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BEING BORN OUT-OF-WEDLOCK: DOES IT AFFECT A CHILD'S SURVIVAL CHANCE? AN EMPIRICAL INVESTIGATION FOR SENEGAL

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Abstract

In this paper, we are interested in the effect of birth status, being born out-of-wedlock or in wedlock, on survival chance before two years old of siblings of same gender in Senegal. The analysis is based on nationally representative data, those from the Demographic and health survey, collected in the country in 2010-2011. Data from the youngest cohort of mothers are exploited. On average, no significant effect is found. This masks significant variations between sub-groups of children. However, contrary to initial expectations, children born out-of-wedlock have similar mortality rate than their siblings born in wedlock, at worst. In some case, their mortality rate is lower. This suggests that resource-based mechanisms exist in Senegal that helps mothers, with an out-of-wedlock birth, to compensate and sometime over-compensate for lack of resource or for fragility. These mechanisms seem to vary between areas and ethnic groups depending on the gender of the child born out-of-wedlock. The only group of children with a higher risk of death is the group of girls born out-of-wedlock, whose mother was adolescent when giving birth to them, belonging to the Serere ethnic group. Informal, private compensatory mechanism does not seem to take place in this specific case.

Key words: Premarital fecundity, marriage, children's mortality, Senegal

Résumé

Cet article s'intéresse aux conséquences du statut à la naissance, être né dans le cadre d'une union maritale ou non, sur les chances de survie au cours des deux premières années de vie d'enfants de même sexe et issus d'une même fratrie au Sénégal. L'analyse est réalisée à partir des données des enquêtes démographiques et de santé collectées dans le pays en 2010-2011 et représentatives au niveau national. L'échantillon utilisé pour l'analyse est celui des mères appartenant aux plus jeunes cohortes. En moyenne, nous n'observons pas d'impact significatif d'être né hors mariage sur la mortalité des enfants relativement à leurs frères et sœurs de même sexe nés dans le cadre d'un mariage. Cependant, ce résultat masque des différences importantes parmi plusieurs sous-groupes d'enfants. Contrairement aux attentes initiales, les enfants nés hors mariage ont des taux de mortalité similaires à leurs frères et sœurs nés dans le cadre d'un mariage et, dans certains cas, ils présentent même des taux de mortalité plus faibles. Ces résultats suggèrent l'existence de mécanismes de solidarité au Sénégal qui aident les mères ayant eu une naissance hors mariage à compenser et parfois même surcompenser un manque de ressources ou une plus forte vulnérabilité. Ces mécanismes semblent varier par zones géographiques et groupes ethniques en fonction du sexe de l'enfant né hors mariage. Seules les filles nées hors mariage appartenant au groupe ethnique des Sérères et dont la mère était adolescente à la naissance de son premier enfant, présentent un risque de mortalité plus élevé. Des mécanismes compensatoires privés informels ne semblent pas s'établir dans ce cas spécifique.

Mots Clés : Fécondité prémaritale, mariage, mortalité infantile, Sénégal

JEL Code: I2, J1, O1

1 Introduction

Child mortality in Sub-Saharan Africa is the highest in the world and exhibits low rates of decline¹. Understanding better the factors driving these persisting high levels of child mortality is therefore clue. In the analysis of the determinants of children’s mortality, women’s poor education, poor health and nutrition as well as adolescent childbearing have been identified as major risk factors (Smith et al., 2003; Conde Agudelo et al., 2005; Guilbert, 2013). Surprisingly, the role of the mother’s marital status at the day of the child’s birth (being married or not, in polygynous union or not) has received little attention. Yet effects are expected since the amount of resources a mother can allocate to her new-born child are likely to be influenced by her marriage status at the child’s birth². In this paper, we are interested in the specific effect of being born out-of-wedlock, that is of being born before the mother’s first marriage. Precisely, we wonder whether two children born from the same mother have a differential mortality rate depending on whether one was born out-of-wedlock and the other in wedlock.

According to Demographic and Health Survey (DHS) data from 25 countries, an average of one in five women in Sub-Saharan Africa had a birth before marriage (Garenne and Zwang, 2006). In Senegal, the context of our study, this proportion amounts to 15% (DHS 2010). Premarital fecundity is not only frequent, it is also rising (whereas total fecundity is globally decreasing): Garenne (2008) compute that, from 1950 to 2000, the proportion of premarital birth in the region increased by 50 percent, rising from 3.8 to 5.7 percent. In Senegal, over the period 1992-2010, comparing data from two DHS, the proportion of women who ever had a premarital birth increased about 2 percentage points. In Senegal, data collected since mid-80’ from two population centers (one located near the capital city Dakar, Niakhar, and another at Mlomp near Ziguinchor in the southern part of the country) show that the frequency of premarital fecundity varies across regions and ethnic groups. While the Serere ethnic group is over-represented in Niakhar, the Diola ethnic group is in Mlomp. In Niakhar, among first-born children born between 1984 and 1995, 16.6% were born before their mother’s first marriage³. In Mlomp, 40% of the children born between 1985 and 1999 were born to single mothers. For demographers, the fact that sexuality and procreation are more and more dissociated in the region can explain the rise of premarital fecundity (Onuoha, 1992; Bledsoe and Cohen, 1993; INED, 2013). Delay of first marriage, if not associated with an increased use of contraceptive methods, can then explain this increase.

A child born out-of-wedlock might have a higher mortality rate than a sibling of same mother born in wedlock for at least three reasons: (1) he potentially lacks the resources a child born from a married mother has access to (financial resources provided by the legitimate father; financial, moral support provided by the in-laws); (2) he is more frequently the first-born child of his mother and he might be more fragile because his mother lacks of knowledge on how taking care of a new-born child (Mahy (2003)); (3) he is the first child of his mother and he might be more fragile than his subsequent siblings of same mother if his mother gave birth to him while being very young. Adolescent childbearing is indeed very risky in terms of both maternal and

¹Based on the 2012 United Nations report on the Millennium Development Goals, mortality rate reduced by 2.4% over the period 2000-2010 in Sub-Saharan Africa.

²Wagner and Mathias (2011) and Gibson and Mace (2007) have for instance investigated the link between children health and mother’s polygynous status (and spouse rank) respectively in 28 Sub-Saharan African countries and in rural Ethiopia. Clark and Hamplová (2013) have analyzed the relationship between single motherhood and child mortality in 11 countries in Sub-Saharan Africa.

³The proportion of premarital pregnancy amounts to 24.4%. Interestingly one third of the premarital pregnancies are legitimated by a marriage before the child’s baptism (often the day of the child’s baptism).

child survival rates (see for instance Meekers (1994); Guilbert (2013)). If channels (2) and (3) are not specific to children born out-of-wedlock, channel (1) is. The higher is the social stigma on premarital births in a country, the tighter should be the resource constraints on raising a child born out-of-wedlock. In presence of social stigma, a single-mother might have difficulties to marry⁴. However, even if she accomplishes marriage, her child born out-of-wedlock may still suffer from discrimination by the in-laws. Marrying the child's father does not necessarily protect the child if the in-laws, who host the mother and the child in most patrilocal societies, feels like the marriage has been forced⁵.

These three channels are likely to be at work in Senegal. In the country, marriage is the arena of reproduction (Dial (2008)) and, according to informal discussions conducted by the authors during 2012, conforming to this social norm still raises consensus, even among urban women of the capital city Dakar⁶. In (Guilbert and Marazyan, 2013), we show that Senegalese women giving birth out-of-wedlock marry later than other women, controlling for several current and background characteristics. If this delay in marriage signals that women with an out-of-wedlock birth are marginalized in the marriage market, then one might worry that children born out-of-wedlock in Senegal receive less resources not only the first years of their live up to their mother's marriage, but also following their mother's marriage. That being said, in Senegal, vulnerable people can count on several types of network to manage their situation. Single-mothers should count on their own kin to mitigate the negative effects, on their welfare and on the one of their child, of any marginalization on the marriage market and/or from the in-laws if they are married. Women's kin can provide assistance through various ways: by making financial transfers and by hosting the single-mother and her child⁷. Therefore, for Senegal, the effect of being born out-of-wedlock on a child's survival rate is difficult to assess on a priori ground. Empirical studies based on large representative data are therefore needed.

To evaluate the effect of out-of-wedlock births on children's survival rate in Senegal, we use data from the Demographic and Health Survey, nationally representative, collected in Senegal in 2010 and 2011. Our methodology consists in comparing the survival status before their two years old of siblings of same gender, given the marital status of their mother at their birth, using a logit model with mother fixed effects. Mortality rate comparison before two years old is justified to overcome the fact that in DHS we do not know whether dead children were residing with their mother or with someone else at the time of their birth. In Senegal, children are used to being fostered out starting from age two. Since fostering-out and out-of-wedlock birth are outcomes which are positively correlated (see Guilbert and Marazyan (2013)), looking at mortality rate differences at higher ages raises the risk of confounding the effect of being

⁴Exploiting data from the population observatory in Niakhar, Adjamagbo et al. (2004) show that marriage is delayed after the birth of a child unless women can marry the child's father which is facilitated if they belong to the same ethnic group (the Serere). If the woman cannot marry the child's father, the fact that she marries later is interpreted by the authors as the sign of the marginalisation of single-mothers on the local marriage market. The fact that the birth of a child delays women's marriage has been observed in other contexts of Sub-Saharan Africa and has also been interpreted as the consequence of social stigma (Johnson-Hanks, 2005; Calvès, 1999).

⁵Ethnographic evidence suggest that births that are out-of-wedlock can also be planned e.g. thought as a mean for a couple to impose their marriage to their family (Dramé (2003); Abega et al. (1994)). Because in such a case the birth is desired, one can consider that the child born out-of-wedlock and his subsequent siblings should be treated as same, at least by their parents. These case are however difficult to identify using standard survey data.

⁶Among the Fulani, one of the two main ethnic groups in the country, early marriage is notably justified as a mean to prevent girls from having a birth while not being married.

⁷The kin can also assist by fostering-in the child after the mother's marriage. In his foster-home, the fact that a child is born out of wedlock should raise less attention. He should therefore receive as much resources as any foster-child in his foster-home.

born out of wedlock and of having been fostered out⁸. This risk is minimized by examining the mortality before two years old. We consider separately children born from mothers who had their first born child while young (less than 18 years old) and for children born from mothers who had their first born child older (18 years old and more). The rationale is that early pregnancy can be a channel through which children born out-of-wedlock have a higher mortality rate (channel (3)). Then comparing groups of women who have the same age at first birth (either adolescent or adult) allows to better isolate the effect of resource constraints from health effects, if any.

To evaluate whether sub-groups of children are at particular risk, we test the extent to which the estimated average effect varies with the mother's marital status at the child's two years old (married/still single), the mother's ethnicity and residing location at the day of interview. Social acceptance of premarital fecundity can indeed vary between ethnic groups and urban and rural locations in Senegal. It would have been interesting also to test whether the effect found varies with whether the mother finally marries the child's father or not. This information is however not available in the DHS. Not taking into account this heterogeneity within the group of children born out-of-wedlock is likely to minimize the estimated average effect⁹. At last, one should remind that any analysis of the effect of premarital fecundity on child mortality suffers from underestimation bias due to the fact that infanticide or abandon, which could be related to premarital fecundity, are not well measured in standard demographic data¹⁰. This is why the effect we estimate should be considered as a lower bound of the true effect. This work adds to existing ones for other countries of Sub-Saharan Africa (Johnson-Hanks, 2005; Gyepi-Garbrah, 1985; Meekers, 1994; Emina, 2011; Calvès, 1999). The careful discussion of sub-groups of children at particular risk is specific to our analysis, as is the control for women unobserved fixed characteristics.

On average, we do not find any significant effect. This result masks significant variations between sub-groups of children. In many cases however children born out-of-wedlock have, at worst, similar mortality rate than their siblings born in wedlock. This suggests that resource-based mechanisms exist in Senegal that help mothers, with an out-of-wedlock birth, to compensate and sometime over-compensate for lack of resource or for fragility associated with single motherhood. These mechanisms seem to vary between areas and ethnic groups depending on the gender of the child born out-of-wedlock. The only group of children with a higher risk of death is the group of girls born out-of-wedlock, whose mother was adolescent when giving birth for the first time, belonging to the Serere ethnic group. Informal, private compensatory mechanism does not seem to take place in this specific case.

The remainder of the paper is organized as follows. Section 2 presents the data and summary statistics. Section 3 presents the estimation of the effect of being born out-of-wedlock on children's mortality. Section 4 presents the heterogeneity analysis. Finally, Section 5 concludes.

⁸Emina (2008) has worked on the implication of out-of-wedlock childbearing on household structure. He found for Cameroon that children born out-of-wedlock are more likely to be fostered out than children born in wedlock.

⁹This information could be recovered for a sub-sample of children: those young enough to co-reside with their mother at the day of interview and who have not been fostered out. Co-residency with the father could be then observed by looking at data collected at the household level. However, since fostering out and out-of-wedlock birth are positively correlated in Senegal (Guilbert and Marazyan (2013)), this implies that the sample of children born out of wedlock still residing with their mother after 2 years old is potentially a selected sample.

¹⁰According to Calvès (2006) these dramatic consequences are not isolated cases in the Cameroonian context.

2 The 2010 DHS data

We use the Senegalese demographic and health survey data, collected in 2010-2011 in the country, which are representative at the national level. While the initial sample counts 15 335 women aged 15 to 49 years old, we restrict our analysis to women aged between 15-35 years old (of number 11 836). Indeed, out-of-wedlock births are events that occur rather early in women’s reproductive life and there is a risk of recall bias on such events with interviewing women from older generations¹¹. In addition, by focusing on young women, we ensure that they grew up under similar social values, notably regarding premarital pregnancies and births.

Among women aged between 15-35 years old (thereafter, our “women sample”), 59.6% have ever given birth. The latter belong to our “ever-mother sample”. Women from the ever-mother sample are the mother of 21 530 children among which 51.2% are boys. These children belong to our “children sample”. This means that in the children sample, all the children of women in the ever-mother sample are reported, regardless of their living status, their residential status and their age at the time of the survey.

Around 15% of the women in the ever-mother sample had a premarital birth (1 063). Given the availability on a monthly basis of the birth history for each woman in the ever-mother sample, we define premarital births as all births that occurred up to one month before a woman’s first marriage. At the child level, 7.05% of the children were born before their mother celebrated her first union (1 518). Interestingly, the data show that one third of the women with a premarital birth had actually more than one premarital birth.

DHS data report actually not the date of the first marriage but the date of the first cohabitation. Yet, in Senegal, several months can separate the celebration of the marriage and cohabitation between spouses. Usually, cohabitation starts when the bride’s family has received the total amount of marital compensations required. Therefore, there is no standard delay between celebration and cohabitation that we could apply to the date of first cohabitation to retrieve the date of the marriage celebration¹². Using the date of the first cohabitation with the first spouse leads likely to overestimate the proportion of women with a premarital birth and the proportion of children born out-of-wedlock. If premarital births are associated to resource constraints and if these constraints vanish as the woman gets married, then we might under-estimate the effect of these constraints on women and children’s welfare. However, the information contained in the timing of first cohabitation is actually the most relevant one to test resource constraints induced by lack of support from the in-laws. Indeed, in Senegal, once married, a woman leaves her household and usually joins that of her husband. The timing of first cohabitation thus implies that the woman has actually joined the household of her husband and/or family-in-law and that she mainly depends on them for dwelling and other resources.

We compare mortality rates before two years old because in Senegal children are used to being fostered out starting from age two (Coppoletta (2009)) and because in DHS, we do not

¹¹Blanc and Rutenberg (1990) analysed the quality of retrospective data, notably those on age at first sexual intercourse, age at first marriage and age at first birth in the DHS. They found that women from older cohorts tend to over report the dates of their first union and births. In fact, when looking at the data we found that women from older cohorts have been married on average at later ages than women from younger ones, which contradicts the slow but certain increase in age at first marriage (Westoff, 2003)

¹²Actually, the marriage celebration itself can be divided into various events: engagement, matrimonial compensations payment, civil and/or religious ceremony, cohabitation, making difficult the choice of the date to identify premarital births (Adjamagbo et al., 2004; Van de Walle and Meekers, 1994). In Senegal, indeed, a couple is considered as married once the parents agreed upon marital compensations to be exchanged for the occasion.

know whether a child was co-residing with his mother or with someone else at the time of his death. Since fostering-out and out-of-wedlock birth are outcomes which are positively correlated in Senegal (see Guilbert and Marazyan (2013)), looking at mortality rate differences at higher ages raises the risk of confounding the effect of being born out-of-wedlock and of having been fostered out. This risk is minimized when examining mortality rates before two years old (two years old included).

2.1 Descriptive statistics

In table 1, characteristics of mothers of children born out-of-wedlock and born in wedlock are presented. Mothers are distinguished in terms of whether they had their first birth before their 18 years old or after 18 years old. As already argued in the introduction, the rationale is that the fragility of children born from mothers younger than 18 years old could be due to the fact that the mother herself was fragile when giving birth (as she had not yet finished her own physical development at that date). This should be less a concern for children born from older women. In table 2, characteristics of children are presented.

At first, we can note that the majority of women with a premarital birth had their first birth while already adult (52.5%). From table 1 we observe that among women of similar ages at first birth, those who had a birth out-of-wedlock became mothers younger than women who became mothers within a union. However, among adolescent mothers, those who had a birth out-of-wedlock had their first sexual intercourse later than women with no premarital birth and very close to their first birth. The reverse is observed among adult mothers. Compared to women with an adult first birth, women who had a premarital birth while adolescent are less likely to be single at the date of the interview. This could be driven by the age difference that leaves a shorter period of time for women with adult first birth to marry before 35 years old¹³, or by the fact that the birth of a child, happening very early in the woman's life, urges a marriage.

Women with premarital birth are clearly more educated than their counterparts of similar ages at first birth. Regarding empowerment variables, we do not observe any difference among women who had their first birth as adolescent, whether they were married or not. However, among the group of women with adult first birth, those who had a birth out-of-wedlock are significantly more empowered. The observation of body mass and wealth indexes reveals that women with premarital births come from richer environments.

We note that women with premarital births have on average less children, which is in line with the fact that they wait longer after their first child birth to have another child (table 2). We observe a five-years gap in age at first marriage among women with similar ages at first birth, women with premarital birth marrying much later. The latter also marry men with higher educational levels. When in polygynous unions, women with premarital birth are less often first wives.

We note no difference in child mortality among women who had their first birth as adolescent, but when looking at the children level, we observe that boys are more vulnerable when born out-of-wedlock. Children born to mothers who had their first birth when adult exhibit lower mortality if born out-of-wedlock, notably girls.

First born children represent one third of the children born out-of-wedlock to women adolescent at first birth and three quarter of those born out-of-wedlock to women adult at first birth.

¹³Maximum age in our sample.

TABLE 1: DEMOGRAPHIC CHARACTERISTICS: MOTHERS OF EVER-BORN CHILDREN SAMPLE

	Women with adolescent			Women with adolescent			Women with adult			Women with adult		
	premarital birth		Mean (1)	non premarital birth		Mean (2)	premarital birth		Mean (3)	non premarital birth		Mean (4)
	N	Mean		N	Mean		N	Mean		N	Mean	
Exogenous characteristics												
Age	505	25.2	2292	25.0	0.63	27.3	3702	27.7	0.05	0.05	0.05	
Age at 1st birth	505	14.8	2292	15.4	0.00	20.7	3702	21.2	0.00	0.00	0.00	
Age at first sex	287	14.5	2164	14.0	0.00	18.2	3627	18.5	0.03	0.03	0.03	
Ever enrolled at school	505	0.35	2292	0.17	0.00	0.57	3702	0.30	0.00	0.00	0.00	
No. older sisters	505	1.56	2292	1.49	0.35	1.61	3702	1.53	0.25	0.25	0.25	
No. older brothers	505	1.87	2292	1.65	0.01	1.67	3702	1.67	0.98	0.98	0.98	
Endogenous characteristics												
Single	505	0.21	2292	0.00	0.00	0.40	3702	0.00	0.00	0.00	0.00	
Accept violence ^(a)	505	0.25	2292	0.27	0.38	0.15	3702	0.20	0.01	0.01	0.01	
No say own health	381	0.76	2211	0.78	0.55	0.73	3499	0.76	0.24	0.24	0.24	
No say large purchase	381	0.77	2211	0.81	0.15	0.74	3499	0.79	0.04	0.04	0.04	
No say visits	381	0.65	2211	0.67	0.41	0.55	3499	0.65	0.00	0.00	0.00	
Knows contraception	505	0.94	2292	0.89	0.00	0.98	3702	0.93	0.00	0.00	0.00	
Low BMI ^(b)	200	0.11	844	0.18	0.01	0.10	1429	0.18	0.00	0.00	0.00	
Normal BMI	200	0.62	844	0.61	0.80	0.62	1429	0.60	0.57	0.57	0.57	
High BMI	200	0.27	844	0.21	0.09	0.28	1429	0.22	0.06	0.06	0.06	
Urban	505	0.36	2292	0.22	0.00	0.53	3702	0.36	0.00	0.00	0.00	
Rural	505	0.64	2292	0.78	0.00	0.47	3702	0.64	0.00	0.00	0.00	
Poorest quintile	505	0.30	2292	0.40	0.00	0.15	3702	0.23	0.00	0.00	0.00	
Poorer quintile	505	0.30	2292	0.29	0.81	0.24	3702	0.23	0.40	0.40	0.40	
Middle quintile	505	0.23	2292	0.17	0.00	0.27	3702	0.23	0.02	0.02	0.02	
Richer quintile	505	0.12	2292	0.09	0.08	0.20	3702	0.19	0.57	0.57	0.57	
Richest quintile	505	0.05	2292	0.05	0.75	0.14	3702	0.13	0.48	0.48	0.48	
Dakar	505	0.06	2292	0.03	0.02	0.11	3702	0.08	0.02	0.02	0.02	
Ziguinchor	505	0.12	2292	0.02	0.00	0.22	3702	0.03	0.00	0.00	0.00	
Diourbel	505	0.05	2292	0.08	0.00	0.04	3702	0.10	0.00	0.00	0.00	
Louga	505	0.03	2292	0.09	0.00	0.04	3702	0.08	0.00	0.00	0.00	
Matam	505	0.06	2292	0.08	0.14	0.04	3702	0.07	0.00	0.00	0.00	
Kafrine	505	0.06	2292	0.10	0.00	0.04	3702	0.07	0.00	0.00	0.00	
Sedhiou	505	0.14	2292	0.07	0.00	0.08	3702	0.07	0.35	0.35	0.35	
No. children <5 in hh	505	3.2	2292	3.5	0.02	2.9	3702	3.5	0.00	0.00	0.00	
No. members in hh	505	14.2	2292	14.0	0.61	13.6	3702	14.3	0.05	0.05	0.05	
No. women in hh	505	3.3	2292	3.1	0.09	3.4	3702	3.3	0.21	0.21	0.21	
Motherhood characteristics												
Total children ever born	505	3.47	2292	3.68	0.04	2.34	3702	2.71	0.00	0.00	0.00	
No. living children	505	3.06	2292	3.24	0.05	2.18	3702	2.49	0.00	0.00	0.00	
Has child dead bf 24 months	505	0.26	2292	0.25	0.96	0.11	3702	0.15	0.00	0.00	0.00	
Has child dead bf 12 months	505	0.22	2292	0.21	0.61	0.10	3702	0.13	0.04	0.04	0.04	
Has child dead bf 1 month	505	0.12	2292	0.13	0.81	0.07	3702	0.08	0.67	0.67	0.67	
Marital characteristics												
Age at first union	397	18.12	2292	13.87	0.00	23.28	3702	18.82	0.00	0.00	0.00	
Divorced	397	0.04	2292	0.04	0.64	0.07	3702	0.05	0.35	0.35	0.35	
Polygamous	381	0.38	2211	0.33	0.06	0.23	3499	0.29	0.02	0.02	0.02	
First wife (among polygamous)	144	0.31	726	0.41	0.01	0.16	1015	0.31	0.00	0.00	0.00	
Spousal age gap	378	16.00	2161	15.72	0.70	12.05	3452	13.39	0.05	0.05	0.05	
Husband ever enrolled	397	0.33	2292	0.20	0.00	0.45	3702	0.30	0.00	0.00	0.00	
Share in the sample	505	18.1%	2292	81.9%		13.1%	3702	86.9%				

(a) The woman considers it normal to be beaten in at least one of the five following situations: going out without asking permission, neglecting the children, arguing with husband, refusing to have sex and burning food.

(b) This classification follows the World Health Organization's recommendations. Are reported only the regions for which a statistically significant difference in the prevalence of women from each group was observed.

TABLE 2: EVER-BORN CHILDREN SAMPLE CHARACTERISTICS

	Children born to mothers with adolescent first birth			Children born to mothers with adult first birth						
	Out-of-wedlock		In wedlock	Out-of-wedlock		In wedlock				
	N	Mean (1)	N	Mean (2)	(1)-(2)	N	Mean (3)	N	Mean (4)	(3)-(4)
First born	762	0.66	9417	0.24	0.00	756	0.74	10595	0.35	0.00
Child gender	762	1.48	9417	1.49	0.92	756	1.50	10595	1.49	0.69
Alive	762	0.86	9417	0.89	0.06	756	0.92	10595	0.92	0.97
Post natal check ^(a)	109	0.67	2142	0.65	0.69	209	0.73	3211	0.74	0.79
Pregnancy desired	173	0.39	3691	0.80	0.00	323	0.40	5567	0.81	0.00
Birth weight (in grams)	112	3108.3	1585	3108.8	1.00	241	2998.3	3304	3087.1	0.11
Succeeding birth interval (in months)	591	40.7	6745	33.3	0.00	451	40.5	6545	32.4	0.00
Age child	762	9.44	9417	6.71	0.00	756	5.80	10595	4.81	0.00
Fostered out	656	0.37	8338	0.14	0.00	696	0.23	9750	0.10	0.00
Fostered out (among first born)	429	0.39	1948	0.22	0.00	517	0.24	3356	0.14	0.00
Girls dead bf 1 month	369	0.06	4577	0.04	0.11	375	0.02	5177	0.03	0.42
Boys dead bf 1 month	393	0.06	4840	0.05	0.85	381	0.06	5418	0.04	0.15
Girls dead bf 12 months	369	0.08	4577	0.07	0.34	375	0.04	5177	0.05	0.18
Boys dead bf 12 months	393	0.12	4840	0.08	0.04	381	0.07	5418	0.06	0.39
Girls dead bf 24 months	369	0.10	4577	0.09	0.41	375	0.04	5177	0.07	0.03
Boys dead bf 24 months	393	0.13	4840	0.10	0.08	381	0.07	5418	0.07	1.00
Girls dead bf 24 months		9.4%							6.5%	
Boys dead bf 24 months		10.6%							7.1%	
Share in the sample		7.5%		92.5%			6.6%		93.3%	

Child gender is equal to 1 when the child is a boy, to 2 when the child is a girl.

^(a) Post natal check takes on the value 1 if the child was medically checked within two months after birth.

Sibship with several children born out-of-wedlock to a same mother are thus more common among women who had their first birth when adolescent. Even though pregnancies were two times less desired when occurring out-of-wedlock, we observe no difference in post natal check among children born to women with similar ages at first birth, no matter their status at birth.

From these descriptive statistics, it is obvious that premarital fecundity is not a random phenomenon and even further, that women with an adolescent premarital birth are different from women with an adult premarital birth. Although the causality is not clear, the former are more likely to be associated with lower welfare outcomes for themselves or their dependants (as measured by their schooling, their children’s survival rate, their marriage characteristics) compared to the latter.

3 Estimation of the average effect

3.1 Empirical Model

We estimate children’s survival rate before two years old using a logit model with mother fixed effects (which amounts to estimating a conditional logit model)¹⁴. Through mother fixed effects, we ensure that siblings of same mothers (at least) are compared. To estimate the effect of interest, we introduce 4 dummies identifying children depending on their gender and their status at birth (out-of-wedlock or in wedlock). Our reference group is boys born in wedlock. We add child level controls that have been shown to be associated with child mortality by the existing literature: twinship, season of birth (this is a dummy variable that equals one if the child was born during the dry season and zero otherwise), group of birth year (7 groups are defined: born in 1977-1981, 1982-1986, 1987-1991, 1992-1996, 1997-2001, 2002-2006 or 2007-2011), and the mother’s age group at the child’s birth (5 groups are defined: less than 16, between 16-19; between 20-28; 29 and older)¹⁵. We also control for whether the child is his mother’s first born child¹⁶. Because a third of women have multiple births out-of-wedlock, this does not raise multicollinearity issue. Separate models are estimated for children born to mothers who had their first birth before their 18 years old and for children born to mothers who had their first birth at 18 years old or older.

Results of the estimated model are presented in table 3. In table 4, we present the p-value of two tests: whether the mortality rates of sisters are different depending on whether they were born out-of-wedlock or in wedlock and whether the mortality difference between brothers depending on their birth status is different from the one between sisters.

As suggested in the introduction, one reason why a child born out-of-wedlock could have a higher mortality rate than a subsequent sibling born in wedlock could be resource constraints. Indeed, whereas the child born in wedlock has both a mother and a father and their respective families to provide him with resources, who contribute to the welfare of children born out-of-wedlock, during their infancy, is less clear: the mother surely contributes, but whether the father, the in-laws do and whether the mother’s kin compensates in case the father and the in-laws do not are open questions. There are two others reasons, both linked to the fact that a child born out-of-wedlock is most of the time the first child born to a woman. The first one

¹⁴Logit estimations are clustered at the mother level.

¹⁵When estimating the model on the sample of children born from mothers older than 18 years old at first birth, the first dummy relative to mother’s age group is naturally dropped, as well as the three first dummies relative to group of birth year.

¹⁶Birth order is defined among reported ever born children.

relates to the mother's inexperience with child care as she just becomes mother. The second one refers to the fact that premarital childbearing is often associated with adolescent childbearing which is detrimental for the health of the mother and the child. By controlling for birth order effects, we estimate the effect of being born out-of-wedlock on siblings' mortality net of the effect of birth order on the same outcome. By comparing groups of women with similar ages at first birth (<18 or ≥ 18), we ensure that pregnancy and birth conditions were similar for the first born children in each group. Indeed, adolescent childbearing is risky because girls are not physically nor psychologically mature yet to bear, deliver and raise a child, and this is the case whether they are married or not¹⁷. Then any differentiated effect of birth status on mortality rate between siblings should be uniquely driven by resource differences.

3.2 Results and interpretation

According to tables 3 and 4, girls and boys born out-of-wedlock have no different mortality rates compared to their siblings of same gender, neither on the sample of children born from mothers who were younger than 18 years old at their first birth (column 1), nor for children born from mothers who were older than 18 years old at their first birth (column 2).

The absence of effects on both samples suggests that out-of-wedlock births are not associated with resource constraints in Senegal. There are several reasons why there could be no effect: the woman's kin transfers to compensate for the reduced resources during singlehood (or during marriage if stigma persists); marriage with the father is sealed rapidly and stigma vanishes with marriage; marriage with any other man is sealed rapidly and stigma vanishes with marriage.

Actually, as we will see in the following, this average result actually masks differences that are revealed when considering more carefully sub-groups of children.

¹⁷For a detailed discussion on this matter see (Guilbert (2013).)

TABLE 3: CHILD MORTALITY LIKELIHOOD BEFORE 24 MONTHS: LOGIT MODEL WITH MOTHER FIXED EFFECTS (ODD RATIOS PRESENTED)

	Mother was adolescent at her first birth Child died < 2 (1)	Mother was adult at her first birth Child died < 2 (2)
Boy born out of wedlock	1.342 (0.402)	0.673 (0.338)
Girl born out of wedlock	1.185 (0.357)	0.475 (0.236)
Girl born in wedlock	0.773** (0.0802)	0.834 (0.102)
First born	1.349** (0.172)	1.668*** (0.271)
Twin	3.296*** (0.749)	3.199*** (0.643)
Born during dry season	0.956 (0.0932)	0.875 (0.119)
Mother's age at birth (<16)	0.955 (0.261)	
Mother's age at birth (16-19)	0.903 (0.150)	1.378 (0.320)
Mother's age at birth (29 +)	1.260 (0.330)	0.643** (0.118)
Controls	YES	YES
Observations	3 499	2 395

Odds ratios are reported. When inferior to one an odds ratio reflects a reduced probability, when superior to one it suggests an increased probability. They can be interpreted in terms of percentage decrease or increase respectively.

Controls include dummies indicating the group of birth year (7 groups are defined: born in 1977-1981, 1982-1986, 1987-1991, 1992-1996, 1997-2001, 2002-2006 or 2007-2011)

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

TABLE 4: CHILD MORTALITY LIKELIHOOD BEFORE 24 MONTHS: RESULTS OF COMPARISON TESTS (REF: TABLE 3)

Column 1: p value of the test	
girl born out-of-wedlock = girl born in wedlock	0.172
difference between girls born in and out-of-wedlock and boys born in and out-of-wedlock	0.702
Column 2: p value of the test	
girl born out-of-wedlock = girl born in wedlock	0.262
difference between girls born in and out-of-wedlock and boys born in and out-of-wedlock	0.758

4 Heterogeneity analysis

In this section, we analyze the heterogeneity of impact along several dimensions: whether the mother married within two years following the birth out-of-wedlock, the residing location: urban or rural and the mother’s ethnic group. Statistics on child mortality likelihood before two years for each status are provided in table 11 in appendix.

4.1 Along the marital status of the mother

In the sub-section, we distinguish children born out-of-wedlock whose mother was still single at their two years old and children born out-of-wedlock whose mother was married at that date (the proportion of women still single two years after the occurrence of a premarital birth is high: 54.5% of the women with premarital births). The rationale is that the resource constraints due to the fact that the mother is unmarried should be tighter for the former group of children compared to the latter as marriage usually brings resources. If so, the former group should have a higher mortality rate than the latter group and than children born in wedlock. However, if women with an out-of-wedlock birth can find alternative ways to additional resources while they are single (like asking help from their kin), we should not find any significant differences between these groups of children¹⁸.

Results of the estimated model are presented in table 5. The p-values of various coefficients-comparison tests are presented in table 6. We find that boys born out-of-wedlock from mothers older than 18 years old at their first birth and who were still single at the child’s two years old have a lower mortality rate than their brothers born in wedlock (column 2). A similar result is found when comparing sisters (first test relative to column 2 in table 6). The decrease in mortality found is of the same size between boys and girls. We do not find any difference between siblings born in and out-of-wedlock when a rapid marriage followed the out-of-wedlock birth. On the sample of children born from mothers who were adolescent at their first birth, we do not find any significant correlation between a child’s birth status and his mortality rate even when we differentiate by the mother’s marital status at the child’s two years old (column 1).

To summarize: on the sample of children born from mothers who were adult at their first birth, the effect ranges from null to positive. In particular, the longer the mother stays single, the higher are the child’s chances of survival. This means that for these children, the mother is able to find resources that temporarily do more than compensating the absence of resources due to not being married. In fact, maybe the mother stayed single because she had the means to, but in the presence of woman’s fixed-effects this finding means that the wealth level of the household she joins after marriage is lower with respect to the one of the household she stays in when single. To test this hypothesis, we checked whether single mothers are part of richer households than women who had a birth out-of-wedlock but are married. We found that single mothers are much less part of households from the poorest quintile of the population than married women with children born out-of-wedlock (15.20% versus 25.20%). We also observe that single mothers are more often not working or employees in the informal sector than married women with premarital birth and less self employed working in the agricultural sector¹⁹. Another explanation may relate

¹⁸Other time thresholds for singlehood were tested (at 2 months, 6 months and one year) but did not reveal significant differences.

¹⁹Using a second source of nationally representative data for Senegal, we also observe that food and non food consumptions of single mothers are higher than those of married women with an out-of-wedlock birth. For more

TABLE 5: TAKING INTO ACCOUNT THE TIMING OF THE MOTHER'S MARRIAGE: CHILD MORTALITY LIKELIHOOD BEFORE 24 MONTHS (LOGIT MODEL WITH MOTHER FIXED EFFECTS, ODD RATIOS PRESENTED)

	Mother was adolescent at her first birth Child died < 2 (1)	Mother was adult at her first birth Child died < 2 (2)
Boy born out of wedlock	1.263	0.919
Mother married at 2 y.o	(0.415)	(0.546)
Girl born out of wedlock	1.167	0.788
Mother married at 2 y.o	(0.500)	(0.444)
Boy born out of wedlock	1.454	0.326**
Mother not married at 2 y.o	(0.660)	(0.166)
Girl born out of wedlock	1.230	0.228**
Mother not married at 2 y.o	(0.454)	(0.145)
Girl born in wedlock	0.773**	0.828
	(0.0802)	(0.102)
First born	1.350**	1.674***
	(0.172)	(0.274)
Twin	3.297***	3.222***
	(0.751)	(0.653)
Born during dry season	0.955	0.875
	(0.0931)	(0.119)
Mother's age at birth (<16)	0.955	
	(0.260)	
Mother's age at birth (16-19)	0.904	1.394
	(0.150)	(0.323)
Mother's age at birth (29 +)	1.259	0.642**
	(0.330)	(0.118)
Controls	YES	YES
Observations	3 499	2 395

Odds ratios are reported. When inferior to one an odds ratio reflects a reduced probability, when superior to one it suggests an increased probability. They can be interpreted in terms of percentage decrease or increase respectively.

Controls include dummies indicating the group of birth year (7 groups are defined: born in 1977-1981, 1982-1986, 1987-1991, 1992-1996, 1997-2001, 2002-2006 or 2007-2011)

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

TABLE 6: TAKING INTO ACCOUNT THE TIMING OF THE MOTHER'S MARRIAGE: CHILD MORTALITY LIKELIHOOD BEFORE 24 MONTHS: RESULTS OF COMPARISON TESTS (REF: TABLE 5)

Column 1: p value of the test		
girl born out-of-wedlock and at 2 years old, her mother was still single = girl born in wedlock		0.227
girl born out-of-wedlock and at 2 years old, her mother was married = girl born in wedlock		0.342
girl born out-of-wedlock and at 2 years old, her mother was married = girl born out-of-wedlock and at 2 years old, her mother was still single		0.918
boy born out-of-wedlock and at 2 years old, her mother was married = boy born out-of-wedlock and at 2 years old, her mother was still single		0.778
difference between boys and girls born in wedlock and out-of-wedlock with mothers single at their 2 years old		0.843
difference between boys and girls born in wedlock and out-of-wedlock with mothers married at their 2 years old		0.734
difference between boys and girls born out-of-wedlock with mothers single or married at their 2 years old		0.896
Column 2: p value of the test		
girl born out-of-wedlock and at 2 years old, her mother was still single = girl born in wedlock		0.043
girl born out-of-wedlock and at 2 years old, her mother was married = girl born in wedlock		0.931
girl born out-of-wedlock and at 2 years old, her mother was married = girl born out-of-wedlock and at 2 years old, her mother was still single		0.109
boy born out-of-wedlock and at 2 years old, her mother was married = boy born out-of-wedlock and at 2 years old, her mother was still single		0.091
difference between boys and girls born in wedlock and out-of-wedlock with mothers single at their 2 years old		0.784
difference between boys and girls born in wedlock and out-of-wedlock with mothers married at their 2 years old		0.964
difference between boys and girls born out-of-wedlock with mothers single or married at their 2 years old		0.824

to the male participation in the decision-making over resources dedicated to children when the woman is married. While being single, the woman can decide on her own the level of resources she wants to dedicate to her child if she enjoys financial autonomy and/or with her parents or other person providing her with resources. The woman may benefit from higher decision-making in this configuration than when sharing decisions with a partner²⁰.

These additional resources may stop once the mother marries replaced by resources brought by the spouse. If the latter (as well as the in-laws) do not discriminate the child born out-of-wedlock, this explains why children born out-of-wedlock whose mother married rapidly have a similar mortality rate than a sibling born in wedlock. Alternatively, these resources can also continue after marriage and compensate strictly the resources a child born out-of-wedlock lacks of, due to discrimination.

On the sample of children born from mothers who were adolescent at their first birth, the status “being born out-of-wedlock” has at worst no effect on survival. This suggests that for women who became mothers as adolescent, marrying rapidly after the birth allows to access an equivalent level of resources than if they had married before the birth; when they do not marry rapidly, their network a priori provides the resources needed to take care of the child.

4.2 Along rural-urban locations

In this sub-section, we go further and estimate the equations presented in table 3 separately for children living in urban and rural areas at the date of the interview²¹. Results for rural children are presented in the two first columns of table 7, results for urban children are presented in the two last ones. The p-values of tests comparing sub-groups of children are presented in table 8.

On the sample of children born from mothers who were adolescent at their first birth (columns 1 and 3, tables 7 and 8), a child’s birth status and his mortality rate remain uncorrelated even if we differentiate by the mother’s residential status at the day of interview. On the sample of children born from mothers who were adult at their first birth, we find that boys born out-of-wedlock currently residing in a rural area have a lower mortality rate than their brothers born in wedlock (column 2, tables 7 and 8). The difference is non significant when comparing brothers in urban areas, as well as sisters both in urban and rural areas. These results are surprising. They could indicate that the means used by mothers who were adults at the time of their first birth to compensate the resources a child born out-of-wedlock could lack vary between areas depending on the gender of the child born out-of-wedlock. One could also think of migration to a rural area as a coping mechanism specifically used to cope with the birth of a boy born out-of-wedlock. In any case, at this stage of the results, “being born out-of-wedlock” has at worst no impact on their survival rate before two years old, whatever the gender of the child and whatever their mother’s age at first birth.

details on the Pauvreté et Structure Familiale survey, see De Vreyer et al. (2008).

²⁰A growing literature shows that more autonomy given to the woman in the household increases the proportion of resources dedicated to the care of children (Fantahun et al. (2007); Maitra (2004) and Eswaran (2002) among others).

²¹The model as the one in table 3 is estimated to ensure that each cell counts a sufficient number of observations.

TABLE 7: DISTINGUISHING LOCATIONS: CHILD MORTALITY LIKELIHOOD BEFORE 24 MONTHS (LOGIT MODEL WITH MOTHER FIXED EFFECTS, ODD RATIOS PRESENTED)

	Rural		Urban	
	Mother was adolescent at her first birth Child died < 2	Mother was adult at her first birth Child died < 2	Mother was adolescent at her first birth Child died < 2	Mother was adult at her first birth Child died < 2
	(1)	(2)	(3)	(4)
Boy born out-of-wedlock	1.112 (0.329)	0.358** (0.176)	2.945 (2.747)	1.262 (1.140)
Girl born out-of-wedlock	1.175 (0.383)	0.497 (0.280)	0.670 (0.689)	0.437 (0.410)
Girl born in wedlock	0.736*** (0.0838)	0.759** (0.0928)	0.928 (0.235)	1.011 (0.285)
First born	1.429*** (0.187)	1.758*** (0.283)	1.022 (0.412)	1.495 (0.543)
Twin	2.733*** (0.591)	3.874*** (0.886)	6.014*** (3.636)	2.438*** (0.815)
Born during dry season	0.988 (0.0980)	0.898 (0.134)	0.653 (0.225)	0.842 (0.230)
Mother's age at birth (<16)	0.954 (0.259)		1.101 (0.908)	
Mother's age at birth (16-19)	1.043 (0.169)	1.161 (0.282)	0.373** (0.181)	2.046 (1.087)
Mother's age at birth (29 +)	1.143 (0.339)	0.630** (0.124)	1.106 (0.793)	0.686 (0.246)
Controls	YES	YES	YES	YES
Observations	2 952	1 798	547	597

Odds ratios are reported. When inferior to one an odds ratio reflects a reduced probability, when superior to one it suggests an increased probability. They can be interpreted in terms of percentage decrease or increase respectively. Two first columns: rural locations; two last: urban location
 Controls include dummies indicating the group of birth year (7 groups are defined: born in 1977-1981, 1982-1986, 1987-1991, 1992-1996, 1997-2001, 2002-2006 or 2007-2011)
 Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

TABLE 8: DISTINGUISHING LOCATIONS: CHILD MORTALITY LIKELIHOOD BEFORE 24 MONTHS: RESULTS OF COMPARISON TESTS (REF: TABLE 7)

Column 1: p value of the test (adolescent first birth and rural)	
girl born out-of-wedlock = girl born in wedlock	0.160
difference between girls born in and out-of-wedlock and boys born in and out-of-wedlock	0.326
Column 2: p value of the test (adult first birth and rural)	
girl born out-of-wedlock = girl born in wedlock	0.457
difference between girls born in and out-of-wedlock and boys born in and out-of-wedlock	0.359
Column 3: p value of the test (adolescent first birth and urban)	
girl born out-of-wedlock = girl born in wedlock	0.756
difference between girls born in and out-of-wedlock and boys born in and out-of-wedlock	0.200
Column 4: p value of the test (adult first birth and urban)	
girl born out-of-wedlock = girl born in wedlock	0.380
difference between girls born in and out-of-wedlock and boys born in and out-of-wedlock	0.192

4.3 Along the ethnic group

Senegal counts six major ethnic groups: the Wolof, the Fulani, the Serere, the Mandingue, the Diola and the Soninké. As already suggested, attitudes toward premarital births can vary across ethnic groups. Separate models are estimated for the four following ethnic groups: the Wolof, the Fulani, the Serere, and all together the Mandingue, the Diola and the Soninké (henceforth: the MDS). Table 12 in the appendix describe women along various characteristics depending on their ethnic group and current location. It can be notably observed that the prevalence of premarital fecundity varies widely by geographical regions (table 1) and by ethnic groups. Premarital fecundity is particularly widespread in the southern part of Senegal where are concentrated the MDS, and less observed among the western and northern parts where live the Wolof and the Fulani. These features are exacerbated in rural areas.

The differences in premarital fecundity prevalence across ethnic groups suggest the existence of different social norms regulating family formation. We then expect to find at worst no effect of premarital fecundity among the MDS for whom the phenomenon is very common, and some potential negative effect among the other ethnic groups, if any.

In table 9, separate models for each ethnic group are estimated for women having their first birth while they were adolescent (columns 1 to 4) or while they were adult (columns 5 to 8). Summary of the results of relevant tests are given in table 10²².

On the sample of children whose mother was adolescent at first birth, boys born out-of-wedlock are not at particular risk of death, whatever the ethnic group considered. In contrast, compared to their sisters born in wedlock, girls born out-of-wedlock have a higher mortality rate when they belong to the Serere ethnic group (first test relative to column 3 in table 10) but a lower one when they belong to the MDS (first test relative to column 4 in table 10). On the sample of children whose mother was adult at first birth, we do not find any significant difference between groups of siblings, whatever the ethnic group considered.

The fact that we do not find significant differences between siblings born of mothers who were adult when they had their first birth but do find some for those born to adolescent mothers suggests that the latter faced more difficulties in accessing resources for their children than women who became mothers later. The reasons could either be that adult mothers enjoy more financial autonomy or that adolescent mothers suffer from lower bargaining power with their kin, when having a birth out-of-wedlock.

That being said, among the Serere: only daughters born out-of-wedlock from a young mother have a higher mortality rate, not sons born out-of-wedlock. There is no reason that the fragility of a young mother passes only to girls. These patterns could suggest that a compensatory mechanism is established only following the birth, out-of-wedlock, of a boy among the Serere (a mechanism that is not established when the mother is old enough). Among the MDS, girls born out-of-wedlock, from young mothers have lower mortality rate compared to their sisters born in wedlock. This could indicate that a compensatory mechanism exists also among the MDS, as in the case of the Serere. However, unlike the Serere, it is established following the birth, out-of-wedlock, of a girl.

²²The model as the one in table 3 is estimated to ensure that each cell counts a sufficient number of observations.

TABLE 9: DISTINGUISHING ETHNIC GROUPS: CHILD MORTALITY LIKELIHOOD BEFORE 24 MONTHS (LOGIT MODEL WITH MOTHER FIXED EFFECTS, ODD RATIOS PRESENTED)

	Mother was adolescent at her first birth			Mother was adult at her first birth				
	Wolof (1)	Fulani (2)	Serere (3)	MDS (4)	Wolof (5)	Fulani (6)	Serere (7)	MDS (8)
Boy born out-of-wedlock	1.402 (0.758)	1.585 (0.637)	0.106 (0.154)	1.795 (1.269)	1.095 (0.868)	0.566 (0.473)	0.354 (0.461)	1.528 (1.321)
Girl born out of wedlock	2.776* (1.690)	0.766 (0.278)	3.976 (3.574)	0.373 (0.343)	0.123* (0.152)	1.258 (0.924)	0.305 (0.321)	1.188 (0.842)
Girl born in wedlock	0.646* (0.144)	0.821 (0.124)	0.860 (0.279)	0.956 (0.219)	0.847 (0.177)	0.708* (0.147)	1.251 (0.439)	0.893 (0.269)
First born	1.279 (0.322)	1.246 (0.235)	2.519** (1.161)	1.288 (0.462)	1.621* (0.427)	0.865 (0.240)	1.802 (0.788)	3.561*** (1.361)
Twin	2.996*** (1.087)	4.613*** (1.626)	2.308 (1.482)	1.448 (0.396)	4.014*** (1.550)	3.500*** (1.045)	2.528* (1.237)	2.738** (1.087)
Born during dry season	0.936 (0.165)	1.096 (0.170)	0.821 (0.275)	0.781 (0.198)	0.694 (0.167)	0.827 (0.160)	1.103 (0.438)	1.744 (0.598)
Mother's age at birth (<16)	0.466 (0.265)	1.228 (0.546)	0.866 (0.715)	3.490* (2.651)				
Mother's age at birth (16-19)	0.872 (0.280)	0.982 (0.275)	0.492 (0.241)	1.375 (0.531)	1.269 (0.540)	1.904* (0.693)	3.745** (2.263)	0.622 (0.339)
Mother's age at birth (29 +)	1.303 (0.655)	1.622 (0.593)	0.802 (0.710)	0.920 (0.562)	0.757 (0.227)	0.672 (0.272)	0.428* (0.189)	0.595 (0.242)
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Observations	873	1 446	355	519	714	763	324	421

Odds ratios are reported. When inferior to one an odds ratio reflects a reduced probability, when superior to one it suggests an increased probability. They can be interpreted in terms of percentage decrease or increase respectively.

Controls include dummies indicating the group of birth year (7 groups are defined: born in 1977-1981, 1982-1986, 1987-1991, 1992-1996, 1997-2001, 2002-2006 or 2007-2011)

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

TABLE 10: DISTINGUISHING ETHNIC GROUPS: CHILD MORTALITY LIKELIHOOD BEFORE 24 MONTHS: RESULTS OF COMPARISON TESTS (REF:

TABLE 9

Mother was adolescent at her first birth:	
Column 1: p value of the test girl born out-of-wedlock = girl born in wedlock difference between girls born in and out-of-wedlock and boys born in and out-of-wedlock	(Wolof) 0.129 0.002
Column 2: p value of the test girl born out-of-wedlock = girl born in wedlock difference between girls born in and out-of-wedlock and boys born in and out-of-wedlock	(Fulani) 0.250 0.853
Column 3: p value of the test girl born out-of-wedlock = girl born in wedlock difference between girls born in and out-of-wedlock and boys born in and out-of-wedlock	(Serere) 0.034 0.119
Column 4: p value of the test girl born out-of-wedlock = girl born in wedlock difference between girls born in and out-of-wedlock and boys born in and out-of-wedlock	(MDS) 0.081 0.308
Mother was adult at her first birth:	
Column 5: p value of the test girl born out-of-wedlock = girl born in wedlock difference between girls born in and out-of-wedlock and boys born in and out-of-wedlock	(Wolof) 0.128 0.118
Column 6: p value of the test girl born out-of-wedlock = girl born in wedlock difference between girls born in and out-of-wedlock and boys born in and out-of-wedlock	(Fulani) 0.237 0.422
Column 7: p value of the test girl born out-of-wedlock = girl born in wedlock difference between girls born in and out-of-wedlock and boys born in and out-of-wedlock	(Serere) 0.743 0.219
Column 8: p value of the test girl born out-of-wedlock = girl born in wedlock difference between girls born in and out-of-wedlock and boys born in and out-of-wedlock	(MDS) 0.895 0.702

5 Conclusion

In this paper, we are interested in the effect of birth status, being born out-of-wedlock or in wedlock, on survival chance before two years old of siblings of same gender in Senegal. For three reasons at least, children born out-of-wedlock are expected to have lower survival rates compared to their siblings born in wedlock. One mechanism that is specific to the status “being born out-of-wedlock” is the lower resources a child born out of wedlock can get relative to a sibling born in wedlock either because he grows up with a mother who is single for a while or because he is discriminated against by his mother’s in-laws once his mother marries. The two other channels are linked to the fact that a child born out-of-wedlock is, in most cases, a first-born child and could be more fragile for this reason. As we control for children birth order effects and compare children born to women with similar ages at first birth, we are able to isolate the resource-constraints effect. The analysis is based on nationally representative data, those from the Demographic and health survey, collected in the country in 2010-2011. Data from the youngest cohort of mothers are exploited.

On average, no significant effect is found. This finding hides significant variations between sub-groups of children. In many cases however children born out-of-wedlock have, at worst, similar mortality rates than their siblings born in wedlock. This result suggests that resource-based mechanisms exist in Senegal to help mothers, with an out-of-wedlock birth, compensating and sometime over-compensating for lack of resource or for fragility. These mechanisms seem to vary along the mothers marital status following the birth of the child and between ethnic groups, depending on the gender of the child born out-of-wedlock. Children born to women who became mother when adult and stayed single for longer actually exhibit lower mortality rates. In this case, marriage does not bring additional resources for children, we actually observe the opposite. The only group of children with a higher risk of death is the group of girls born out-of-wedlock, whose mother was adolescent when giving birth to them, belonging to the Serere ethnic group. Informal, private compensatory mechanism does not seem to take place in this specific case.

A Appendix

TABLE 11: STATISTICS ON CHILD MORTALITY LIKELIHOOD BEFORE 24 MONTHS BY STATUS

	Mother adolescent at her first birth			Mother adult at her first birth		
	All	Boys	Girls	All	Boys	Girls
Born out-of-wedlock Mother married at 2 y.o	14.7% (39)	19.4% (27)	9.6% (12)	7.4% (17)	8% (9)	6.8% (8)
Born out-of-wedlock Mother single at 2 y.o	10.4% (52)	10.2% (26)	10.7% (26)	4.9% (26)	6.7% (18)	3.1% (8)
Born in wedlock	9.7% (912)	10.4% (503)	8.9% (409)	6.9% (729)	7.1% (384)	6.7% (345)
Rural	10.6% (845)	9.5% (473)	11.7% (372)	7.6% (573)	8.1% (310)	7.1% (263)
Urban	7.1% (158)	7.5% (83)	6.8% (75)	5.2% (199)	5.2% (101)	5.3% (98)
Wolof	8.8% (252)	9.4% (135)	8.1% (117)	5.6% (216)	6.5% (129)	4.7% (87)
Fulani	10.7% (442)	11.7% (255)	9.6% (187)	7.8% (260)	7.9% (133)	7.8% (127)
Serere	8.4% (76)	7.6% (34)	9.1% (42)	6% (104)	6.2% (54)	5.8% (50)
MDS	11.5% (145)	11.5% (73)	11.5% (72)	8.7% (134)	8.3% (65)	9.2% (69)

TABLE 12: WOMEN 15-45, DHS 2010: BASIC INDIVIDUAL AND HOUSEHOLD LEVEL CHARACTERISTICS

	Urban				Rural			
	Wolof	Fulani	Serere	MDS	Wolof	Fulani	Serere	MDS
N	7460	6845	2473	4154	13896	15936	6404	5435
Age	31.71	30.15	32.44	31.17	29.82	29.09	30.84	29.22
HH head link =head	0.06	0.06	0.07	0.04	0.03	0.02	0.05	0.01
HH head link =spouse	0.27	0.32	0.33	0.24	0.38	0.39	0.31	0.34
HH head link =daughter	0.13	0.14	0.15	0.10	0.05	0.08	0.12	0.11
HH head link =daughter in law	0.19	0.15	0.14	0.14	0.20	0.18	0.24	0.14
HH head link =sister	0.06	0.05	0.06	0.06	0.02	0.05	0.03	0.02
Wealth quintile (1=lower; 5=higher)	3.92	3.37	3.82	3.45	2.46	1.70	2.04	1.98
HH owns cattle	0.48	0.58	0.48	0.49	0.83	0.91	0.90	0.91
In hh. a member has a bank account	0.38	0.38	0.38	0.53	0.27	0.18	0.19	0.29
HH size	15.33	13.60	12.97	17.29	15.32	14.13	14.29	15.35
HH head=female (2=no)	1.31	1.24	1.34	1.26	1.15	1.09	1.18	1.12
HH head age	55.03	53.85	54.88	54.90	53.75	51.64	55.69	53.91
HH hosts an elderly (>50 years old)	0.82	0.81	0.79	0.82	0.84	0.77	0.85	0.86
N. years of education	2.71	2.55	3.55	3.10	0.55	0.73	1.40	1.51
Is curr. married	0.87	0.85	0.85	0.78	0.95	0.93	0.91	0.88
Age first marriage	19.50	17.77	19.97	18.83	17.60	16.16	18.11	17.61
Out-of-wedlock birth	0.17	0.17	0.21	0.27	0.09	0.10	0.15	0.25
Age first birth	20.61	19.22	20.91	20.04	19.14	18.08	19.58	18.80
Works	0.47	0.39	0.48	0.54	0.34	0.31	0.33	0.54
<i>Among those currently married</i>								
N. children ever born	3.62	3.69	3.78	3.69	3.92	3.99	4.32	3.99
Average birth interval (months)	39.49	37.30	39.22	40.85	35.51	34.53	34.49	35.50
Married several times	0.13	0.17	0.20	0.18	0.11	0.14	0.12	0.16
Co-reside with spouse	0.66	0.64	0.66	0.62	0.68	0.71	0.57	0.68
In a polygynous union	0.31	0.29	0.28	0.26	0.38	0.37	0.28	0.37
<i>Among those working</i>								
Management	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00
Clerical	0.08	0.06	0.12	0.04	0.01	0.01	0.02	0.01
Sales	0.60	0.59	0.48	0.56	0.44	0.35	0.59	0.28
Service	0.18	0.18	0.20	0.18	0.17	0.09	0.15	0.06
Skilled labor	0.01	0.01	0.00	0.03	0.03	0.01	0.01	0.00
Agri self employed	0.02	0.05	0.01	0.07	0.27	0.45	0.11	0.32
Agri employee	0.02	0.00	0.00	0.02	0.06	0.08	0.01	0.29
Domestics	0.08	0.08	0.17	0.08	0.00	0.01	0.10	0.03
Unskilled labor	0.01	0.02	0.00	0.02	0.01	0.00	0.01	0.01

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