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Working Paper No 2012-12
February 2012

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Abstract: This paper uses data from the Demographic and Health Surveys for about 30 sub-Saharan African countries to investigate the link between the birth of an "unintended child" and schooling decisions of children (dropout and entry). After controlling for local unobserved heterogeneity, we show that the birth of an "unintended child" hinders child schooling. It reduces the probability of current school enrolment. As for school dynamics, it increases the probability that a child aged 6 to 18 years drops out of school and it decreases the probability that a child aged 6 to 9 years starts schooling. These results suggest that an unexpected birth strengthens household's resources constraints and reduces human capital investments. The results also highlight the importance of the timing of the unexpected birth and the heterogeneity of the effect according to child characteristics.

Key words: unwanted fertility, education school dropout, school enrollment

JEL Classification: J13, I20, O12

The authors thank David Shapiro and Flore Gubert for useful comments. They also thank participants to They also acknowledge financial support for this research from Fond National de la Recherche (FNR) of Luxembourg.
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1. Introduction

During their life course, households are exposed to different type of shocks, collateral shocks as well as idiosyncratic ones. One important source of idiosyncratic shocks stems from demographic phenomena (such as fertility and mortality) that occur within the household. In developed countries, fertility is for the most part effectively controlled, while in many developing countries, fertility remains high and a much larger share of childbearing is unexpected. In sub-Saharan Africa, the total fertility exceeds desired fertility by almost 0.5 to 1 child per women and unmet need for contraceptive use is quite high (between 10 and 25%)[4]. In such a specific context, when a pregnancy is unwanted, childbearing can be viewed as a shock. It is therefore interesting to study to what extent unplanned children bearings affect household outcomes.

A fertility shock might affect various household outcomes, including: household living conditions, children health and mortality, and children's education. Regarding education, an unexpected birth within the household can be particularly damaging for children already at school. Indeed, an unexpected pregnancy leads to a birth that represents an unplanned increase in family size. The consequences of such fertility shocks on children's education can be studied within the general framework of the Quantity-Quality model (Becker and Lewis, 1973). This model presumes that households allocate resources to each child to improve its quality. A direct implication of this model is a trade-off between per child investment (quality) and the number of children in the family (quantity).

From an empirical perspective, the literature on the relation between quality and quantity of children is huge and diverse. The papers cover different regions in the world including the following countries: US (Blake, 1981, Downey, 1995), France (Goux and Maurin, 2005), Thailand (Knodel et al., 1990, Knodel and Wongsith, 1991), Kenya (Gomes, 1984), Botswana (Chernichovsky, 1985), Ghana and Cote d'Ivoire (Montgomery et al., 1995), Malaysia (Sudha, 1997), China (Lu and Treiman, 2008), Hungary (Van Eijck and De Graaf, 1995) and Cameroon (Eloundou-Enyegue and Williams, 2006). In the developed countries, the literature displays a consistent negative relationship between the number of siblings and children's schooling (Becker and Lewis, 1973, Becker and Tomes, 1986, Sewell and Shah, 1968, Blake, 1981). However, in developing countries, the literature shows mixed conclusions. In some contexts a negative relationship is found (Cote d'Ivoire, Ghana), while in others a positive relationship is observed (Kenya, Botswana). These results raise the possibility of systematic variation in the relation across societies as noted by Eloundou-Enyegue and Williams (2006).

The empirical literature treats family size either as given /exogenous or uses various sets of variables to instrument for its endogeneity. In the first case, the exogeneity hypothesis is debatable (Morduch, 2000) and in the second the validity of the instruments is also questionable. Moreover, when studying the link between fertility or family size and education outcomes, most studies in developing countries use a static approach: neither the timing of changes in family size nor that of its effect on school outcomes is explicitly taken

[4] www.measuredhs.com

into account. A more dynamic approach consists of both dating fertility changes and their impact on school outcomes.

This paper focuses on changes in fertility originating from unintended pregnancies. A child born out of an unintended pregnancy can be treated as an unexpected shock on family size. This approach provides the possibility to consistently examine the effects of an exogenous family size variation on household decision making. It is not common in the literature and has been used by Montgomery and Lloyd (1999). Using DHS data, these authors analyze the impact of excess fertility and unwanted fertility on children's school attainment in four countries (Dominican Republic, Egypt, Kenya and the Philippines). Their analyses show a significant negative effect of unwanted fertility and excess fertility on school attainment in the Dominican Republic and the Philippines. No effect is found in the other two countries. But it is important to mention that their outcome variable, the number of completed school grades, is a variable resulting from a cumulative process. And, on the other side, an unexpected pregnancy is a one-off event[5]. So these authors investigate the effect of a one-off event (unwanted pregnancy) which occurs at a given time on the overall school outcome. In particular, in their setup, the timing of the unwanted fertility change in the schooling process of a child is not given special attention. Another related paper is by Myhrman et al. (1995). Myhrman et al. show that, in Northern Finland, being a child born out of an unintended pregnancy increased the risk that men would not go on to upper secondary school by 6.0 percentage points and that women would not do so by 6.3 percentage points. The contribution of this paper is twofold. First, it investigates the short-run effect of having an unintended child on contemporaneous school dynamics: dropout and entry of school-age children. Regarding dropping out, we investigate whether the presence of an unintended child pushes children already at school out of school. With school entry, we examine whether the presence of an unintended child delays school entry. In studying school entry, the sample is restricted to young children who have never been to school. Second, the paper uses data from about 30 countries, all located in sub-Saharan Africa, where the propensity of having an unintended child is relatively high.

The reminder of this paper is organized as follows. The next section suggests a conceptual framework to understand the way that an unintended birth affects household behaviors. Section 3 presents the data and our empirical strategy. The results, discussion and conclusion are respectively in sections 4 and 5.

2. Conceptual framework

We assume a household utility function that depends on two "goods": children's school achievement S and consumption good C. The contribution of child schooling to household utility varies with child types: girls, boys, son or daughter and fostered children. Hence..

U=$U_0(C, S_1, S_2, S_3, ..., S_t)$,where t is the number of type of children considered.

[5] A least as measure in the DHS surveys

Let's suppose that the price of the consumption good is normalized to one and that fertility is given. The household chooses the level of consumption and the schooling level of every child to maximize its utility. We also suppose that the utility function is quasi-concave and twice–differentiable.

The household maximization program is given by:

$$\underset{C,S_1...S_t}{Max} : U_0(C, S_1, S_2, S_3, ..., S_t)$$

$$s.t.\ C + \sum_{i=1}^{t} p_i S_i \leq R_0$$

where p_i represent the (direct and indirect) costs of education. We allow these prices to vary according to child types. One important source of variation of p_i is the indirect or opportunity cost of education. R_0 represents the household's income.

At the optimum under the hypothesis of a fixed number of children and saturated budget constraint, we have that $U'_{0S_i} / p_i = U'_{0S_j} / p_j = ... = U'_{0S_t} / p_t = U'_{0c}$ where i ≠ j ≠ t and i, j, t represent a "type" of child.

So, the household chooses at the optimum $(C_0^*, S_{01}^*, ..., S_{0t}^*)$.

When a shock or an unintended pregnancy occurs and leads to an "unanticipated" birth, the new birth changes the economic environment of the household and leads to an additional fixed costs (k). Hence, total costs faced by the household increases and the per child available resources decreases. .. The budget constraint is then tightened ($R_1 = R_0 - k < R_0$) and the household reaches a new utility level U_1In general, households will adjust both consumption and schooling in such a way that it minimizes the lost of utility due to a tightened of the budget. However, for a household that is at a subsistence consumption level, when an adverse shock occurs, it will only adjust children's schooling. If the cost of education is identical for all children (p_i= p for all i) and if parents do not discriminate among their children (U'_{si}=U' for all i), then, the education of all children will be equally affected by the shock.

When they are differences in schooling costs and preferences among children, the adjustment of schooling demand is driven by preferences and schooling costs. Let's suppose that the household has two types of children: children with higher marginal utility of schooling (U'_{0S_h}) and children with lower marginal utility of schooling (U'_{0S_l}).

At the optimum, we still have that $U'_{S_h} / P_h = U'_{S_l} / P_l$. If schooling costs are equal and preferences are different, parents would reduce the investments in the education of children with higher marginal utility by less than the reduction in investments in the education of

children with lower marginal utility[6]. If marginal utilities are equal and costs are different, children with higher education cost will suffer more. Girls and fostered children often have higher (opportunity) costs of education [Mason and Khander (1996), Alderman and Gertler (1997), Glick and Sahn (2000) Alderman and King (1998)].

We have supposed that in case of fertility shock, the additional cost born by the household is the same regardless of the characteristics of the unintended child. If we think of heterogeneous cost of unintended child (k_k), then, the advent of unintended children with different characteristics may affect differently the household. It is conceivable that an unintended child by the spouse of the household head might affect schooling compared to an unintended child by a fostered girl living in the household.

3. Empirical strategy

Data and descriptive analysis

This paper uses data from Demographic and Health Surveys (DHS) to investigate the link between the the presence of a child born out of an unintended pregnancy and schooling decisions (dropout and entry). The DHS program was originally developed by the U.S. Agency for International Development (USAID). Since 1984, DHS have collected, analyzed and disseminated accurate and representative data for more than 200 surveys in more than 75 countries. DHS data are collected with the support of ICF Macro, based in the United States. The Samples are representative at national and sub national levels.[7] DHS survey methodologies and questionnaires are standardized so that data are comparable across countries. The surveys offer detailed information on various subjects, including education, health, as well as detailed information on women's fertility, activities and participation in the decision-making process. DHS also provides interesting information for our analysis of the impact of recent fertility on households schooling strategies.
We use nearly 30 DHS data sets for our analysis. Table 9A in appendix provides the list of countries and year of the survey.

Measurement

The fertility shock measurement

During DHS surveys, all women who had given birth during the 5 years prior to the survey date were asked specific questions. For each of those births, they were asked the following question: "At the time when you became pregnant with [……][8] , did you want to become pregnant then, did you want to wait until later, or did you not want to have any (more)

[6] Proof: under the assumption of decreasing marginal utilities, the equality of prices and the higher utility of type h over type l child, $U'_{S_l} = U'_{S_h}$ implies that $S_l < S_h$

[7] http://www.measuredhs.com/

[8] [name of the child]

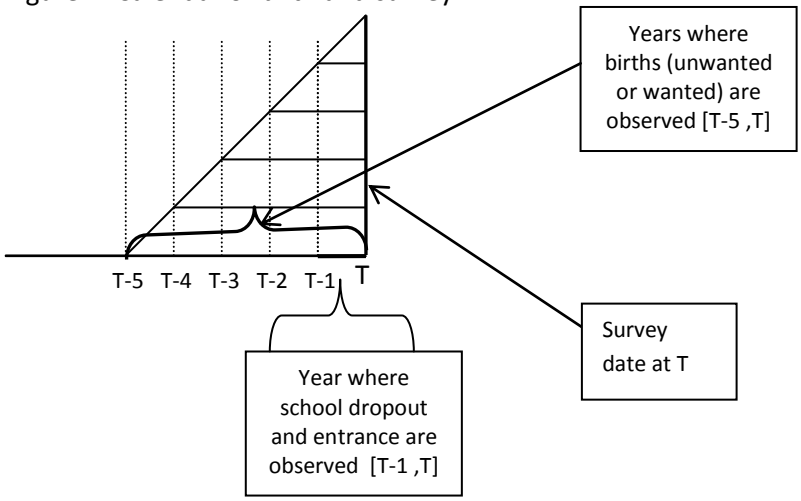
children at all?"Women who said they wanted to become pregnant later were additionally asked to indicate how much longer they wanted to wait.[9].

Our measure of fertility shock is defined as follows: all households hosting a woman who gave birth but who did not wanted to become pregnant then are considered to have experienced an unintended child birth or a fertility shock. Fertility shock is measured as a dummy variable: equals 1 when an unintended birth was reported in the household and equals 0 otherwise. Following Santelli et al. (2003), mistimed[10] pregnancies are not considered unintended[11]. As indicated in figures 1 and 2 bellow, all births are dated.

The schooling dynamic measurement

DHS surveys have a well documented module on education of children aged 6 to 18 years. This paper uses two measurements of schooling dynamics. The first is whether or not a child (between 6 and18 years old) who attended school the year prior to the survey was currently attending school (**dropout**); the second dependent variable indicates whether or not a child (between 6 and9 years old) who was not enrolled in school during the previous year joins the schooling system during the survey year (**entry**).

Figure 1. Calendar of birth and survey



Wealth. A household wealth index is computed by adding up the number of durable goods owned by the household. The maximum value is 11. From the index, the dummy variable Poor indicates whether the household owned only 2 items or less.

[9] Kaufmann et al. (1997) compare the sequence of DHS questions for assessing pregnancy intentions to the corresponding sequence of the National Survey of Family Growth (NSFG) in the U.S and find no systematic bias in the two sequences.

[10] A research note by Pulley et al. (2003) shows that reported mistimed pregnancy is not a unitary construct. Using the National Survey of Family Growth, they observe that. They were few differences between intended and moderately mistimed pregnancies, and between seriously mistimed and unwanted pregnancies.

[11] In some specifications (available upon request), we explicitly account for mistimed pregnancies in two ways. First, we add a dummy variable for mistimed pregnancy in the regression. Second, depending on the mistimed period length, we consider part of mistimed pregnancies as unintended and the other part as intended. These alternative approaches to the data do not alter the main message of this paper.

The sample consists of all 574,414 children aged 6 to 18 in the countries listed. Almost half of them are female and the average age is 11 years. Among them, 63% were enrolled in school the year before the survey. They constitute the group of children at risk in studying dropping out.

Regarding entrance, we are interested in first entry. The actual question is whether the presence in a household of a child born out of an unintended pregnancy delays school entry young children. Young children, aged from 6 to 9 years, are those considered for the analysis of entry to school, and they constitute 37% of the sample. The table 1 presents the descriptive statistics of the main variables.

Table 1: Descriptive statistics of main variables

	Without an unintended child		With an unintended child		Full sample	
	Mean	sd	Mean	sd	Mean	sd
Unintended child					0.10	0.30
At school the year of the survey	0.63	0.69	0.67	0.69	0.63	0.69
Female	0.49	0.50	0.50	0.50	0.49	0.50
Age	11.27	3.65	11.28	3.65	11.27	3.65
Young (aged 6 to 9 years)	0.37	0.48	0.37	0.48	0.37	0.48
Son or daughter of head	0.70	0.46	0.77	0.42	0.71	0.45
Wealth	2.27	2.15	2.06	2.02	2.25	2.13
Poor(Dummy variable)	0.44	0.50	0.48	0.50	0.45	0.50
Household size	7.66	4.14	9.23	4.32	7.81	4.19
Age of head of household	47.91	13.60	46.41	12.03	47.77	13.46
Female head (Dummy varaible)	0.23	0.42	0.24	0.43	0.23	0.42
Head Education (years)	4.01	4.73	4.45	4.36	4.05	4.70
Observation	518538		55465		574414	

The proportion of children living in a household with an unintended child is 10%. This percentage accounts for all unintended children irrespective of their age. Figure 2 shows the percentage of children living in a household with an unintended child of given age. It shows that about 3% of children live in a household where the unintended child was born the year of the survey and that the proportion decrease with age. This decreasing pattern may be due to two factors. The first stems from potential bias due to retrospectively reporting intentions. Such reports of intentions are likely influenced by the present of the child. Reported intentions become generally positive over time (Santelli et al. 2003). The second stems from potential excess mortality of children born out of unintended pregnancies. Many studies have suggested an association between unintended pregnancy and risk factors for poor health outcomes (Kost et al., 1998; Altfeld et al., 1998; Joyce et al., 2000).

Figure 2: Percentage of children living in a household with an unintended child of a given age

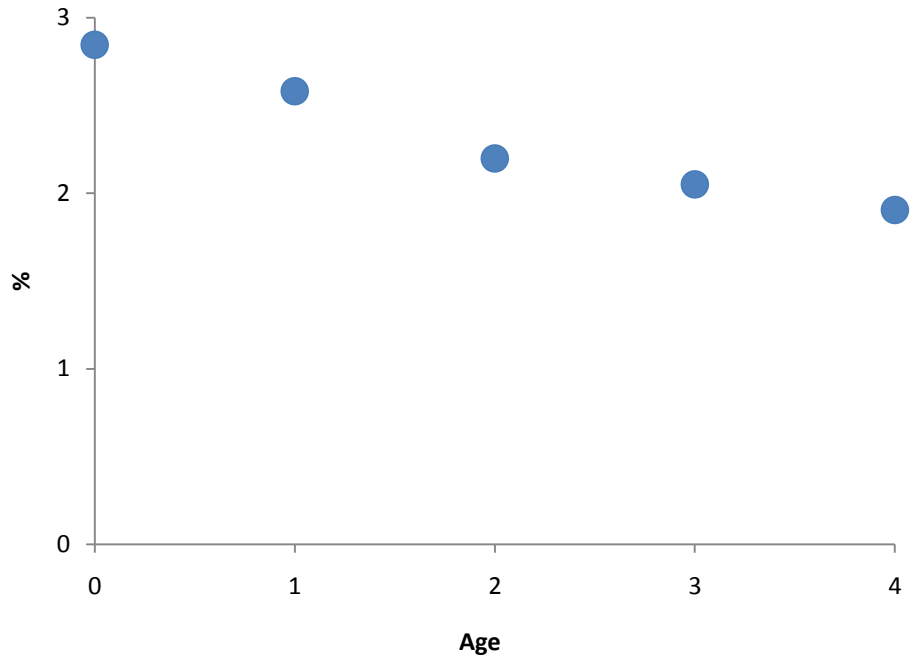


Table 2 shows the comparison of the dropout rate and the entry rate among children living in households with and without an unintended child. To compute the dropout rate, we restrict the sample to children who were enrolled at school the year before the survey. Similarly, to compute the entry rate, the sample is restricted to young children who were not enrolled the year prior to the survey[12]. The outcome of the comparison test is striking. Children living in a household hosting an unintended child have a significantly higher probability of dropping out and a lower probability of starting school. This is the main message of the paper. In the next section, with a regression model, we will investigate whether this message still holds when we take account of potential effects of other variables on dropout and entry rates.

Table 2: Comparison of dropout and entrance rates

	Dropout rate (%)	Entrance rate (%)
With an unintended birth	4	25
Without an unintended birth	3	30
P value	0.00	0.00

[12] The outcome of the comparison test remains if the full sample is used instead.

A linear probability model of schooling

We consider a child who was enrolled in school the year prior to the survey. We define the binary dependent variable Y_{ijk} for a child i of household j in cluster k by:

$$Y_{i,j,k} = \begin{cases} 1 & \text{if child i of household j is enrolled in school} \\ 0 & \text{if child i of household j is not enrolled in school} \end{cases}$$

The linear probability model (LPM) is defined by

$$P\left(Y_{ijk} = 1 \middle| X\right) = X'_{i,j,k}\,\beta + \delta F_{jk} + H'_{j,k}\,\gamma + u_k + \varepsilon_{i,j,k}$$

where X_{ijk} is a vector of child-specific covariates, H_{jk} are household characteristics (proxy for household's wealth, head of household's education, household size) and u_k represents the strata fixed effect, and $\varepsilon_{i,j,k}$ is the unobserved error term.
The variable F_{jk} indicates whether an unintended birth occurred in household j in cluster k over the past four years prior to the survey date.

The vector of covariates X_{ijk} includes child characteristics (gender, age). The strata fixed effect captures all strata observed and unobserved characteristics and in particular, the supply side of education and price of labor. The model is estimated by ordinary least squares (OLS). Estimated standard errors and t statistics are heteroskedasticity-robust. Theoretically, unless the range of X is severely restricted, this model can lead to negative probabilities or to probabilities that are higher than one. However, it turns out that the LPM often seems to give good estimates of the partial effects on the response probability near the center of the distribution of covariates (Wooldridge, 2002, chap. 15). As a robustness check, we use alternative estimators including conditional logit and the ''trimmed estimator'' (Horrace and Oaxaca (2006).

4. Results

The main effect of unintended fertility on school dynamics (dropout and entry)

Table 1A in the annex shows the estimated coefficients of the regression model on dropping out. The dependent variable dropout takes the value 1 when the child is not enrolled at school the current schooling year but was enrolled the year before. The results indicate that the presence of a child (under five) born out of an unintended pregnancy in a household increases the probability that a child (aged 6 to 18) who was enrolled in school drops out. So, an unexpected increase in the number of children increases the dropout rate of children aged 6 to 18 years. The effect is significant and its magnitude is around 1%. The magnitude can be considered relatively low but it is important to underline that it is an annual rate. The medium-term cumulative effect might turn out to be very important.

Table 2A shows the estimated coefficients of the regression model on school entry. The dependent variable school entry takes the value 1 when the child is enrolled the current schooling year but was not enrolled the year before. The school entry rate of children aged 6-9 years old is also significantly lower for children living in a household with an unintended child (table 2A). Actually, the entry rate falls by 1.2% when a household faces a fertility shock. Thus, the presence of a child born out of an unintended pregnancy has a negative impact on schooling. In particular it delays first school entry. It is important to stress the fact that we have controlled for supply side factors through cluster fixed effects and then our results reflect the intrinsic constraints faced by households.

Is there any long-lasting effect?

Whereas we can only observe school dynamics (dropout or entry) between the previous year and the year of survey, DHS data record the status of all the births (wanted/unwanted) that occurred during the last five years before each survey (Figure 1). It's then possible to disentangle the effect of fertility shock according to the age of the unintended child (within the five-year interval preceding the survey) and then to elaborate on the nature the link. Is the timing of the shock of interest?

The results (table 3A in annex) show that the effect of fertility shock on school entry and dropout seems to be transitory. Indeed, the effect of the presence of an unintended child on dropping out declines over time, from 1.4% the year of the birth to 0.76% one year after the fertility shock. Beyond the second year the coefficients become very low and not statistically significant. Regarding school entry, the effect of the presence of an unintended child is restricted to the year of birth. An unintended birth reduces the entry rate by 2.7% the birth year, and there is no effect at all afterward.

But the immediate link between unexpected birth and school entry or exit should not attenuate its damaging effect for at least two reasons. First, children who drop out from school lost years of education. Second, giving that childbearing spans a longer period of time, the consequences of an unintended birth might end up having a long-term effect on the total number of grades in school that a child would accumulate throughout his schooling course.

Household wealth effect

The second source of heterogeneity of the fertility shock effect is household position in the wealth distribution. If the household belongs to the poorest group, then in case of an exogenous adverse fertility shock, given that it cannot reduce its consumption of other goods, the only adjustment mechanism would be through reducing schooling expenditures. Investment in education would be sacrificed. The analysis confirms this assertion, but with a nuance according to the school dynamic considered (exit or entry). In case of fertility shock, dropping children out from school is a strategy used by almost all the households whatever their position in the wealth distribution (table 1A). This result reflects the burden of a fertility shock. Even non-poor households need to adjust their behavior to cope with such a shock.

Regarding school entry (table 2A), the presence of an unintended child seems to negatively affect school entry only among the poor. The effect is significant and its magnitude is about

1.3%. Unlike the poor, the presence of an unintended child has no effect on child school entry among non-poor households.

The fact that adjustment via dropout is similar along the wealth distribution while adjustment via entry is essentially used only by poor households could be interpreted as follows: in case of an exogenous shock, dropping some children from school is sufficient to reach another acceptable equilibrium for wealthier households while poorer ones need an additional severe adjustment which occurs through reducing school enrollment of 6-9 year old children.

Fertility shock and gender of the schooling child

In discussing the interaction of gender with fertility shock, we begin with a look at its marginal effect. Everything else being equal, girls face a higher risk than boys of not being enrolled in school and of dropping out (tables 1A and 2A). This is very often observed in developing countries. Column 5 of table 1A reveals that, when a household experiences a fertility shock, the schooling situation of girls worsens as the dropout rate almost doubles. At least two mechanisms can be put forward to explain this configuration. The first may be the fact that girls' education is less valued than education of boys in the household. So when household faces adverse shock that reduces per child resources, the "optimal" adjustment is to reduce investment in girls' quality rather than in that of boys. We can call this a "preference" mechanism. The second one is more specific to childbearing shock: a new baby needs care and rearing. These activities are traditionally devoted to women and girls, a sort of specialization in housework. So a birth, especially an unexpected one, increases the opportunity cost of girls' schooling. The school dropping out could reflect, for some girls, this increase. When considering school entry, girls do not face an additional disadvantage due to the arrival of a new baby (Column 5 table 2a).

Fertility shock and the relationship to household head of the schooling child

In the African context, child fostering is a widespread practice and is very often described as reflecting some form of extended-family solidarity. Yet it's unclear whether fostered children receive equivalent investment in human capital as that of the household head's own children. Some studies conclude that fostered children are discriminated against whereas others come out with opposite results (Pilon. 2003 provides a literature review). In this study, it appears that fostered children face higher dropout rates. The probability of dropping out is 1.2% higher for fostered children. Children of the household head are also more likely to start schooling compared to fostered children (table 1A and 2A). When an unexpected birth occurs in a given household, fostered kids' probability of dropping out of school is 1.2% compared to 0.41% for the household head's own children. So this result tends to suggest that in case of adverse shocks, consequences are transferred on to fostered children even though they are already initially disadvantaged. Regarding school entry, there is no additional disadvantage due to fertility shock.

The newborn characteristics (relationship to the household's head) also matter.

As stated in the conceptual framework, the importance given to each newborn (through the amount or resources devoted to him, k) may depend on its relationship to the household

head.. Given that in this study we suppose that the effect of unexpected childbearing passes through the tightening of the resource constraint, we should expect the impact of child bearing on school outcomes to vary according to the relationship of the newborn to the head of the household. In table 4A, we investigate the effect of the unintended birth according to whether the birth is by the spouse of the household head or not. The results in table 4A show that unexpected child bearing from the household head spouse positively affects school dropout and negatively influences school entry. But when the additional baby belongs to a secondary[13] female household member, it hardly influences school entry.

The effect of unintended fertility on current school enrolment

Finally, we look at the average effect of living in a household with an unintended child on school enrolment. Table 7A shows the estimated coefficients of the regression model of school enrolment. The dependent variable takes the value 1 when the child was enrolled in school the year of the survey. The model is estimated for all children aged 6 to 18. The table shows that, on average, living in a household that hosts a child born out of an unintended pregnancy hinders school enrolment in general.

Robustness checks

Horrace and Oaxaca (2006) stress the bias and inconsistency of OLS on the linear probability model and suggest that a ''trimmed estimator'' may reduce OLS bias. We implement the "trimmed estimator" proposed by restricting the sample size to observations for which the predicted probabilities are between 0 and 1. The trimmed sample represents 86% of the initial sample on dropout. In the case of school entry, all predicted values are between 0 and 1. The results from the estimated "trimmed estimator" (table 5A) are qualitatively similar.

The alternative to the LPM would be a fixed-effects Logit model. The condition fixed-effects Logit model is not suitable in this case because only clusters that display some heterogeneity in the outcome variable are taken into account in estimating the model. The requirement is very binding in this set-up because in many clusters in our sample, even when children characteristics are different, the outcome variable takes only either the value one or the value zero. That is, all children in those clusters are either in or out of school. Discarding them would be ignoring important variations in the whole schooling process. However, Table 6A shows estimated coefficients of a conditional fixed-effects logit. It also shows the reduction in sample sizes. For school dropout, the sample is reduced by 50%. Regarding school entry, the sample is reduced by 22%. It is striking to observe that, even on these sub-samples, the patterns of our results remains.

Finally, we restricted the sample used to estimate dropout, entry and school enrolment to households that have witness a new-born over the five years prior to the survey data. The restriction allows identifying the effect of having an unintended birth as compared to that of having a child born out of a wanted pregnancy. The results are shown in table 8A. The

[13] i.e who is not the spouse of the head of household, nor the household head herself

coefficient of the variable unintended birth suggests that, compared to intended birth, unintended still have a damaging effect on schooling and schooling dynamics.

5. Conclusion

When family planning is widespread, fertility is largely under control and births due to unexpected pregnancies are unusual. In such contexts, families with given preferences (observable and unobservable) and constraints, first desire a kid and then give birth after. On the contrary, in many developing countries, and especially in the African context, effective contraceptive methods, even when available, are seldom used. Some children are born out of an unintended pregnancy. The birth of unintended child is unexpected and can be viewed as a shock that households must cope with. In this study we focus on impacts of this shock on household schooling investments. More specifically, we are interested in changes in school entry and dropout following the birth of an unintended child. We use nearly 30 DHS databases on 20 sub-Saharan African countries. All surveys were conducted after the year 2000. The surveys make it possible to capture recent school dynamics on the one hand, and on the other, to identify children born out of unintended pregnancies among births that occurred within a five-year interval prior to the surveys. To measure the effect of this unexpected childbearing on schooling, we use a linear probability model (LPM) and control for unobservable heterogeneity with fixed-effects. The results show that fertility shocks lead to an underinvestment in young children's education. That is, when an unexpected birth occurs in a given household, all else equal, it reduces the probability of first school entry of children aged 6 to 9 years and increases the dropout rate of children aged 6 to 18 years already in school. This paper also investigates whether the heterogeneity of fertility shocks is relevant for schooling. Do gender and the relationship to the household head of the unintended child affect schooling differently? In parallel, are some children more affected by the fertility shock? The results suggest that an unintended birth that occurs during the current academic year is more damaging for current school enrolment than those that occurred 2 to 4 years prior to the academic year. In addition, an unintended child of the household head has a more damaging effect than an unintended child of other household members.

The results suggest that children of the household head are less affected by the presence of an unintended child in the household compared to other children living in the household. Female children are more affected by the presence of an unintended child in the household than male. Overall, the results of this paper suggest that the presence of child born out of an unintended pregnancy in a household affect negatively current schooling. Such an effect could have long-lasting consequences on human capital accumulation. Pushing for effective use of contraception should thus remain in the policy agenda of African policy makers.

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Annex

Table 1A: LPM of recent fertility shock on current school drop-out of children aged 6-18 years

VARIABLES	(1) All_	(2) Poorer	(3) Richer	(4) Male	(5) Female	(6) Son/daughter of hh head	(7) Other children
Unintended birth	0.0057***	0.0064***	0.0050***	0.0012	0.0102***	0.0041***	0.0122***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.003)
Son or daughter of the head	-0.0121***	-0.0073***	-0.0155***	-0.0084***	-0.0160***		
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)		
Female	0.0064***	0.0074***	0.0060***			0.0043***	0.0108***
	(0.001)	(0.001)	(0.001)			(0.001)	(0.001)
Age	0.0097***	0.0103***	0.0091***	0.0088***	0.0108***	0.0085***	0.0115***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Wealth proxy	-0.0025***	-0.0039***	-0.0018***	-0.0022***	-0.0029***	-0.0026***	-0.0026***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Schooling delay[14]	0.0021***	0.0012**	0.0023***	0.0027***	0.0017***	0.0023***	0.0015***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Household size	-0.0004***	-0.0007***	-0.0004***	-0.0005***	-0.0003**	-0.0004**	-0.0004*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Head of household age	-0.0001***	-0.0001**	-0.0002***	-0.0001**	-0.0002***	0.0002***	-0.0002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female headed household	-0.0043***	-0.0036**	-0.0060***	-0.0047***	-0.0043***	0.0002	-0.0071***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Head of household education	-0.0007***	-0.0015***	-0.0005***	-0.0007***	-0.0007***	-0.0007***	-0.0010***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.0511***	-0.0577***	-0.0457***	-0.0444***	-0.0539***	-0.0642***	-0.0724***
	(0.003)	(0.006)	(0.004)	(0.004)	(0.004)	(0.003)	(0.006)
Observations	341,235	127,815	213,420	178,016	163,219	240,651	100,584
R-squared	0.025	0.024	0.027	0.020	0.032	0.021	0.031
Number of strata	13,194	10,620	11,900	13,102	12,841	13,137	12,037

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

[14] This variable measures the difference between hypothetical grade of a child and its current grade. The hypothetical grade is computed under the assumption that the child starts schooling at the age of 6 and advances one grade every year.

Table 2A: LPM of recent fertility shock on current school entry of children aged 6-9 years

	(1) All_	(2) Poorer	(3) Richer	(4) Male	(5) Female	(6) Son/daughter of hh head	(7) Other children
Unintended birth	-0.0116**	-0.0127**	-0.0059	-0.0052	-0.0088	-0.0078	-0.0063
	(0.005)	(0.006)	(0.009)	(0.007)	(0.007)	(0.005)	(0.013)
Son or daughter of the head	0.0240***	0.0148***	0.0368***	0.0153***	0.0283***		
	(0.003)	(0.004)	(0.005)	(0.005)	(0.005)		
female	-0.0072***	-0.0041	-0.0131***			-0.0086***	0.0039
	(0.002)	(0.003)	(0.004)			(0.003)	(0.006)
age	0.0429***	0.0480***	0.0370***	0.0479***	0.0382***	0.0469***	0.0391***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.003)
Wealth proxy	0.0292***	0.0298***	0.0280***	0.0294***	0.0287***	0.0303***	0.0287***
	(0.001)	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Household size	-0.0024***	-0.0031***	-0.0016***	-0.0034***	-0.0017***	-0.0026***	-0.0012
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Head of household age	-0.0001	-0.0001	-0.0003	-0.0000	-0.0002	-0.0010***	0.0009***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female headed household	0.0167***	0.0135***	0.0268***	0.0110*	0.0237***	0.0009	0.0304***
	(0.004)	(0.005)	(0.008)	(0.006)	(0.006)	(0.005)	(0.008)
Head of household education	0.0106***	0.0102***	0.0099***	0.0109***	0.0106***	0.0116***	0.0086***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Constant	-0.1133***	-0.1324***	-0.0777***	-0.1333***	-0.0926***	-0.0913***	-0.1060***
	(0.011)	(0.015)	(0.019)	(0.016)	(0.015)	(0.012)	(0.026)
Observations	115,404	64,706	50,698	58,181	57,223	87,785	27,619
R-squared	0.028	0.026	0.024	0.031	0.027	0.033	0.022
Number of strata	12,141	9,480	9,728	11,160	11,060	11,446	9,417

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3A LPM of recent fertility shock on current school entry and dropout: timing of the unexpected birth

VARIABLES	(1) Dropout	(2) Entry
Unintended birth the year of survey	0.0139***	-0.0273***
	(0.002)	(0.008)
Unintended birth in year before survey	0.0076***	0.0023
	(0.002)	(0.009)
Unintended birth two years before survey	0.0027	-0.0155
	(0.002)	(0.009)
Unintended birth three years before survey	0.0002	-0.0002
	(0.002)	(0.009)
Unintended birth four years before survey	-0.0035	-0.0107
	(0.002)	(0.010)
Son or daughter of the head	-0.0120***	0.0241***
	(0.001)	(0.003)
Female	0.0063***	-0.0073***
	(0.001)	(0.002)
Age	0.0097***	0.0429***
	(0.000)	(0.001)
Wealth proxy	-0.0025***	0.0292***
	(0.000)	(0.001)
Schooling delay	0.0021***	
	(0.000)	
Household size	-0.0005***	-0.0023***
	(0.000)	(0.000)
Head of household age	-0.0001***	-0.0001
	(0.000)	(0.000)
Female headed household	-0.0043***	0.0167***
	(0.001)	(0.004)
Head of household education	-0.0007***	0.0106***
	(0.000)	(0.001)
Constant	-0.0513***	-0.1134***
	(0.003)	(0.011)
Observations	341,235	115,404
R-squared	0.026	0.029
Number of strata	13,194	12,141

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Schooling delay measures the difference between hypothetical grade of a child and its current grade. The hypothetical grade is computed under the assumption that the child starts schooling at the age of 6 and advances one grade every year.

Table 4A LPM of a spouse fertility shock on current school entry and dropout: effect unintended head's child

VARIABLES	(1) Dropout	(2) Entry
Unintended head's child	0.0032**	-0.0135***
	(0.001)	(0.005)
Unintended non head's child	0.0129***	0.0017
	(0.003)	(0.012)
Son or daughter of the head	-0.0118***	0.0245***
	(0.001)	(0.003)
Female	0.0063***	-0.0072***
	(0.001)	(0.002)
Age	0.0097***	0.0429***
	(0.000)	(0.001)
Wealth proxy	-0.0025***	0.0292***
	(0.000)	(0.001)
Schooling delay	0.0021***	
	(0.000)	
Household size	-0.0005***	-0.0024***
	(0.000)	(0.000)
Head of household age	-0.0001***	-0.0001
	(0.000)	(0.000)
Female headed household	-0.0045***	0.0166***
	(0.001)	(0.004)
Head of household education	-0.0007***	0.0106***
	(0.000)	(0.001)
Constant	-0.0506***	-0.1134***
	(0.003)	(0.011)
Observations	341,235	115,404
R-squared	0.026	0.028
Number of strata	13,194	12,141

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Schooling delay measures the difference between hypothetical grade of a child and its current grade. The hypothetical grade is computed under the assumption that the child starts schooling at the age of 6 and advances one grade every year.

Table 5A: Estimated LPM on a trimmed sample (Horrace and Oaxaca procedure)

VARIABLES	(1) dropout	(2) entry
Unintended child	0.0076***	-0.0116**
	(0.001)	(0.005)
Son or daughter of the head	-0.0160***	0.0240***
	(0.001)	(0.003)
Female	0.0095***	-0.0072***
	(0.001)	(0.002)
Age	0.0129***	0.0429***
	(0.000)	(0.001)
Wealth proxy	-0.0036***	0.0292***
	(0.000)	(0.001)
Schooling delay	0.0031***	
	(0.000)	
Household size	-0.0006***	-0.0024***
	(0.000)	(0.000)
Head of household age	-0.0002***	-0.0001
	(0.000)	(0.000)
Female-headed household	-0.0057***	0.0167***
	(0.001)	(0.004)
Head of household education	-0.0011***	0.0106***
	(0.000)	(0.001)
Constant	-0.0840***	-0.1133***
	(0.004)	(0.011)
Observations	294,609	115,404
R-squared	0.029	0.028
Number of strata	13,187	12,141

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Schooling delay measures the difference between hypothetical grade of a child and its current grade. The hypothetical grade is computed under the assumption that the child starts schooling at the age of 6 and advances one grade every year.

Table 6A : Conditional fixed effect logit model and LPM of school dropout (same sample for clogit and LPM)

	(1) Clogit	(2) LPM
The dependant variable is dropout		
Unintended child	0.1928***	0.0101***
	(0.036)	(0.002)
Son or daughter of the head	-0.3997***	-0.0227***
	(0.024)	(0.002)
Female	0.2623***	0.0119***
	(0.022)	(0.001)
Age	0.3886***	0.0186***
	(0.006)	(0.000)
Wealth proxy	-0.1106***	-0.0051***
	(0.009)	(0.000)
Schooling delay	0.0855***	0.0038***
	(0.006)	(0.000)
Household size	-0.0143***	-0.0008***
	(0.004)	(0.000)
Head of household age	-0.0030***	-0.0002***
	(0.001)	(0.000)
Female headed household	-0.1474***	-0.0083***
	(0.027)	(0.002)
Head of household education	-0.0357***	-0.0015***
	(0.003)	(0.000)
Constant		-0.1000***
		(0.006)
Observations	170,727	170,727
R-squared		0.050
Number of strata		5,798

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

Schooling delay measures the difference between hypothetical grade of a child and its current grade. The hypothetical grade is computed under the assumption that the child starts schooling at the age of 6 and advances one grade every year.

Table 6A : Conditional fixed effect logit model and LPM of school entry (same sample for clogit and LPM)

	(1) clogit	(2) LPM
The dependant variable is school entry		
Unintended child	-0.0794**	-0.0149**
	(0.032)	(0.006)
Son or daughter of the head	0.1753***	0.0314***
	(0.024)	(0.004)
Female	-0.0524***	-0.0098***
	(0.018)	(0.003)
Age	0.3378***	0.0587***
	(0.009)	(0.002)
Wealth proxy	0.1951***	0.0373***
	(0.009)	(0.002)
Household size	-0.0176***	-0.0031***
	(0.003)	(0.001)
Head of household age	-0.0007	-0.0001
	(0.001)	(0.000)
Female headed household	0.1309***	0.0235***
	(0.026)	(0.005)
Head of household education	0.0618***	0.0128***
	(0.003)	(0.001)
Constant		-0.1863***
		(0.015)
Observations	85,233	85,233
R-squared		0.037
Number of strata		8,153

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7A: LPM of recent fertility shock on current school enrolment of children aged 6-18 years

	(1) All_	(2) Poorer	(3) Richer	(4) Male	(5) Female	(6) Son/daughter of hh head	(7) Other children
The dependant variable is current school enrolment							
Unintended birth	-0.0157***	-0.0200***	-0.0102***	-0.0044	-0.0264***	-0.0132***	-0.0226***
	(0.002)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)
Son or daughter of the head	0.0782***	0.0465***	0.1018***	0.0598***	0.0926***		
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)		
female	-0.0382***	-0.0320***	-0.0422***			-0.0322***	-0.0453***
	(0.001)	(0.002)	(0.002)			(0.001)	(0.002)
age	-0.0039***	0.0012***	-0.0075***	0.0002	-0.0083***	0.0028***	-0.0129***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Wealth proxy	0.0219***	0.0388***	0.0166***	0.0221***	0.0215***	0.0261***	0.0142***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Household size	-0.0001	-0.0005	0.0000	-0.0004	0.0003	0.0000	-0.0003
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Head of household age	0.0009***	0.0009***	0.0009***	0.0008***	0.0011***	-0.0009***	0.0011***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female headed household	0.0340***	0.0306***	0.0438***	0.0345***	0.0344***	0.0067***	0.0456***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Head of household education	0.0090***	0.0133***	0.0075***	0.0094***	0.0088***	0.0105***	0.0072***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.5136***	0.4277***	0.5922***	0.4840***	0.5126***	0.5684***	0.6860***
	(0.005)	(0.008)	(0.006)	(0.006)	(0.006)	(0.005)	(0.008)
Observations	574,407	256,317	318,090	293,974	280,433	407,706	166,701
R-squared	0.023	0.012	0.031	0.018	0.028	0.022	0.022
Number of strata	13,484	11,505	12,304	13,473	13,468	13,468	13,310

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 8A: LPM of recent fertility shock on dropout, entry and current school enrolment of children (sample restricted to households with new born)

	Dropout (6-18 year)	Entry (6-9 years)	enrolment(6-18 year)
Unintended birth	0.0036**	-0.0078	-0.0052**
	(0.001)	(0.005)	(0.003)
Son or daughter of the head	-0.0150***	0.0377***	0.0960***
	(0.001)	(0.004)	(0.002)
Female	0.0085***	-0.0081***	-0.0506***
	(0.001)	(0.003)	(0.002)
Age	0.0087***	0.0458***	-0.0002
	(0.000)	(0.001)	(0.000)
Wealth proxy	-0.0028***	0.0288***	0.0244***
	(0.000)	(0.002)	(0.001)
Schooling delay	0.0014***		
	(0.000)		
Household size	-0.0007***	-0.0019***	0.0012***
	(0.000)	(0.000)	(0.000)
Head of household age	-0.0000	-0.0003**	0.0004***
	(0.000)	(0.000)	(0.000)
Female headed household	-0.0017	0.0093*	0.0280***
	(0.001)	(0.005)	(0.003)
Head of household education	-0.0008***	0.0108***	0.0106***
	(0.000)	(0.001)	(0.000)
Constant	-0.0400***	-0.1483***	0.4310***
	(0.004)	(0.014)	(0.006)
Observations	178,593	80,527	328,404
R-squared	0.025	0.032	0.027
Number of strata	12,912	11,142	13,378

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Schooling delay measures the difference between hypothetical grade of a child and its current grade. The hypothetical grade is computed under the assumption that the child starts schooling at the age of 6 and advances one grade every year

Table 9A: List of countries and years of the DHS survey.

Country	Year (s) of the survey (s)
Benin	2001, 2006
Burkina Faso	2003
Cameroon	2004
Congo.	2005
Democratic Republic of Congo.	2007,
Ethiopia	2000, 2005
Ghana	2003, 2008
Kenya	2003, 2008
Guinea	2005
Lesotho	2004
Liberia	2007
Madagascar	2003-04, 2008-09
Malawi	2000, 2004
Mali	2001, 2006
Mozambique	2003
Namibia	2000, 2006-07
Niger	2006
Nigeria	2003, 2008
Senegal	2005
Tanzania	2004-05

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