

# Koranic Schools in Senegal : A real barrier to formal education ?<sup>1</sup>

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## Abstract

State education systems in Sahelian countries do not teach religious education, which is provided by the informal sector. This article is a first attempt to quantitatively study how this dual educational system works and whether the potential competition between both systems is a key factor behind low primary school enrolment in Senegal. The analysis is based on a unique national dataset covering 1,800 households, with detailed information on formal and Koranic schooling of 5 to 21 year-old children. In our sample, over half of the girls and 60% of the boys attend a Koranic school for at least one year, although most of them stay for only two to three years. We present a brief background on Islam and Koranic schools in Senegal to provide a better understanding of the complexity of the subject. We then examine the determinants of Koranic schooling before going on to analyze its compatibility with formal schooling. A descriptive analysis shows that children who attend Koranic school for a few years have a higher probability of attending formal primary school than those who do not go to Koranic school at all and those who pursue long Koranic studies. So as to identify the substitution between Koranic schools and formal school, we use an instrumental strategy based on the opening of formal schools. Our I.V. estimations show that substitution effect dominates for boys. This substitution probably shows that both school careers are considered as relevant educational choices by some Senegalese households, and that there is competition between formal school enrolment and Koranic education in Senegal.

As the opening of formal schools changes the formal school enrolment decisions, the choice of full time Koranic enrolment is probably partly due to the poor quality of formal schools. Hence, improving the quality of formal education could actually raise formal school enrolment. The existence of full time Koranic education could therefore be partly a signal indicating the poor quality of the formal school system. However it is probably the case that this existence is also partially based on real preferences for religious education. The preferences of some households for Koranic education could therefore prevent formal primary education even if the quality of formal education is good. The potential existence of such households would raise the question of an improved integrated education system facilitating them finding a balance between the two types of education.

# 1 Introduction

In many Muslim Sahelian countries, state education does not include religious teaching. So religious education takes place in the informal sector. These countries post among the lowest primary school enrolment rates in the world and have informal Koranic schools.

After looking at the particularities of Islam in Senegal and how Koranic schools operate, this paper studies the duality of the Senegalese education system, and assesses whether there is both types of education compete for the time of the children or the resources of the parents.

## 1.1 Islam in Senegal

Muslims account for 94%<sup>1</sup> of the Senegalese population. Islam came from North Africa in the 10th century and was initially the religion of the elite along the trans-Saharan trading routes, according to Robinson (2004). In the 19<sup>th</sup> century, a massive conversion movement swept through all of society's strata, fueling the army of "Jihads" against the European colonizers and non-Muslim states (Robinson, 1985).

Today, most Senegalese Muslims (90%) are members of Sufi brotherhoods (known in Arabic as "tariqah", "confrérie" in French). Sufi is a mystical branch of Islam, notably characterized by the intensity of the master-disciple relationship. The master ("marabout" in Senegalese French, "shaykh" in both Arabic and Wolof) teaches his method ("tariqah" means "way", "path") to his disciples, who seek the ultimate truth through spiritual practices and asceticism. There are four main Islamic brotherhoods in Senegal, but two, namely the Tijanyyah and the Muridiyyah represent over 80%.

Contrary to the Tijanyyah which originated from Alegeria and came to Senegal in the early 19<sup>th</sup> century, the Muridiyyah, founded by Sheikh Ahmadou Bamba in 1885, is a native Senegalese brotherhood well established in Wolof society. It was initially a rural movement which then spread to the urban centers. Although it reportedly ranks second in size, it is the most active brotherhood and is particularly successful at attracting urban youth. As already noted by Diop (1981) this clear strategy announces the hegemony of the brotherhood. Today, portraits of its founder can be seen all over the walls of Dakar.

The attractiveness of the Muridiyyah seems to be due to its adaptation to the local social context. Sy (1980) explains that the Muridiyyah appeared in the 19<sup>th</sup> century in response to colonial influence and hierarchical Wolof society. Tuba, their holy center, is an impressive illustration of the brotherhood's economic success : the modern city rose up out of the peanut fields, built by remittances from disciples all around the world. It is now the second largest city in Senegal, with over 450,000 inhabitants in 2002 according to the Population census data.

It is important to bear in mind that the country is renowned for its tolerant Islam. Recently, however, a new Islamist movement known locally as "Ibadou" has been spreading throughout the urban elite. Its success is particularly manifest in the universities, where a growing number of young women wear the veil. To our knowledge, there are no reliable sources available to provide accurate information on the extent of the phenomenon.<sup>2</sup>

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1. Source : CIA - The World Factbook : <https://www.cia.gov/library/publications/the-world-factbook/geos/sg.html>

2. Villalon (2004) quotes a sociological study that estimates the proportion of veiled women on university campuses at between 5 and 10%.

## 1.2 Islamic schools in Senegal

In common with many other Muslim countries, state schools offer little or no religious education. So children are sent to (informal) Koranic school. In view of the particularity of the practice of Islam in this region, we now give a short presentation of Koranic schools in Senegal. Although they are often perceived merely as institutions that put children on the streets begging, Koranic schools actually encompass a broader reality.

It is very hard to obtain reliable data on Koranic education in Senegal. They take on a variety of forms, from informal village schools to more formal Franco-Arab schools. There is no rigid structure to informal Koranic schools in Senegal and in neighboring countries. However, three levels can be identified : (Following World Bank (1999))

- The primary Koranic level : once children are able to speak, typically between three and five years old, they are often sent to Koranic school where they are given a basic knowledge of the Koran.
- The secondary Koranic level : some of the children who have memorized large portions of the Koran are then taught “Islamic science”, i.e. translating the holy book and the written traditions of the religion.
- Higher Koranic studies : a few students proceed to this level, usually with eminent masters and often in prestigious Islamic universities in North Africa or other Muslim countries.

This description is naturally quite subjective. For example, Gandolfi (2003) defines five Koranic school levels by sub-dividing the first two levels above into two sub-levels. This structure seems to be very similar in many Muslim Sub-Saharan regions.

The first two Koranic levels (denoted here as primary and secondary Koranic levels) are locally known as “écoles coraniques” in French and “daara” in Wolof. This elementary teaching begins with learning the Koran by heart without understanding it, begging the question as to what skills are actually transmitted. Although students are taught to read and write Koranic verses, they rarely master Arabic. The ultimate aim of this school is to prepare the children to become good Muslims. The main values transmitted are obedience, respect, and submission. Pedagogical strategies may include corporal punishment and begging for food, whenever the child lives with the Koranic master. These harsh treatments are supposed to allow students to experience humility and solidarity, both highly valued in Sufi Islam<sup>3</sup>.

It is also believed that children learn more away from their parents, who cannot then interfere with the master’s strict discipline (Perry, 2004). In this case, as tuition in traditional Koranic schools is usually free, and Koranic masters cannot afford to feed all their pupils, Talibes<sup>4</sup> are fed by neighbors. It is indeed a common practice for some families to be informally assigned to feed some Talibes. However, it is also very common to see Koranic students begging for food at traffic lights in some areas (especially downtown Dakar).

The practice of fostering children is widespread in West Africa. However, it is very hard to obtain accurate estimates of the number of children fostered out to Koranic masters. A recent household survey in Senegal estimates that they represent approximately 1% of boys aged 15 or under (see Beck, 2009). Children’s rights advocates tend to exploit these figures to alarm public opinion and officials, since children fostered out to Koranic masters often live

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3. As is certainly not always the case, the violence inflicted on Koranic students by their masters is somehow tolerated and deemed normal treatment, cf. Sy (1980) and the first pages in Kane’s famous novel, *Ambiguous Adventure*.

4. Koranic school students in Wolof although there is some confusion here, since the term refers to disciples in the broad sense and therefore any Murid followers.

very deprived existences. Perry (2004) analyzes the discrepancy between their assertions and the local population's experience, in a small-scale study of rural Wolof Tijane. The media often focus on urban Talibes begging with tin cans on the streets of business districts and tourist areas, dressed in rags and in poor health. The local press and internet<sup>5</sup> regularly cover stories on Koranic masters exploiting their Talibes by forcing them to collect a certain amount of money per day under the threat of physical punishment. Former Talibes who run away from their harsh masters often become street children. UNICEF estimates that 100,000 children beg in Senegal<sup>6</sup> and Understanding Children's Work (2007)<sup>7</sup> estimates that 90% of child beggars in Senegal are former Talibes.

However, children fostered to Koranic masters represent only a minority of Koranic students in Senegal. Many primary school pupils attend simultaneously Koranic school either after school or during vacations. Usually they will only learn basic knowledge to be able to recite the prayers.(Gandolfi, 2003)

As traditional Koranic schools do not have any precise timetables or curricula, unlike the formal education system, there is no guarantee of the quality of the teaching. However, there have been attempts to modernize them. The most significant example of this is the development of Franco-Arab schools ("*école franco-arabe*" similar to "*madrassa*" in other contexts) since the 1950s, with recent growth in the 2000s (Ibid.), in an endeavour to balance formal and religious schooling. In this paper, Franco-Arab schools are defined as formal education. Indeed, in some Franco-Arab schools, pupils take the same exams as in formal state schools, so these schools are undoubtedly formal.

In Dakar, many pre-school Islamic institutions have emerged, providing an alternative to traditional Koranic schools. One difference between the two systems is that these modern institutions have relatively high fees (Gandolfi (2003) mentions up to CFAF 1,000 per month in Dakar.).

Finally beyond the main aim of teaching the Koran to the children, Koranic schools allow students to bond and generate reliable networks. The economic success of the Murids makes Murid Koranic schools potentially useful to be able to benefit from the brotherhood's powerful network in the informal sector (World Bank, 1999) and in illegal migration channels (See for instance Lacombe (2000) about Murid networks in Spain.).

### 1.3 Is there any competition with (formal) primary schools ?

Senegal is part of the UN's Education For All (EFA) Programme, which aims to achieve universal primary education as part of the Millennium Development Goals. Yet primary education is a long way from being universal, with a 57% net primary school enrolment rate posted in 2002 and 71% in 2007<sup>8</sup> Supply-side issues are certainly a key barrier to access to education, but demand-side issues are also believed to play an important role. When uneducated parents do not see the benefits of formal schooling, their motivation to send their children to school is low. Conversely, sending children to Koranic school may be the result of higher perceived returns described earlier. In addition, some Senegalese see the state system of formal education

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5. See, for example : <http://www.irinnews.org/report.aspx?reportid=50001>

6. [http://www.unicef.org/protection/senegal\\_34961.html](http://www.unicef.org/protection/senegal_34961.html)

7. Inter-Agency Research Cooperation Project on child labor involving the ILO, UNICEF and the World Bank.

8. UNESCO-UIS website, [http://stats.uis.unesco.org/unesco/TableViewer/document.aspx?ReportId=121&IF\\_Language=eng&BR\\_Country=6860&BR\\_Region=40540](http://stats.uis.unesco.org/unesco/TableViewer/document.aspx?ReportId=121&IF_Language=eng&BR_Country=6860&BR_Region=40540)

as a legacy of colonization but, by contrast, see Koranic school as closer to Senegalese traditions.<sup>9</sup> As mentioned earlier though, the two systems may not necessarily compete, since many children are sent to Koranic school at the end of their (formal) schooldays (and on weekends and during vacations). Hence, the two types of education are theoretically compatible.

Despite their pervasive influence in contemporary Senegal, Koranic schools have been neglected by development planners. This article is, to our knowledge, the first attempt to quantitatively study links between the two types of schooling and potential substitutabilities or complementarities using a unique data set on education with information on Koranic (and formal) schooling in Senegal.<sup>10</sup> Given the many similarities with Koranic schooling in other Sahelian countries where low primary school enrolment rates are encountered, conclusions drawn from this national survey could give some clues as to the mechanisms in play in neighboring countries as well.

Section 2 presents our dataset followed by some descriptive statistics on Koranic school enrolment. Section 2 analyzes the determinants of Koranic education and presents our empirical strategy to study the possible links between Koranic and formal schooling. Results and policy implications conclude.

## 2 Data and descriptive statistics on Koranic schooling

### 2.1 The dataset

In this paper, we use the EBMS<sup>11</sup> dataset. It is a national household survey conducted in Senegal in 2003 on 1,800 households. The data collected contain detailed information on the educational paths of household members and their relatives (parents, siblings and children), including longitudinal information on the formal school career. It also includes information on the living conditions : possession of durable goods, employment status, health, etc. The survey also includes unique (to our knowledge) information on Koranic schooling, with data on Koranic school enrolment length for each household member aged between 5 and 21. It does not include any other information on Koranic school career, and in particular no longitudinal information. Appendix A gives details and descriptive statistics of the variables used in this paper.

The EBMS survey was designed to resurvey some of the pupils that took school attainment tests during the previous PASEC Senegal survey.<sup>12</sup> The PASEC survey randomly selected 20

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9. See in particular Huet-Gueye and de Léonardis (2005) for a lexical and morphosyntactical analysis of parents' social perceptions vis-à-vis schooling choices for their children. Traditionalist versus modernist views clearly shapes Koranic versus formal schooling choices.

10. Andrabi, Das, Khwaja, and Zajonc (2006) estimate the proportion of children attending religious primary schools in Pakistan. The purpose of their paper, namely comparing the rate of Koranic school enrolment reported by newspapers with the actual enrolment rate, is not relevant in this paper. Instead, we focus on the compatibility between the acquisition of formal human capital and religious education.

11. EBMS is a survey of household education and well-being in Senegal : *“Education et Bien-être des Ménages au Sénégal”*. This survey was designed by a team of researchers from Cornell University, USA and from LEA-INRA, France, and conducted in association with the Centre de Recherche en Economie Appliquée (Dakar, Senegal). The authors would like to thank Christelle Dumas and Sylvie Lambert for making the data available.

12. PASEC is an education system analysis program : *“Programme d'Analyse des Systèmes Educatifs de la CONFEMEN”* (created in 1991 following the Jomtien Conference on *Education for All*). CONFEMEN is the oldest organization in the union of French-speaking countries : *“Conférence des Ministres de l'Education ayant le français en partage”* set up in 1960. PASEC conducted a panel survey in Senegalese primary schools between 1995 and 2000. This panel included school attainment tests. For further information on the PASEC Programme,

second grade pupils from 99 primary schools in 1995. The households in the neighborhoods of 60 schools surveyed by PASEC were resurveyed by EBMS. In each of these neighborhoods, the maximum number of households possible (up to 20) with at least one PASEC child were surveyed. Other households in the school's catchment area (village or neighborhood in urban areas) were surveyed, bringing the total number of households surveyed in each community up to 30. All the information used in this survey was collected during the EBMS survey.

This particular sampling design has certain repercussions on inference issues. First, each surveyed community has a school at least since 1995. As a result, Koranic school enrolment is observed provided formal schooling is also available. This tends to underrepresent remote areas where there were no primary schools until recently. Second, PASEC households are in our sample because they enrolled a child in second grade for the 1995/1996 school year. Consequently, recently formed households are probably underrepresented in our sample. Households with very low preferences for formal schooling may also be underrepresented.

This section presents some descriptive statistics on Koranic school enrolment in our sample, and then analyzes its determinants.

## 2.2 Age on enrolment in Koranic school

In Figure 1, we plot the proportion of children who have attended Koranic school and their age in our dataset. Two effects can explain the differences between the enrolment rates of the older and the younger cohorts. First, the proportion of children in the older cohort who have not yet attended Koranic school, but will attend Koranic school in the future is smaller. Second, the difference in Koranic school enrolment between the two cohorts is affected if Koranic school enrolment decreases (or increases) over time. With the data in hand, the two mechanisms are theoretically unidentifiable. However, we observe that the Koranic school access rate of boys increases sharply with age up to 11 years old. It increases sharply only until the age of 9 for girls. We therefore assume that girls aged more than 9 and boys aged more than 11 will not be enrolled in the future in Koranic schools if they have not been enrolled yet.

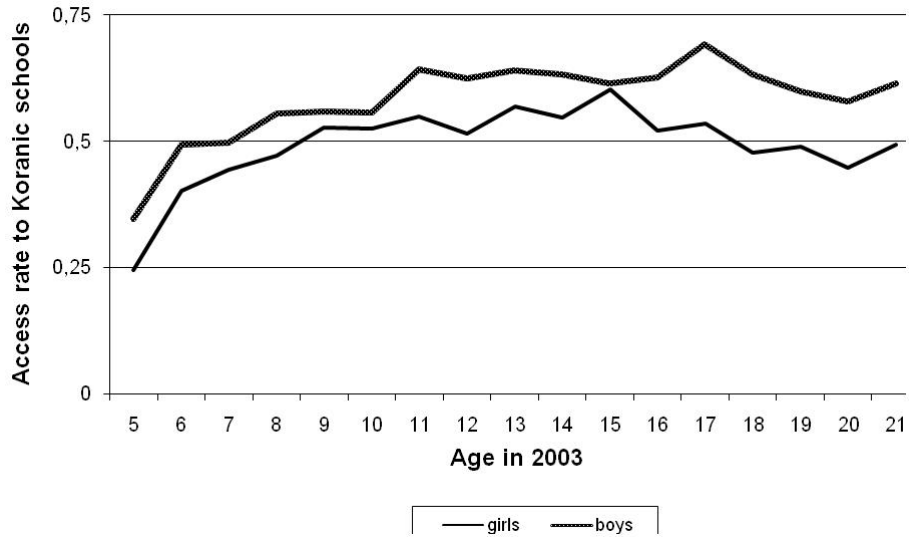
In Figure 2, we plot the average length of Koranic schooling against age in 2003. In this case, the number of years spent in Koranic school does not increase after 18 years old for the boys and 15 years old for the girls. Consequently, we make the following assumption : girls over 15 and boys over 18 have finished their Koranic schooling.

## 2.3 Length of Koranic schooling

Table 1 shows the distributions of the length of Koranic schooling for girls and boys. The distributions are computed for those individuals old enough for us to reasonably assume that Koranic schooling is over : namely girls 15 or older and boys 18 or older. For this reason, there are more girls than boys in the sample.

We observe that approximately half of the girls and 40% of the boys have never attended Koranic school. The majority of children who go to Koranic school attend for two to three years. Only 15% of girls and 27% of boys attend Koranic school for more than three years.

FIGURE 1 – Koranic school enrollment by age in 2003



Note : The access rate to Koranic schools is the share of children having been enrolled in Koranic schools at least one year.

FIGURE 2 – Schooling duration in Koranic school and age in 2003

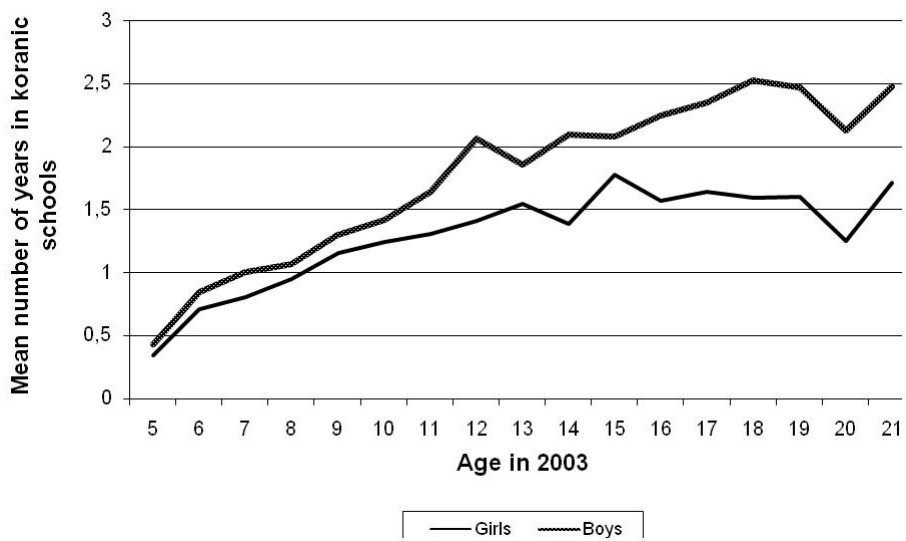


TABLE 1 – Number of years in Koranic school for boys and girls

| Nb. of years in Koranic school | Girls (15 y. o. or more) | Boys (18 y. o. or more) |
|--------------------------------|--------------------------|-------------------------|
| 0                              | 49,1%                    | 40,3%                   |
| 1                              | 8,9%                     | 6,9%                    |
| 2                              | 15,8%                    | 14,5%                   |
| 3                              | 10,4%                    | 11,0%                   |
| 4                              | 5,5%                     | 7,2%                    |
| 5                              | 5,1%                     | 7,8%                    |
| 6                              | 1,7%                     | 3,8%                    |
| 7                              | 1,0%                     | 1,9%                    |
| 8 or more                      | 2,4%                     | 6,5%                    |
| Nb. of obs.                    | 1752                     | 780                     |

## 2.4 Determinants of Koranic schooling

In Table 2, we estimate different specifications for the determinants of Koranic school enrolment for girls. In columns 1, we estimate two specifications of a probit model for the determinants of attending a Koranic school. In columns 2, 3 and 4, we estimate the determinants of the number of years in Koranic school with OLS. We include in the sample all girls aged 15 and over, as we observed in Figure 2 that girls over 15 have probably finished their Koranic schooling. In Table 3, we run the same regressions for boys over 18 years old, since previous observations show that they have probably finished their Koranic schooling.

Standard economic theories summarized recently by Glewwe (2002) or Orazem and King (2008) give insights on the factors affecting the demand for education. The interpretation scheme is mainly based on the seminal work of Becker (1967), meaning that depend on the costs and advantages of education.

Concerning the advantages of education, the skills learnt at school are probably the main reasons why children enroll. The preferences for religious education are probably strongly heterogeneous, and the data do not include any proxy for these skills. We nevertheless observe that ethnic group is a strong determinant of Koranic schooling, which might be explained by differences in preferences for religious education. The main ethnic group in Senegal, Wolof, is taken as a reference. Two ethnic groups attend Koranic school significantly less : the Serer and the Dioula. The average number of years of Koranic schooling is between 0.5 and 1 year lower for Serer and Dioula girls respectively compared to Wolof girls (with an average of 1.6 years of Koranic schooling) and between 0.8 and 1.4 years lower for Serer and Diola than Wolof boys (average : 2.4 years of schooling). The Soninké ethnic group posts greater Koranic school attendance among boys and girls, and the Pulaar ethnic group among boys only. Regressing the number of years spent in Koranic school on the ethnic groups explains 7.9% of the variance for boys and 4.6% for girls, whereas regressing the last grade attended in formal school on the ethnic groups explains 1.4% of the variance for boys and 2.9% for girls. Ethnicity explains a larger part of the variance in Koranic school than in formal school enrolment. This underlies the

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see [http : //www.con.femen.org/](http://www.con.femen.org/)

TABLE 2 – Determinants of Koranic school enrolment for girls

|   | Has ever attended<br>Koranic school<br>(probit model) | Number of years in<br>Koranic school (OLS) |                     |                     |
|---|---|--|---------------------|---------------------|
|   | (1)   | (2)  | (3)                 | (4)                 |
| Age   | -0.063**<br>(0.016)                                   | -0.051+<br>(0.028)                         | -0.077*<br>(0.031)  | -0.071*<br>(0.029)  |
| Rural   | -0.220<br>(0.138)                                     | -0.159<br>(0.225)                          | -0.072<br>(0.212)   | -0.067<br>(0.236)   |
| Wealth (Possession of durable goods)            | 0.177**<br>(0.055)                                    | 0.257**<br>(0.087)                         | 0.401**<br>(0.120)  | 0.515**<br>(0.113)  |
| Father's Education                              | 0.031<br>(0.028)                                      | 0.005<br>(0.051)                           | -0.029<br>(0.052)   | 0.025<br>(0.066)    |
| Mother's Education                              | 0.045<br>(0.028)                                      | 0.062<br>(0.062)                           | 0.035<br>(0.074)    | 0.000<br>(0.065)    |
| The household's head works in the formal sector | -0.088<br>(0.090)                                     | -0.338*<br>(0.134)                         | -0.666**<br>(0.172) | -0.470**<br>(0.161) |
| The household's head is farmer                  | 0.107<br>(0.124)                                      | 0.085<br>(0.224)                           | 0.002<br>(0.277)    | 0.166<br>(0.234)    |
| Ethnic group : Pulaar                           | 0.080<br>(0.132)                                      | 0.108<br>(0.255)                           | 0.659*<br>(0.300)   | 0.403<br>(0.301)    |
| Ethnic group : Serere                           | -0.482**<br>(0.157)                                   | -0.784**<br>(0.212)                        | -0.416+<br>(0.236)  | -0.430+<br>(0.229)  |
| Ethnic group : Dioula                           | -0.673**<br>(0.216)                                   | -0.973**<br>(0.252)                        | -0.296<br>(0.384)   | -0.623+<br>(0.336)  |
| Ethnic group : Mandingue                        | 0.047<br>(0.223)                                      | 0.161<br>(0.360)                           | 0.273<br>(0.301)    | 0.256<br>(0.316)    |
| Ethnic group : Soninke                          | 0.657*<br>(0.295)                                     | 1.403*<br>(0.593)                          | 1.946**<br>(0.469)  | 1.067+<br>(0.576)   |
| Ethnic group : Others                           | 0.010<br>(0.207)                                      | 0.169<br>(0.396)                           | 0.563<br>(0.570)    | 0.312<br>(0.441)    |
| Number of sisters (same father)                 |   |  | 0.069<br>(0.046)    |                     |
| Rank among sisters (same father)                |   |  | -0.105+<br>(0.058)  |                     |
| Number of sisters (same mother)                 |   |  |                     | 0.136+<br>(0.068)   |
| Rank among sisters (same mother)                |   |  |                     | -0.177*<br>(0.067)  |
| Observations                                    | 1680  | 1673                                       | 783                 | 1137                |
| $R^2$   |   | 0.063                                      | 0.101               | 0.081               |
| log-likelihood                                  | -1082   |  |                     |                     |

Notes : \*\* p<0.01, \* p<0.05, + p<0.1. Robust standard errors in parentheses

TABLE 3 – Determinants of Koranic school enrolment for boys

|   | Has ever attended<br>Koranic school<br>(probit model) | Number of years in<br>Koranic school (OLS) |                     |                     |
|---|---|--|---------------------|---------------------|
|   | (1)   | (2)  | (3)                 | (4)                 |
| Age   | -0.042<br>(0.047)                                     | -0.080<br>(0.098)                          | -0.084<br>(0.128)   | -0.118<br>(0.103)   |
| Rural   | -0.125<br>(0.179)                                     | 0.279<br>(0.356)                           | 0.037<br>(0.436)    | 0.261<br>(0.440)    |
| Wealth (Possession of durable goods)            | 0.106<br>(0.073)                                      | 0.586**<br>(0.182)                         | 0.681*<br>(0.339)   | 0.421<br>(0.279)    |
| Father's Education                              | 0.030<br>(0.038)                                      | -0.160*<br>(0.065)                         | -0.175<br>(0.110)   | -0.184*<br>(0.077)  |
| Mother's Education                              | -0.011<br>(0.050)                                     | -0.128<br>(0.118)                          | -0.215<br>(0.179)   | -0.078<br>(0.132)   |
| The household's head works in the formal sector | -0.013<br>(0.121)                                     | -0.087<br>(0.281)                          | -0.119<br>(0.370)   | -0.157<br>(0.329)   |
| The household's head is farmer                  | 0.019<br>(0.189)                                      | -0.043<br>(0.366)                          | 0.058<br>(0.508)    | -0.363<br>(0.451)   |
| Ethnic group : Pulaar                           | 0.195<br>(0.149)                                      | 0.867*<br>(0.427)                          | 0.783<br>(0.484)    | 0.527<br>(0.445)    |
| Ethnic group : Serere                           | -0.907**<br>(0.143)                                   | -1.377**<br>(0.309)                        | -1.308**<br>(0.461) | -1.594**<br>(0.414) |
| Ethnic group : Dioula                           | -0.501**<br>(0.181)                                   | -0.790*<br>(0.353)                         | -0.927*<br>(0.456)  | -1.223**<br>(0.394) |
| Ethnic group : Mandingue                        | 0.085<br>(0.290)                                      | 0.283<br>(0.560)                           | 0.576<br>(0.663)    | 0.098<br>(0.629)    |
| Ethnic group : Soninke                          | 0.315<br>(0.324)                                      | 0.587<br>(1.295)                           | 1.955+<br>(1.021)   | 1.525<br>(1.172)    |
| Ethnic group : Others                           | 0.013<br>(0.308)                                      | -0.347<br>(0.587)                          | -0.680<br>(0.619)   | 0.010<br>(0.739)    |
| Number of brothers (same father)                |   |  | -0.152*<br>(0.068)  |                     |
| Rank among brothers (same father)               |   |  | -0.031<br>(0.118)   |                     |
| Number of brothers (same mother)                |   |  |                     | -0.007<br>(0.086)   |
| Rank among brothers (same mother)               |   |  |                     | -0.083<br>(0.102)   |
| Observations                                    | 747   | 746  | 424                 | 557                 |
| $R^2$   |   | 0.109                                      | 0.138               | 0.118               |
| log-likelihood                                  | -454.1  |  |                     |                     |

Notes : \*\* p<0.01, \* p<0.05, + p<0.1. Robust standard errors in parentheses

fact that culture is probably a strong determinant of Koranic schooling. However, there may be some interference with religious brotherhood effects, since ethnic group and brotherhood affiliation are related as explained in the first section.

Religious skills associated with Koranic school enrolment are not easy to define, and may depend on the context. Hence the quality of Koranic education remains a theoretical concept. However, teaching strategies in Senegalese Koranic schools are known for being highly heterogeneous, and the quality of Koranic schools is very variable, according to Senegalese people themselves. The data at hand do not provide any insight into that. The Koranic school system is not centralized, hence the local quality of Koranic education may depend on the context. Besides the parental preferences for religious knowledge, the economic returns to Koranic school may be one of the reasons for Koranic school enrolment. As mentioned earlier, Koranic school may provide with networks which can be valuable on the job market. Again, Tables 2 and 3 do not control for these mechanisms. It is nevertheless worth noting that there is probably no return to Koranic school enrolment in the formal sector. This could explain why the girls are less enrolled in Koranic schools when the household head works in the formal sector. In addition, boys have shorter Koranic school studies when the father has a lot of formal education. It could be that one of the costs of long Koranic school studies is the incompatibility with long formal school studies.

Among the skills taught in Koranic education, Koranic transmits internalized moral values at the heart of them : respect for their parents. Hence parents could invest in shaping their children's propensity for being loyal. When reaching old-age, parents will have to rely on their children's support due to the still limited access to formal pension systems. In his Nobel lecture, Becker (1993) argues that economists have excessively relied on altruism for the enforcement of inter-generational contracts and suggested instead accounting for the endogenous formation of preferences within the family (Becker 1993 and 1996). Parents would try to instill a feeling of guilt if children do not respect social norms (here taking care of their ageing parents). In this view, investing in religious and traditional educations which inculcate such "family values" would seem promising to shape a son's loyalty. Hence in Akerlof's (1983) words, the Koranic school is seen as a "loyalty filter". This could help resolve the commitment issue related to old-age support. Some evidence of such strategic parental behavior in Senegal is illustrated in Auriol and Demonsant (2009). Based on a primary small-scale household survey in rural Northern Senegal, they show how migrant sons who remit were more likely to have attended Koranic school instead of primary school.

The differences between ethnic groups in Koranic school enrolment may be an illustration of the differences in the valuation of these family values. In addition, this produces another explanation of the fact that fathers with formal education or households whose head works in the formal sector are less likely to enroll their children in Koranic schools. Indeed, the values parents want to transmit to their children may be less traditional when the family is involved in the formal sector.

The costs of Koranic school may be very heterogeneous. Indeed, many Koranic schools do not have any official fees. Instead, the social norm is that households help Koranic masters. Again, Tables 2 and 3 do not include any proxy for the heterogeneity of implicit or explicit costs of Koranic schools in different locations. The cost of Koranic school may be especially difficult to bear under credit constraints. The effects of credit constraints on Koranic school enrolment are nevertheless undetermined, as Koranic schools are most of time officially free. The social norm encouraging the households to help the Koranic master is probably softened when households

FIGURE 3 – Joint distribution of Formal school access and time spent in Koranic school for boys and girls



face strong credit constraints. Boarding Koranic schools may even have negative costs, as the child is fed by his school through begging.

### 3 Koranic and formal schooling

This section looks into the link between Koranic and formal schools in Senegal, and assesses whether the duality of the education system is a barrier to the universal primary education goal. To answer this question, we assess whether parents face a mutually exclusive choice between the two education systems. The section first briefly describes the joint distribution of Koranic school enrolment and formal school enrolment. It then presents the identification strategy and finally the results.

#### 3.1 Correlations between formal and Koranic school enrolment

The potential correlation between Koranic and formal schooling provides some insight into the link between the two education systems and their potential common determinants. Figure 3 shows the joint distribution of formal school access rates and Length of Koranic school enrolment for girls over 15 and boys over 18 years old. The children who have never been to Koranic school have a lower formal school enrolment rate than those who have a few years of Koranic schooling. A total of 66% of girls with no Koranic education and 85% of girls with one year of Koranic education have attended formal school (respectively 84% and 94% for boys). However, although a few years spent in Koranic school do not seem to be a deterrent to formal school enrolment, the proportion of children having attended formal school decreases significantly after three years of Koranic schooling for girls and four years for boys.

Figure 3 does not give any precise information about the effect of Koranic education on formal education. The demand for Koranic education and the demand for formal education are actually likely to be highly correlated. For instance, some children, especially girls, could well be excluded from any schooling system for financial reasons. This would explain why Koranic and formal schooling are correlated for these children. One robust result we obtain, though, is that Koranic schooling and formal education are far from incompatible.

Tables B.1 and B.2 in the appendix show multinomial logit models, checking that the shape of the curve is robust to the inclusion of control variables. Table B.3 in the appendix shows that this shape may be attenuated for children whose maximum grade is high. Nevertheless, the maximum grade coefficient is more than ten times smaller than the enrolment coefficient. Only 10% of children aged over 15 have reached grade 10 at formal school.

Finally, a correlation between demand for Koranic and formal education is probable, and would cause an endogeneity bias in the coefficient of these tables. Only I.V. estimations can give us unbiased results. Formal education supply shocks are the only exogenous shocks at hand that we can use to observe interactions between Koranic and formal schooling. Indeed, to our knowledge, there are no household surveys containing information on the supply of Koranic education, given the informal nature of this system.

### 3.2 Substitution and income effects

What happens when a school opens in a particular place? The availability of formal schools provides a useful proxy for variations in the price of “formal” human capital. If parents sometimes need to make a choice between Koranic and formal education, the expected Koranic enrolment rate could marginally decline. This section presents the economic reasoning behind why our results give an answer to a relevant public policy issue.

Let us consider two goods : formal and Koranic human capital. In the standard microeconomic theory, the effect of a decrease of the price of “formal” human capital on Koranic school enrolment is called a cross price elasticity. Cross price elasticities includes two different economic mechanisms : the substitution and income effect. The substitution effect is the most intuitive. Suppose a formal school opens. If Koranic and formal schools are substitutes, parents will substitute Koranic for formal education, which becomes less expensive per “unit of human capital”. The substitution effect has an interesting symmetric property (if the utility function exists and is “sufficiently” differentiable.) i.e. if the opening of a formal school reduces Koranic schooling by substitution, then the opening of a Koranic school will decrease formal schooling by substitution. Nothing implies that both effects are quantitatively similar.

The income effect, can also be easily interpreted in our case. Again, suppose that a formal school opens : for children who would have gone to formal school anyway, travel time decreases, so that the time constraint slacks off. As a result, it could induce an increase in the length of Koranic schooling, as free time generated can be reallocated to other activities. The income effect is *not* symmetric under reasonable hypotheses. Nevertheless, the sign of this effect is almost certainly known : it is positive for normal goods, and it is realistic to assume that human capital is a normal good in the Sahelian context. So the time spent in Koranic school is likely to increase as the budget and/or time constraint is relaxed. We expect this effect to be small.

In our case, the relevant public policy question is not whether opening Koranic schools would hinder universal primary schooling. Laws cannot regulate Koranic schools as they belong to the informal sector : it seems neither feasible nor desirable to ban Koranic schools from opening or to close existing ones. The relevant question is rather to what extent both education systems can be combined and whether Koranic schooling prevents formal schooling. Hence the question is whether there is a substitution between Koranic school enrolment and formal school enrolment.

This paper assumes that the “Koranic human capital” and “formal human capital” are both

normal goods in Senegal. Hence, if opening formal schools decreases Koranic schooling, then there is substitution between both systems (and the substitution effect overrides the income effect). We might therefore tend to underestimate (the magnitude of) the substitution between Koranic enrolment enrolment.

### 3.3 Effect of the opening of formal schools on Koranic school enrolment

Our instrumental strategy to study the interaction between Koranic and formal schooling relies on the opening of formal schools. The dataset contains detailed information on formal schools, including the opening year for nearly all formal schools in each community. This provides us with an identification strategy to identify the substitution effect between Koranic and formal schools. In each community, we compare children who are too old to have benefited from the opening of schools (cohort A) with the younger ones (cohort B). In communities where a school opened, we expect the difference in school enrolment between cohorts A and B to be greater than in the rest of the country. This double difference (between cohorts and between communities) gives the substitution effect we seek to identify. If whenever a formal school opens, cohort B is less inclined to go to Koranic school, this shows that it is sometimes expensive for households to simultaneously cumulate both schooling systems.

#### First Stage estimates

Before turning to the effects of opening formal schools on Koranic schooling, we start by checking that they do affect formal schooling. Table 4 estimates several specifications of model (1).  $X_i$  is a vector of covariates for child  $i$  including age, wealth, household head works in the formal sector, household head is farmer, age and ethnic group dummies. *Formal School Access* takes value 1 if a child has ever been enrolled in a formal school, 0 otherwise. *Nb Schools<sub>i</sub>* is the number of recent schools in the community opened when child  $i$  was 9, 10 or 11 (According to the specification. Appendix A gives a precise definition of all the variables in Table 4)  $\overline{Nb Schools}$  is the average of the different cohorts of the community.

$$Formal\ School\ Access_i = \mathbb{1}(\alpha_1 Nb\ Schools_i + \alpha_2 \overline{Nb\ Schools} + X_i \beta + \varepsilon) \quad (1)$$

This model is actually the first stage of our identification strategy. We run a regression of formal school enrolment of a child<sup>13</sup> on the number of formal schools that opened before s/he reached a given age. This estimation should control for community fixed effects. Hence the effect of the number of formal schools on enrollment is identified with the differences in the number of schools between different cohorts of the same community.

In non-linear equations like probit or biprobit models, community fixed effects usually lead to non-convergent estimates. Chamberlain (1980) proposes a solution to overcome this problem : controlling for the community average of the explanatory variables. The coefficients of the explanatory variables are then identified by the difference between the individual explanatory variable and the community average, like in linear fixed effects. This specification includes a control for the community mean of the number of formal schools that opened. This controls for the potential endogeneity of school openings : the school openings on school enrollment is

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13. Attending at least one year of formal school.

TABLE 4 – Effect of the opening of formal schools on formal school enrolment

|  | Girls            |                  |                  |                  | Boys             |                   |                   |                   |
|--|------------------|------------------|------------------|------------------|------------------|-------------------|-------------------|-------------------|
|  | (1)              | (2)              | (3)              | (4)              | (5)              | (6)               | (7)               | (8)               |
| Mean number of schools opened in the community                 | .24<br>(.134)*   | -.007<br>(.171)  | .117<br>(.128)   | .061<br>(.145)   | .478<br>(.318)   | .636<br>(.303)**  | .183<br>(.223)    | .21<br>(.208)     |
| Square(Mean number of schools opened in the community)         |                  |                  |                  |                  | -.292<br>(.182)  | -.387<br>(.173)** |                   |                   |
| Number of recent secondary schools opened at age 9             | .155<br>(.08)*   | .221<br>(.11)**  |                  |                  |                  |                   |                   |                   |
| Number of recent primary or secondary schools opened at age 10 |                  |                  | .181<br>(.087)** | .188<br>(.096)** | .205<br>(.099)** | .19<br>(.113)*    |                   |                   |
| Number of recent primary or secondary schools opened at age 11 |                  |                  |                  |                  |                  |                   | .434<br>(.164)*** | .399<br>(.174)**  |
| Average marginal effect of an additional school                | .047<br>(.024)** | .052<br>(.026)** | .055<br>(.026)** | .044<br>(.023)*  | .04<br>(.019)**  | .033<br>(.019)*   | .073<br>(.023)*** | .061<br>(.023)*** |
| Control variables  | No               | Yes              | No               | Yes              | No               | Yes               | No                | Yes               |
| Observations   | 1816             | 1726             | 1816             | 1726             | 1933             | 1848              | 1933              | 1848              |
| log-likelihood   | -1027.71         | -737.118         | -1028.516        | -732.41          | -754.558         | -641.041          | -747.989          | -637.588          |
| $\chi^2$ -test for the instruments                             | 3.753            | 4.012            | 4.333            | 3.857            | 4.235            | 2.816             | 7.013             | 5.251             |
| Corresponding p-value  | .053             | .045             | .037             | .05              | .04              | .093              | .008              | .022              |

Notes : Probit model. Dependant variable : has ever attended formal school. Robust standard errors clustered by community in parentheses. \* significant at 10% ; \*\* at 5% ; \*\*\* at 1%. Control variables : age, wealth, household head works in the formal sector, household head is farmer, age and ethnic group dummies.

identified on the number of formal schools that opened before the child reached a given age and the community average of this variable. In addition, the introduction of age dummies controls for the national time trend in school enrolment.

The table displays different model specifications numbered 1 to 8. To obtain a reasonable sample size, we focus on 15 to 21 year-old children. Given the entry age of formal school is rarely higher than 11 years old in the EBMS data, children will not enter formal school in the future.

These results show that the opening of formal schools does increase the probability of being sent to one. The average marginal effect shows that the probability of being sent to school improve by 5 percentage points, which is not negligible. The effect remains significantly positive after the introduction of cohort effects. However, the effect is not always significant at the 5% level, depending on the model specification : estimates are rather imprecise. Therefore, the effect of the opening of formal schools on Koranic schooling will also be imprecise, as we will see below.

The  $\chi^2$ -test for the significance of the instrument is less than 10 in each specification.<sup>14</sup>

## Main results

Table 5 estimates the effect of formal schooling instrumented by formal school openings on Koranic schooling. Hence we estimate various specifications of model (2). It reports only estimation of coefficient  $\delta_1$ .<sup>15</sup>

$$\mathbb{1}(Koranic\ School_i \geq x\ years) = \mathbb{1}(\delta_1 Formal\ School\ Access_i + \delta_2 \overline{Nb\ Schools} + X_i\beta + \varepsilon) \quad (2)$$

We estimate this coefficient on all children from 15 to 21, bearing the risk of having boys still enrolled in Koranic schools, which can bias our estimations. The simple probit specifications in columns (a) and (h) estimate directly equation (2). We do not report the other coefficients apart from  $\delta_1$ . Each line gives the average marginal effect corresponding to the coefficient  $\delta_1$  for a given value of  $x$ . It basically sums up previous findings already illustrated in Figure 3. Hence girls who have been one year or more to Koranic school have the same probability of attending formal school as the ones who have never been to Koranic school. The reason is that girls who have been to Koranic school are of two types. On the one hand, those who have been to Koranic school for a short time only have a high formal school enrollment. On the other hand, those who have attended Koranic school for many years and are less likely to attend formal school. It can be seen scrolling down column (a) that the ones who have been for over 5 years to Koranic school are the ones who are the least likely to have attended formal school.

Columns (b), (c), (d), (e), (g), (h), (i) and (j) present bivariate probit models (see Amemiya, 1974) where formal school enrolment has been instrumented by the number of formal school openings affecting the child only, controlling for the mean number of schools opened in the community. The specification is called Model (3).

$$\begin{cases} Formal\ School\ Access_i = \mathbb{1}(\alpha_1 Nb\ Schools_i + \alpha_2 \overline{Nb\ Schools} + X_i\beta + \varepsilon_{if}) \\ \mathbb{1}(Koranic\ School \geq x\ years) = \mathbb{1}(\delta_1 Formal\ School\ Access_i + \delta_2 \overline{Nb\ Schools} + X_i\beta + \varepsilon_{ik}) \end{cases} \quad (3)$$

Vytlacil and Yildiz (2007), prove that models like (3) with a dummy endogenous variable can be semiparametrically identified in theory. Model (3) is however estimated parametrically, with a maximum likelihood technique, the errors term  $(\varepsilon_{if}, \varepsilon_{ik})$  are assumed to follow a bivariate normal distribution. Again, only the coefficient for  $\delta_1$  is reported, and each line corresponds to a value of  $x$ . We report the average marginal effect corresponding to the coefficient  $\delta_1$ .

These specifications estimate the effect of the variations of the price of “formal human capital” on Koranic school access. The specification of model (3) with *Formal School Access<sub>i</sub>* as endogenous variable is justified by the fact that we intend to estimate a substitution between Koranic school enrolment and formal school enrolment. We nevertheless need to have in mind that an income effect may bias the coefficient  $\delta_1$  to 0.

14. An F-test of 10 is frequently considered as required in a linear setting to avoid the weak instruments bias, and the F-test for linear specifications follow the same distribution than the  $\chi^2$ -test here. This is, however, indicative here as all second-stage estimations are non-linear.

15. *Koranic School<sub>i</sub> ≥ x years* takes value 1 if Number of years in Koranic School of child *i* is greater or equal to *x* years.

TABLE 5 – Effect of the opening of formal schools on Koranic schooling, bivariate probit models, average marginal effects

| first-stage specification                                       | Girls              |                 |                 |                 |                    | Boys               |                    |                    |                    |      |
|---|--------------------|-----------------|-----------------|-----------------|--------------------|--------------------|--------------------|--------------------|--------------------|------|
|   | a                  | b               | c               | d               | e                  | f                  | g                  | h                  | i                  | j    |
| simple probit   | (1)                | (2)             | (3)             | (4)             | (5)                | (6)                | (7)                | (8)                | (9)                | (10) |
| 1 year or more, $x = 1$   | .444<br>(.518)     | .13<br>(.15)    | .169<br>(.592)  | .077<br>(.162)  | -.342<br>(.123)*** | -.069<br>(.034)**  | -.346<br>(.104)*** | -.372<br>(.178)**  | -.374<br>(.057)*** |      |
| 2 years or more, $x = 2$  | -.012<br>(.035)    | -.24<br>(.658)  | .039<br>(.157)  | -.007<br>(.168) | -.386<br>(.165)**  | -.121<br>(.033)*** | -.103<br>(.336)    | -.436<br>(.131)*** | -.287<br>(.362)    |      |
| 3 years or more, $x = 3$  | -.055<br>(.032)*   | -.409<br>(.332) | .018<br>(.138)  | -.005<br>(.148) | -.393<br>(.216)*   | -.222<br>(.035)*** | -.309<br>(.313)    | -.597<br>(.084)*** | -.416<br>(.183)**  |      |
| 4 years or more, $x = 4$  | -.069<br>(.024)*** | -.348<br>(.379) | .062<br>(.078)  | .052<br>(.085)  | -.245<br>(.44)     | -.282<br>(.032)*** | -.339<br>(.295)    | -.587<br>(.403)    | -.43<br>(.2)**     |      |
| 5 years or more, $x = 5$  | -.058<br>(.02)***  | -.211<br>(.325) | -.033<br>(.081) | -.025<br>(.074) | -.396<br>(.442)    | -.284<br>(.031)*** | -.23<br>(.298)     | -.684<br>(.159)*** | -.366<br>(.18)**   |      |
| The number of school openings is an instrument                  | No                 | Yes             | Yes             | Yes             | Yes                | No                 | Yes                | Yes                | Yes                | Yes  |
| Control for the mean number of school openings in the community | Yes                | Yes             | Yes             | Yes             | Yes                | Yes                | Yes                | Yes                | Yes                | Yes  |
| Control variables   | Yes                | No              | Yes             | Yes             | Yes                | Yes                | No                 | Yes                | No                 | Yes  |
| Observations  | 1566               | 1736            | 1649            | 1736            | 1649               | 1771               | 1853               | 1771               | 1853               | 1771 |

Notes : Bivariate probit models predicting the probability of attending at least one year of formal school and the probability of attending more than n years of Koranic school (n between 1 and 5, depending on the line). Only the coefficient of the effect of attending formal school on Koranic schooling is displayed. Control variables : age, wealth, household head works in the formal sector, household head is farmer, age and ethnic group dummies in the simple probit model. The mean number of schools opened is always included as an additional explanatory variable in both steps when it is not an instrument. Sample : children over 15 years old. Robust standard errors clustered by community in parentheses. + significant at 10%; \* at 5%; \*\* at 1%.

As in Table 4, we intend to estimate the effect of the openings of formal schools. This requires to control for community fixed effects. Instead of real fixed effects, we use the Chamberlain (1980) approach, controlling for the community average  $\overline{Nb\ Schools}$ , which is the average across the different cohorts of the community of the “number of recent schools opened at age 9” (or age 10 or 11, according to the first stage specification).

These specifications do not show any statistically significant effect of school enrolment on access to Koranic schools for girls. Nevertheless, the estimates’ standard errors are large, and it is worth noting that the power of this regression does not allow for the effects of the simple probit model to be identified.

In these estimations, the substitution effect between Koranic and formal schooling is stronger than in the simple probit for boys. The average marginal effects are impressive : between 30% and 50%. This would mean that between 30% and 50% of boys who enter formal education after the opening of a school would have enrolled in a Koranic school otherwise. It is nonetheless worth noting that some of the average marginal effects of the simple probit model are close to 30% for boys. Conversely, the curve in Figure 3 does not seem to hold for boys, as the effect of school enrolment is approximately the same in each line. This probably means that there is a correlation between the unobservable characteristics causing Koranic school enrolment and the unobservable characteristics causing formal school enrolment. Two reasons can explain this. First, the preferences for Koranic and formal education may be correlated, for example because some parents value education in general more than others. Second, households facing credit constraints may need their children’s work, decreasing simultaneously the demand for both types of education.

These estimates find different results for boys and girls. In fact, there seems to be a strong substitution between Koranic and formal enrolment for boys, whereas our specifications do not detect any substitution for girls. It is indeed credible that the determinants of the Koranic education choice are different for boys and girls, and that full-time Koranic enrolment is more frequent for boys.

This substitution from Koranic to formal enrolment is somewhat surprising, as the increase in formal school enrolment associated with the opening of a new formal school could result in part-time Koranic enrolment. So it is probably the case that the two kinds of education are not fully differentiated for some Senegalese households.

### **Endogenous attrition**

Another concern could be endogenous attrition due to school enrolment. School enrolment probably affects the occupational choices, so that uneducated people could leave the surveyed households to work or marry elsewhere. If some potential household members from our sample left the surveyed households before 2003 because of educational choices, there could be a selection bias. Indeed, some household members may be in our sample because a school opened in the community.

There is at least two indirect ways to assess whether this can be the case. First, if uneducated people had left the households surveyed in 2003, the size of the cohorts may depend on school openings. Indeed, there must be more children in cohorts affected by a school opening (like cohort B above) than in other cohorts (like cohort A the first paragraph of section 3.3). Additional regressions available upon request do not show any support for this either for boys or for girls.

In addition, if there is selection, the individuals in our data may have different observable characteristics in cohorts A and B. For example, suppose the children from poor households are more likely to leave their household early. When a new school becomes available for cohort A, more children are enrolled in formal school, and as a result, stay in their household. We should have more children from poor households in cohort A than in cohort B. Provided children from wealthy households do not leave their household anyway, there should be as many children from wealthy households in cohorts A and B

Additional regressions available upon request show some evidence of such selection bias for girls : girls who were affected by a school opening (as girls from cohort A) live in poorer households, and the ethnic composition is not the same in cohorts A and B for girls. We did not find any evidence of similar selection issue for boys. This is not counter-intuitive, because women marry younger than men in Senegal, so that they may leave their parents' household at a younger age than males. However, given the lack of precision of the IV estimates for girls in Table 5, this problem does not really change the interpretation of the main results.

## 4 Conclusions

We use a unique Senegalese dataset with information on both formal and Koranic schooling taken from a national household survey to carefully analyze the link between the two educational systems outside ideological debates and stereotypes. The mass media tend to focus on Koranic pupils begging in the streets, equating them with the plague of street children. This tends to distort the image of Koranic school, which can take many different forms.

In the sample, about half of the girls and 60% of boys attend Koranic school for at least one year. The vast majority of them attend Koranic school for two to three years only. Only a third of the boys who attend Koranic schools pursue beyond three years and only half this proportion of girls do so. The dominance of boys in Koranic schools probably mirrors the dominance of men in Islam. Koranic schooling of girls appears to be a more recent phenomenon. This could be linked to women's empowerment in recent years, which has resulted in higher school enrolment for girls in both systems.

On further analysis of the determinants of Koranic schooling, we find the following main results. As it is commonly the case with formal education, a wealth effect seems to affect the length of Koranic schooling, since the opportunity cost of schooling may be higher for poorer households with a greater demand for child labor (mainly for domestic chores). We also find that the length of Koranic schooling is reduced by the father's formal education for boys and the household head working in the formal sector for girls. This emphasizes the differences between formal and Koranic education, as people involved in the formal sector are less inclined to send their children to Koranic schools. Another important finding consistent with the idea that Koranic schooling decisions are embedded in a cultural context is that ethnic group variables are a strong determinant of both initial enrolment and length of Koranic education.

More interesting still is the link between both institutions. Simple descriptive statistics show that both systems can indeed coexist. A simple scatter plot even reveals that the children who never attended Koranic school are less likely to attend formal school than those who spent a few years in Koranic schools. In order to identify the substitution between Koranic schools and formal school, we use an instrumental strategy based on the opening of formal schools. Our I.V. estimations show that substitution effect dominates for boys. This substitution probably means that both school careers are considered as relevant educational choices by some Senegalese

households. It is nevertheless worth noting that increasing the number of formal schools actually increases formal school enrolment rates, despite the competition with Koranic schools. Hence the relevance of the choice of full time Koranic school enrolment for households seems to depend on the quality of formal education supply. The existence of full time Koranic education could therefore be partly a signal indicating the poor quality of the formal school system.

Nevertheless, the choice of full time Koranic enrolment is probably not only due to the poor quality of formal schools. It is probably the case that this choice is partially based on real preferences for religious education. Not all the households have absolute preferences for formal education : formal education is available in virtually all the sample, and some children still choose full time Koranic enrolment. The preferences of some households for Koranic education could therefore prevent formal primary education even if the quality of formal education is high. It is nevertheless not possible to assess the existence of such households with our data. The potential existence of such households would raise the question of an improved integrated education system facilitating them finding a balance between the two types of education.

## Annexes / Appendix

# Annexe A

## Data appendix

**Has ever attended formal school** takes value 1 if the child has ever been enrolled in a formal school and 0 otherwise.

**Has ever attended Koranic school** takes value 1 if the child has ever been enrolled in A Koranic school and 0 otherwise.

**Number of years in Koranic school** is self-declared.

**Age** is self-declared and probably approximative. For example, there are more individuals aged 20 than 19 and 21 in the sample.

**Rural** takes value 1 if the community is rural and 0 if it is urban.

**Wealth (Possession of durable goods)** is a composite indicator for possession of durable goods, obtained by a principal component analysis.

**Father's education** takes value 1 if the father never went to school, 2 if he began but did not finish primary school, 3 if he finished primary school but did not began secondary school, etc.

**Mother's education** takes value 1 if the mother never went to school, 2 if she began but did not finish primary school, 3 if she finished primary school but did not began secondary school, etc.

**The household head works in the formal sector** takes value 1 if the household head declares working in the formal sector, 0 otherwise.

**The household head is farmer** takes value 1 if the household head declares working in any agricultural activity, 0 otherwise.

**Ethnic groups** are self declared. Fulbe and Halpulaar are grouped together in the Pulaar group.

TABLE A.1 – Descriptive statistics for the variables of this paper

|  | N    | mean  | standard deviation | min.  | max. |
|--|------|-------|--------------------|-------|------|
| Has ever attended formal school  | 3749 | 0.794 |                    | 0     | 1    |
| Has ever attended Koranic school                                       | 3633 | 0.574 |                    | 0     | 1    |
| Number of years in Koranic school                                      | 3619 | 1.957 | 2.474              | 0     | 16   |
| Age  | 3780 | 17.41 | 1.937              | 15    | 21   |
| Rural  | 3780 | 0.489 |                    | 0     | 1    |
| Wealth (Possession of durable goods)                                   | 3773 | 0.126 | 0.957              | -1.48 | 2.99 |
| Father's education   | 3684 | 2.242 | 1.950              | 1     | 8    |
| Mother's education   | 3687 | 1.576 | 1.221              | 1     | 8    |
| The household head works in the formal sector                          | 3780 | 0.295 |                    | 0     | 1    |
| The household head is farmer   | 3780 | 0.298 |                    | 0     | 1    |
| Ethnic group : Wolof   | 3780 | 0.366 |                    | 0     | 1    |
| Ethnic group : Pulaar  | 3780 | 0.213 |                    | 0     | 1    |
| Ethnic group : Serere  | 3780 | 0.180 |                    | 0     | 1    |
| Ethnic group : Dioula  | 3780 | 0.059 |                    | 0     | 1    |
| Ethnic group : Mandingue   | 3780 | 0.133 |                    | 0     | 1    |
| Ethnic group : Soninke   | 3780 | 0.048 |                    | 0     | 1    |
| Number of sisters (same father, girls)                                 | 846  | 5.150 | 2.771              | 1     | 17   |
| Rank among sisters (same father, girls)                                | 846  | 2.889 | 2.024              | 1     | 13   |
| Number of sisters (same mother, girls)                                 | 1226 | 3.553 | 1.674              | 1     | 9    |
| Rank among sisters (same mother, girls)                                | 1226 | 2.182 | 1.333              | 1     | 9    |
| Number of brothers (same father, boys)                                 | 1088 | 5.534 | 2.708              | 1     | 16   |
| Rank among brothers (same father, boys)                                | 1088 | 3.057 | 1.972              | 1     | 16   |
| Number of brothers (same mother, boys)                                 | 1432 | 3.746 | 1.632              | 1     | 11   |
| Rank among brothers (same mother, boys)                                | 1432 | 2.238 | 1.268              | 1     | 8    |
| Number of recent secondary schools opened at age 9 (girls)             | 1933 | 0.226 | 0.485              | 0     | 2    |
| Number of recent primary or secondary schools opened at age 10 (girls) | 1933 | 0.480 | 0.801              | 0     | 3    |
| Number of recent primary or secondary schools opened at age 10 (boys)  | 1816 | 0.419 | 0.771              | 0     | 3    |
| Number of recent secondary schools opened at age 11 (boys)             | 1816 | 0.655 | 1.128              | 0     | 5    |

Notes : All children aged 15-21 are in the sample, unless specified. This is the sample for Tables 4 and 5

**Number of siblings of same mother (or father)** is available only if the mother (or the father) is in the household in 2003. There is therefore a lot of missing values for these variables. Table 2 includes the number of sisters for girls, Table 3 includes the number of brothers for boys. Hence Table A.1 summarizes the number of sisters for girls and the number of brothers for boys.

**Rank among siblings of same mother (or father)** is available only if the mother (or the father) is in the household in 2003. It takes value 1 if the person doesn't have any elder sibling of the same mother (father), 2 if there is one elder sibling, etc.

**Number of recent secondary schools opened at age 9** is the number of recent secondary schools cited in the community questionnaire opened before child  $i$  reaches age 9.

A recent school is here a school that was not opened in 1991. The eldest children in our sample were age 9 in 1991. We intend to capture the difference of the number of school between different cohorts of the same community generated by school openings. Hence the schools opened in 1991 or before are not of interest : all the cohorts of our sample benefited from these schools when they were 9. Conversely, the schools opened in 1992 or after are of interest : some of the children benefited from these schools when they were 9, and some other cohorts don't.

**Number of recent primary or secondary schools opened at age 10** is the number of recent primary or secondary schools cited in the community questionnaire opened before child  $i$  reaches age 10.

A recent school is here a school that was not opened in 1992. The eldest children in our sample were age 10 in 1992. We intend to capture the difference of the number of school between different cohorts of the same community generated by school openings. Hence the schools opened in 1992 or before are not of interest : all the cohorts of our sample benefited from these schools when they were 10. Conversely, the schools opened in 1993 or after are of interest : some of the children benefited from these schools when they were 10, and some other cohorts don't.

**Number of recent primary or secondary schools opened at age 11** is the number of recent secondary schools cited in the community questionnaire opened before child  $i$  reaches age 11.

A recent school is here a school that was not opened in 1993. The eldest children in our sample were age 11 in 1993. We intend to capture the difference of the number of school between different cohorts of the same community generated by school openings. Hence the schools opened in 1991 or before are not of interest : all the cohorts of our sample benefited from these schools when they were 11. Conversely, the schools opened in 1993 or after are of interest : some of the children benefited from these schools when they were 11, and some other cohorts don't.

**Community mean number of recent secondary schools opened at age 9** is the mean of "Number of recent secondary schools opened at age 9" in the community. It is hence the average of this variable on the different cohorts of the community.

**Community mean number of recent primary or secondary schools opened at age 10** is the mean of "Number of recent primary or secondary schools opened at age 10" in the community. It is hence the average of this variable on the different cohorts of the community.

**Community mean number of recent primary or secondary schools opened at age 11** is the mean of “Number of recent primary or secondary schools opened at age 11” in the community. It is hence the average of this variable on the different cohorts of the community.

# Annexe B

## Tables

TABLE B.1 – The determinants of years spent in Koranic school for girls, multinomial logit specification

| Time spent in Koranic school              | 1 year              | 2 years           | 3 years           | 4 years           | 5 years           | 6 years or more     |
|---|---------------------|-------------------|-------------------|-------------------|-------------------|---------------------|
| Rural                                     | -0.754<br>(0.245)** | -0.291<br>(0.272) | -0.443<br>(0.324) | 0.164<br>(0.319)  | -0.220<br>(0.403) | -0.155<br>(0.451)   |
| Father's Education                        | 0.069<br>(0.075)    | 0.093<br>(0.063)  | -0.002<br>(0.056) | 0.001<br>(0.073)  | -0.001<br>(0.118) | -0.003<br>(0.084)   |
| Mother's Education                        | 0.138<br>(0.060)*   | 0.025<br>(0.067)  | 0.048<br>(0.081)  | 0.115<br>(0.092)  | 0.020<br>(0.193)  | 0.155<br>(0.116)    |
| Has ever been enrolled in a formal school | 1.088<br>(0.331)**  | 0.581<br>(0.281)* | 0.202<br>(0.404)  | -0.436<br>(0.517) | 0.070<br>(0.568)  | -1.340<br>(0.474)** |
| Last grade in formal school               | -0.065<br>(0.048)   | -0.042<br>(0.038) | 0.016<br>(0.054)  | 0.053<br>(0.066)  | -0.021<br>(0.080) | 0.099<br>(0.069)    |

Notes : Robust standard errors clustered by community in parentheses. + significant at 10%; \* significant at 5%; \*\* significant at 1%. The reference is no Koranic education. Other covariates : age, wealth, household head works in the formal sector, household head is farmer, ethnic dummies.

TABLE B.2 – The determinants of years spent in Koranic school for boys, multinomial logit specification

| Time spent in Koranic school              | 1 year             | 2 years           | 3 years or more     |
|---|--------------------|-------------------|---------------------|
| Rural                                     | -1.025<br>(0.423)* | -0.163<br>(0.297) | -0.045<br>(0.275)   |
| Father's Education                        | 0.167<br>(0.058)** | 0.004<br>(0.049)  | -0.025<br>(0.039)   |
| Mother's Education                        | -0.002<br>(0.119)  | 0.033<br>(0.079)  | -0.030<br>(0.070)   |
| Has ever been enrolled in a formal school | 1.279<br>(0.453)** | 0.663<br>(0.375)+ | -0.954<br>(0.270)** |
| Last grade in formal school               | -0.074<br>(0.041)+ | -0.014<br>(0.036) | 0.038<br>(0.029)    |

Notes : Robust standard errors clustered by community in parentheses. + significant at 10%; \* significant at 5%; \*\* significant at 1%. The reference is no Koranic education. Other covariates : age, wealth, household head works in the formal sector, household head is farmer, ethnic dummies.

TABLE B.3 – The determinants of time spent in Koranic school for boys and girls, prediction of the cumulative distribution

| Probit model predicting the probability of enrolment in koranic school more than : | Coefficient                               | Girls              |                         | Boys                |                         |
|--|---|--------------------|-------------------------|---------------------|-------------------------|
|  |   | probit coef.       | average marginal effect | probit coef.        | average marginal effect |
| 1 year   | Has ever been enrolled in a formal school | .104<br>(.139)     | .039<br>(.052)          | -.215<br>(.16)      | -.075<br>(.053)         |
|  | Last grade in formal school               | -.003<br>(.019)    | -.001<br>(.007)         | .003<br>(.016)      | .001<br>(.007)          |
| 2 years  | Has ever been enrolled in a formal school | -.108<br>(.156)    | -.04<br>(.057)          | -.45<br>(.148)***   | -.163<br>(.05)***       |
|  | Last grade in formal school               | .013<br>(.021)     | .005<br>(.008)          | .021<br>(.016)      | .008<br>(.006)          |
| 3 years  | Has ever been enrolled in a formal school | -.384<br>(.158)**  | -.122<br>(.052)**       | -.764<br>(.141)***  | -.283<br>(.05)***       |
|  | Last grade in formal school               | .037<br>(.02)*     | .011<br>(.016)          | .028<br>(.016)*     | .01<br>(.021)           |
| 4 years  | Has ever been enrolled in a formal school | -.501<br>(.138)*** | -.125<br>(.037)***      | -1.029<br>(.137)*** | -.352<br>(.048)***      |
|  | Last grade in formal school               | .038<br>(.021)*    | .009<br>(.02)           | .032<br>(.016)**    | .009<br>(.026)          |
| 5 years  | Has ever been enrolled in a formal school | -.453<br>(.148)*** | -.086<br>(.03)***       | -1.049<br>(.144)*** | -.323<br>(.049)***      |
|  | Last grade in formal school               | .024<br>(.024)     | .004<br>(.017)          | .018<br>(.016)      | .004<br>(.024)          |
| Observations   |   | 1643               | 1643                    | 1761                | 1761                    |

Notes : Robust standard errors clustered by community in parentheses. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Sample : children over 15 years old. Other covariates : age, wealth, household head works in the formal sector, household head is farmer, ethnic dummies, rural cluster, parental education.

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