fem lab. part.	0.637	-0.333	0.413	0.463	-0.309	0.566
Female fertility	0.635	-0.337	0.412	0.441	-0.353	0.554
Dietary diversity	0.633	-0.350	0.409	0.489	-0.286	0.563
Food expenditure	0.626	-0.343	0.408	0.559	-0.289	0.490

Man-Woman=Correlation between the years of schooling of the man and the woman. Man-Bargain=Correlation between years of schooling of the man and bargaining index. Woman-Bargain=Correlation between years of schooling of he woman and bargaining index.

B. Theoretical framework

Consider a household of two adults: father (f) and mother (m) and, for the sake of simplicity, one child. Both parents are assumed to have fixed work and income. The household derives utility from consumption and child labor. We demonstrate the effect of the woman's bargaining power on child labor using (Basu, 2006; Reggio, 2011). The household maximizes the utility function in (2).

$$U^H = \theta U^m(x, h, A) + (1 - \theta)U^f(x, h, A) \tag{2}$$

such that

$$x = \bar{Y} + wh \tag{3}$$

where θ is the relative bargaining parameter of the mother, x is a vector of market purchased goods, h is the number of hours of child labor, A is a vector of household environmental parameters that affect household utility, and Y^H is total household income from all sources, w is the wage of child labor. Maximizing (2) subject to the constraint yields the demand for h as:

$$h = c(x, \theta, Y^H, A, w)$$

We assume that both the mother and the father are dis-satisfied with child labor hence $U_h^i < 0$ and $U_{hh}^i < 0$, $i = \{m, f\}$ and further assume that $U_{(x,h)}^i$ is non-negative (Reggio, 2011). The household will maximizes utility from child labor by equating the marginal utility of child labor to the marginal benefit. An implicit function involving the marginal utility and benefit of child labor can be derived from the first order conditions of the utility maximization problem.

$$F = \theta U_h^m(x,h) + (1-\theta)U_h^f(x,h) + [\theta U_x^m(x,h) + (1-\theta)U_x^f(x,h)]w \tag{4}$$

Using the implicit function theorem, the effect of mother bargaining power on child labor can be derived as follows:

$$F_\theta = U_h^m(x,h) - U_h^f + [U_x^m(x,h) - U_x^f(x,h)]w \tag{5}$$

$$F_h = \theta U_{hh}^m(x,h) + (1-\theta)U_{hh}^f(x,h) + [\theta U_{xh}^m(x,h) + (1-\theta)U_{xh}^f(x,h)]w \tag{6}$$

then

$$\frac{\partial h}{\partial \theta} = \frac{F_\theta}{F_h} = \frac{U_h^m(x,h) - U_h^f + [U_x^m(x,h) - U_x^f(x,h)]w}{\theta U_{hh}^m(x,h) + (1-\theta)U_{hh}^f(x,h) + [\theta U_{xh}^m(x,h) + (1-\theta)U_{xh}^f(x,h)]w} \tag{7}$$

The ceteris paribus effect of the women's bargaining power on child labor can be determined by the difference between the women's marginal dis-utility of child labor and $[U_h^m(x,h)]$ and indirectly through the marginal utility of the women $[U_x^m(x,h)]$. If the marginal dis-utility is higher than marginal utility, the increasing the woman's bargaining power leads to a fall in child labor and vice versa. However, if the two are the same then child labor will not change with a change in the relative bargaining position of the woman.