THE EFFECT OF FERTILITY LEVELS ON THE EDUCATIONAL ATTAINMENT OF CHILDREN IN UGANDA

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Abstract

This paper examines the relationship between fertility levels and the educational attainment of children in Uganda. It seeks to address whether or not lower fertility rates increase the amount of education a child receives, while controlling for other factors that also impact a child's educational attainment. Such factors include: primary income earner's occupation (an indicator of family income), parents' educational attainment, region (urban/rural), child's age, and mother's age. Upon controlling for all of these factors, the literature suggests that there is a small negative relationship between a mother's fertility and her children's educational attainment. Although the results obtained were statistically significant for both data sets, they had opposite signs and were not economically significant. Therefore, the data suggests that there is a minimal amount of correlation between mother's fertility and her children's educational attainment, but there is little evidence for a causal relationship.

I. Introduction

At this point in time, it appears very unlikely that Sub-Saharan Africa will reach the United Nations' Millennium Development Goals that were set as benchmarks for reducing extreme poverty by 2015. If in fact fertility and children's educational attainment are inversely related, as the hypothesis of this paper suggests, then reducing fertility rates in Sub-Saharan African countries could assist this region in reaching the second Millennium Development Goal, which seeks to achieve universal primary education by ensuring that children everywhere, boys and girls alike, will have the ability to complete primary school (United Nations). However, based on the literature examining the relationship between mother's fertility and children's educational attainment, and the data analysis carried out in this paper, it is clear that there is little to no correlation between these two variables.

When the educational attainment of children is regressed against mother's fertility, mother's age, and child's age, the results show that there is a small negative correlation, although it is not as large as one might expect. However, once additional variables are included in the regression, which also have the potential to affect the educational attainment of children, the effect of fertility begins to decrease. In one of the data sets analyzed in this paper, the effect actually becomes slightly positive by the time all of the controls are included in the final regression. Even though there is a small amount of correlation in the final models, which is statistically significant, the results are not economically significant because a mother would have to give birth to a humanly infeasible number of children in order to reduce the amount of schooling that each of her children receives by one year.

The method developed by Altonji et al (2005) can be used in order to further scrutinize the insignificance of this effect. Scatter plots have also been included, which depict the relationship between the residuals of two regressions: one with mother's fertility as the dependent variable, and the other with children's educational attainment as the dependent variable. In both cases, all of the remaining explanatory variables are included as the independent variables. Both the results from the Altonji method and these scatter plots further reduce the magnitude of the effect of a mother's fertility on the years of schooling that each of her children receives.

II. Literature Review

There is a vast amount of literature examining the rapid population growth that continues to occur in Sub-Saharan Africa, and in particular, the effect of education on fertility levels. Many researchers are concerned with the population explosion in this region over the last 30 years, mainly because of its negative consequences with respect to economic growth. For example, Sub-Saharan Africa "was the only developing region to suffer a decline in per capita income during the period 1980-2000" (Bauer 287). Researchers then examined the relationship between declining fertility and economic growth. An important related question "is to what extent fertility desires are determined by economic influences and to what extent by social and cultural forces. This is also the key question for the design of efficient policies that would enable Sub-Saharan Africa to get out of poverty" (Bauer 287). Some of the key factors that have been studied, with respect to their effect on desired fertility, are: high levels of child mortality, the economic utility of children, cultural factors such as identification with clans, and the educational attainment of parents.

According to the World Development Indicators, child mortality of children under the age of 5 is 14% in Uganda, 17% in all of Sub-Saharan Africa, and 0.6% in the OECD countries. Bauer et al found that fear of child mortality often contributes to higher desired levels of fertility in this region. However, the data also suggests that parental education decreases the level of desired fertility, because it encourages healthier lifestyles and investment in preventative health measures for children. Thus, parents with more education are less likely to find it necessary to insure themselves against high child mortality by giving birth to additional children, because those they have will be less at risk for contracting the infectious diseases responsible for a large proportion of early childhood mortality.[1]

The economic utility of children is another factor that affects desired and actual fertility levels. As explained by Becker in *A Treatise on the Family*, the demand for children depends on the net cost of children, which "is reduced if they contribute to family income by performing

[1] The information contained in the preceding paragraph is based on Bauer et al: 290.

household chores, working in the family business, or working in the marketplace. [Thus,] an increase in the 'earning' potential of children would increase the demand for children" (138). This explains the urban-rural fertility differentials, as children have more productive capacity on farms than in cities. However, the contribution that children have on family farms has declined as a result of farming techniques becoming more mechanized and complex. Consequently, farm families have been substituting education for the work their children traditionally would have done on the farm. Furthermore,

> Since rural schools are too small to be efficient, and since the cost in time and transportation of attending school is greater to farm children, the cost advantage of raising children on farms has narrowed, and possibly has been reversed, as farm children have increased the time they spend in school. Not surprisingly, therefore, urban-rural fertility differentials have narrowed greatly in developed countries during this century. (Becker 139)

However, as the data analysis in this paper will show, this is not the case in Uganda. In this country, fertility levels in rural regions continue to be significantly greater than those in urban regions. In addition to being potential sources of labor, children are also seen as a security net for parents as they age or in case they encounter periods of poor health. This is especially important in developing countries such as Uganda, which do not have social security systems in place.[2]

Another factor that contributes to the urban-rural fertility gap is the Ugandan clan culture. Pressure for high fertility exists in order to keep fertility above mortality, to ensure the clan's survival. As a result, it is often the case that "clan leaders exert pressure on clan members to

[2] The information contained in the preceding paragraph is based on Becker: 138-139.

contribute personally to the growth of the clan population by having a greater number of children. Especially for men, social status in traditional Ugandan society is thus closely tied up with the number of children they have" (Bauer 292). Based on the data analysis carried out by Bauer et al, higher educational attainment appears to have a smaller effect on the fertility levels of those with strong clan linkages. In addition, "the largest proportion of people with strong clan loyalty have completed less than the first half of primary school" (Bauer 293). However, their data also suggests that even though there is a strong positive correlation between clan loyalty and high fertility levels, "education has the capacity to eliminate the influence of the clan on fertility decisions" (Bauer 294).

Therefore, parents' education has been found to have a significant negative relationship to desired fertility levels. There are a number of factors that may account for this relationship. For example, as mentioned previously, education has been found to decrease the fear of disease, as parents invest in preventative measures to reduce the chances of their children contracting life-threatening illnesses. In addition, parents with higher levels of educational attainment tend to be better equipped to support themselves financially in old age or in times of illness, and therefore are less reliant on having their children fill this "safety net" role. Lastly, "the influence of traditional community institutions that favor childbearing is moderated by higher education" (Bauer 296). Thus, education mitigates the effects of the previously mentioned factors that contribute to high desired fertility.

The previously cited literature suggests that a more educated adult population would dampen fertility rates and thereby help slow the population explosion in Sub-Saharan Africa. Thus, it is important to examine the possible determinants of the educational attainment of children, because educated children will become educated parents. Therefore, it is also important to take into account the literature that discusses the relationship between a mother's fertility and the educational attainment of her children. The general consensus of this literature is that higher fertility has a small negative affect on the educational attainment of children.

According to one source, "children with many siblings or closely spaced siblings are generally assumed to fare less well than children with fewer siblings in terms of such human development indicators as mortality, nutrition, and educational attainment" (Cassen 182). Thus, those parents who have more children for fear of high child mortality are actually increasing the chances that their children will die young, as additional children constrain family resources, which are important to a child's development. Therefore, in addition to the aforementioned direct effects on children's educational attainment, sibling numbers also influence factors that have an indirect effect, including nutrition and health.[3]

The family's resource constraint is not only affected by more siblings, but also by structural changes in the economy. Many developing countries with rapidly growing populations have experienced economic downturns that have led to social sector budget cuts. Consequently, "the cost to parents of education and health for their children has risen at the same time that the level and quality of publicly provided services has been cut back. This combination of rapid population growth and economic adjustment can have extremely negative implications for family resources and overall levels of child investment" (Cassen 197). Therefore, higher fertility has not only made it more expensive for individual families to invest in the education and health of their children, but it has also made it more difficult for developing countries to provide quality public health and educational services due to increased costs of providing such services to an ever-increasing population. With regards to the direct effects on education, "children's

[3] The information in the preceding paragraph is based on Cassen: 181-198.

participation or progress in school, as well as the level of parental investments in schooling (in terms of expenditures), were found to be usually, but not always, negatively associated with numbers of siblings. The size and the statistical significance of these effects varies substantially across countries and across groups within countries" (Cassen 185).[4]

Similarly, another study concluded that, "by and large, additional children reduce the years of schooling completed by other children in the household, but the size of this effect is usually small. The size of the effect also depends on the level of economic development, cultural traditions about the family, and the role of the state in providing education to children" (Ahlburg 3). One way in which to control for the variation in levels of economic development within Uganda is by including an indicator variable for geographical region, since urban and rural regions are at noticeably different levels of development. This affects children's educational attainment through their access to schools and through their parents' financial ability to send them to school. A child's access to school is also affected by the role of the state in providing public services, including schools, for children. In addition, as described in the previously mentioned literature, strong clan linkages can greatly influence the amount of education that clan members receive and the amount of children that members are encouraged to have. Furthermore, these studies conclude that,

> Large families do not have a statistically significant impact on educational attainment, as revealed in regression models that account for a wide variety of factors potentially influencing educational outcomes. Where a statistically significant result is revealed, it is usually negative, but the size of the impact is typically quite small. Moreover, in around one-third of the models the impact is positive. (Ahlburg 70)

[4] The information contained in the preceding paragraph is based on Cassen: 181-198.

This conclusion agrees with the results obtained in the data analysis that is carried out in this paper. Both data sets produce statistically significant results, but the effects are so small they are not economically significant. Also, one of the data sets produced a small negative effect, while the other produced a small positive effect. In both cases, the sign on the coefficient of mother's fertility changes as additional controls are included in the model.

III. Data

The data sets analyzed in this paper were gathered from Demographic and Health Surveys (DHS) and Integrated Public Use Microdata Series – International (IPUMS-I). They were obtained for the years 2000/01 and 2002, respectively. From DHS, there were a number of data sets available, which were merged using the unique case identification numbers in order to place all the variables included in the regressions in the same data set. From IPUMS-I, a data extract was created that includes all the variables contained in the regressions, which consist of the following: child's educational attainment (yrschlchild), mother's fertility (momsfert), mother's age (momsage), child's age (childage), geographical region (urban), mother's educational attainment (momseduc), father's educational attainment (dadseduc), and primary income earner's occupation. In both of these data sets, the variables for region and primary income earner's occupation are binary variables, and the variables for highest level of educational attainment are expressed in single years. Furthermore, the occupational categories differ for the two data sets. For DHS, the occupations include professionals, sales workers, manual laborers, and agricultural workers. For IPUMS-I, the occupations include professionals, business owners, and subsistence farmers.

After complete data sets were compiled from each source, they were analyzed using Stata. To begin, summary statistics were obtained for each variable, as well as for a number of variables while controlling for another variable. Such summary statistics for IPUMS-I are contained within Table 1 in the appendix of this paper, and similar statistics for DHS can be found in Table 2. For example, it was meaningful to summarize mother's fertility and years of schooling separately for each geographical region, as well as each occupation. By doing so, it is possible to depict the differences in fertility and a child's educational attainment associated with these specific exogenous factors. The difference in average mother's fertility between the urban and rural regions of Uganda is 0.93 and 1.42, according to the DHS and IPUMS-I data sets, respectively. Therefore, on average, mothers in rural areas tend to have one more child than mothers in urban areas. One possible explanation for this could be that families in rural regions are more likely to rely on agriculture as their primary source of income, which means parents are likely to have more children in order to have extra helping hands. The data supports this hypothesis, as it not only reveals fertility differences due to regional location, but also based on the primary income earner's occupation. According to the IPUMS-I data, business owners and agricultural workers have 0.06 and 1.28 more children on average than professionals, respectively. Similarly, the DHS data reveals that sales workers, manual laborers and agricultural workers have 0.28, 0.86 and 1.29 more children than professionals, respectively. In both scenarios, families who rely on agriculture as their primary source of income have on average more children than families reliant on income from any other occupational group.

In addition to the variations in fertility that exist between regions and primary income earner's occupations, there are also noticeable disparities in the educational attainment of children along these same group divisions. Without controlling for any other factors that may affect a child's schooling, children whose families live in rural regions receive 1.20 and 0.91 fewer years of schooling on average than children living in urban regions, according to IPUMS-I and DHS, respectively. Furthermore, based on the IPUMS-I data, children who are members of agricultural families receive, on average, 0.80 fewer years of schooling than children whose parents are business owners, and 1.60 fewer years of schooling than children of professional parents. These disparities are even more pronounced in the DHS data, which shows children whose parents rely on agriculture as their primary source of income receive 1.13 fewer years of schooling than children whose parents are sales workers, 1.19 fewer years of schooling than those whose parents are manual laborers, and 3.20 fewer years of schooling than children whose parents are professionals.

IV. Empirical Models and Econometrics

As is evident in the descriptive statistics discussed in the previous section, there are many factors that have the potential to affect a child's educational attainment, apart from his/her mother's fertility. In order to determine whether or not mother's fertility has any effect on educational attainment, linear models were created with child's years of schooling as the dependent variable. The final model includes all of the observable factors, for which data was available, that one might expect could affect a child's educational attainment. The independent variables included in this model consist of the following: mother's fertility, mother's age, child's age, region, parents' levels of educational attainment, and primary income earner's occupation. Mother's age is included because the older the mother, the older the child is likely to be, and the more education the child is likely to have received. Child's age was included for the same reason. A binary variable for region is also included in this regression because, as shown by the descriptive statistics, children in rural areas of Uganda have lower levels of educational attainment on average than children in urban areas. Parents' level of education is also included, because this can affect the amount of education that a child receives for a variety of reasons: it can demonstrate the level at which parents value education, as well as influence parental occupation and family income. In addition, a set of binary variables is included to indicate the primary income earner's occupation, because as evidenced again by the descriptive statistics, education varies greatly by parents' occupation.

The first linear regression that was used in order to obtain OLS estimates for both data sets was

$$\text{(1)} \qquad \text{yrschlchild} = \alpha + \beta^{*}\text{momsfert} + \varepsilon.$$

The coefficient estimates for momsfert were 0.1639 and 0.2974, for the IPUMS-I and DHS data sets, respectively. Both of these OLS estimates show that there is a small positive relationship between a mother's fertility and her children's educational attainment. This is exactly the opposite effect from what one might expect to find. However, after looking at the explanatory power of these regressions, expressed by the value of R-squared, it is clear that fertility alone does not explain much of the variation in years of schooling. The values of R-squared are 0.03 for IPUMS-I and 0.08 for DHS. Therefore, 8% of the variation in children's educational attainment can be explained by fertility in the IPUMS-I sample, while only 3% of the variation can be explained by fertility in the DHS sample. This suggests that there is omitted variable bias, which could explain the counterintuitive relationship that coefficient estimates depict between mother's fertility and a child's educational attainment.

In order to try to fix the bias created by omitted variables, additional variables were included in the model that could further explain the variation in the years of schooling a child receives. First, mother's age and child's age were included, so the new model became,

$$(2) \qquad \text{yrschlchild} = \alpha + \beta\text{*momsfert} + \gamma\text{*momsage} + \delta\text{*childage} + \varepsilon.$$

With both data sets, after controlling for these two variables, the effect of fertility on children's educational attainment became negative. The new coefficient estimates for momsfert then became -0.0331 for the IPUMS-I data and -0.1257 for the DHS data. The R-squared values have now also jumped to 0.57 and 0.68, for IPUMS-I and DHS, respectively. Therefore, as much as 68% of the variation in years of schooling for a child can be explained by the variables included in model (2). However, even though the new coefficient estimates for momsfert are statistically significant and are negative, which is the sign that the literature suggests one will find, they are not economically significant. In both of these data sets, if a mother has an extra child, it will decrease the amount of schooling that each of her other children will receive by less than one year. In fact, according to the IPUMS-I data, a mother would need to have 33.3 children in order to decrease the amount of schooling that each of her children receives by one year. This result is less drastic in the DHS data, where a mother would only need to have 7.7 children in order to decrease the educational attainment of each of her children by one year. Given that the average fertility of mothers in Uganda is 5.8, the result from the DHS data is in fact economically significant. However, since the model still only explains 68% of the variation in educational attainment for children, it is still likely that other omitted variables could be biasing this estimate.

Since regional location appears to play a large role in educational attainment and fertility in the descriptive statistics, the next variable included in the regression is a binary variable that indicates region. This variable equals one if the family lives in an urban area in Uganda, and equals zero if the family lives in a rural area. The linear model thus becomes,

$$(3)\ \text{yrschlchild} = \alpha + \beta^*\text{momsfert} + \gamma^*\text{momsage} + \delta^*\text{childage} + \lambda^*\text{urban} + \varepsilon.$$

Under this model, the OLS estimate for the coefficient on momsfert decreased to -0.0175 for the IPUMS-I data and -0.0954 for the DHS data. At the same time, the R-squared increased to 0.58 and 0.69, for IPUMS-I and DHS, respectively. Therefore, while adding an indicator variable for regional location increased the explanatory power of the model, it also decreased the effect of fertility on the educational attainment of children. Now, the birth of an additional child will have an even smaller effect on the educational attainment of other children in the family. A mother will now have to give birth to 50 children in the IPUMS-I sample and 11.1 children in the DHS sample in order to decrease the amount of schooling her children will receive by one year.

In the next set of models, variables are included for mother and father's education, as well as a set of indicator variables for the primary income earner's occupation. However, these models are slightly different for the two data sets because each has different occupational groups for the primary income earner. For the IPUMS-I data, the new model is,

$$\begin{aligned}(4\text{-I})\quad \text{yrschlchild} &= \alpha + \beta^*\text{momsfert} + \gamma^*\text{momsage} + \delta^*\text{childage} + \lambda^*\text{urban} \\ &+ \eta^*\text{momseduc} + \phi^*\text{dadseduc} + \mu^*\ \text{professional} + \theta^*\text{busowner} + \varepsilon.\end{aligned}$$

The new coefficient estimate for momsfert under this model is 0.0078, and the R-squared is now 0.63. This means that this model now explains 63% of the variation in a child's educational attainment. Furthermore, the relationship between mother's fertility and the educational attainment of her children has now become positive again, but it is a miniscule effect. As we have seen before, this value is statistically significant, but it is economically insignificant because it is so small. A mother would have to give birth to over 100 children in order for each child to receive one additional year of schooling, which is completely infeasible in the real world. For the DHS data, the new model becomes,

$$(4\text{-D})\quad yrschlchild = \alpha + \beta*momsfert + \gamma*momsage + \delta*childage + \lambda*urban + \eta*momseduc + \varphi*dadseduc + \mu*professional + \theta*clerical + \phi*sales + \xi*manuallabor + \varepsilon.$$

The coefficient for momsfert in this case is -0.0497, and the value of R-squared is 0.71. Therefore, this model explains 71% of the variation in the years of schooling that a child receives. The effect of mother's fertility on the educational attainment of her children is still negative, but again it is economically insignificant. In order for a mother to decrease the amount of schooling that each of her children receives by one year, she would have to give birth to at least 20 children.

Lastly, variables were added for child's age squared and mother's age squared, in order to control for the possibility of a quadratic relationship between a child's educational attainment and each of these variables. After including these variables, the final IPUMS-I model becomes,

$$(5\text{-I})\ yrschlchild = \alpha + \beta*momsfert + \gamma*momsage + \varphi*momsage\_sq + \delta*childage + \xi*childage\_sq + \lambda*urban + \eta*momseduc + \phi*dadseduc + \mu*professional + \theta*busowner + \varepsilon.$$

The coefficient for mother's fertility has decreased slightly from the previous model to 0.0077, and the value of R-squared is still 0.63. Therefore, this model still explains 63% of the variation in years of schooling. A similar model was created for the DHS data, which is the following,

$$(5\text{-D})\quad yrschlchild = \alpha + \beta*momsfert + \gamma*momsage + \psi*momsage\_sq + \delta*childage + \omega*childage\_sq + \lambda*urban + \eta*momseduc + \varphi*dadseduc + \mu*professional + \theta*clerical + \phi*sales + \xi*manuallabor + \varepsilon.$$

In this model, the coefficient for mother's fertility has also decreased slightly to -0.0339, but the value of R-squared increased substantially to 0.79. Thus, this model now explains 79% of the variation in years of schooling.

In order to further scrutinize the relationship between fertility and the educational attainment of children in Uganda, the method developed by Altonji et al (2005) was utilized. In order to attempt to control for omitted variable bias resulting from the existence of unobservable factors, they suggest, "using the relationship between an endogenous variable and the observables to make inferences about the relationship between the variable and the unobservables" (Altonji 169). They carry out this method by using a ratio of selection on the unobservables to selection on the observables, which is "computed using the coefficients from two OLS regressions with and without controls" (Bellows 43). This ratio determines how large selection on the unobservables would have to be in order to explain away the entire effect of the endogenous variable. In other words, this quantifies the importance of the omitted variables needed to explain away the entire effect of this variable (Bellows 43). With respect to the analysis carried out for this paper, the Altonji method is used in order to determine how large the effect of unobservables would have to be in order to explain away the entire effect of fertility on a child's educational attainment. In replicating this method, model (1) is used as the OLS regression with no controls, and models (5-I) and (5-D) as the OLS regressions with controls. With regards to the DHS data, the Altonji results are not very informative because the sign of the coefficient changed between the model without controls and the model with controls. However, the Altonji results for the IPUMS-I data strengthen the conclusion that fertility does not affect a child's educational attainment. These results suggest that selection on the unobservables would only need to be 0.05 times as large as selection on the observables in order to explain away the entire effect of fertility on a child's educational attainment. It is very likely that selection on the unobservables would exceed this amount, and therefore if they could somehow be controlled for, the effect of fertility would likely be zero.

In addition, residuals were also obtained from the following two regressions:

$$\text{momsfert} = \alpha + \gamma\text{*momsage} + \delta\text{*childage} + \lambda\text{*urban} + \eta\text{*momseduc} + \varphi\text{*dadseduc} + \mu\text{* professional} + \theta\text{*clerical} + \phi\text{*sales} + \xi\text{*manuallabor} + \varepsilon. \tag{6}$$

$$\text{yrschlchild} = \alpha + \gamma\text{*momsage} + \delta\text{*childage} + \lambda\text{*urban} + \eta\text{*momseduc} + \varphi\text{*dadseduc} + \mu\text{* professional} + \theta\text{*clerical} + \phi\text{*sales} + \xi\text{*manuallabor} + \varepsilon. \tag{7}$$

Model (6) is a regression of mother's fertility on the remaining explanatory variables, while model (7) is a similar regression, but with children's educational attainment as the dependent variable. After these regressions were run and the residuals were obtained, scatter plots were created with the residuals for mother's fertility on the horizontal axis and the residuals for children's educational attainment on the vertical axis. These graphs are depicted for both the IPUMS-I and DHS data sets, in figures 1 and 2 in the appendix, respectively. Due to the large number of observations, they were divided into fifty bins, and the mean of the residuals in each bin from model (6) is plotted against the mean of the residuals in each bin from model (7). The IPUMS-I graph depicts a very small positive correlation between the two sets of residuals, while the DHS graph depicts a slightly larger negative correlation between them. However, the slopes of both of the linear fit lines are nearly zero. Therefore, this is yet another illustration of the lack of correlation between a mother's fertility and the educational attainment of her children.

V. Conclusion

Many researchers are concerned with the negative consequences that rapid population growth has had, and continues to have, on economic growth in Sub-Saharan Africa. Rapid population growth does appear to have negative consequences on economic growth in the short run, by "straining the region's capacity to raise per capita incomes and average levels of welfare" (Scribner 1). However, rapid population growth does not appear to have as dire consequences on economic growth in the long run as one might otherwise expect. When examining the long run effects, by looking at time in terms of decades and generations, economic growth becomes focused entirely on sustaining and increasing standards of living. One way to measure standards of living is by assessing educational attainment, where higher levels of educational attainment reflect higher standards of living. Higher educational attainment also has the potential to increase productivity, which in turn contributes to higher standards of living.

When looking at economic growth in the long run, high levels of fertility do not decrease the educational attainment of the population as much as one might expect. In fact, when controlling for other factors that also influence educational attainment, the effect of fertility is nearly zero. Therefore, if we are attempting to assist developing countries in achieving higher living standards through education channels, it is evident that reducing fertility is not the answer in and of itself. Rather, there are many other structural realities that continue to perpetuate low educational attainment in Uganda. Such factors include: regional differences in access to and quality of education, a family's primary source of income, level of income, clan linkages, etcetera. Thus, it is clear that in order to encourage long run economic growth in Uganda, we must address a multitude of factors that influence the educational attainment of the population. Furthermore, at this time, it does not appear that fertility is one of these factors, because given the current structural situation, the number of siblings that a child has does not have an appreciable effect on the amount of education that the child will receive. Once these structural challenges affecting access to schooling have been addressed, a negative relationship will likely emerge between family size and a child's educational attainment, as seen in more developed countries (Cassen 186). At that time, it would be wise to utilize resources to encourage reductions in fertility levels. However, in the presence of all of these structural challenges, resources will be put to better use in developing countries such as Uganda, if they are applied to other policies besides those intended to reduce fertility levels.

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Appendix: Tables and Figures

Table 1: Descriptive Statistics, IPUMS 2002

Variable	*# of Obs.*	*Proportion of Sample*	*Mean*	*Std. Dev.*
Panel A: Full Sample				
momsfert	520968	100%	6.634	3.007
yrschlchild	520968	100%	2.707	2.802
momseduc	520968	100%	3.431	3.588
dadeduc	520968	100%	5.564	4.056
Panel B: Rural Areas				
momsfert	478220	92%	6.751	2.996
yrschlchild	478220	92%	2.608	2.700
Panel C: Urban Areas				
momsfert	42748	8%	5.334	2.820
yrschlchild	42748	8%	3.812	3.577
Panel D: Subsistence Farmers				
momsfert	415218	80%	6.859	2.992
yrschlchild	415218	80%	2.562	2.643
Panel E: Business Owners				
momsfert	24354	5%	5.634	2.812
yrschlchild	24354	5%	3.360	3.268
Panel F: Professionals				
momsfert	56550	11%	5.577	2.838
yrschlchild	56550	11%	3.618	3.425

Source: IPUMS International. Minnesota Population Center. 21 February 2009. <https://international.ipums.org/international/>.

Table 2: Descriptive Statistics, DHS 2000/01

Variable	*# of Obs.*	*Proportion of Sample*	*Mean*	*Std. Dev.*
Panel A: Full Sample				
momsfert	5002	100%	5.768	2.542
yrschlchild	5002	100%	1.645	2.652
momseduc	5002	100%	4.336	3.838
dadseduc	5002	100%	6.537	4.222
Panel B: Rural Areas				
momsfert	3782	76%	5.996	2.544
yrschlchild	3782	76%	1.423	2.329
Panel C: Urban Areas				
momsfert	1220	24%	5.062	2.404
yrschlchild	1220	24%	2.330	3.378
Panel D: Agricultural Workers				
momsfert	2379	48%	7.011	2.278
yrschlchild	2379	48%	1.916	2.595
Panel E: Sales Workers				
momsfert	285	6%	6.000	2.157
yrschlchild	285	6%	3.042	3.415
Panel F: Manual Laborers				
momsfert	218	4%	6.583	2.497
yrschlchild	218	4%	3.101	3.483
Panel G: Professionals				
momsfert	61	1%	5.721	2.207
yrschlchild	61	1%	5.115	4.195

Source: Measure DHS. ICF Macro. 19 February 2009. < http://www.measuredhs.com>.

Table 3: Effect of Fertility on Child's Educational Attainment (IPUMS-I): OLS Estimates

Dependent Variable: Children's Educational Attainment (in single years)					
Explanatory Variables	**(1)**	**(2)**	**(3)**	**(4-I)**	**(5-I)**
momsfert	0.1639	-0.0331	-0.0175	0.0078	0.0077
	(0.0013)	(0.0010)	(0.0010)	(0.0010)	(0.0010)
momsage		0.0159	0.0148	0.0169	-0.0076
		(0.0004)	(0.0004)	(0.0004)	(0.0024)
childage		0.4739	0.4711	0.4693	0.6056
		(0.0006)	(0.0006)	(0.0006)	(0.0029)
urban			1.101	0.2897	0.2950
			(0.0093)	(0.0097)	(0.0097)
momseduc				0.1011	0.1009
				(0.0008)	(0.0008)
dadseduc				0.0932	0.0936
				(0.0007)	(0.0007)
professional				0.1414	0.1424
				(0.0089)	(0.0088)
busowner				0.3062	0.3053
				(0.0118)	(0.0118)
momsage_sq					0.0003
					(0.00003)
childage_sq					-0.0056
					(0.0001)
constant	1.6196	-2.757	-2.8842	-3.9348	-4.2159
	(0.0093)	(0.0118)	(0.0117)	(0.0116)	(0.0425)
R-squared	0.0309	0.5666	0.5780	0.6298	0.6314
Observations	520968	520968	520968	520968	520968

Source: IPUMS International. Minnesota Population Center. 21 February 2009. <https://international.ipums.org/international/>.

Table 4: Effect of Fertility on Child's Educational Attainment (DHS): OLS Estimates

Dependent Variable: Children's Educational Attainment (in single years)					
Explanatory Variables	**(1)**	**(2)**	**(3)**	**(4-D)**	**(5-D)**
momsfert	0.2974	-0.1257	-0.0954	-0.0497	-0.0339
	(0.0141)	(0.0116)	(0.0117)	(0.0117)	(0.0100)
momsage		0.0434	0.0378	0.0249	-0.0320
		(0.0045)	(0.0044)	(0.0043)	(0.0205)
childage		0.4003	0.3965	0.3891	-0.0468
		(0.0048)	(0.0048)	(0.0046)	(0.0108)
urban			0.5973	0.1974	0.2091
			(0.0502)	(0.0543)	(0.0458)
momseduc				0.0645	0.0621
				(0.0069)	(0.0058)
dadseduc				0.0485	0.0427
				(0.0060)	(0.0051)
professional				0.8384	0.8566
				(0.1933)	(0.1631)
sales				0.1684	0.2747
				(0.0929)	(0.0785)
manuallabor				0.4280	0.4950
				(0.1014)	(0.0855)
momsage_sq					0.0008
					(0.0003)
childage_sq					0.0251
					(0.0006)
constant	-0.0706	-1.9178	-2.0303	-2.3675	-0.2874
	(0.0891)	(0.1026)	(0.1016)	(0.1013)	(0.3214)
R-squared	0.0812	0.6769	0.6857	0.7087	0.7928
Observations	5002	5002	5002	5002	5002

Source: Measure DHS. ICF Macro. 19 February 2009. < http://www.measuredhs.com>.

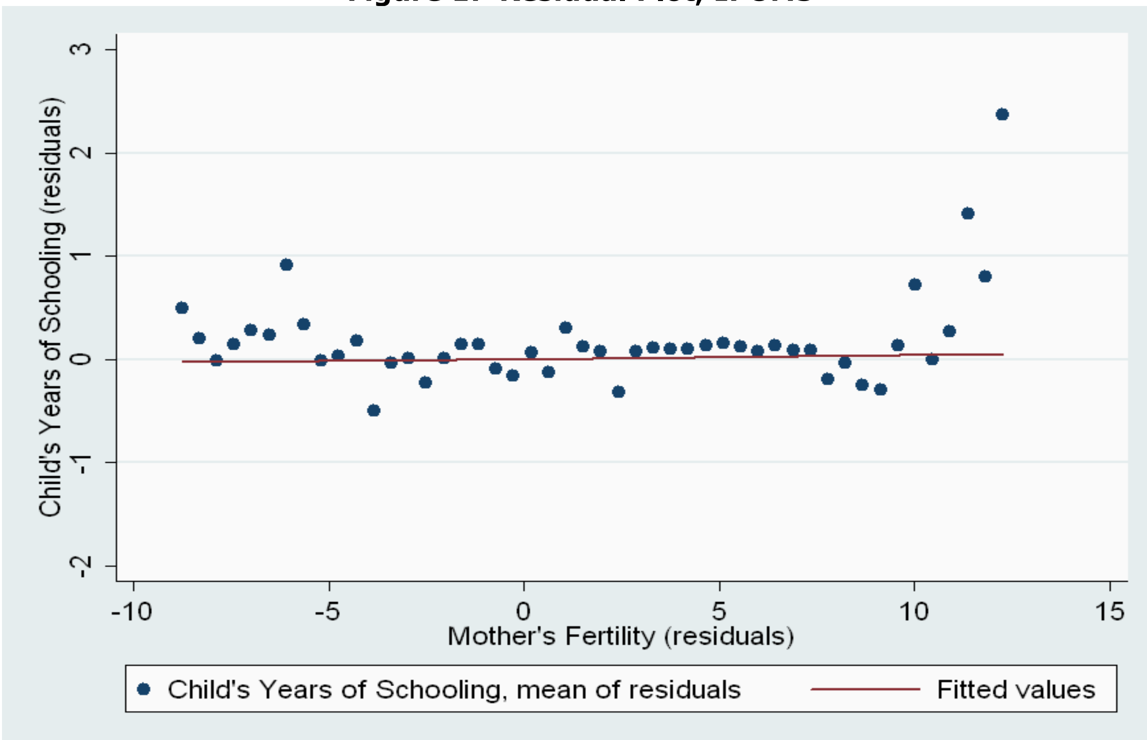
Table 5: Altonji Results

	IPUMS	**DHS**
$\text{®}_{OLS, NC}$	0.1639	0.2974
$\text{®}_{OLS, C}$	0.0077	-0.0339
$\dfrac{\hat{\text{®}}_{OLS, C}}{\hat{\beta}_{OLS, NC} - \hat{\beta}_{OLS, C}}$	0.0493	-0.1023

Sources: IPUMS International. Minnesota Population Center. 21 February 2009. <https://international.ipums.org/international/>.

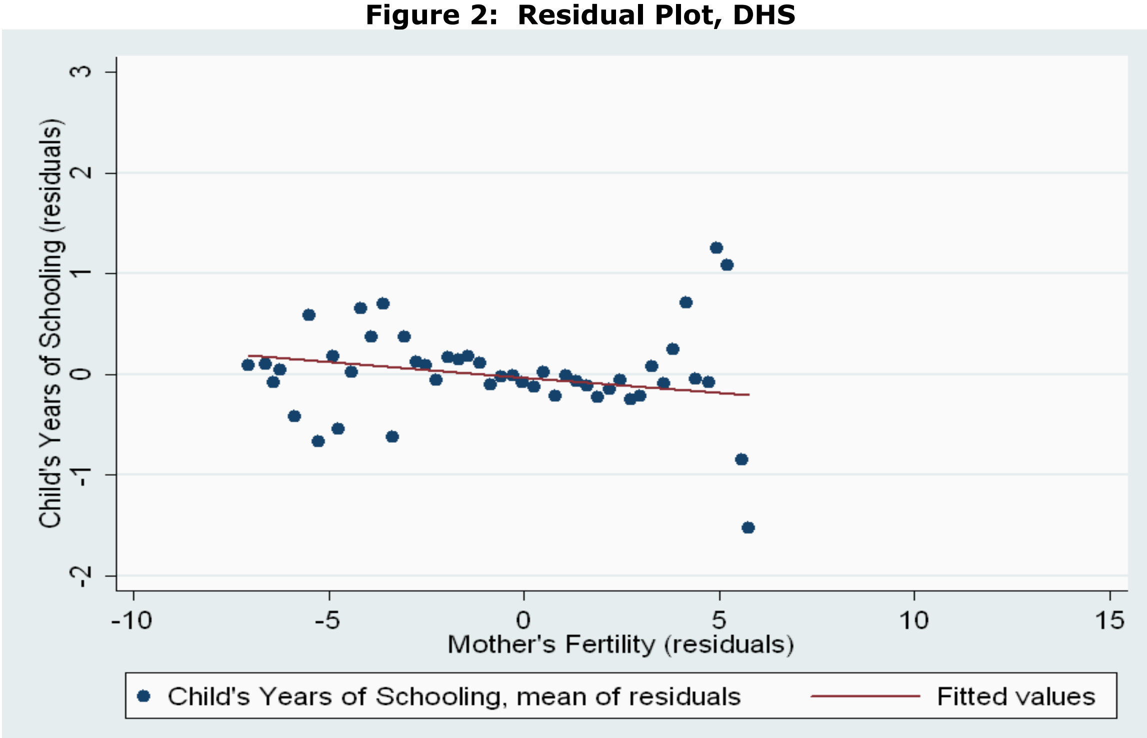
Measure DHS. ICF Macro. 19 February 2009. < http://www.measuredhs.com>.

Figure 1: Residual Plot, IPUMS



Source: IPUMS International. Minnesota Population Center. 21 February 2009. <https://international.ipums.org/international/>.

Figure 2: Residual Plot, DHS



Source: Measure DHS. ICF Macro. 19 February 2009. < http://www.measuredhs.com>.