Educational achievement and socioeconomic background: causality and mechanisms in Senegal

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Abstract

This paper addresses the question of intergenerational schooling mobility in Senegal. We use an original survey conducted in 2003 that provides instruments to deal with the endogeneity of parent's education. In Senegal, school supply has been increasing a lot over the last decades, individuals who are now adults had different exposure to the schooling system, depending on where they lived when they were young and on their birth cohort. Hence a first set of instruments describes the infrastructures available in the environment in which parents lived when they were ten years old. Moreover, variation in education demand for a child is also driven by his/her position among his/her siblings, since older children tend to be less educated in West Africa. Being the first born is random but implies different educational outcomes than other birth ranks. Hence, the second set of instruments describes whether the parents were the first born among their same sex siblings. The estimated effect of father's education more than doubles when its endogeneity is accounted for. Unexpectedly, mother's education comes out as a lesser determinant. We then focus on the understanding of the channels through which parental education affects children's schooling. We present results pointing at the importance of the direct impact of parental education relative to the effect passing through wealth or household activity choices.

Introduction

It is common belief in development economics that mother's schooling has a major impact on child education and that this effect is substantially greater than the one of father's education. Behrman (1997) actually compiled a large number of estimates and finds no corroboration for this claim, except for the fact that mothers tend to have a positive impact for educational inputs that fathers do not have. However, he stresses that

> Most existing studies do not control for possible biases in the estimated effects of mother's schooling due to unobserved (by analysts) abilities and preferences that directly affect child education and that are correlated with mother's schooling.

While this remark might not hold true anymore for studies on developed countries, it remains relevant for those on developing countries. In fact, compared to the huge literature on education demand, few papers take into account this issue of endogeneity and none of it do it on an African country. Broadly speaking, there are three different streams: one which consists in instrumenting parental education by relatives' education (own parents, sisters, sometimes twins or adoptees)[1] and a second one which consists in differenciating parents' education with regard to relatives' education.[2] The last one uses changes in compulsory schooling laws to instrument for variations in education attainment.[3] The first strategy reduces measurement error issues while the second deals with unobservable characteristics

[1] Behrman and Taubman (1985); Lillard and Willis (1994); Barros and Lam (1996)

[2] Behrman, Foster, Rosenzweig, and Vashishtha (1999); Behrman and Wolfe (1987); Behrman and Rosenzweig (2002); Antonovics and Goldberger (2005); Björklund, Lindahl, and E. (2006); Plug (2004); Sacerdote (2007)

[3] Black, Devereux, and Salvanes (2005); Oreopoulos, Page, and Stevens (2006); Maurin and McNally (2008)

transmitted from one generation to the next. Consistently, most of papers in the first set tend to find IV estimates greater than the OLS while it is the opposite for the second set. As will be discussed later, these two strategies have weaknesses and are unlikely to provide suitable instruments. The third one deals with both issues but may only identify impacts for those affected by the reform; in most cases, they find IV estimates higher than the OLS results. In addition, potential assortative matching between husbands and wives point to the fact that impact of mother's education should be evaluated along with that of father's education. The goal of this paper is therefore to exhibit the causal relationship from parental education to children's schooling.

Identifying such causal impact requires some exogenous sources of variation of parental education. In a country like Senegal, but more generally for Africa, school supply has been increasing widely over the last decades, as improvements in schooling rates can testify. Individuals who are now adults had thus different exposure to the schooling system, depending on where they lived when they were young and on their birth cohort. In the data we use, we know whether they had access to schools when they were age 10. Moreover, variation in education demand for a child is also driven by his/her position among his/her siblings, since older children tend to be less educated in West Africa. We argue that these two sources of variation allow to identify the causal impact of parental education on children's schooling. In addition, the relevant information is known for both parents, which permits to measure the effect of mother's education conditional on father's and vice-versa.

From a policy perspective, shedding light on the causal impact of parental education on children schooling gives some insights on the transmission of inequalities of education. Since schooling is thought of as one of the most important factor of the social mobility processes (Behrman, 1999), it could be of major importance to fight against this factor of intergenerational persistence of inequalities. In some sense, since school is a social policy tool that is relatively easy to monitor for a government, having a clear view on how far it can be used for this purpose would be useful. In the short term, compensating inequalities originating in different socio-economic backgrounds may not be straightforward and the possibility to do so depends highly on the mechanisms at stake. In fact, parental education is expected to affect children's schooling outcomes through different channels. The most obvious ones are that parental education is expected to have an impact on households' income and wealth and to be a potentially essential input in the child's education production function. It could also alter households information and anticipation with regards to the returns to education and shape their preferences towards the education of their children. If impact through parental wealth is at stake, providing additional transfers can compensate for inequalities in socioeconomic background. If, however, the effect of parental education is mainly a direct one, policy implications are not as simple but it implies that an improvement in school enrollment at one time will sustain itself over generations. A second objective of the paper is thus to gain some insights as to the mechanisms of transmission of education from one generation to the next, concentrating on the role of wealth.

In this paper, we therefore deal with two questions: impact of parental education and possible channels for this impact. Our main results show that father's education is an important determinant of schooling outcomes. Mother's education comes out as a lesser determinant. Wealth appears to absorb some of the impact of parental education, suggesting that this impact on their children's education transits through the increased income it allows. Nevertheless, the remaining direct effect stays very important, equal to about 80% of the marginal effect originally attributed to parental education.

Section 1 describes the data used in this study and presents some descriptive statistics. Identification strategy is discussed in section 2, while section 3 presents and discusses the estimates of the causal impact of parental education on schooling achievement. Section 4 investigates into the possible mechanisms of transmission of such an effect and the last section concludes.

1 Description of the data

1.1 The context

In Senegal, education level is low but steeply increasing over time. In fact, while adult literacy rate in 2003 was only 39%[4], raw primary enrollment ratio amounted to 80%. This latter figure partly hides the difficulties faced by the education system. Indeed, if raw admission rates amount to 95%, only 70% of ever enrolled children complete primary schooling. As a result, only half of the children receive a full primary education. Further, poverty in Senegal is widespread with two thirds of the population living with less than 2$ a day.

[4]Source: Human Development Report, data for 2003.

1.2 The survey

The data used in this paper comes from an original survey entitled Éducation et Bien-Être des Ménages au Sénégal (EBMS) [5] conducted in 2003. This survey covers a national sample of 1800 households, clustered in 60 villages or quarters. It provides information on household composition, household asset ownership and housing characteristics, as well as on education, health, employment status and activities of every household member.[6]

For each child, we know his/her parents' education. Regarding economic background, the survey collects information on durable goods and housing. A permanent income indicator is built using principal factor analysis (Sahn and Stifel, 2003; Filmer and Pritchett, 2001).[7] It is a continuous variable, centered and reduced.[8]In addition, if parents and children live together at the time of the survey, the EBMS data also contains information on parents' living conditions when they were age 10. We know in particular the birth order of the parents and the infrastructures accessible to them at that time (primary school, lower and upper secondary school, health care providers).

[5]This survey was designed by the authors in collaboration with a team from Cornell University, USA and implemented in association with the Centre de Recherche en Économie Appliquée (Dakar, Senegal).

[6]The sample is clustered around schools and is therefore not representative of the whole population for education, since it includes children who have on average more schooling than the general population. It is nevertheless representative of the population in terms of religion, ethnic groups and demographic characteristics.

[7]Blau (1999) shows that the effect of permanent income is much more important than the one of transitory income for the American children.

[8]Weights obtained and used to construct the indicator are available from the authors. Household ranking according to this indicator is stable when alternative subsets of variables are used.

1.3 Some descriptive statistics on education and schooling mobility

For children who have never been enrolled at the time of the survey, but will enter school in the future, the information regarding enrollment is censored. In our analysis, to avoid the difficulties linked to censoring of this variable, we restrict the sample of interest to children between the ages of 10 and 21 and assume that children who have not yet entered school when they reach age 10 will never do so.[9]

In this sample, 18% of the individuals have never been to school despite school being compulsory from age 7 onwards. Only 58% of children in this age range are currently enrolled. These average numbers hide differences between boys (of whom 86% have been to school) and girls (only 77%) and a much greater discrepancy between urban and rural areas where those numbers amount respectively to 91% and 74%.[10] Table 1 panel A shows that for those who have some education, half of them did not complete their primary schooling. Obviously, those younger than 13 cannot possibly have completed their primary education anyway. Regarding parental education, the fact that 60% of the fathers and three quarters of the mothers of the children aged 10 to 21 have no schooling at all, testifies of the steep increase in schooling across time in Senegal. Panel B of Table 1 shows that current enrollment rate increases markedly with the parents' education level. There is a huge step up when comparing children whose parents have no schooling to those with at least some primary schooling and that it then increases regularly with the father's education (the profile with

[9] In our sample, about 3% of the children who went to school entered at age 10 or later.

[10] Complete tables of descriptive statistics discussed here are available on the authors's web page

respect to the mother's education is flatter). An upward trend in the probability of having been to school also appears when children are sorted by household's wealth quartile (from 68% in the bottom quartile to 94% in the upper one).

A descriptive analysis based on the relevant mobility matrices (see Table 4 for an example) also gives some sense of the relatively low schooling mobility in Senegal. If one considers two individuals aged between 14 and 20, one whose father has no education at all and the other whose father has been to primary school but did not complete it, the situation where the first one does not get any education and the second gets some primary education is 6.55 times more likely to happen than the reverse. This is a very high reproduction coefficient since in the case of perfect schooling mobility, reproduction coefficients would be equal to 1.

2 A simple model of intergenerational schooling mobility

The section describes the strategy of the paper to identify the impact of parent's socioeconomic characteristics on the education of their children. With this objective, we estimate a simple model of the impact of parental education on education demand for the children where endogeneity of parental education is dealt with.

2.1 The empirical model

We consider here a reduced form model where the role played by parental education in determining schooling achievement is emphasized. The equation of interest is:

$$s_{ch} = \alpha s_{fh} + \beta s_{mh} + X_{ch}\Gamma + u_{ch} \tag{1}$$

where s_{ch} is a measure of schooling achievement of child c in household h, s_{fh} stands for father's schooling and s_{mh} mother's schooling; X_{ch} is a set of other determinants of the child's schooling and the last term encompasses unobservable variables affecting the child's outcome, such as productivity in upbringing, preferences toward schooling, expectations regarding returns to education, ownership of productive assets, environment, network etc. This unobserved heterogeneity can be thought of as encompassing a child specific component as well as a component common to all the siblings (household effect).

Behrman (1997) stresses the fact that control variables should be parsimonious in order not to lessen the impact of parental education.[11] Nevertheless, it is important to control for factors that may be correlated with parents' schooling but not caused by it or for factors driving education demand (even if not correlated with socio-economic background) in order to reduce standard errors. For these reasons, we introduce community fixed effects so that parental education does not pick up better endowments in schooling infrastructures in the neighborhood. We also introduce gender, household size and position among siblings as determinants of education demand but do not introduce household wealth in a first step since we focus on the disaggregation of the impact of socio-economic background later on.

Parental education may be correlated with the unobserved heterogeneity term u_{ch}, thereby generating endogeneity biases in the estimation of equation (1). A first source of correlation between unobserved heterogeneity and parental education is the existence of transmission effects. First, if environment, abilities or preferences towards schooling are transmitted

[11]This would be the case for instance if we were to introduce variables such as textbooks or educational expenses, that are partly driven by parents' education.

through generations (dynastic characteristics), then these variables determine both parents' and children's schooling. Second, parents specific ability might affect their own educational achievement as well as make them more able to support their children in their schooling. It will therefore be correlated with the error term in the above model. The other source of endogeneity is possible measurement errors on parental education.

Decomposing the source of endogeneity in this way, gives a theoretical basis to discard some instruments for parents' education previously used in the literature. The transmission effect prevents variables such as grand-parental education or education of the parent's siblings to be valid instruments. In fact, the unobserved dynastic characteristics will affect those as well as parental education itself. One might then think of using differences between parent's education and the education of their relatives, since this would remove the dynastic heterogeneity. Nevertheless, this would not wipe out the specific unobserved characteristics of the parent. Therefore, education of relatives are theoretically not valid instruments.

The next section describes in detail the instruments we have chosen to deal with these sources of endogeneity. A more extensive discussion about the theoretical validity and tests of the exclusion restrictions is postponed until section 3.3.

2.2 Choice of instruments

The first set of instruments describes the primogeniture status of the parent. In fact, some literature describes the fact that eldest children are less likely to be enrolled in school (Emerson and Souza, 2008). A liquidity constraint could prevent the first child to go to school,

while it could be relaxed for younger siblings either if the elder one contributes to household's income or simply because parents are further on in their life cycle. Another possible rationale is that parents wish to keep their eldest boy at home so as to insure he will remain by them in old age. In addition, no direct effect of parent birth order is expected on children's education.[12] We used two ranking variables: "having no older brother" and "having no older sister". In the end, what turns out to be significant is whether the child is the eldest among same sex siblings. Nevertheless, primogeniture could convey other differences in terms of parental treatment: they could inherit more and thus have more assets, or be the ones the rest of the family tend to rely on, etc. Therefore, we compare observable characteristics of individuals, depending on whether they are the eldest among same sex siblings. There are no significant differences between the two groups in any of the dimensions observed, except for the number of siblings.[13] Indeed, the probability to be the eldest is higher in a small family than in a large one. We deal with that point in section 3.3. Finally, given the similarity in terms of observables and although it does not preclude correlation with unobservable characteristics, primogeniture can be seen as "as good as random".

The second set of instruments describes the presence of education and health infrastructures accessible to the parents in their childhood. Indeed, proximity of schools affects the price of education through reducing costs of transportation, of having meals outside the home or of boarding. This set of instruments comprises dummy variables for the presence of primary school, lower secondary school, upper secondary school, and health care center

[12]It can be further argued that the only exogenous position in the birth order is that of the eldest child, while being the youngest is not (parents have decided to stop having children after this one).

[13]The corresponding table is available on the authors'web page.

in their neighborhood when they were age 10.[14] It may not be exogenous if grand-parents with higher preferences for education moved in order to provide schooling to their offspring, if there is a recall bias correlated with education or if the presence of a secondary school proxies for quality of primary schooling. We discuss further exogeneity of these instruments in section 3.3. The fact that we control for places where the children live at the time of the survey (through communities' fixed effects) helps the exclusion restriction to be satisfied. In fact, absent of them, low geographical mobility and persistence in infrastructures over time could make endowments at the time of the parents proxy for those available to today's children. In addition, community fixed effect also control for price differences.

In total, the identification hypotheses are that adults who were the eldest among their siblings or who grew up far from schools are identical to adults who did not have these experiences in childhood, except that they ended up less educated. We also provide results when using only one set of instruments at a time since it requires weaker identification hypotheses. Considering two sets of instruments allows a larger share of the population to be used for the identification. In addition, the use of dummies for the availability of nearby schools for each level provides variation for the full support of parental educational levels.

2.3 The empirical specification

The outcome of interest is education of the children. We consider two measures of it: first, whether the child ever went to school ("child enrollment"), and second, what is the level attained. Since the sample excludes children below age 10, left censoring is likely to be a

[14] Card (1995) used distance to college to instrument education level when estimating returns to education.

very minor issue for both these variables and can be ignored.

The level attained is measured by an ordinal variable that takes 8 different values corresponding to the education levels given in Table 1.[15] For this variable, right censoring is an issue. Indeed, for the large part of the children who declare attending school, final schooling attainment (s^*_{ch}) is not observed. It is only known to be greater than the one they had reached at the time of the survey (s_{ch}). Drop-out followed by re-entry is not a problem here since it concerns only 4% of children who ever entered school. s_{ch} itself is determined as follows:

$$s^*_{ch} = \alpha s_{fh} + \beta s_{mh} + X_{ch}\Gamma + u_{ch} \tag{2}$$

$$s_{ch} \begin{cases} = s^*_{ch} & \text{if child } c \text{ has completed his/her schooling} \\ < s^*_{ch} & \text{if child } c \text{ is still enrolled} \end{cases} \tag{3}$$

We will henceforth assume that the censoring is exogenous and only due to the age of the child, relative to the level s/he wants to reach.

To describe parental education, we also use the final level of education, treated as a continuous variable.[16] Sample statistics for all the variables used are given in Table 5 (appendix).

3 Estimated effects of parental education

In this section, we estimate the global causal impact of parental education on children's educational trajectory, that includes both direct and indirect effects.

[15] We also have estimated the same model using the full information of the last grade completed and find very comparable results.

[16] A specification search, done before any instrumentation, showed that, in general, the share of variance explained is slightly better when using the level of parental education rather than whether they ever enrolled.

3.1 Sample and instrumentation

First recall that the chosen instrumental variables are only available for children who live with both their parents, i.e. 2592 children aged 10 to 21. The whole sample includes 6793 individuals aged 10 to 21. Such selection based on co-residence with both parents raises a suspicion of endogenous selection. Nevertheless, since we collected information on the parents even when they do not reside with their child, we can compare the two samples to assess the extent of the selection problem. It appears that these two samples hardly differ in terms of observable characteristics (see Table 5, in appendix). This does not rule out the possibility of selection on unobservable. However, Table 6 shows that estimation results are very similar on both the full and the restricted sample before instrumentation.

The instrumentation is shown in Table 7 (appendix). As can be seen from the table, instruments are jointly significant. Further, the instrumental variables alone explain respectively 16% and 9% of the variance of father's education and mother's education. These regressions show that, as expected, being the oldest boy is detrimental to education and that having grown up in an environment with more infrastructures enhances education.

3.2 Main results

A probit estimation of child enrollment as a function of parental education provides the first set of results. The estimated marginal effects are given in the upper panel of Table 2, with and without instrumentation. In order to check whether results are consistent throughout the use of the different instruments, three instrumental strategies are implemented: first we consider the two sets of instruments separately (primogeniture variables on the one hand and

infrastructure dummies on the other) and, then, in a second step, we pull them together. The direction of the bias is estimated to be the same whatever the instruments chosen. It appears clearly that primogeniture instruments are too weak on their own to correct for endogeneity bias. When using all instruments, father's education is rejected as exogenous variable at the 10% level, but we cannot reject that maternal education is exogenous (see results of the exogeneity test in column 4).[17] Hence, our core results are those presented in column 5 where father's education is instrumented using both sets of instruments while mother's education isn't.

Before instrumentation, we find a significantly positive impact of both father's and mother's education. Instrumenting parental education leads us to reevaluate upward the impact of father's education but downward the role of mother's education. For an average child, increasing it by 1 level increases the probability of enrollment by 4.7 percentage points when not instrumented (panel A, col. 1) and by 7.9 percentage points when instrumented (panel A, col. 5). The impact remains quite low, but this is partly due to the fact that most children enter school. According to our core results, mother's education hardly affects the probability of enrollment.

Therefore, those results not only do not point to a prominent impact of mother's education, but also rather suggest a much stronger impact of father's education (the two coefficients are statistically different from each other at the 3% level). Mechanisms that are suggested by the literature to explain the predominant role of mother's education rely on the

[17]The p-value given for the test is the significance level of the residual of the first-stage equation when introduced in the second stage equation, following **?**.

fact that mothers dedicate a larger share of their resources to education thereby improving the productivity of the human capital production function. In the context under scrutiny here, parental education might influence children's schooling mainly through other channels (through a direct preference effect for example, or through its impact on information and anticipation on the returns to education) and this could explain why fathers, acting as the main household decision makers, may have a dominant role here.

We found a negative endogeneity bias on father's schooling and not on mother's. This is consistent with the fact that mothers answer survey questions for themselves more often than fathers do, so that father's education is liable to larger potential measurement error. The directions of the observed endogeneity biases are stable across the whole range of specifications we experimented with. Finally, the effect of control variables (Table 6 in appendix) remains stable when parental education is instrumented: being a boy affects enrollment positively while being the eldest child affects it negatively.

Table 8 in appendix provides the results of the same estimations carried out separately for rural and urban areas (upper panel) and for boys and girls (lower panel). Those results are qualitatively similar to the core results. With instrumentation, the impact of father's education increases while that of mother's education becomes non significant. Once instrumented, although the point estimates are slightly higher in rural areas and for boys, they are not significantly different from their urban or girl counterpart.

We pursue our study with an estimation of the final level of education attained as a function of parental education (panel B of Table 2).[18] In this model, we generally fail to reject

[18]The same controls as before are significant and generally of the same sign (Table 6).

the exogeneity of the parents' education, but again, when instrumented, the estimated impact of father's education increases, while that of mother's decreases and becomes insignificantly different from zero. Since the two variables "ever enrolled" and "level attained" measure two aspects of the child's education, it is difficult to believe that father's education could be exogenous in one case and not in the other. Hence, our preferred specification, given in column 5 treats father's education as endogenous. This estimation indicates a significantly positive effect of both parents' education, with the point estimate for the father's education being nearly the double of that for the mother's. Nevertheless, these two coefficients are not significantly different from each other.

3.3 Empirical discussion of the instruments' validity

To conclude this analysis, we conduct a series of tests on the instruments in order to assess the limits previously mentioned in the paper.

Let us start with the question of primogeniture. Even if being the eldest is exogenous in the sense it is random and not controlled by the individual, it is correlated with the number of siblings since the more children, the less each one is likely to be the eldest. Number of siblings being potentially correlated with preferences towards human capital accumulation (Becker and Tomes, 1976), this could induce some correlation between being the eldest and unobserved heterogeneity. To assess the existence of such a correlation, our strategy is to assume that each couple wants at least three children. This assumption does not seem unreasonable in a country where an average woman gives birth to 5 children. For the subsample of children born among the three first in households with at least 3 children,

the likelihood of being the oldest among those three is the same for everyone in the sample and hence is uncorrelated with household preferences. We run the same regression for this subsample of children and find similar results.[19]

Regarding the use of dummies for the presence of health and education infrastructures in the neighborhood during childhood, we already pointed out different issues, the most important being the endogenous placement and a possible recall bias correlated with education. Since we do not know where the parents lived when they were age 10, we have to rely on the identifying restriction that being the eldest child is exogenous to test the conditional validity of the remaining instruments.[20] In our core model (column 5 of Table 2), the conditional exogeneity of the presence of infrastructure is not rejected ($P > \chi^2 = 0.69$ in the enrollment model and $P > \chi^2 = 0.94$ in the final level model).[21]

In total, our results suggest real differences of chances for two children whose backgrounds differ. For two children, one whose father has no education while the other's father has completed primary education (the difference in father's education such as measured by our variable is thus of 2 levels), then the second one has 15.8 percentage points more chances to enter school than the first. On the final level attained, we find that the above difference in their father's schooling should induce a difference of 0.85 level of education between the children. The following section aims at disentangling some possible mechanisms at play in

[19] Results not reproduced here but available from the authors.

[20] We introduce the infrastructures variables into the equation of interest (and keep them in the instrumentation equation) and check whether their coefficients are significantly different from zero or not.

[21] If one is willing to make the reverse hypothesis that infrastructures are exogenous in order to test the conditional exogeneity of being the eldest child, the test does not reject conditional exogeneity either.

this intergenerational transmission of education.

4 Assessing possible mechanisms

When parents are educated, it is not only the learning environment of the child that changes, but also many other characteristics of the living conditions. Among other things, educated parents are in general wealthier, less often operating a farm and have fewer children. Since wealth and detention of productive assets usually determine time allocation decisions for the children (Mueller, 1984; Dumas, 2007), it is interesting to understand whether the effect of parental education[22] on children's schooling is mainly a direct one or transits through these other changes for the children.

Simple correlations show that, in our data, father's education is positively correlated with wealth and negatively with livestock holding, area of land owned, and possession of an enterprise. We thus run a decomposition exercise using these variables. It does not exhibit causal impacts of these new factors but nevertheless allows us to assess by how much the effect of paternal education is dampened when we control for the changes in these variables.

4.1 Wealth

Wealth is likely to be endogenous for precisely the same reasons as parental education is. Nevertheless, it is worth noting that we expect the bias arising from measurement error to be relatively limited, since it is built on information the enumerators could easily check (housing

[22]In the following sections, we focus on father's education since it consistently came out as a significant determinant in the previous estimations.

conditions and durable goods ownership).[23] The instrumentation of this variable is carried out with the same set of instruments as those used for education (Table 7 in appendix).

The second and third columns of Table 3, panel A, gives the estimation of the impact of parent's education and wealth on the probability of having ever been enrolled in school in the case where only father's education is instrumented and in the case where wealth is as well. Instrumentation affects the results to the point that the impact of wealth becomes not significantly different from zero once instrumented. The positive bias on the coefficient of the wealth variable is consistent with the fact that some unobservable variables positively correlated with both parental wealth and children achievement are now accounted for. Nevertheless, tests fail to reject exogeneity. A similar result is apparent in Table 3, panel B, where the results of the decomposition exercise conducted for education level are presented. Since, in addition, instrumentation is rather weak, the specification where only the father's education is instrumented is preferred. The effect of father's education "net" of its impact on wealth remains equivalent to about 80% of the total effect (compare column (2) to column (1) in Table 3, suggesting that the impact of parental education does not transit mainly through its impact on wealth.

4.2 Productive assets

This decomposition exercise can be continued by the introduction of other controls that are correlated with parental education, namely an index of livestock holding, a dummy for

[23] An additional motive for not considering current income as most of the literature does is that it creates even more biases (simultaneity bias, namely) and thus is more difficult to instrument for. Given that no consumption nor income data have been collected, we are not in the position to compare the two approaches.

whether the household owns an enterprise and a measure of land holding. These variables reflect the household's activity choices. Column (4) in both panels of Table 3 shows that livestock ownership has a negative impact on enrollment while the other two variables have no additional explanatory power in the estimated models. The negative impact of livestock is consistent with the fact that children are often in charge of the care of livestock and that such labor might deter schooling. When comparing columns (2) and (4), it appears that controlling for assets ownership slightly increases the estimate for father's education but that the resulting coefficient is not statistically different from the one without these controls. Hence, the effect of parental education does not seem to transit through a change in parents' activity choices.

Although this decomposition exercise does not provide causal estimates, it is useful in giving us a sense for how much of the association between child and parental education can be attributed to various factors. In total, the direct impact of father's education that is not absorbed by controls for the wealth or activity choices of the household remains relatively important. This "residual" impact of parental education reflects the effect it has on parental preferences, information and anticipation with respect to children's education and to returns to education, as well as a higher productivity in the human capital production function.

5 Conclusion

This paper examines the relationship between economic and social backgrounds and schooling attainment in Senegal. It focusses more specifically on intergenerational schooling mobility.

The data we use, an original survey conducted in 2003, provide instruments that allow us

to deal with the issue of endogeneity of parental education variables. Instrumenting proved important since the estimated effect of father's education on enrollment increases by nearly 70% when its endogeneity is accounted for.

The results underline that children are not on an equal footing with regard to their chances of ever going to school and of attaining a given grade. Origin matters and influence both the probability of entering school and the final education level attained. This effect does not seem to be transmitted through improvements of living conditions or activity choices made at the level of the household and which could be determinant for children's time allocation choices (it accounts for a maximum of one fourth of father's education effect). It is therefore a direct effect, that in itself may encompass a number of different mechanisms. Educated parents may value education differently, have different expectations on returns to education, be able to help their children with homework, manage to have children in better health which could also contribute to their ability to learn, and so on.

The literature on this issue generally stresses the crucial role of mothers in determining their children's outcomes, and explains it by their input in the education and health production through the time spent with children notably for homework. We found that father's education matters more than mother's education. In the Senegalese context, the decision to keep children in or out of the formal schooling system is very much in a father's hands, but the daily presence after school hours is indeed more likely to be that of the mother. The role of father's education on the increase in children's schooling outcomes could then suggest that the main mechanisms at play are those arising from information, preferences

and expectations regarding education and its returns. It would be of interest to disentangle formally between these different mechanisms but this is left for future research.

From a policy point of view, this implies that if a particular effort for promoting education was made for one generation, it would have lasting effects for the following generation. This rather optimistic conclusion should nevertheless be toned down in two ways. First, as mentioned above, providing income might not be sufficient to increase education demand. Hence more subtle means might have to be developed, maybe through education campaigns that affect information and expectations of the parents. Second, even if successful, such push to the average level of education might not affect intergenerational schooling mobility. In order to improve equality of opportunities, identifying educational inputs that might compensate for the lack of parental education should therefore be a central objective: not only it would contribute to promote education in a given cohort, but it might be one of the few means at hand that can be used in a redistributive manner to help in increasing mobility.

References

Antonovics, K., Goldberger, A., 2005. Does increasing women's schooling raise the schooling of the next generation? American Economic Review 95, 1738–1744.

Barros, R., Lam, D., 1996. Income and educational inequality in children's schooling attainment. In: Birdsall, N., Sabot, R. H. (eds.), Opportunity Foregone: Education in Brzail, The John Hopkins University Press for the Inter-American Development Bank, Baltimore, 337–366.

Becker, G., Tomes, N., 1976. Child endowments and the quantity and quality of children. Journal of Political Economy 84, 143–162.

Behrman, J., 1997. Mother's schooling and child education: a survey. Pier Working Paper 97-025, Penn Institute for Economic Research.

Behrman, J., 1999. Social mobility: Concepts and measurement in Latin America and the Caribbean. In: Birdsall, N., Graham, C. (eds.), New Markets, New Opportunities? Economic and Social Mobility in a Changing World, The Brookings Institution and the Carnegie Endowment for International Peace, Washington, D.C.

Behrman, J., Foster, A., Rosenzweig, M. R., Vashishtha, P., 1999. Women's schooling, home teaching, and economic growth. Journal of Political Economy 107, 682–714.

Behrman, J., Rosenzweig, M., 2002. Does increasing women's schooling raise the schooling of the next generation? American Economic Review 92, 323–334.

Behrman, J., Taubman, P., 1985. Intergenerational mobility in earnings in the U.S: Some estimates and a test of becker's intergenerational endowments model. Review of Economics and Statistics 67, 144–151.

Behrman, J., Wolfe, B., 1987. Investments in schooling in two generations in pre-revolutionary Nicaragua: the roles of family background and school supply. Journal of Development Economics 27, 395–419.

Björklund, A., Lindahl, M., E., P., 2006. The origins of intergenerational associations: Lessons form swedish adoption data. Quaterly Journal of Economics 121, 999–1028.

Black, S., Devereux, P., Salvanes, K., 2005. Why the apple doesn't fall far: Understanding intergenerational transmission of human capital. American Economic Review 95, 437–449.

Blau, D., 1999. The effect of income on child development. The Review of Economics and Statistics 81, 261–276.

Card, D., 1995. Using geographic variation in college proximity to estimate the return to schooling. In: Christofides, L., Grant, E., Swidinsky, R. (eds.), Aspects of Labor Market Behaviour: Essays in Honour of John Vanderkamp, Toronto: University of Toronto Press.

Dumas, C., 2007. Why do parents make their children work? A test of the poverty hypothesis in rural areas of Burkina Faso. Oxford Economic Papers 59, 301–329.

Emerson, P., Souza, A., 2008. Birth order, child labor and school attendance. World Development Forthcoming.

Filmer, D., Pritchett, L., 2001. Estimating wealth effects without expenditure data - or tears: an application of educational enrollment in states of india. Demography 38, 115–132.

Lillard, L., Willis, R. J., 1994. Intergenerational educational mobility: Effects of family and state in Malaysia. The Journal of Human Resources 29, 1126–1166.

Maurin, E., McNally, S., 2008. Vive la révolution! long term returns of 1968 to the angry students. Journal of Labor Economics 26, 1–35.

Mueller, E., 1984. The value and allocation of time in rural Botswana. Journal of Development Economics 15, 329–360.

Oreopoulos, P., Page, M., Stevens, A., 2006. The intergenerational effects of compulsory schooling. Journal of Labor Economics 24, 729–760.

Plug, E., 2004. Estimating the effect of mother's schooling on children's shooling using a sample of adoptees. American Economic Review 94, 358–368.

Sacerdote, B., 2007. How large are the effects from changes in family environment? a study of korean american adoptees. Quaterly Journal of Economics 122, 119–157.

Sahn, D., Stifel, D., 2003. Exploring alternative measures of welfare in the absence of expnditure data. Review of Income and Wealth 49, 463–489.

A Tables in the text

Table 1: Levels of education, for children 10 to 21 years old, and for their parents; probability of having ever been enrolled in school, by parents' education level

Panel A: Levels of education for children and their parents

Code	Level	Child	Father	Mother
1	no schooling	18.3%	60.4%	74.2%
2	incomplete primary	39.6%	6.8%	7.7%
3	complete primary	19.1%	12.4%	9.6%
4	incomplete lower secondary	16.7%	4.1%	3.1%
5	complete lower secondary	3.3%	7.0%	3.5%
6	incomplete higher secondary	2.2%	1.8%	1.2%
7	complete higher secondary	0.7%	4.3%	0.4%
8	university	0.1%	3.2%	0.3%

Panel B: Child's probability of having ever been enrolled in school, by parents' education levels

Code	Education level	of the father	of the mother
1	no schooling	73%	77%
2	incomplete primary	91%	95%
3	complete primary	94%	95%
4	incomplete lower secondary	96%	98%
5	complete lower secondary	97%	98%
6	incomplete higher secondary	99%	100%
7	complete higher secondary	98%	100%
8	university	99%	95%

Table 2: Impact of parental education on schooling outcomes

	(1)	(2)	(3)	(4)	(5)
Panel A : probability of having ever been enrolled					
Father's education	0.047***	0.125**	0.107***	0.091***	0.0794***
	(0.008)	(0.057)	(0.034)	(0.029)	(0.0190)
Mother's education	0.027**	-0.348	-0.067	-0.035	0.00116
	(0.013)	(0.235)	(0.072)	(0.063)	(0.0191)
father's edu exogeneity		0.139	0.050	0.083	0.0605
mother's edu exogeneity		0.113	0.200	0.342	
# Obs	2234	2439	2293	2234	2234
Pseudo-R^2	0.21	0.21	0.22	0.21	0.21
Panel B : final level of education					
Father's education	0.302***	0.746	0.482***	0.474***	0.423***
	(0.042)	(0.565)	(0.186)	(0.175)	(0.102)
Mother's education	0.320***	-0.934	0.147	0.149	0.219**
	(0.070)	(1.616)	(0.386)	(0.364)	(0.0956)
father's edu exogeneity		0.364	0.197	0.157	0.078
mother's edu exogeneity		1.497	0.416	0.344	
# Obs	2592	2710	2657	2592	2592
Pseudo R^2	0.131	0.128	0.132	0.132	0.132
Instrumented variables :					
Father education	no	yes	yes	yes	yes
Mother education	no	yes	yes	yes	no
Instruments	None	Eldest child	Infrastructures	Both	Both
F-stat Father's education		14.06	54.97	42.33	14.29
F-stat Mother's education		1.99	30.52	21.31	

Note: Estimation is performed by maximum likelihood. RHS variables include child's gender, whether the child has no older brother, no older sister, household size, communities fixed effects. Coefficients reported are marginal effects. Standard errors are clustered at the household level. ***, ** and * mean respectively that the coefficient is significantly different from 0 at the 1%, 5% and 10% level. 1st-stage regressions are provided in Table 7. Lines entitled father's or mother's edu exogeneity provide p-values for tests of exogeneity of these variables.

Table 3: Decomposition of the effect of background variables on schooling outcomes

	(1)	(2)	(3)	(4)
Panel A : probability of having ever been enrolled				
Father's education	0.0794***	0.0668***	0.0838**	0.0733***
	(0.0190)	(0.0200)	(0.0420)	(0.0197)
Mother's education	0.00116	-0.00469	0.00331	-0.00253
	(0.0191)	(0.0179)	(0.0265)	(0.0166)
Wealth		0.0688***	-0.0496	0.0534**
		(0.0235)	(0.265)	(0.0242)
Livestock				-0.0121**
				(0.00581)
Enterprise				0.0469**
				(0.0223)
Land area (in ln)				-0.00263
				(0.00266)
father's edu exogeneity	0.0605	0.163	0.279	0.0838
wealth exogeneity			0.597	
Pseudo R^2	0.211	0.227	0.227	0.237
# of observations	2234	2234	2234	2194
Panel B : final level of education				
Father's education	0.423***	0.334***	0.387	0.360***
	(0.102)	(0.111)	(0.238)	(0.112)
Mother's education	0.219**	0.175*	0.200	0.169*
	(0.0956)	(0.0896)	(0.143)	(0.0875)
Wealth		0.541***	0.176	0.521***
		(0.132)	(1.495)	(0.137)
Livestock				-0.0471
				(0.0350)
Enterprise				0.0862
				(0.114)
Land area (in ln)				0.0154
				(0.0156)
father's edu exogeneity	0.078	0.238	0.060	0.134
wealth exogeneity			0.132	
Pseudo R^2	0.132	0.142	0.142	0.145
# of observations	2592	2592	2592	2563
Instrumented variables:				
Father education	yes	yes	yes	yes
Mother education	no	no	no	no
Wealth		no	yes	no
F-stat Father's education	14.29	11.99	14.29	11.42
F-stat Wealth			2.89	

Note: Dependant variables are "having ever been enrolled in school" for panel A and final level of education for panel B. Estimation is performed by maximum likelihood. RHS variables include child's gender, whether the child has no older brother, no older sister, household size, communities fixed effects. Coefficients reported are marginal effects. Standard errors are clustered at the household level. ***, ** and * mean respectively that the coefficient is significantly different from 0 at the 1%, 5% and 10% level. 1st-stage regressions are provided in Table 7. Lines entitled father's edu and wealth exogeneity provide p-values for tests of exogeneity of these variables.

B Tables in appendix

Table 4: Intergenerational Schooling Mobility (father) (children aged from 14 to 20)

Child	Lev 1 vs.			Lev 2 vs.		Lev 3 vs.
Father	Lev 2	Lev 3	Lev 4	Lev 3	Lev 4	Lev 4
No schooling vs.						
Incomplete primary	6.55	3.66	6.93	0.56	1.06	1.89
	(1.50)	(0.78)	(1.40)	(0.09)	(0.17)	(0.26)
Complete prim. or more	5.99	5.45	8.35	0.91	1.40	1.53
	(1.28)	(1.03)	(1.53)	(0.14)	(0.21)	(0.17)
Complete lower sec or more	20.04	4.38	47.8	0.72	2.39	3.33
	(6.96)	(4.80)	(15.5)	(0.12)	(0.36)	(0.39)
Incomplete primary vs.						
Complete prim. or more	0.91	1.49	1.21	1.63	1.32	0.81
	(0.27)	(0.41)	(0.31)	(0.34)	(0.25)	(0.13)
Complete lower sec or more	3.06	3.93	6.91	1.29	2.26	1.76
	(1.23)	(1.52)	(2.58)	(0.28)	(0.44)	(0.28)
Complete primary or more vs.						
Complete lower sec or more	3.35	2.64	5.73	0.79	1.71	2.17
	(1.32)	(0.99)	(2.09)	(0.16)	(0.32)	(0.31)

Note: Education levels: 1 if never attended school, 2 if dropped out before the end of primary, 3 if still in primary, 4 if entered secondary.
Reading: The first coefficient means that: 2 children, one whose father has no education and the other whose father has some incomplete primary education, are 6.55 more likely to reproduce the position of their fathers rather than to reverse it. In this particular mobility matrix, coefficients obtained for the highest level of education are not very meaningful since the youngest children of this sample cannot possibly have completed lower secondary education and may not have dropped out yet. Nevertheless, regarding the lower levels of education, at age 14, every one should have at least entered primary school so that the reproduction coefficient in the upper left corner of the matrix is likely to be correct. In fact, it is very similar to the one obtained when concentrating on an older cohort where all have completed their education.

Table 5: Sample statistics

	Sample 1			Sample 2		
Variable	Sample size	Mean	Std. Dev.	Sample size	Mean	Std. Dev.
Ever enrolled in school	6793	0.81	0.38	2592	0.83	0.37
Level attained	6793	2.56	1.25	2592	2.53	1.23
Father's level	6793	2.28	1.98	2592	2.45	2.11
Mother's level	6793	1.60	1.24	2592	1.65	1.27
Wealth	6793	0.04	0.95	2592	−0.03	0.96
Boy	6793	0.51	0.49	2592	0.54	0.49
Household's size	6793	12.76	6.01	2592	12.98	5.94
No older brother	6793	0.52	0.49	2592	0.42	0.49
No older sister	6793	0.58	0.49	2592	0.50	0.50
Age	6793	15.12	3.11	2592	14.68	3.09

Note: Sample 1: children 10 to 21 years old for whom all the explicative variables are not missing; Sample 2: children 10 to 21 years old for whom the instrumentation variables are available, i.e parents live at home.

Table 6: School enrollment and final level: effect of the controls, comparison of the samples

	School enrollment			Final level		
Sample	Whole	Reduced	Reduced	Whole	Reduced	Reduced
Father's edu instrumented	no	no	yes	no	no	yes
Father's education	0.0446***	0.0469***	0.0913***	0.266***	0.263***	0.451***
	(0.0039)	(0.0077)	(0.0285)	(0.021)	(0.038)	(0.152)
Mother's education	0.0403***	0.0267**	-0.0347	0.297***	0.340***	0.129
	(0.0069)	(0.0128)	(0.0631)	(0.035)	(0.062)	(0.338)
Boy	0.0751***	0.0653***	0.0739***	0.530***	0.273***	0.305***
	(0.0082)	(0.0153)	(0.0164)	(0.053)	(0.078)	(0.082)
Household size	0.00018	-4.72e-05	-9.00e-05	0.000	-0.002	-0.002
	(0.0008)	(0.0018)	(0.0019)	(0.005)	(0.009)	(0.009)
No older brother	-0.0253***	-0.00710	-0.0155	-0.044	0.193**	0.156*
	(0.0080)	(0.0158)	(0.0166)	(0.053)	(0.084)	(0.086)
No older sister	-0.0241***	-0.0381**	-0.0365**	-0.121**	-0.165**	-0.160*
	(0.0082)	(0.0157)	(0.0157)	(0.056)	(0.084)	(0.084)
Constant				2.707***	2.831*	2.648***
				(0.252)	(0.350)	(0.387)
# of Observations	6843	2234	2234	6793	2592	2592
Pseudo-R^2	0.226	0.208	0.211	0.104	0.131	0.132

Note: Additional controls include communities fixed effects. Coefficients reported are marginal effects. Standard errors are clustered at the household level. ***, ** and * mean respectively that the coefficient is significantly different from 0 at the 1%, 5% and 10% level.

Table 7: Instrumentation of parental background variables

		Father education	Mother education	Wealth
Father side	no older brother	-0.442***	-0.109**	-0.038*
		(0.068)	(0.043)	(0.023)
	no older sister	0.065	0.002	-0.027
		(0.071)	(0.044)	(0.024)
	primary school	0.874***	0.250***	0.209***
		(0.103)	(0.064)	(0.034)
	low. 2ndary school	0.425***	-0.014	0.086*
		(0.139)	(0.088)	(0.046)
	upp. 2ndary school	0.222	0.252***	0.045
		(0.145)	(0.092)	(0.048)
	health care	-0.012	-0.023	-0.042
		(0.119)	(0.075)	(0.040)
Mother side	no older brother	-0.008	0.034	-0.021
		(0.068)	(0.043)	(0.023)
	no older sister	-0.312***	-0.011	-0.073***
		(0.069)	(0.043)	(0.023)
	primary school	-0.133	0.111+	0.011
		(0.105)	(0.066)	(0.035)
	low. 2ndary school	0.343***	0.273***	0.022
		(0.127)	(0.081)	(0.042)
	upp. 2ndary school	0.548***	0.173**	0.201***
		(0.133)	(0.085)	(0.044)
	health care	0.300**	0.249***	0.037
		(0.116)	(0.073)	(0.039)
	Observations	2637	2631	2655
	R-squared	0.44	0.39	0.70
	Partial R^2	0.16	0.09	0.08

Note: The instrumentation of parental wealth and of parental education level is done by OLS. Control variables of the regression of interest are included (including community fixed effects) but omitted in the table. * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors in parentheses.

Table 8: Impact of parental education on having ever been enrolled in school, by gender and by living area

	(1)	(2)	(3)	(4)
	No instrumentation		Instrumentation	
	Rural	Urban	Rural	Urban
Father's education	0.080***	0.021***	0.093**	0.067***
	(0.009)	(0.003)	(0.044)	(0.028)
Mother's education	0.055***	0.024***	0.027	-0.065
	(0.017)	(0.005)	(0.102)	(0.058)
	Boy	Girl	Boy	Girl
Father's education	0.035***	0.063***	0.125***	0.090**
	(0.004)	(0.007)	(0.041)	(0.043)
Mother's education	0.030***	0.062***	-0.037	-0.031
	(0.007)	(0.007)	(0.091)	(0.096)

Note: Dependant variable is "having ever been enrolled in school" and estimation is performed by maximum likelihood. RHS variables include child's gender, whether the child has no older brother, no older sister, household size, communities fixed effects. Estimations are run separately by living area and by gender. Coefficients reported are marginal effects. Standard errors are clustered at the household level. ***, ** and * mean respectively that the coefficient is significantly different from 0 at the 1%, 5% and 10% level.