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Mother's voluntary fertility control and Children's schooling in Ouagadougou, Burkina Faso

Bougma, Moussa
Ph.D Student, University of Montreal
moussa.bougma@umontreal.ca or bougmous@yahoo.fr

Kobiané, Jean-François
University of Ouagadougou
jfkobiane@issp.bf

Abstract

Empirically and especially in developing countries in recent years, children from small families accede and progress in school more than those from large families. But, is this an unexpected consequence of more ressources that happen to be available (*dilution*) or is it a planned behavior (*selection*) ? The present study attempts to test whether there is an evidence supporting the planned behavior hypothesis in Ouagadougou (Burkina Faso), essentially by separating children whose mothers have intentionally limited their fertility from those whose mothers experienced secondary infertility problems. The results show that children from the first group are more chance to attend school than those from the second group. This selection of children from small families by choice in school investment suggests that the negative relationship noticed between fertility decline and children's schooling in sub-Saharan Africa in recent years should not be interpreted as only a *dilution effect*, but as a sum of two effects : *"pure" dilution* and *selection*.

Keywords: Fertility, schooling, selection effect, Ouagadougou, Burkina Faso

1. Introduction

The fertility transition in both developed and developing countries has often been accompanied by a substantial improvement in the welfare of children, including their educational attainment (King 1987; Becker 1991; Ashraf et *al*. 2011). Based on this empirical observation, two competing hypothesis are evoked in the literature to explain the negative relationship noticed between the number of children and their educational attainment. The first hypothesis (*resource dilution*) states that parents have limited resources (here understood in the wider sense: both material resources such as money and non-material ones such as time and patience) to spend on educating their children so that those who have fewer children can invest more per child (Blake 1981, 1989; King 1987). That is why in the West (Lindert 1977; Blake 1981, 1989; Hanushek 1992; Steelman et *al*. 2002) and in East and South East Asia (Knodel et al. 1990; Knodel and Wongsith 1991; Sathar and Lloyd 1994; DeGraff et *al*. 1996; Anh et *al*. 1998; Maralani 2008; Li et *al*. 2008), where the biological parents are responsible to bring up the child, a strong negative correlation was noticed between the number of children and their educational attainment. In african societies, particulary in sub-Sahara Africa, where children's education is a shared charge within extended kinship systems (Gomes 1984; Lloyd and Blanc 1996), the dilution of biological parents ressources dies down so that weak negative effects on the size of the offspring is noticed on the schooling of children (Eloundou-Enyegue and Williams 2006; Kraval et al. 2013).

Parallel to this explanation based on the assumption of family resources diminishing according to the social realities of each context, the researchers also wonder whether the

negative correlation between fertility decline and investment in human capital of children is not the visible manifestation of a planned behavior (Becker and Lewis 1973; Becker and Tomes 1976 ; Becker 1981; Knodel et al. 1990; Montgomery and Kouame 1995; Montgomery and Lloyd 1999; Black et al. 2005; Schultz 2007; Maralani 2008). Indeed, couples who value the education of their children may also be more likely to limit their family size, because they believe that having fewer children will allow them to offer a better education. This second explanation, based on a *selection* process in which couples who opt for better education of children also opt for small families, has received very little attention in the literature. However, it is difficult to protest against, even in developing countries, the fact that parents consider the well-being of children in their fertility decisions (Knodel et al. 1990; Eloundou-Enyegue and Williams 2006; Schultz 2007; Maralani 2008). It is true that in a relatively distant past, the majority of couples in developing countries had a limited control on their fertility and, consequently, they could have more or less children than expected. In such a situation, a negative relationship noticed between the number of children and their education could only be interpreted as an effect of *"pure" dilution* of resources. However, nowadays, with the expansion of family planning programs to master population growth and substantial improvement in women's education, particularly in urban environment, we are far from a *natural fertility* to the extent that couples have more and more a control on their fertility (Bloom 2003). This new context is able to modify the relationship between quantity and quality of children in sub-Sahara Africa, because, couples who value their children's education can easily from now on to resort to modern contraception to control efficiently their fertility in order to better invest in their children's schooling.[1] The fullness of the effects of planned behavior of couples on children's schooling is largely unknown and advanced research are needed (Maralani 2008). Thus, by mobilizing original data in relation to what is generally available in traditional sources of data (censuses, demographic and health survey, etc.), this study aims to test the planned behavior hypothesis in Ouagadougou school investment.

This issue is particularly relevant in the context of Ouagadougou (capital of Burkina Faso) where two concomitant phenomena have grown in recent years. On the one hand, fertility behavior have considerably evolved: between 1993 and 2010, the prevalence of modern contraception has increased from 19.9% to 33% (i.e., an increase of 13 percentage points) ; and fertility rate has decreased from 4.7 to 3.4 children per woman, while in rural environment it has only decreased from 7.3 to 6.7 during the same period (INSD and Macro International Inc. 2012). On the other hand, children's education has

[1] Such a strategy was difficul to implement at the time where modern contraceptive methods were rare, less kown, less effective and less attainable (Schultz 2007).

known a substantial improvement,[2] and qualitative data have also revealed that parents in Ouagadougou are increasingly aware that schooling is key to children's social adaptation and to their successful entry into the labor market later on. Despite the current unemployment crisis, families pin their hopes on school as a means of preparing their children for a better future (see Baux 2007). This presumes that couples are able to operate conscious choices in their fertility decions that may be linked to their willingness to invest in the human capital of their offspring. Thus, would it possible that presently in Ouagadougou couples be in a logic of fertility limitation in response to their desire to invest in their children's education? By examining this question in the context of Ouagadougou, this study provides additional insights to understand the methodological and substantial aspects of *fertility/schooling* links in sub-Saharan Africa.

2. Theoretical and empirical considerations

The «quantity-quality tradeoff» theory assumes a negative relationship between the number of children and the investment in their human capital (Becker and Lewis 1973; Becker and Tomes 1976). According to this human capital theory, parents wish to provide their children with a certain level of education. As resources are limited (here understood in the wider sense: both material resources such as money and non-material ones such as time), the achievement of this schooling objective depends on the number of children they decide to have. If parents ultimately decide to give priority to the number (or quantity) of children, it will necessarily be to the detriment of quality, i.e., of the average level of schooling they can provide. Inversely, if parents rather decide to give priority to the quality of children, it will necessarily be to the detriment of quantity; whence the negative relationship. However, in interpretation terms, this negative relationship that is postulated and empirically noticed between quantity and quality of children may reflect at the same time a *"pure" dilution effect* of resources and a planned behavior (i.e., a *selection* of children from small families by choice in school investment). These two effects (*dilution* and *selection*) are not necessarily exclusive, because they both contribute to strengthen the negative impact of high fertility on children's education. First of all, as resources are limited, parents with fewer children can devote more resources to the education of each of their children (Blake 1981, 1989). Secondly, with the expansion of modern contraceptive methods, parents who value their children's education are able to reduce effectively their fertility in order to better ensure the schooling of their children (Schultz 2007); which contributes to reinforce schooling inequalities between children from small families and those from large families.

[2] The latest general population censuses show for example that the net rate of school attendance for children aged 7-12 residing in Ouagadougou went from 66.7% to 81.1% between 1996 and 2006 (Bayala-Ariste 2009; Pilon 2007).

The *dilution effect* has largely been evaluated in various contexts, for instance by using instrumental variables to generate an exogenous variation in fertility (United States: Caceres 2004; Israel: Angrist et al 2005; Norway: Black et al 2005; Colombia: Baez 2008 Brazil: Ponczek and Souza 2012; Indonesia: Maralani 2008; Vietnam: Dang and Rogers 2013; Philippines: Dumas and Lefranc 2013; China: Li et al. 2008, Qian 2009, Rosenzweig and Zhang 2009). However, one of the rare attempts that has explicitly tested the planned behavior hypothesis (*selection effect*) in the children's school investment is the Knodel, Havanon, and Sittitrai (1990)' study realized in rural environment in Thailand. The study was focused on retrospective data and the objective was to examine the objective and perceived consequences of the number of children of a couple on the socioeconomic welfare of the family (the welfare was defined in education of children terms and in terms of wealth accumulation and employment of women). The survey was focused on 600 couples who reported not wanting any more children and who were supposed to have completed their family size, but was different in terms of final family size, including small families (i.e., one or two living children) and large family (i.e., with four or more living children). Among small families, the study has distinguished small families by choice from those due to involuntary secondary infertility. To assess the planned behavior hypothesis (*selection*), the study has compared the school attendance rates of children from small families by choice to the ones of children from small families by accident (i.e., the mothers of these children experienced fertility troubles). The results have showed that there was no difference between the two groups of children, and the authors concluded to the absence of a planned behavior through which couples who had chosen to invest more in their children's schooling would have also opted to limit the number of their children. Then, the authors have interpreted the negative relationship noticed between family size and children's schooling in rural environment in Thailand only like a *"pure" dilution* of parental resources.

3. Methods

Data

The data used in this study are from two complementary sources: the Ouagadougou Health and Demographic Surveillance System (Ouaga HDSS, or Observation de la population de Ouagadougou: www.issp.bf/OPO/) and the Burkina Faso Demtrend survey.

The Ouaga HDSS is a system of longitudinal data collection that has followed since October 2008, in five zones of the city of Ouagadougou (Kilwin, Tanghin, Nonghin, Nioko 2, and Polesgo), a population of around 80,000 individuals presenting a diverse socioeconomic profile. After an initial survey in 2008 that captured individual characteristics (age, sex, ethnic background, level of education, religion, marital status, etc.), follow-ups have been conducted every six months on the populations in the selected

zones, each time documenting demographic events in each household: births, deaths, immigration, emigration, and unions (Rossier et al. 2012).

Demtrend is a retrospective survey conducted in 2012 on the Ouaga HDSS platform with the specific objective of assessing the consequences of fertility strategies and household composition on the schooling of children in the zones covered by the Ouaga HDSS. The survey covered all women 35-59 years of age having had at least one child surviving until the age of three years and residing in one of the five zones of the Ouaga HDSS, for a total of 2,952 women.[3] The survey made use of some data already produced by the Ouaga HDSS and collected additional complementary information on fertility behaviors and family formation, the schooling of all children (whether residing in the household or elsewhere), family networks and their involvement in children's education, family origins, and parents' perceptions of schooling. Women's voluntary fertility limitation was captured using a semi-open-ended question addressed to women aged 35-59: 'Do you have your current number of children because you no longer *wished* to have any, or because you no longer *could* have any?' This question allowed us to identify two categories of women: women who declared having voluntarily limited their fertility and those who declared having experienced secondary infertility problems (i.e., they would have liked to have more children, but they could not have any for biological reasons).

The initial analysis sample includes 4,157 children aged 6-16 years old[4] from these two groups of women presented above. 244 children, who represent 5.9% of the 4,157 children, were excluded from the analysis for missing information. Finally, the analysis sample includes 3,913 children aged 6-16 with complete information on all included variables in the analysis, this represents 94.1% of the initial sample analysis. As we can notice, the level of reporting of included variables in the analysis is very high (94.1%). In addition, a comparison of the structure of valid data and missing data on several complete characteristics of children (mother's fertility limitation, number of siblings, child's age, child's sex) reveals a similarity between children included in the analysis and those excluded from the analysis (see Table A1 in appendix). Therefore, this exclusion of children with missing information has no effect on the results.

[3] Women are distributed as follows: 1,009 in Kilwin; 382 in Nioko 2; 500 in Nonghin; 168 in Polesgo; and 893 in Tanghin.

[4] The *Loi d'orientation de l'éducation* (Education Act) of 2007 in Burkina Faso requires parents to enroll their children in school from their sixth birthday and keep them there at least until their sixteenth birthday (Burkina Faso 2007). Therefore, the age group of children aged 6-16 allows us to better grasp the budget constraint of families in schooling terms.

Definitions of variables

Child's schooling: Schooling is the dependent variable in this analysis. It is captured by the child's school attendance which takes the value 1 if the child goes to school at the survey time, and zero otherwise.

Mother's voluntary fertility Limitation : It is the main independent variable in the analysis. It takes the value 1 if the mother of the child declares having voluntarily limited her fertility, and zero if she declares having experienced secondary infertility problems.

Number of siblings : It is the second interest independent variable in the study. The number of siblings of a child is the offspring size of his mother in which this child is excluded. As to the offspring size, it includes all children of the woman, alive at birth, subsequently deceased or not, residing in the household or living elsewhere. This measure allows to better capture the budgetary constraints of parents than the number of children residing in the household, because confided children for schooling reasons can continue to receive funding from their biological parents. Furthermore, one way or another, the deceased children have competed at a given time with the surviving children at the survey time on family resources.

Household socioeconomic status : The literature, a long time ago, has established a positive correlation between the household socioeconomic status and the education of children by reason of the direct costs of schooling and the opportunity costs of tasks (paid or unpaid) of which children have able to fulfill if they were not in school. One of the challenges of the analysis is to control the level wealth of the household of children. Not having a direct measure of the level wealth of the household such as parental income, we use a composite indicator as a proxy of the level wealth of the household. It is based on the characteristics of the dwelling, durable goods equipment, sources of water supply, and systems of refuse and wastewater management of the household. This indicator was constructed by using the method of principal component analysis[5] (PCA) and by distinguishing subsequently five categories of household, i.e., the lowest class (20 % of the poorest or 1st quintile), lower class (2nd quintile), middle class (3rd quintile), higher class (4th quintile) and the highest class (20% of the richest or 5th quintile).

Family support networks: In African context, if parents with high fertility wish their children to receive schooling when they do not have means, they can call on family support systems in order to alleviate their financial constraints. The two channels through which this family support occurs is the *fosterage (fortering)* (Pilon 2005; Eloundou-Enyegue and Shapiro 2005; Akresh 2009) and the participation of members of the

[5] The first factorial axis, which explains 42.4% of the total variance of all factorial axes, was selected. The results of this PCA are not presented here for lack of space but are available upon request.

extended family (grandparents, aunts, uncles, etc.) to the payment of tuition (Baland et al. 2013). Thus, the family support networks for schooling is captured in this study by monetary or in-kind (fostering) assistance that the woman and her spouse have already received from their extended family for their children's schooling[6]. Three groups of children were distinguished for analytical purposes: children whose parents received no help from their family network in their children's education, children whose parents have received support from their family network in tuition, and those whose parents received support in fostering.

Other characteristics of parents and children: Beyond the characteristics of the school supply (availability and quality), some characteristics of parents and children themselves influence the chances of children's schooling (Chernichovsky 1985 ; Marcoux 1994 ; Lloyd and Blanc 1996; Kobiané 2006). According to the available information, the characteristics of parents are captured in this study by characteristics of mothers: age, ethnic group (mossi or not), religion (muslim, christian), and marital status (married, unmarried). Child characteristics include gender (boy, girl), birth order (eldest child, subsequent child), status of residence (resides in the household in formal zone, resides in the household in informal zone, resides elsewhere in Ouagadougou, resides outside of Ouagadougou), number of siblings who died, age and age squared.[7] The status of child residence has been added in the analysis to control the school supply.

Statistical analysis

The analysis consists to assess the effect of planned reproductive behavior of women in the education of their children. We postulate that the voluntary birth control emanates from a willingness of parents to better invest in the education of their offspring. Therefore, among the children from small families, we expect, all things being equal, to notice a better school attendance of children whose mothers have voluntarily limited their fertility as compared to those whose mothers experienced secondary infertility problems.

We began with bivariate association of school attendance with mother's voluntary fertility limitation. Then, we used logistic regression models[8] to examine the correlations between school attendance and mother's voluntary fertility limitation as well as the other explanatory variables. We estimated three types of logistic regression models. First, we

[6] By assuming that children of spouse who have been helped also are children of the woman.

[7] Given the curvilinear relationship between age and school attendance (Figure 2), we introduce age squared as an additional control variable. However, to avoid multicollinearity between age and age squared, we at first standardized age before calculating age squared.

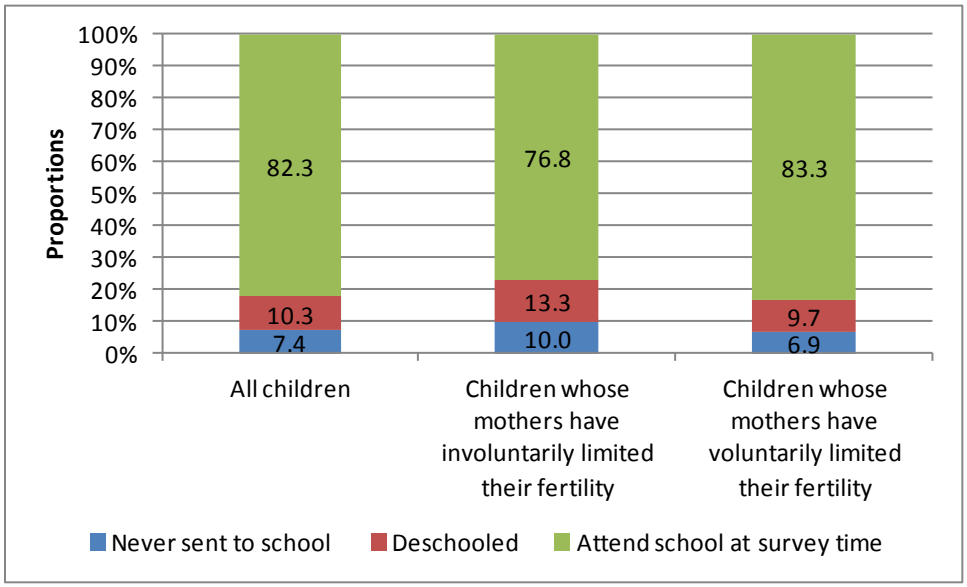
[8] As the dependent variable is dichotomous, that is to say, the child goes to school (or not) at the survey time, the simple logistic regression is the appropriate analysis model.

evaluated the effect of mother's voluntary fertility limitation as well as that of each of the other explanatory variables (gross effects model or model 0). Then, we simultaneously included in the same model the mother's voluntary fertility limitation and the other independent variables to assess the net effect of each variable (net effects model or model 1). The final step of the analysis consisted of examining the variation in the relationship between mother's voluntary fertility limitation and school attendance according to the number of siblings. Thus, to test if the number of siblings modifies the relationship between the mother's voluntary fertility limitation and the school attendance, we fitted logistic regression which included an interaction term between the mother's voluntary fertility limitation and the number of siblings (model 2). This last model enabled us to see if children from small families by choice are selected in school investment. In all models, we calculated linearized standard errors to take into account the correlated nature of responses from individuals in both the same mother and the same household (in order to control some unobserved heterogeneity).

4. Results

Figure 1 shows the school status of the two groups of children aged 6-16: children whose mothers have voluntarily limited their fertility (group 1) and those whose mothers experienced secondary infertility problems (group 2). Three school status have been distinguished for each group of children: never sent to school, deschooled and attend school at survey time.

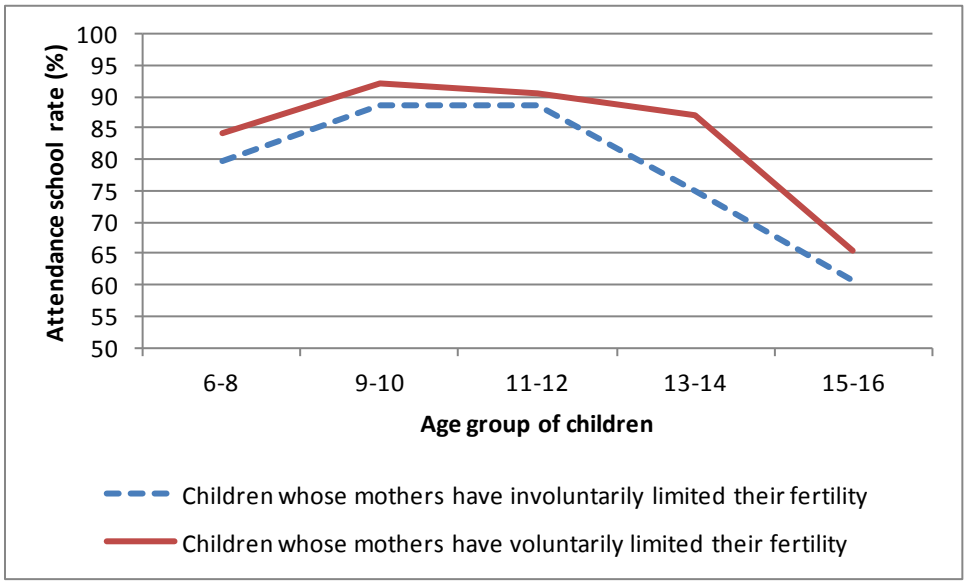
Figure 1 : School status of children aged 6-16, by mother's voluntary or involuntary fertility limitation, Ouagadougou, Burkina Faso, 2012



Note: The proportions are weighted using sampling weights provided by the Ouaga Demtrend Survey, and take the clustering at mother and household levels into account.
Source: HDSS-DEMTREND, Ouagadougou (Burkina Faso) 2012.

As might be expected, the school attendance rate is higher in group 1 (83.3%) than in group 2 (76.8%). This inequality of 6.5 percentage points between the two groups of children is the result of the mechanical advantage of the children from group 1 in both the access to school and the level of school drop. Indeed, one tenth (10%) of children from group 2 were never sent to school, and 13.3% of them dropped out school. These proportions are respectively 6.9% and 9.7% at children's from group 1 (Figure 1). This double benefit of children from group 1 (the access to school and the school drop) as compared to those from group 2 is noticed whatever the age group of children.[9] (Figure 2).

Figure 2 : Attendance school rate of children aged 6-16, by children's age group and mother's voluntary or involuntary fertility limitation, Ouagadougou, Burkina Faso, 2012



Note: The proportions are weighted using sampling weights provided by the Ouaga Demtrend Survey, and take the clustering at mother and household levels into account.
Source: HDSS-DEMTREND, Ouagadougou (Burkina Faso) 2012.

Therefore, the voluntary birth control seems to promote a better education for children. However, this bivariate correlation, which is noticed in the expected sense between voluntary limitation of fertility of the mother and the school attendance of her children can be misled if the two groups of children have different profiles. Table 1 shows by the way the distribution of sample analysis by distinguishing between the two groups of

[9] The grouping together of children aged 6-8 can be explained by the fact that the official age of entry into first grade of primary school in Burkina Faso is 6 years with a tolerance threshold for children aged 7-8 (Burkina Faso 2007).

children. Children in group 1 are more represented in the sample (84.6%) than those in group 2 (15.4%). Moreover, except some sociodemographic characteristics (household socioeconomic status, mother's age, mother's ethnic group, family support network for children's schooling, child's place of residence), all other analysis variables discriminate the two groups of children. Indeed, the number of siblings (i.e., the number of brothers and sisters alive at birth) is higher in group 1 than in group 2 (4.8 against 4.0, p <0.001), while the number of siblings who died is lower in group 1 than in group 2 (0.7 against 0.9, p <0.001). In addition, children in group 1 are 43.3% whose mothers are christians and 91% whose mothers are currently married, while these proportions are respectively 28.6% and 84% for children in group 2. Thus, both groups of children have different profiles that can also explain the schooling inequalities noticed in the bivariate analysis; whence the need to do a multivariate analysis in order to assess the net relationship between the mother's voluntary fertility limitation and the school attendance of children.

Table 1 : Descriptive statistics of children according the fact that their mothers have voluntarily or involontarily limited their fertility, Ouagadougou, Burkina Faso, 2012

Variables	All children (n=3,913)		Children whose mothers have involuntarily limited their fertility (n=603)		Children whose mothers have voluntarily limited their fertility (n=3,310)		P value
	n	% or Mean (SD)	n	% or Mean (SD)	n	% or Mean (SD)	
Number of Siblings (range: 0-13)	3,913	4.7 (2.00)	603	4.0 (2.3)	3,310	4.8 (1.9)	<0.001
Number of Siblings Who Died	3,913	0.7 (0.03)	603	0.9 (1.2)	3,310	0.7 (1.0)	<0.001
Household Socioeconomic Status							
Quintile 1	984	27.7	148	27.5	836	27.8	
Quintile 2	771	21.0	126	21.3	645	21.0	
Quintile 3	837	20.6	127	22.2	710	20.4	0.968
Quintile 4	670	15.4	105	14.4	565	15.6	
Quintile 5	651	15.2	97	14.7	554	15.3	
Mother's Age (range: 35-59)	3,913	41.6 (4.48)	603	41.8 (4.7)	3,310	41.6 (4.4)	0.273
Mother's Religion							
Muslim	2,300	59.0	439	71.4	1,861	56.7	<0.001
Christian	1,613	41.0	164	28.6	1,449	43.3	
Mother's Ethnicity							
Mossi	3,523	90.0	552	92.0	2,971	89.7	0.274
No-Mossi	390	10.0	51	8.0	339	10.3	
Mother's Marital Status							
Married	3,510	89.9	509	84.0	3,001	91.0	0.004
Unmarried	403	10.1	94	16.0	309	9.0	
Family Support Network							
No support	2,750	70.1	430	71.5	2,320	69.9	0.546

School Fees	548	13.4	70	11.1	478	13.8	
Fostering	615	16.5	103	17.3	512	16.4	
Child's Place of residence							
In household, formal area	2,101	48.7	311	46.2	1,790	49.1	0.150
In household, no formal area	1,305	37.6	196	35.8	1,109	37.9	
Elsewhere in Ouagadougou	173	4.9	32	7.2	141	4.5	
Outside of Ouagadougou	334	8.9	64	10.7	270	8.5	
Child's Sex							
Boy	1,993	52.1	288	48.8	1,705	52.8	0.099
Girl	1,920	47.9	315	51.3	1,605	47.2	
Child's Age (range: 6-16)	3,913	11.6 (3.06)	603	11.8 (3.1)	3,310	11.6 (3.1)	0.072
Birth order							
Eldest child	229	7.2	62	13.1	167	6.1	<0.001
Subsequent child	3,684	92.8	541	87.0	3143	93.9	

Note: (SD) = Standard deviation. The proportions and the means are weighted using sampling weights provided by the Ouaga Demtrend Survey, and take the clustering at mother and household levels into account. [a]p-value based on Chi-squared test for proportions differences or t-test for mean (standard deviation) differences between Children whose mothers have voluntarily limited their fertility and Children whose mothers have involuntarily limited their fertilty.
Source: HDSS-DEMTREND, Ouagadougou (Burkina Faso) 2012.

The results of the logistic regression are contained in Table 2. As already indicated, we have produced three logistic regression models (model 0, model 1 and model 2). Model 0 includes one explanatory variable (gross effects model). The results of this first basic model show that children in group 1 have 51% more chance to attend school than those in group 2 (p = 0.015). The model 1 includes all explanatory variables without an interaction term. The results of this second model confirm the benefit of children in group 1 in the school investment as compared to those in group 2. Indeed, children whose mothers have voluntarily limited their fertility have 75% more chance to attend school than those whose mothers have unwittingly limited their fertility (p = 0.001). As we can notice, the relationship between the voluntary fertilty limitation of the mother and the school attendance of her children becomes stronger in presence of other explanatory variables, including the number of siblings. This means that the number of siblings alters the relationship between the mother's voluntary birth control and the children's school attendance. This observation is confirmed in model 2 which includes all explanatory variables with an interaction term between the mother's fertility limitation and the number of siblings. The coefficient of the interaction between these two variables is negative and significant[10] (coefficient = -0.144, p = 0.074). Therefore, children from small families whose mothers have voluntarily limited their fertility are selected in school investment. Indeed, among singletons (i.e., children having no brother and sister), children whose mothers have voluntarily limited their fertility have 3.35 times more

[10] Exp (interaction coefficient) = 0.87 means that interaction coefficient = ln (0.87) = -0.144.

chance to attend school than those whose mothers have unwittingly limited their fertility (Table 2). This advantage of children in group 1 in the school investment, as compared to those in group 2, decreases in proportion as the number of siblings increases. This can be noticed through Figure 3 which shows the evolution of the effect of the voluntary fertility limitation of the mother on the probability for her children to attend school. We can notice that the effect of the voluntary fertility limitation of the mother on the school attendance of children is positive and significant when the number of siblings is less than six. Yet, when the number of siblings is more than six, the correlation between the two variables is not statistically significant.[11] (Figure 3). Therefore, in school investment, there are a selection of children from small families by choice as compared to those from small families by accident.

Table 2 : Odds ratios of school attendance of children aged 6-16, Ouagadougou, Burkina Faso, 2012

Explanatory variables	Odds Ratio (95% CI)		
	Model 0	Model 1	Model 2
Mother's Fertility Limitation (MFL)			
Involuntary *(r)*	1.00	1.00	1.00
Voluntary	1.51 (1.08—2.11)*	1.75 (1.27—2.41)**	3.35 (1.50—7.51)**
Number of Siblings	0.83 (0.77—0.88)***	0.79 (0.72—0.87)***	0.88 (0.75—1.03)
MFL x Number of siblings[a]	—	—	0.87 (0.74—1.01)†
Household Socioeconomic Status			
Quintile 1 *(r)*	1.00	1.00	1.00
Quintile 2	1.52 (1.06—2.17)*	1.49 (1.03—2.14)*	1.47 (1.02—2.11)*
Quintile 3	2.13 (1.61—2.81)***	2.18 (1.56—3.03)***	2.19 (1.58—3.05)***
Quintile 4	3.88 (2.85—5.30)***	4.22 (2.82—6.31)***	4.20 (2.80—6.30)***
Quintile 5	11.38 (7.03—18.43)***	10.20 (5.75—18.07)***	10.04 (5.66—17.83)***
Mother's Religion			
Muslim *(r)*	1.00	1.00	1.00
Christian	1.40 (1.10—1.78)**	1.43 (1.12—1.84)**	1.43 (1.12—1.84)**
Mother's Ethnicity			
Mossi *(r)*	1.00	1.00	1.00
No-Mossi	1.63 (1.06—2.51)*	1.13 (0.72—1.78)	1.13 (0.71—1.79)
Mother's Marital Status			
Married *(r)*	1.00	1.00	1.00
Unmarried	0.60 (0.41—0.89)*	0.85 (0.59—1.22)	0.85 (0.59—1.21)
Family Support Network			
No support *(r)*	1.00	1.00	1.00
School Fees	0.98 (0.72—1.34)	1.13 (0.83—1.55)	1.14 (0.83—1.57)
Fostering	0.97 (0.73—1.28)	1.55 (1.09—2.19)*	1.55 (1.09—2.21)*
Child's Place of residence			
In household, formal area *(r)*	1.00	1.00	1.00

[11] Indeed, zero crosses the confidence intervals of the estimated coefficients.

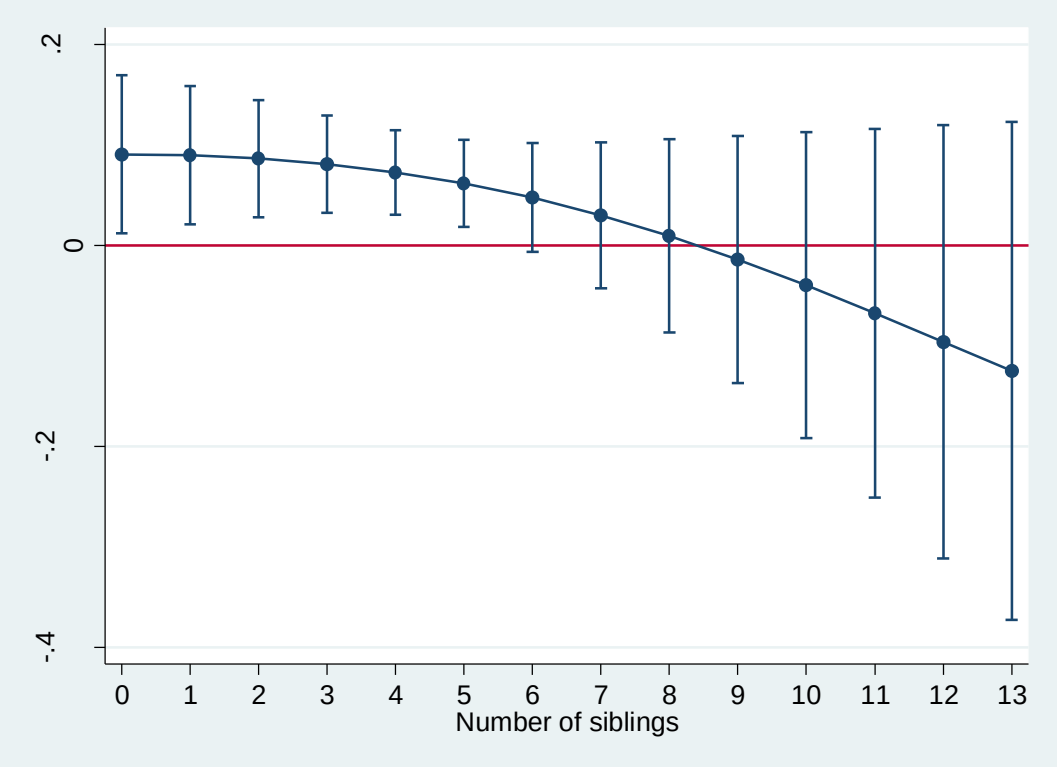
In household, no formal area	0.48 (0.38—0.61)***	0.94 (0.70—1.27)	0.96 (0.72—1.29)
Elsewhere in Ouagadougou	0.17 (0.11—0.27)***	0.30 (0.16—0.54)***	0.31 (0.17—0.55)***
Outside of Ouagadougou	0.18 (0.13—0.25)***	0.30 (0.20—0.44)***	0.31 (0.21—0.46)***
Child's Sex			
Boy *(r)*	1.00	1.00	1.00
Girl	1.19 (0.98—1.44)†	1.24 (1.005—1.53)*	1.24 (1.002—1.53)*
Birth order			
Eldest child	0.89 (0.54—1.46)	1.06 (0.63—1.77)	1.10 (0.64—1.86)
Subsequent child *(r)*	1.00	1.00	1.00
Mother's Age	0.99 (0.96—1.03)	1.02 (0.97—1.06)	1.02 (0.98—1.06)
Child's Age	0.87 (0.84—0.91)***	0.41 (0.35—0.47)***	0.41 (0.35—0.47)***
Child's Standardized Age Square	1.36 (1.12—1.66)**	0.03 (0.02—0.06)***	0.03 (0.02—0.06)***
Number of Siblings Who Died	0.82 (0.74—0.91)***	1.17 (1.03—1.32)*	1.17 (1.03—1.32)*
Sample size	3,913	3,913	3,913

Note : *** p<0.001; ** p<0.01; * p<0.05; † p<0.10. *(r)* = Reference group. [a]Interaction between mother's fertility limitation and number of siblings. Model 0 include one explanatory variable (Gross effects model). Model 1 include all explanatory variables without interaction between mother's fertility limitation and number of siblings. Model 2 include all explanatory variables with interaction between mother's fertility limitation and number of siblings. All the models are weighted using sampling weights provided by the Ouaga Demtrend Survey, and take the clustering at mother and household levels into account.
Source: HDSS-DEMTREND, Ouagadougou (Burkina Faso) 2012.

This selection of children from small families by choice in school investment can also be observed by examining the relationship between the number of siblings (which is one of the variables of interest in this analysis) and the school attendance. Indeed, the regression coefficient of sibship size on school attendance noticed in the stratum of children whose mothers have voluntarily limited their fertility (coefficient = -0.269) is twice more than the one noticed in the stratum of children whose mothers experienced secondary infertility problems[12] (coefficient = -0.126). As mothers of children in group 2 had fertility troubles, we can think that the variation in their fertility is exogenous, because this change took place in circumstances beyond their control. Then, the relationship between the number of siblings and the school attendance can only be approximated to a *"pure" dilution effect* of resources, which would explain the weak negative effect of the sibship size noticed in the stratum of children in group 2. Thus, the strong negative relationship between the number of siblings and the school attendance noticed in the stratum of children in group 1 can be explained by the accumulation of a *"pure" dilution effect* of resources and a *selection effect*, because mothers of children in this group deliberately planned their fertility.

[12] The regression coefficient of the number of siblings on the school attendance of children in group 1 and the one of those in group 2 are deducted from the model 3.

Figure 3 : Effect of mother's voluntary fertility control on school attendance of children aged 6-16, by number of siblings, Ouagadougou, Burkina Faso, 2012



Note: The Figure was constructed with Stata's "margins" command based on Model 2 (Table 2). The points represent the coefficients of the impact of mother's voluntary fertility limitation on probability of children's school attendance, and the bars represent the confidence intervals (CI) at 95%.
Source: HDSS-DEMTREND, Ouagadougou (Burkina Faso), 2012

5. Discussion and conclusion

Two competing hypothesis are evoked to explain the negative relationship noticed between the number of children and the investment in their human capital: *dilution effect* (i.e., with more children, parents can devote fewer resources to each child's education) and *selection effect* (i.e., parents who place more importance on their children's education opt to limit their fertility). The dilution hypothesis has received a huge attention in the literature, while the selection hypothesis has been less often addressed (Knodel et al. (1990) is an exception). Thus, the aim of our study was to evaluate the planned behavior hypothesis in school investment in Ouagadougou, Burkina Faso.

The results show that among children from small families (i.e., the number of siblings is less than six), those whose mothers have voluntarily limited their fertility have more chance to attend school than those whose mothers have involuntarily limited their fertility. Whence an evidence supporting the planned behavior hypothesis in investment

in children's human capital in Ouagadougou. However, Knodel, Havanon, and Sittitrai (1990) found an absence of planned behavior in childen's schooling in their study conducted in Thailand. The different contexts in which the two studies were conducted explains the difference between our results and those from Knodel, Havanon, and Sittitrai (1990). Indeed, the Knodel, Havanon, and Sittitrai (1990)' study was realized there are two decades and more, and furthermore in Thai villages. Whereas our study was conducted in 2012 in urban environment, particularly in Ouagadougou, capital of Burkina Faso, which is a different context of a rural environment. The planned behavior hypothesis in investment in children's human capital that is verified in our study may be explained by the enthusiasm of parents for the school and the expansion of family planning programs in sub-Saharan Africa during the recent years. Indeed, like Baux (2007) reports,

> *In Ouagadougou, parents are increasingly aware that schooling is key to children's social adaptation and to their successful entry into the labor market later on. Despite the current unemployment crisis, families pin their hopes on school as a means of preparing their children for a better future. Children, for their part, all hold on to the dream of someday becoming an "office worker"* (Baux 2007: 83) *[Authors' translation].*

This great attention that parents give to their children's education also takes place in an environment marked by a greater availability of contraceptive methods allowing them to efficiently control their fertility (Tankoano 1990). In fact, in the past, the practice of modern contraception was illegal in Burkina Faso, as it was subject to the Act of 1920, which prohibited propaganda on contraceptive methods and products (Ministère de la santé 2012). The first family planning (FP) policy action plan was conceived in 1985. Its implementation required different legislative measures, mainly regarding the repeal of the portion of the Act of 1920 prohibiting all advertising on contraceptives; the regulation of prescription and of the sale of contraceptives; the censorship of press articles containing false information on contraceptives; and the imposition of severe sanctions on all perpetrators and accomplices of clandestine abortions. Based on of this new legislation, FP services were effectively implemented in Ouagadougou in 4 maternal and child health centers (*Centres de santé maternelle et infantile*, SMI) in February 1985, and then in 3 SMI centers in Bobo Dioulasso in May 1985. Since then, FP services have been gradually extended across the country, and it should be noted that other centres provide FP services in Ouagadougou, including the midwife clinic, the Association burkinabè pour le bien-être familial (ABBEF – Burkinabe Association for Family Well-Being), and some private clinics (Ministère de la santé 2012). Thus, couples who want to enhance the education of their children can easily have recourse to the modern contraception to control effectively their fertility in order to realize their educational aspirations. Such a strategy was difficult to implement when modern contraceptive methods were rare, less known, less effective,

less accessible, or even banned. This is consistent with the dynamic of the contraceptive use noticed in Ouagadougou, since the prevalence rate of modern contraception has increased by 13 percentage points between 1993 and 2010 (INSD and Macro International Inc 2012).

Another interesting result that deserves to be emphasized is the heterogeneity of the *selection effect* according to the siblings size. Indeed, the effect of mother's voluntary fertility limitation on the probability of child's school attendance is positive when child's siblings size is less than six. But, when the number of siblings is greater than six, there is no difference between children whose mothers have voluntarily limited their fertility (group 1) and those whose mothers have involuntarily limited their fertility (group 2). Better, when the number of siblings is greater than eight, children in group 2 have more chance to attend school than those in group 1, even if the differences are not statistically significant (see Figure 3). Thus, beyond the anticipated costs of children's schooling in parents's reproductive behavior, the education of children requires an additional condition, supposedly a sufficient level of wealth. For example, in the interviews conducted by Knodel, Havanon, and Sittitrai (1990) with Thai couples on the education of children, the majority of participants spoke about poverty as an obstacle to educational projects for their children. This is particularly plausible in the Burkinabe urban context, where the incidence of poverty, which was only 10.4% in 1994, has pratically doubled in 2003 (19.9%). At the same time, school expenses incurred by urban households reached an average of U.S. $117, either more than 70% of the poverty threshold that was U.S. $165 in 2003 (INSD 2003). This growing poverty, combined with greater increasingly solicitations of households in education financing (Compaoré et al 2007.), and difficulties in access to housing in Ouagadougou (Boyer and Delaunay 2009; Boyer 2010), may compell couples to limit their children's schooling at sustainable levels by family resources, even if the well-being of children has been the subject of a compromise in reproductive decisions. As the guiding principle fertility decisions of African parents would be a strategy to reduce the family risk (see Gomes 1984; Eloundou-Enyegue 1994 ; LeGrand et al 2003), in cases of financial hardship, parents who are more attentive to well-being of their children can direct them to non-academic training as learning jobs (Kobiané 2006).

We must note that the Ouaga HDSS population, on which our study is based, is not representative of the city of Ouagadougou, but rather of its periphery. The populations living in these peripheral zones tend to be younger, more likely to be from a rural background, and poorer than those living in the city center (Rossier et al. 2012). Therefore, the results of this study are not representative of the entire city of Ouagadougou. Despite this limitation, the selection of children from small families by choice in school investment (planned behavior hypothesis) empirically confirmed in our study suggests that the negative relationship noticed between the number of children and

their schooling in sub-Saharan Africa in recent years should not be interpreted as only a *dilution effect*, but as a sum of two effects: *"pure" dilution* and *selection*.

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Appendix

Table A1 : Descriptive statistics of valid cases and missings, Ouagadougou, Burkina Faso, 2012

Variables with complete information	% or Mean (Std. Dev.)		p[a] value
	Valid cases n=3913	Missings n=244	
Mother's fertility limitation			
Involuntary	84.2	84.5	0.9332
Voluntary	15.8	15.5	
Number of siblings	4.7 (2.00)	4.6 (1.95)	0.3703
Child's Age	11.6 (3.06)	11.6 (3.08)	0.9206
Child's Sex			
Boy	52.1	50.1	0.5573
Girl	47.9	49.9	
All observations	94.1	5.9	

Note: The proportions and the means are weighted using sampling weights provided by the Ouaga Demtrend Survey, and take the clustering at mother and household levels into account. [a]p-value based on Chi-squared test for proportions differences or t-test for mean (standard deviation) differences between valid cases and missings. Source: HDSS-DEMTREND, Ouagadougou (Burkina Faso) 2012

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