**NoPoor Project**

**Effects of international migration and remittances on child's time allocation:**

**Evidence from Senegal[1]**

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**Abstract**

This paper examines on the repercussions of international migration and remittances on children's time allocation in the Senegalese households at origin using the unique 2009 household survey on migration and remittances in Senegal. We focus on children of age 6 to 15 and distinguish three activities: school attendance, paid activities and non paid activities. We account for endogeneity and selection using the Propensity matching approach. To gain a better understanding of how family migration and remittance-receipt affect children's activities, we follow the same strategy as Amuedo-Dorantes (2010) to separate the migration from the remittance effect. We find significant positive effect of remittances on children's school attendance. Indeed the proportion of recipient children is 5.75 % points higher than the non-recipient counterpart. The remittances effect on paid activity is also positive but relatively weak and non-significant. In contrast remittances reduce non-paid activity significantly (-2.39% points). In contrast, international impacts negatively on school attendance by promoting for both paid and non-paid activity. According to the residence area, the results show that remittances' effect promote school attendance whatever the area but the effects are higher in rural in comparison to urban area. These results are similar to those found in Ecuador (Calero and al. (2009)). The results suggest also a differential effect of remittance according the gender. The impact of remittances on activity is higher for boys in relation to girls. These results are in line with those found in Nepal (Vogel and Korinck, 2012; Bansach and Chezum, 2009). From a policy perspective, our results underscore the importance of distinguishing between the impacts of remittances and migration in policy making. Specifically, if the objective is to raise investments in children's human capital, policies that aimed at increasing remittance flows (e.g., by lowering remitting costs or by offering matching funds) can prove particularly helpful for developing countries impacted with extensive out-migration.

## 1. Introduction

The issue of migration impact on sending communities has been stressed by the New Economics of Labor Migration (NELM) pioneered by Stark (1978) and Stark and Levhari (1982). According to the NELM theory, the migrant is part of a spatially extended household that acts collectively to lessen idiosyncratic risks by keeping cooperation over long distances. Thus, for a household, having a migrant member working elsewhere is a strategy to manage uncertainty, diversify the income portfolio and alleviate liquidity constraints through remittances (Stark, 1991). Remittances sent by migrants or inheritance left at origin represent potential means to smooth consumption (Rosenzweig and Stark, 1989) and overcome credit or risk constraints for sending households (Lucas, 1987; Stark, 1991).

However, migration might also induce perverse effects in sending households. These include loss of labor forces and human capital, and several opportunity costs for missing working capital, skills, and income (Stark, 1991).

For instance, adults' absence because of migration may translate into less schooling for children as they are needed to undertake housework or market work to help meeting short-term labor and cash shortages.

Also, the absence of adult household members because of migration, especially that of parents, can have disruptive effects on the educational attainment of children left behind at home by leaving children with less supervision or less emotional support (Alcaraz et al., 2010; Amuedo-Dorantes et al., 2010; Edwards and Ureta, 2003; Hanson and Woodruff, 2003). Conversely, remittances could also increase the reservation wage of remaining household members, and so affect their labor participation and supply decisions.

Although the development effects of migration on origin communities have received a lot of attention from both scholars and policy makers, the impacts of migration and remittances on children's times allocation of family left behind have been less documented in the migration literature. Until recently, there has been a growing body of literature concerning the impact of migration on the children in origin communities. However, most literature on this topic is the effects of international migration (such as Alcaraz et al., 2012; Amuedo-Dorantes and Pozo, 2010; Calero et al., 2009; Edwards and Ureta, 2003; Hanson and Woodruff, 2003; McKenzie and Rapoport, 2011). Furthermore, the existing studies seem to yield contradicting results: some studies show that migration has a positive effect on left-behind children's education, while others indicate that the effect is negative or there is no effect at all. One possible reason is that those studies do not distinguish remittances from the effect of migration and thereby their conclusions are based on only the net migration effect or the net remittance effect.

In sub-Saharan Africa, how both migration and remittances affect those left behind remains not fully understood. There is a relative lack of systematic and quantitative studies – that go beyond anecdotes - about migration's repercussions on the sending communities. Yet, knowing these repercussions is of crucial interest for most African countries as they are experiencing greater than ever internal and international movements of people. Senegal counts among the prominent emigration countries in sub-Saharan Africa. One Senegalese household out of ten counts at least one emigrant among its members (Daffé, 2008). Emigrants represented 4.9 percent of the Senegalese population in 2010, compared to 2.5% for sub-Saharan Africa as a whole (World Bank, 2011). Conversely, Senegal figures among the top remittance recipients in sub-Saharan Africa. In 2010, the country ranked fourth, behind Nigeria, Sudan, and Kenya. An estimated US$ 1.2 billion were sent into the country as remittances in 2010, which represents about 9 percent of 2009 GDP. For comparison, in 2008, the net foreign direct investments (FDI) received by the country were US$ 0.7 billion, while the net official development aid (ODA) was at US$ 1.1 billion (World Bank, 2011).
This widespread readiness and desire to travel or migrate and the sizable magnitude of migration and remittances flows make Senegal an interesting setting for investigating migration's effects on the left behind in sub-Saharan Africa.

The objective of this paper is to examine the impact of migration and remittances on time allocation of left-behind children in Senegal by disentangling the effect of remittances from

that of migration. The data set used in this paper comes from the 2009 Survey on Migration and remittance. It is a unique nationally representative dataset, which allows us to distinguish the disruptive effect of migration from the income effect of remittances. Due to the fact that still many of elementary or middle school-age children in Senegal are not yet enrolled in schools and are involved in work activities, we focus on children of age 6-15. Obviously, having migrant or receiving remittances may be influenced by the same factors that influence the activities of children in the household. We then account for endogeneity and selection using the Propensity matching approach (PSM).

The contributions of this paper are at least twofold. Firstly, it adds to the relatively growing literature by examining the effect of international migration and remittances on the activities of left-behind children in Senegal. Secondly, it is the first attempt to disentangle the effect of migration on educational attainment and work activities of left-behind children from that of remittances in the context of Senegal, while other papers on this topic neglect the difference between the effects of migration and remittances.

We find significant positive effect of remittances on children's school attendance. The proportion of recipient children is 5.75 % points higher than the non-recipient counterpart. The remittances effect on paid activity is also positive but relatively weak and non-significant. In contrast remittances reduce non-paid activity significantly (-2.39% points). In contrast, international impacts negatively on school attendance by promoting for both paid and non-paid activity. According to the residence area, the results show that remittances' effect promote school attendance whatever the area but the effects are higher in rural in comparison to urban area. These results are similar to those found in Ecuador (Calero and al. (2009)). The results suggest also a differential effect of remittance according the gender. The impact of remittances on activity is higher for boys in relation to girls. These results are in line with those found in Nepal (Vogel and Korinck, 2012; Bansach and Chezum, 2009).
From a policy perspective, our results underscore the importance of distinguishing between the impacts of remittances and migration in policy making. Specifically, if the objective is to raise investments in children's human capital, policies that aimed at increasing remittance flows (e.g., by lowering remitting costs or by offering matching funds) can prove particularly helpful for developing countries impacted with extensive out-migration.

The remainder of this paper is organized as follows. Section2 present a brief background on migration, remittances and schooling in Senegal. The related literature of the study is presented in section 3. Section 4 describes the empirical estimation approach. The data we use is presented in section 5 where some descriptive statistics are discussed. We then present and comment the estimation results in section 6. The last section concludes.

## 2. Brief Background on migration, remittances and schooling in Senegal
Senegal is an ideal country for studying the impact of migration and remittances on children's education outcome. Senegal has almost 5% of its population live as migrants, and remittance also plays important role in its economy, and flow of remittance to Senegal is among the highest in Sub-Saharan Africa region.

Historically, Senegal was not a country of origin, but rather the destination of migrants. There is, however, evidence of a turnaround since the 1990s, with Senegal becoming more and more a country of emigration. This is the result of economic and demographic

revolution, mainly due to economic crisis started in 1970s and intensified in 1990s combined with high population growth, leading to the near-quadrupling of the population of Senegal since its independence in 1960. As a consequence of the crisis, chances of employment within the civil service have dwindled markedly, while development in the private sector is too weak to bring any significant relief to the labor market. International migration was initially a reaction to this crisis situation. Accordingly, young people's career objective is increasingly directed towards the international labor market.

Senegal has a long tradition of international migration which was initially directed towards other countries of the continent, before moving, after the Second World War, to Europe and France in particular. The Senegalese diaspora is now present and active everywhere in the world. If until the mid-1970s, Senegalese emigration was "reserved" for certain categories of the population and limited geographical areas, it concerns now a wider range of socio-professional categories and ethnic groups. Now many women migrate alone or as heads of household. Although it has greatly diminished over the last three years the number of clandestine departures is still important. Temporary and circular migration movements have increased sharply. These changes are the combined effect of the deteriorating socio-economic conditions, increasing demographic imbalances, changes in the environment, technological revolutions and social networks.

According to the Digest of Statistics 2011 on migration and remittances (World Bank 2011), the number of Senegalese emigrants would amount to just over 636,000 in 2010, equivalent to 4.9 % of the total population. The evolution of emigration over the last twenty years clearly reflects the emergence of new destinations. While during the period 1988-1992, one out of three migrants was only established outside Africa, it passed to one in two in the late 1990s and two out of three now. The traditional destinations for Senegalese  France and Central Africa in particular) are declining in favour of countries like Italy, Spain and the United States. The main countries of destination of migrants today are the Gambia, France, Italy, Mauritania, Spain, Ivory Coast, Gabon, United States, Mali and Guinea-Bissau. Although they are closely related to the economic situation and living conditions of the population in general, the determinants of migration of Senegalese also assume both microeconomic, cultural and sociological aspects.

Senegal, as in most sub-Saharan African countries, the reasons and determinants of migration have not fundamentally changed since the beginning. They remained essentially of economic and social order. The lack of employment opportunities in the domestic labour market, prospects for higher incomes and a better welfare in the countries of destination remain the leading causes of migration. But if most migration from Senegal continues to be a need for survival, it appears that more and more migrants are part of economic strategies in the medium and long term to meet better working conditions authorized by the qualifications and skills acquired before departure.

According to Senegal's balance of payments, remittances of workers increased from 5.6% and 10.1% of GDP during 2002 to 2009. This growth raised Senegal to 4th place among recipient countries in Sub-Saharan Africa (after Nigeria, Sudan, and Kenya) in the total volume of remittances and to fifth place (after Lesotho, Togo, Cape Verde, and Guinea-Bissau) in remittances as a percentage of GDP. Remittances have become the principal source of external financing for the Senegalese economy, far exceeding FDI; external borrowing; and ODA, which had long been the most reliable and stable source of financing.

The total volume of migrant remittances is difficult to estimate because a large proportion does not pass through the official channels. Many migrants use the informal channel—carrying cash themselves, sending it through intermediaries, or transferring funds using new techniques such as telephone or fax transfers. Comparison with traditional financial flows from abroad gives an idea of the overall contribution of remittances to the national economy.

Education for children between 6-15 years-old in Senegal is mandatory. Nevertheless, the lack of resources coupled with population growth and a rapidly declining average age more than doubled the school-age population in three decades, which classroom construction, materials development, and teacher education could not begin to keep pace with. Moreover, many parents are still reluctant to send their children to school, and drop-out rates are high. Decision of attending formal education is instilled with the mores of society from an early age of a child. It is therefore interesting to know how prevalence of migration and remittance affect education of children in Senegal.

## 3. Related literature

Several papers have studied the effect of migration or remittances on child labor, schooling, or educational attainment in developing countries (J. Bouoiyour and al. (2014), Q. Zhao and al. (2014), V.B. Salas (2014), S. Fransen and al. (2014), Z. Intemann and al. (2014), E. Auriol and al. (2012), C. Alcaraz and al.(2012), Feng Hu (2012), C. Amuendo-dorantes (2010), N. Williams (2009) and C.Calero and al. (2009)). However, the results seem mixed and even contradictory across countries and also within the same country. Results vary according to the context. In Mexico, Hanson and Woodruff (2003) estimate the overall impact of migration on educational attainment. They found that migration is positively associated with educational attainment for girls in rural communities and whose mothers have three years or less of education. For boys and for girls whose mothers are more educated, migration does not seem to have an effect. However, Borraz (2005) found that the positive effect reported by Hanson and Woodruff prevails only in villages with small size population (less than 2500 residents). In larger villages, he did not notice a significant effect of migration on child schooling.

Other studies contradict Hanson and Woodruff's finding and suggest the presence of negative effects of migration on schooling in rural Mexico. Evidence from McKenzie and Rapoport (2006) indicates that migration depresses educational attainment for the majority of children in Mexico's rural communities. Using state historical migration rates to instrument for migration, McKenzie and Rapoport (2006) found a significant and negative effect of migration on schooling attendance and attainment for older children in rural Mexico. Besides, Antman (2010) found that the short run effect of a father's migration in Mexico is a reduction of the younger children's study hours and participation in school, while the older boys (12-15 years old) increase their work hours and work participation outside the home.

Conversely, Cox-Edwards and Ureta, (2003) and Acosta (2006) studied the effects of migrant remittances on schooling in El Salvador, and both found that remittances promote schooling among children within migrant sending households. Cox-Edwards and Ureta (2003) provide evidence that remittances reduced school dropout rates, while Acosta (2006) reports that children in migrant households are more likely to be enrolled in school, compared with

children in households without migrants. In Pakistan, Mansuri (2006) reports a significant positive effect of migration on school attainment and child labor market activity in rural areas. Her results show that children in migrant households are not only more likely to attend school; they are also more likely to stay in school and accumulate more years of schooling in comparison to their counterparts in non-migrant households in the same village. They are also less likely to be involved in economic work and report working for substantially fewer hours. She also finds large gender differentials in the gains from migration at the benefits of girls.

What all these studies have in common is their focus on the econometric challenges of estimating the effect of migration on the left-behind. As migration is a non-random selective process, assessing its impact requires controlling for the decision to migrate. Otherwise, the estimation results could be biased. The econometric problems related to controlling for the migration decision mainly refer to selection bias and endogeneity (omitted variables bias, reverse causation, etc) issues.

Various approaches are used to address these issues. These approaches include using panel data analysis, the standard experimental models, difference-in-difference estimation, OLS method, propensity scores matching (Acosta (2006), Esquivel (2007), Valerie and Shariff) and the instrumental variable technique (Adams and Pages (2005), Beaudouin (2006),McKenzie and Sasin (2007), Hans (2010), Panday (2011) etc.)). In the literature, a wide range of instruments are used to address the econometric problems of migration estimation. This includes historic migration data (Hanson and Woodruff, 2003; Hildebrand and McKenzie, 2005; McKenzie and Rapoport, 2006; Alcaraz, Chiquiar, and Salcedo, 2010), local weather (Munshi, 2003), geography (Borraz, 2005), pre-migration distance (McKenzie, Gibson, and Stillman, 2006), social networks (Acosta, 2006; Karamba, Quiñones, and Winters, 2011), cultural and sociological factors (Mansuri, 2006); visa lottery experiment (McKenzie, Gibson, and Stillman, 2006; Gibson, McKenzie, and Stillman, 2011), and economic conditions at destination countries (Yang, 2008; Antman, 2010). In what follows. We adopt as J.bouoiyour 2014, S.Fransen and al., 2014 and A.Cuecuecha, 2008, the propensity scores matching approach to evaluate the impact of migration and remittances on the child time allocation.

## 4. Estimation strategy

To analyze the effect of remittance receipt on children's activity, the potential outcome approach or Roy-Rubin-model (Roy (1951), Rubin (1974)) constitutes our conceptual framework. The main items of this model are individuals, treatment and potential outcomes. In our case, individuals are children aged from 6 to 15 years old, treatment is a binary variable $T_i$ equals one if individual i receives remittances or lives in migrant household and zero otherwise and outcome represents child activity (i.e this later can be school attendance, paid activity or non-paid activity). The potential outcomes are defined as $Y_i(T_i)$ for each individual i, where i=1,…,N and N denotes total population. The remittance effect (or treatment effect) for an individual i can be written as:

$$\Delta_i = Y_i(1) - Y_i(0) \tag{1}$$

$Y_i(1)$ is the outcome of individual i if he is treated and $Y_i(0)$ is his outcome if he is not treated. The fundamental evaluation problem arises because only one of the potential outcomes is observed for each individual i. Therefore, estimating the individual treatment

effect is not possible and one has to concentrate on (population) average treatment effects. Hence, we estimate the impact of remittance receipt on children's activity by using "Average Treatment effect on Treated (ATT)"which is defined as:

$$\Delta_{ATT} = E(\Delta \mid T=1) = E(Y(1) \mid T=1) - E(Y(0) \mid T=1) \tag{2}$$

Where $\Delta_{ATT}$ is the Average Treatment effect on Treated (ATT) and E (.) means mathematical expectation. The problem with estimating Equation (2) is that the expectation of outcome of a remittance-receiving household in the case of no remittance i.e $E(Y(0) \mid T=1)$ (the counterfactual) cannot be observed. The difference $\Delta = E(Y(1) \mid T=1) - E(Y(0) \mid T=0)$ can be estimated, but is potentially a biased estimator of $\Delta_{ATT}$ (Rajeev H. Dehejia and al,2002).This bias is explained by the fact that the average situation of treated households would not have been the same as that of non-beneficiary households in the absence of treatment. To eliminate this bias, Y$_i$(0) and T$_i$ must be independent so that $E(Y(0) \mid T=1) = E(Y(0) \mid T=0)$. Weaker assumptions of conditional independence as well as common support
can be applied to evaluate the counterfactual and so to estimate of $\Delta_{ATT}$(Rosenbaum and Rubin, 1983).

Given that we have cross-section data, two main methods can be used to estimate the counterfactual to reduce the bias when the conditional independence assumption holds. We can use Ordinary least squared (O.L.S) but If the covariates averages are very different, the results can be sensitive to minor changes in the specification (Guido M. Imbens and al., 2008). The other alternative is Matching method. In this work, we use Propensity Score Matching for the purpose (PSM) because it requires fewer assumptions about the distribution of the error term and PSM is also a semi parametric method imposing fewer constraints on the functional form of the treatment model (Shahidur R. Khandker,2010).

### a)  The propensity score matching to control for bias selection

As Bouoiyour J and al.(2014), Fransen S. and al. (2014) and Jimenez-soto E. and al.(2012), we follow Rosenbaum and Rubin (1983, 1985) by performing propensity score matching (PSM) to reduce the bias selection. The PSM approach consists to pair each treated observation (treated households) with a similar control observation (untreated household) on the basis of their propensity scores, and to interpret the outcome of the control observation as the counterfactual outcome of the treated observation in the absence of treatment. We follow three steps to implement this method.

The first stage involves estimating propensity score defined as the conditional probability of receiving remittance given pretreatment characteristics:

$$p(X)=Pr(T=1 \mid X) \tag{3}$$

We estimate the propensity score by using logit regression. We refer to the literature for selecting variables X. These variables include socioeconomic characteristics as age, age squared, gender, educational level, employment, tenure Housing and marital status of the household head. There are also some household characteristics such as the dependency

ratio, the size of the household, the region of residence and a household asset index[2] as proxy for household wealth as Acosta P. (2011) and Fransen S. and al. (2014). We have considered all these variables and we adopt the method of stepwise regression[3] to select our variables using the AIC criterion. We keep the variables which minimizes AIC criterion. We retain the following characteristics: gender, age, age squared, the number of study years, index of wealth, the size of household and the region of residence.

The second stage consists to match each treatment household with an untreated household that has close propensity score (and which are therefore comparable to treated households on the basis of the observed characteristics). In the purpose to verify the robustness of the results, we use two matching methods as Fransen S. and al. (2014) and Bouoiyour J. and al. (2014): Nearest Neighbor and Kernel. Rosenbaum and Rubin (1983) show that if the propensity scores p ($X_i$) of the individual i are known, then the average effect of Treatment on the Treated (ATT)can be estimated as follows:

$$\Delta_{ATT} = E (\Delta \mid T = 1) = E(Y(1) \mid T = 1, p(X)) - E(Y(0) \mid T = 0, p(X)) \qquad (4)$$

In the third stage, we conduct three tests to assess the matching quality. We begin by proceeding to the covariate balancing test after matching. Common balancing checks used are the reduction in the absolute standardized bias, the reduction in the pseudo $R^2$ in logit models predicting treatment, p-values of the likelihood ratio tests before and after matching, and t-tests for equality of means (Jimenez-Soto E., 2012). However, Imai and al.(2008) have shown that results from the t-tests are sensitive to sample size and can be misleading. Therefore, we use only the first two balancing checks, these results being independent of sample size. Then, we check the overlap and the region of common support between treatment and comparison group by using the propensity score histogram of matched treated and untreated households. Implementing the common support condition ensures that any combination of characteristics observed in the treatment group can also be observed among the control group (Bryson, Dorsett, and Purdon, 2002). Finally, we proceed to the sensitivity analysis after matching using the bounding approach (Rosenbaum, 2002) as Fransen S. (2014) and Bouoiyour J. (2014). For binary outcomes, Aakvik (2001) suggests using the Mantel and Haenszel (1959)test statistic. For that we implement this test by using *mhbounds* command available in Stata.

### b) Separating remittance from household migration effects

A large number of studies conclude that international remittances have positive and significant effect on education investment in source countries(Adams and Cuecuecha (2010), Acosta (2011)). The traditional explanation for the positive effect of remittances on education investment is that Remittances relax this resource constraint, thus allowing households to expand the education opportunities for their children (Gyimah-Brempong K., 2014). Whereas a second group of research concludes that emigration has a negative impact on investment in education (McKenzie and Rapoport (2011), Amuedo-Dorantes C., (2010)).

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[2]This index is computed using a First Principal component statistical procedure in which we include the following items: access to safe water, access to electricity, the number of rooms by capita, bicycle, device DVD / VCD / VCR, computer, mobile phone, fixed telephone, automobile, motorcycle, tractor, agricultural land, non-agricultural land, homeownership, radio, television, refrigerator and air-conditioner.
[3]The function used is boot.stepAIC implemented in the R package MASS

In effect, parental absence as a result of migration can have disruptive effects on the children. This affects the schooling of the children. Another possible reason is Children may have less time to devote to schooling because they engage in market activities to earn income to replace the migrant's former contributions to the household's income. Hence, in the presence of concurrent migration effect, it is inappropriate to attribute choices in schooling to remittances alone.

We follow the same strategy as Amuedo-Dorantes (2010) to separate the migration from the remittance effect. First, we distinguish households with a family member currently abroad (non-migrant households) from households without migrants and we focus our attention on non-migrant households to isolate the impact of the receipt of remittances from the effect of family migration on the schooling of children. Second, we repeat the analysis expanding our sample to include children residing in migrant households in order to evaluate empirically the sign of the migration effect on the schooling of children. We then compare the impact of remittance receipt in the two situations to gain a better understanding of how family migration and remittance-receipt affect children's schooling.

## 5. Data

To ascertain the impact of international migration and remittances on children's activities, we use the data from Migration and Remittances Household Surveys in Senegal (Equate Menage sur La Migration et Les Transferts de Fonds au Senegal– EMTFS) conducted in 2009, which is part of the Africa Migration Project undertaken jointly by the African Development Bank, CRES, and the World Bank. The survey collects national representative information on three types of households: households without migrants, households with internal migrants and households with international migrants. EMTFS- 2009 is based on a sample of 1953 households covering 17878 individuals. Unlike other survey on migration and remittance, the advantage of EMTFS is that it covers national representative information rather than only communities or regions with high incidence of migration.

The data on Migration and Remittances Household Surveys is very rich on information. The survey covered recent migration and remittance trends, housing conditions, household assets and expenditures, use of financial services, internal and international migration and remittances from former and non-former household members, (that is, individuals who regularly send remittances but have not been part of the current household) and return migration patterns. The survey instrument obtained also information on a variety of demographic, social, and economic characteristics, such as education, marriage status, housing conditions, labor force participation, skills.

The survey shows that 23.41% households have international migrant and 24.13%of them have internal migrant. The rest represent households without migrant (52.46%). The remittance-receiving households represent 42.83% of the population 52.36% of Households reported receiving some remittances from former household members and only 6.11% of them have received remittances from relatives who have never been members of household. In addition, most of the remittances come from former household member and the majority of them (59.41%) live abroad.

**Table 1 : Type of households**

| Type of household | Freq. | Percent | Cum. |
| --- | --- | --- | --- |

| | | | |
|---|---|---|---|
| Non-Migrant Households | 1024 | 52 | 52 |
| Internal-migrantHousehold | 471 | 24 | 77 |
| International-migrant Household | 457 | 23 | 100 |
| Total | 1953 | 100 | |

Source: Survey on migration and remittances household in Senegal, 2009.

We focus our analysis on children aged 6 to 15 resulting in a sample of 4443 individuals. Table A3 (annex) provides summary statistics for all children, as well as for children residing in international migrant households and non-migrant households. Out of the 6013 children, 2269 (37.7%) live in international migrant households. The other 3744 children live in household that do not have any members currently living outside of the house. 56% of all children reside in remittance-receiving households. When we distinguish according to whether the children reside in a non-migrant in relation to a migrant household, we find that the probability of living in a remittance-receiving household is greater for children in migrant households relative to children in non-migrant households. Indeed 86% of the children residing in migrant households receive remittances as opposed to 39 % in non-migrant households.

## 6. Estimations Results
### 6.1. Remittances and child activity
We begin by evaluating the impact of remittance on child activity by focusing our attention on non-migrant households. The first step is to estimate the probability of receiving remittances as a function of household characteristics. The results of the estimation of the logit model are presented in Table 2. The characteristics of households seem to play key role on the remittance status of the household. In effect, children living in households headed by women have higher odds of receiving remittances. There are also a significant non-linear link between the age of household head and the remittance receipt because the coefficient related to age and that related to age squared are both significant. Their opposite signs indicate that there is a turning point of the effect of the age on the probability to receive remittance. In other terms, the age has negative effect on the probability until some threshold from which the effect become positive. The threshold is estimates at 52 years old. Acosta P. (2011) found a non-linear link between the age and the probability to receive remittances for the case of El Salvador. Likewise, the characteristics of the household are important. The odds are higher for children residing at Matam, Diourbel, Louga, Saint-louis and Kaolack in comparison to Dakar. In addition, the results indicate a significant positive effect of the size of household on the probability to receive remittance. Concerning the wealth level of household, we note that the children living in both second and third quartile have significant higher odds to receive remittance than Children residing in the first quartile. But the odds to receive remittance for children in fourth quartile are not significantly different of those in first quartile.

**Table 2**: The Probability to receive remittances (**children living in non-migrant households**)

| Dependant variable=Treatment | Coef. | Odds ratio. | Coef. Std. | Z |
|---|---|---|---|---|

| | | | | err. |
|---|---|---|---|---|
| Gender of household head | 1.3 | 3.69 | 0.11 | 11.99*** |
| Age of household head | -0.11 | 0.9 | 0.02 | -5.17*** |
| Age of household head squared | 0,00 | 1.00 | 0,00 | 5.47*** |
| Size of household | 0.05 | 1.05 | 0.01 | 7.37*** |
| Study years of household head | 0,00 | 1,00 | 0.01 | 0.11 |
| **Index of wealth (ref=quantile 1)** | | | | |
| Quantile 2 | 0.26 | 1.3 | 0.16 | 1.70* |
| Quantile 3 | 0.42 | 1.52 | 0.16 | 2.55** |
| Quantile 4 | -0.02 | 0.98 | 0.18 | -0.09 |
| **Region of residence (ref=Dakar)** | | | | |
| Matam_dummy | 0.55 | 1.74 | 0.17 | 3.18*** |
| Diourbel_dummy | 0.79 | 2.2 | 0.17 | 4.71*** |
| Louga_dummy | 0.33 | 1.39 | 0.19 | 1.75* |
| Saint louis_dummy | 0.37 | 1.44 | 0.19 | 1.92* |
| Thies_dummy | 0.4 | 1.49 | 0.19 | 2.13** |
| Kaolack_dummy | 0.53 | 1.7 | 0.2 | 2.64*** |
| Other regions_dummy | 0.48 | 1.62 | 0.18 | 2.63*** |
| **Constant** | 0.62 | 1.86 | 0.59 | 1.04 |
| **Observation** | | 2800 | | |

Standard errors in parentheses0
$^{*}p< 0.1.$ $^{**}p< 0.05.$ $^{***}p< 0.001$
Source: Survey on migration and remittances household in Senegal, 2009.

The estimates of previous model provide the propensity scores used to match each receiving-remittance household with non-remittance-receiving household. The Average Treatment Effect on Treated (ATT) obtained from Kernel and nearest neighbor matching is presented in the table 3. The different matching methods provide very similar results. Remittances have significant positive effect on school attendance of children. Indeed the proportion of recipient children is 5.75 % points higher than the non-recipient counterpart. The remittances effect on paid activity is also positive but relatively weak and non-significant. In contrast remittances reduce non-paid activity significantly (-2.39% points).

**Table 3: Impact of remittances on children aged 6 to 15 years (children living in non-migrant households)**

| Variable | Treated | Controls | ATT | Std. | T-stat |
|---|---|---|---|---|---|
| **Kernel estimator (gaussian)** | | | | | |
| Observations | 1088 | 1579 | | | |

| | | | | | |
|---|---|---|---|---|---|
| Schooling_dummy | 65,72% | 59,96% | 5,75% | 2,13 | 2,71** |
| Paid activity | 2,21% | 1,57% | 0,63% | 0,59 | 1,07 |
| Non paid activity | 4,32% | 6,71% | -2,39% | 1,05 | -2,28** |
| Other | 27,76% | 31,75% | -3,9% | 2,02 | -1,98 |

**Nearest neighbour**

| | | | | | |
|---|---|---|---|---|---|
| Observations | 1088 | 1579 | | | |
| Schooling_dummy | 65,72% | 61,46% | 4,26% | 2,33 | 1,83 |
| Paid activity | 2,21% | 1,68% | 0,53% | 0,64 | 0,82 |
| Non paid activity | 4,32% | 6,72% | -2,40% | 1,16 | -2,06* |
| Other | 27,76% | 30,15% | -2,39% | 2,22 | -1,08 |

*$p < 0.1$, **$p < 0.05$, ***$p < 0.001$

Source: Survey on migration and remittances household in Senegal, 2009.

An important part of the PSM procedure is to assess the performance of matching. For that, we proceed to covariate balancing test in the distribution of observables between the two groups such that the distribution of observable covariates is approximatively the same for both groups after matching. The table 4 shows lower pseudo $R^2$ and insignificant p-values of the likelihood ratio tests after matching. The mean standardized bias reduction after matching ranged from 66.21% to 77.24%.Rosenbaum and Rubin (1985)proposed that when the mean standardized bias after matching is larger than 20%, there is residual bias. In our case, the mean standardized biases after matching ranged from 3.3% to 4.9% across the different matching methods, meaning that bias was significantly reduced by matching. This result indicates that covariate balance is improved after matching and there are no systematic differences in the covariates between remittance receiving and non-remittance-receiving households. Biases could also result if there is a failure of common support (Ravallion, 2008). Figure A1 show that we have a sufficient rate of overlapped propensity scores between treated and untreated households so that observations in the treated group could find matched firms in the untreated group with a similar propensity score.

**Table 4 : PSM balancing test (children living in non-migrant households)**

| Matching method | Pseudo R2 Before matching | Pseudo R2 After Matching | P > Chi2 Before Matching | P > Chi2 After matching | Mean Standardized Bias before matching | Mean Standardized bias after matching | Total percentage of bias reduction |
|---|---|---|---|---|---|---|---|
| Kernel (Gaussian) | 0,09 | 0,004 | 0,00 | 0,75 | 14,50 | 3,30 | 77,24% |
| Nearest neighbor | 0,09 | 0,01 | 0,00 | 0,09 | 14,50 | 4,90 | 66,21% |

*p< 0.1, **p< 0.05, ***p< 0.001

Source: Survey on migration and remittances household in Senegal, 2009.

The following part of the analysis consists to expand the sample by including children residing in migrant households also and we repeat the same analysis by following the same step as previously. The results of the probability to receive remittances are presented in the table A1. They are almost similar as previously results except that the relation between the index of wealth and the probability change. We found that the odds of children in the fourth quartile are significant lower than the odds of those in first quartile and there are no difference in term of odds to receive remittance between the second and the third quartile in comparison to the first quartile. The figure A2 supports the assumption of common support. The imbalance test in the table A3 shows a significant reduction of bias which indicates a good performance of matching.

Table 4 presents the results of remittance effect on children activity without distinguish the migration status of household. Remittances have a significant positive effect (3.43%) on school attendance and significant negative effect (-1.55%) on non-paid activity.In overall, the results don't change in relation to previously except that the effects are smaller in relation to the effects obtained on non-migrant household only. Therefore, we deduce, as Catalina Amuedo-Dorantes (2010), that migration eliminates the positive effect of remittance and impacts negatively school attendance by promoting for both paid activity and non-paid activity.

The final part of the analysis consists to expand the sample by including children residing in migrant households also and we repeat the same analysis by following the same step as previously. The results of the probability to receive remittances are presented in the table A1. They are almost similar as previously results except that the relation between the index of wealth and the probability change. We found that the odds of children in the fourth quartile are significant lower than the odds of those in first quartile and there are no difference in term of odds to receive remittance between the second and the third quartile in comparison to the first quartile. The figure A2 supports the assumption of common support. The imbalance test in the table A3 shows a significant reduction of bias which indicates a good performance of matching.

Table 6 presents the results of remittance effect on children activity without distinguish the migration status of household. Remittances have a positive effect (3.43%) on school attendance at 10% level and significant negative effect (-1.55%) on non-paid activity. Therefore, as previously, we find that remittances promote school attendance. The sensibility of the effects to "hidden bias" is almost the same as previously.

**Table 6:** Impact of remittances on children aged 6 to 15 years (remittance household + migrant household)

| Variable | Treated | Controls | ATT | Std. | T-stat |
|---|---|---|---|---|---|
| **Kernel estimator** | | | | | |
| Observations | 2644 | 1581 | | | |
| Schooling_dummy | 66,49% | 63,06% | 3,43% | 1,81 | 1,89** |

| | | | | | |
|---|---|---|---|---|---|
| Paid activity | 1,85% | 1,29% | 0,56% | 0,47 | 1,20 |
| Non paid activity | 4,46% | 6,02% | -1,55% | 0,93 | -1,67** |
| Undetermined | 27,19% | 29,63% | -2,44% | 1,73% | -1,41* |
| **Nearest neighbour** | | | | | |
| Observations | 2644 | 1581 | | | |
| Schooling_dummy | 66,49% | 63,65% | 2,84% | 2,03 | 1,40 |
| Paid activity | 1,85% | 1,13% | 0,73% | 0,52 | 1,39 |
| Non paid activity | 4,46% | 5,98% | -1,52% | 1,06 | -1,43 |
| Undetermined | 27,19% | 29,25% | -2,05% | 1,94 | -1,06 |

*$p< 0.1$, **$p< 0.05$, ***$p< 0.001$
Source: Survey on migration and remittances household in Senegal, 2009.

In overall, the results don't change in relation to previously except that the effects are smaller in relation to the effects obtained on non-migrant household only. However, the significance of the effect on school attendance decreases. As Catalina Amuedo-Dorantes (2010), these results illustrate the importance of separating the remittance effect from the disruptive effect of contemporaneous family migration when assessing the impact of remittance receipt.

### 6.2. Sensibility analysis

The previous results rely on the assumption that there is a set of observable conditioning variables that PSM captures all the relevant differences between the treated and the control groups so that the non-treatment outcome is independent of treatment status, conditional on those characteristics (Smith & Todd,2005; Wooldridge, 2010). But it is important to investigate whether the significant causal effect estimated from the PSM is susceptible to the influence of unobserved covariates. Hence we conduct a sensitivity analysis to explore the extent to which unobserved heterogeneity or "hidden bias" between remittance-receiving households and non-remittance-receiving households would affect the estimates. Table 5 presents the results of sensitivity analysis. The causal effect of remittance on school attendance is robust to negative unobserved selection. However this causal effect is insensitive to a positive hidden bias that would affect the odds of receiving remittances by a factor of 30% but become sensitive to a positive hidden bias that would affect the odds of receiving remittances by a factor of 70%. We note that the significance levels on the bounds fall first (at Γ=1.3) and then rise again (at Γ=1.7). This second significant value of $p_{mh}^{+}$ indicates a significant negative treatment effect because we assume a large positive unobserved heterogeneity, which turns our previously significant positive treatment effect into a negative one (Sascha O. Becker and al, 2007). Furthermore, the causal effect of remittance on non-paid activity is robust to positive unobserved selection. This causal effect is insensitive to a negative hidden bias that would affect the odds of receiving remittances by a factor of 40%.

**Table 5: Sensitivity Analysis by using Mantel-Haenszel Bounds (children living in non-migrant households)**

| Gamma (Γ) | Q_mh+ | Q_mh- | p_mh+ | p_mh- |
|---|---|---|---|---|

| School attendance_dummy | | | | |
|---|---|---|---|---|
| 1 | 5,03 | 5,03 | 0,00*** | 0,00*** |
| 1.1 | 3,86 | 6,21 | 0,00*** | 0,00*** |
| 1.2 | 2,79 | 7,29 | 0,00*** | 0,00*** |
| 1.3 | 1,80 | 8,29 | 0,04** | 0,00*** |
| 1.4 | 0,89 | 9,21 | 0,19 | 0,00*** |
| 1.5 | 0,05 | 10,08 | 0,48 | 0,00*** |
| 1.6 | 0,66 | 10,89 | 0,25 | 0,00*** |
| 1.7 | 1,41 | 11,66 | 0,08* | 0,00*** |
| 1.8 | 2,11 | 12,38 | 0,02** | 0,00*** |
| 1.9 | 2,77 | 13,07 | 0,00*** | 0,00*** |
| 2 | 3,40 | 13,73 | 0,00*** | 0,00*** |
| Paid activity_dummy | | | | |
| 1 | 1,16 | 1,16 | 0,12 | 0,12 |
| 1.1 | 0,83 | 1,49 | 0,20 | 0,07* |
| 1.2 | 0,53 | 1,80 | 0,30 | 0,04** |
| 1.3 | 0,26 | 2,09 | 0,40 | 0,02** |
| 1.4 | 0,00 | 2,35 | 0,50 | 0,01** |
| 1.5 | -0,06 | 2,60 | 0,52 | 0,00*** |
| 1.6 | 0,17 | 2,84 | 0,43 | 0,00*** |
| 1.7 | 0,37 | 3,07 | 0,35 | 0,00*** |
| 1.8 | 0,57 | 3,28 | 0,28 | 0,00*** |
| 1.9 | 0,76 | 3,49 | 0,22 | 0,00*** |
| 2 | 0,93 | 3,69 | 0,18 | 0,00*** |
| Non paid activity_dummy | | | | |
| 1 | 3,58 | 3,58 | 0,00*** | 0,00*** |
| 1.1 | 4,15 | 3,02 | 0,00*** | 0,00*** |
| 1.2 | 4,67 | 2,51 | 0,00*** | 0,01** |
| 1.3 | 5,17 | 2,05 | 0,00*** | 0,02** |
| 1.4 | 5,62 | 1,62 | 0,00*** | 0,05* |
| 1.5 | 6,06 | 1,22 | 0,00*** | 0,11 |
| 1.6 | 6,47 | 0,85 | 0,00*** | 0,20 |
| 1.7 | 6,86 | 0,51 | 0,00*** | 0,31 |
| 1.8 | 7,23 | 0,18 | 0,00*** | 0,43 |
| 1.9 | 7,59 | -0,05 | 0,00*** | 0,52 |
| 2 | 7,94 | 0,24 | 0,00*** | 0,41 |
| Other activities | | | | |
| 1 | 3,74 | 3,74 | 0,00*** | 0,00*** |
| 1.1 | 4,86 | 2,63 | 0,00*** | 0,00*** |
| 1.2 | 5,88 | 1,61 | 0,00*** | 0,05* |
| 1.3 | 6,83 | 0,68 | 0,00*** | 0,25 |
| 1.4 | 7,71 | 0,10 | 0,00*** | 0,46 |
| 1.5 | 8,53 | 0,90 | 0,00*** | 0,18 |
| 1.6 | 9,30 | 1,65 | 0,00*** | 0,05* |
| 1.7 | 10,02 | 2,36 | 0,00*** | 0,01** |

| 1.8 | 10,71 | 3,02 | 0,00*** | 0,00*** |
| 1.9 | 11,37 | 3,66 | 0,00*** | 0,00*** |
| 2 | 11,99 | 4,26 | 0,00*** | 0,00*** |

Gamma : odds of differential assignment due to unobserved factors
Q_mh+ : Mantel-Haenszel statistic (assumption: overestimation of treatment effect)
Q_mh- : Mantel-Haenszel statistic (assumption: underestimation of treatment effect)
p_mh+ : significance level (assumption: overestimation of treatment effect)
p_mh- : significance level (assumption: underestimation of treatment effect)
*$p< 0.1$, **$p< 0.05$, ***$p< 0.001$
Source: Survey on migration and remittances household in Senegal, 2009.

## 6.3. Differences effect of remittance by geographic and demographic groups

The above results for the impact of remittances on child activity do not discriminate by demographic groups. However the impact of remittance on children's schooling can differ according to some characteristics as gender, residence place, poor status, etc. (Mansuri, 2006; Hanson and woodruff, 2002). To gain a better understanding of the effect of remittance on child activity, we repeat the analysis for children in non-migrant households distinguishing according to residence area and gender. The table 7 illustrates the impact of remittances according to the residence area. The results show that remittances' effect promote school attendance whatever the area but the effects are higher in rural area in comparison to urban area. These results are similar to those found in Ecuador (Calero and al. (2009)). The results for the probability to receive remittance, the imbalance test and the sensitivity analysis are presented in annex.

**Table 7 : Impact of remittances on children aged 6 to 15 years according to the residence place (remittance household only)**

| | Urban area | | | Rural area | | |
|---|---|---|---|---|---|---|
| Observations | Treated : 526 | | | Treated : 517 | | |
| | Control : 858 | | | Control : 753 | | |
| **Kernel estimator (gaussian)** | ATT | Std. | T-stat | ATT | Std. | T-stat |
| Schooling_dummy | 4,87% | 2,63% | 1,86* | 9,42% | 3,15 | 2,99*** |
| Paid activity | 0,71% | 0,66% | 1,08 | 0,66% | 1,01 | 0,65 |
| Non paid activity | -1,93% | 1,06% | -1,83** | -2,91% | 1,85 | -1,57* |
| Undetermined | -3,66% | 2,46% | -1,49 | -7,17% | 3,17 | -2,26** |
| **Nearest neighbour** | ATT | Std. | T-stat | ATT | T-stat | T-stat |
| Schooling_dummy | 3,36% | 2,85% | 1,18 | 9,72% | 3,40 | 2,86** |
| Paid activity | 0,63% | 0,71% | 0,90 | 0,95% | 1,10 | 0,86 |
| Non paid activity | -1,53% | 1,18% | -1,30 | -3,21% | 2,01 | -1,60 |
| Undetermined | -2,46% | 2,66% | -0,92 | -7,47% | 3,43 | -2,18* |

*$p< 0.1$, **$p< 0.05$, ***$p< 0.001$
Source: Survey on migration and remittances household in Senegal, 2009.

Table 8 indicates the impact of remittances according to the gender. The results suggest a differential effect of remittance according the gender. The impact of remittances on activity is higher for boys in relation to girls. But we note that the effect is more clear in term of significance for boys. The results are in link with those found in Nepal (Vogel and Korinck,

2012; Bansach and Chezum, 2009).In contrast, Mansouri (2006) in rural Pakistan and Calero and al. (2009) in Ecuador found that the effects of remittance are higher for girls in relation to boys. The results for the probability to receive remittance, the imbalance test and the sensitivity analysis are presented in annex.

**Table 8 : Impact of remittances on children aged 6 to 15 years according to the gender (remittance household only)**

| | boys | | | Girls | | |
|---|---|---|---|---|---|---|
| Observations | Treated : 554 | | | Treated : 532 | | |
| | Control : 814 | | | Control : 753 | | |
| Kernel estimator (gaussian) | ATT | Std. | T-stat | ATT | Std. | T-stat |
| Schooling_dummy | 8,17% | 2,63 | 2,75*** | 2,85% | 3,04 | 0,94 |
| Paid activity | 0,57% | 0,66 | 0,60 | 0,76% | 0,68 | 1,11 |
| Non paid activity | -1,81% | 1,06 | -1,24* | -2,89% | 1,49 | -1,94* |
| Undetermined | -6,93% | 2,46 | -2,47** | -0,72% | 2,91 | -0,25 |
| Nearest neighbour | ATT | Std. | T-stat | ATT | T-stat | T-stat |
| Schooling_dummy | 9,13% | 3,16 | 2,89** | 3,50% | 3,18 | 1,10 |
| Paid activity | 0,35% | 1,00 | 0,35 | 0,71% | 0,70 | 1,01 |
| Non paid activity | -2,21% | 1,57 | -1,41** | -3,33% | 1,58 | -2,10 |
| Undetermined | -7,27% | 2,99 | -2,43 | -0,88% | 3,05 | -0,29 |

*p< 0.1, **p< 0.05, ***p< 0.001
Source: Survey on migration and remittances household in Senegal, 2009.

**7. Conclusion**

Our paper examines the impact of international migration and remittance receipt on time allocation of children of families left behind in Senegal using the unique 2009 household survey on migration and remittances. We focus our analysis on children aged 6 to 15. We follow the same strategy as Amuedo-Dorantes (2010) to separate the migration from the remittance effect to gain a better understanding of how family migration and remittance-receipt affect children's schooling. We find that remittances have a significant positive effect (3.43%) on school attendance and significant negative effect (-1.55%) on non-paid activity. In overall, the results don't change in relation to previously except that the effects are smaller in relation to the effects obtained on non-migrant household only. Therefore, we deduce, as Catalina Amuedo-Dorantes (2010), that migration impacts negatively on school attendance by promoting for both paid activity and non-paid activity. According to the residence area, the results show that remittances' effect promote school attendance whatever the area but the effects are higher in rural area in comparison to urban area. These results are similar to those found in Ecuador (Calero and al. (2009)). The results for the probability to receive remittance, the imbalance test and the sensitivity analysis are presented in annex. The results suggest a differential effect of remittance according the gender. The impact of remittances on activity is higher for boys in relation to girls. But we note that the effect is more clear in term of

significance for boys. These results are in line with those found in Nepal (Vogel and Korinck, 2012; Bansach and Chezum, 2009). The results of sensitivity analysis show that the effect of remittance on school attendance is robust to negative unobserved selection. However this causal effect is insensitive to a positive hidden bias that would affect the odds of receiving remittances by a factor of 30% but become sensitive to a positive hidden bias that would affect the odds of receiving remittances by a factor of 70%. From a policy perspective, our results underscore the importance of distinguishing between the impacts of remittances and migration in policy making. Specifically, if the objective is to raise investments in children's human capital, policies that aimed at increasing remittance flows (e.g., by lowering remitting costs or by offering matching funds) can prove particularly helpful for developing countries impacted with extensive out-migration.

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# Annex

**Figure A1:** The Propensity Score Histogram of Matched individuals (**children living in non-migrant households**)
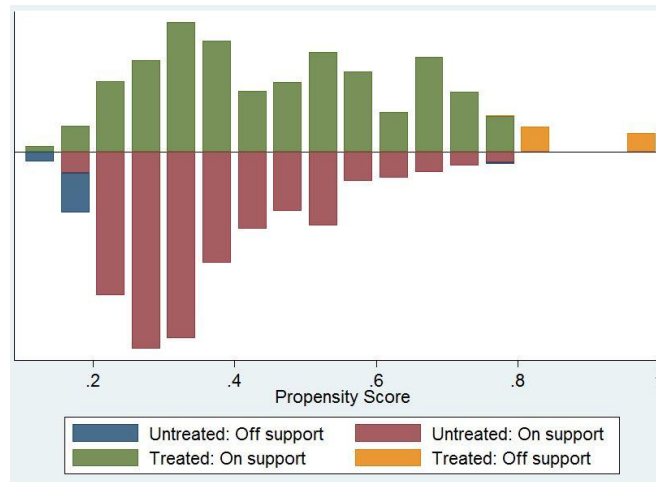


Source: Migration and remittances household survey in Senegal, 2009.

**Figure A2:** The Propensity Score Histogram of Matched individuals (**children living inmigrant households + children living in non-migrant households**)
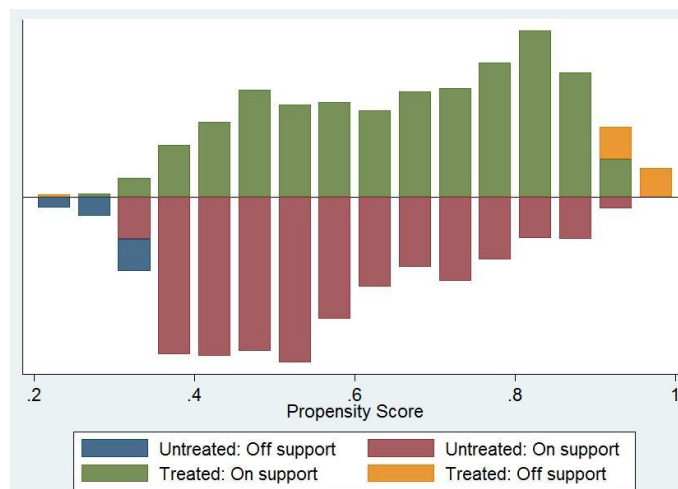


Source: Migration and remittances household survey in Senegal, 2009.

**Table A1**: The Probability to receive remittances (**Children living in non-migrant + migrant household**)

| Dependant variable=Treatment | Coef. | Odds ratio. | Coef. Std. err. | Z |
|---|---|---|---|---|
| Gender of household head | 1.4 | 4.07 | 0.09 | 15.12*** |
| Age of household head | -0.11 | 0.9 | 0.02 | -6.18*** |
| Age of household head squared | 0.001 | 1 | 0 | 6.99*** |
| Size of household | 0.07 | 1.07 | 0.01 | 11.38*** |
| Study years of household head | 0.01 | 1.01 | 0.01 | 0.58 |
| **Index of wealth (ref=quantile 1)** | | | | |
| Quantile 2 | -0.15 | 0.12 | -1.28 | -0.15 |
| Quantile 3 | -0.15 | 0.12 | -1.22 | -0.15 |
| Quantile 4 | -0.69 | 0.14 | -5.12 | -0.69*** |
| **Region of residence (ref=Dakar)** | | | | |
| Matam_dummy | 0.55 | 1.74 | 0.13 | 4.14*** |
| Diourbel_dummy | 0.59 | 1.8 | 0.13 | 4.45*** |
| Louga_dummy | 0.2 | 1.22 | 0.15 | 1.37 |
| Saint louis_dummy | 0.54 | 1.71 | 0.15 | 3.66*** |
| Thies_dummy | 0.11 | 1.11 | 0.15 | 0.72 |
| Kaolack_dummy | 0.73 | 2.07 | 0.16 | 4.66*** |
| Other regions_dummy | 0.53 | 1.7 | 0.14 | 3.72*** |
| **Constant** | 1.01 | 2.74 | 0.5 | 2.01 |
| **Observation** | | 4443 | | |

Standard errors in parentheses
$^{*}p< 0.1.$ $^{**}p< 0.05.$ $^{***}p< 0.001$
Source: Migration and remittances household survey in Senegal, 2009.

**Table A2 :**PSM balancing test (**Children living in non migrant + migrant household**)

| Matching method | Pseudo R2 Before matching | Pseudo R2 After Matching | P > Chi2 Before matching | P > Chi2 After matching | Mean Standardized Bias before matching | Mean Standardized bias after matching | Total percentage of bias reduction |
|---|---|---|---|---|---|---|---|
| Kernel (Gaussian) | 0,11 | 0,00 | 0,00 | 0,28 | 16,20 | 2,30 | 85,80% |
| Nearest neighbor | 0,11 | 0,01 | 0,00 | 0,00 | 16,20 | 5,60 | 65,43% |

*p< 0.1, **p< 0.05, ***p< 0.001

Source: Migration and remittances household survey in Senegal, 2009.

**Table A3:** Sensitivity Analysis by using Mantel-Haenszel Bounds(**Children living in non-migrant + migrant household**)

| Gamma (Γ) | Q_mh+ | Q_mh- | p_mh+ | p_mh- |
|---|---|---|---|---|
| **School attendance_dummy** | | | | |
| 1 | 5,91 | 5,91 | 0,00*** | 0,00*** |
| 1.1 | 4,45 | 7,38 | 0,00*** | 0,00*** |
| 1.2 | 3,12 | 8,73 | 0,00*** | 0,00*** |
| 1.3 | 1,89 | 9,97 | 0,03** | 0,00*** |
| 1.4 | 0,76 | 11,12 | 0,22 | 0,00*** |
| 1.5 | 0,23 | 12,21 | 0,41 | 0,00*** |
| 1.6 | 1,22 | 13,22 | 0,11 | 0,00*** |
| 1.7 | 2,14 | 14,18 | 0,02** | 0,00*** |
| 1.8 | 3,02 | 15,09 | 0,00*** | 0,00*** |
| 1.9 | 3,84 | 15,96 | 0,00*** | 0,00*** |
| 2 | 4,63 | 16,78 | 0,00*** | 0,00*** |
| **Paid activity_dummy** | | | | |
| 1 | 0,69 | 0,69 | 0,25 | 0,25 |
| 1.1 | 0,31 | 1,07 | 0,38 | 0,14 |
| 1.2 | -0,04 | 1,42 | 0,52 | 0,08* |
| 1.3 | 0,11 | 1,75 | 0,46 | 0,04** |
| 1.4 | 0,40 | 2,05 | 0,34 | 0,02** |
| 1.5 | 0,68 | 2,34 | 0,25 | 0,01** |
| 1.6 | 0,93 | 2,61 | 0,18 | 0,00*** |
| 1.7 | 1,18 | 2,86 | 0,12 | 0,00*** |
| 1.8 | 1,41 | 3,11 | 0,08* | 0,00*** |
| 1.9 | 1,62 | 3,34 | 0,05* | 0,00*** |
| 2 | 1,83 | 3,56 | 0,03** | 0,00*** |
| **Non paid activity_dummy** | | | | |
| 1 | 4,20 | 4,20 | 0,00*** | 0,00*** |
| 1.1 | 4,94 | 3,47 | 0,00*** | 0,00*** |
| 1.2 | 5,62 | 2,80 | 0,00*** | 0,00*** |
| 1.3 | 6,26 | 2,20 | 0,00*** | 0,01** |
| 1.4 | 6,86 | 1,64 | 0,00*** | 0,05* |
| 1.5 | 7,42 | 1,12 | 0,00*** | 0,13 |
| 1.6 | 7,96 | 0,64 | 0,00*** | 0,26 |
| 1.7 | 8,46 | 0,19 | 0,00*** | 0,43 |
| 1.8 | 8,95 | 0,11 | 0,00*** | 0,46 |
| 1.9 | 9,42 | 0,51 | 0,00*** | 0,30 |
| 2 | 9,86 | 0,90 | 0,00*** | 0,18 |
| **Other activities** | | | | |
| 1 | 4,33 | 4,33 | 0,00*** | 0,00*** |
| 1.1 | 5,72 | 2,94 | 0,00*** | 0,00*** |
| 1.2 | 6,99 | 1,68 | 0,00*** | 0,046** |
| 1.3 | 8,17 | 0,51 | 0,00*** | 0,30 |
| 1.4 | 9,27 | 0,49 | 0,00*** | 0,31 |

| | | | | |
|---|---|---|---|---|
| 1.5 | 10,29 | 1,49 | 0,00*** | 0,07* |
| 1.6 | 11,26 | 2,43 | 0,00*** | 0,01** |
| 1.7 | 12,17 | 3,31 | 0,00*** | 0,00*** |
| 1.8 | 13,03 | 4,14 | 0,00*** | 0,00*** |
| 1.9 | 13,86 | 4,93 | 0,00*** | 0,00*** |
| 2 | 14,64 | 5,68 | 0,00*** | 0,00*** |

Gamma : odds of differential assignment due to unobserved factors

Q_mh+ : Mantel-Haenszel statistic (assumption: overestimation of treatment effect)

Q_mh- : Mantel-Haenszel statistic (assumption: underestimation of treatment effect)

p_mh+ : significance level (assumption: overestimation of treatment effect)

p_mh- : significance level (assumption: underestimation of treatment effect)

*$p< 0.1$, **$p< 0.05$, ***$p< 0.001$

Source: Migration and remittances household survey in Senegal, 2009.

**Table A4**: The Probability to receiveremittances in urban area (**children living in non-migrant households**)

| Dependant variable=Treatment | Coef. | Odds ratio. | Coef. Std. err. | Z |
|---|---|---|---|---|
| Gender of household head | 1,09 | 2,99 | 0,13 | 8,33 |
| Age of household head | -0,14 | 0,87 | 0,03 | -5,06 |
| Age of household head squared | 0,00 | 1,00 | 0,00 | 5,14 |
| Size of household | 0,04 | 1,04 | 0,01 | 3,56 |
| Study years of household head | 0,00 | 1,00 | 0,01 | -0,12 |
| **Index of wealth (ref=quantile 1)** | | | | |
| Quantile 2 | 0,41 | 1,51 | 0,16 | 2,59 |
| Quantile 3 | 0,30 | 1,34 | 0,18 | 1,66 |
| Quantile 4 | 0,21 | 1,23 | 0,21 | 0,99 |
| **Constant** | 2,10 | 8,20 | 0,78 | 2,68 |
| **Observation** | | 1448 | | |

Standard errors in parentheses

*$p< 0.1$. **$p< 0.05$. ***$p< 0.001$

Source: Migration and remittances household survey in Senegal, 2009.

**Figure A3:** The Propensity Score Histogram of Matched individuals in urban area (**children living in non-migrant households)**
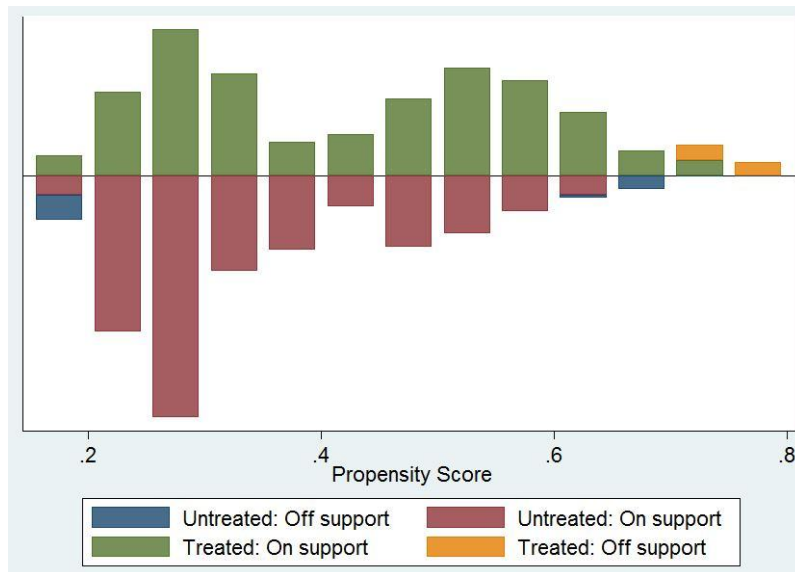
Source: Migration and remittances household survey in Senegal, 2009.

**Table A5 :** PSM balancing test in urban area  (**children living in non-migrant households**)

| Matching method | Pseudo R2 Before matching | Pseudo R2 After Matching | P > Chi2 Before matching | P > Chi2 After matching | Mean Standardized Bias before matching | Mean Standardized bias after matching | Total percentage of bias reduction |
|---|---|---|---|---|---|---|---|
| Kernel (Gaussian) | 0,07 | 0,01 | 0,00 | 0,56 | 14,10 | 6,40 | 54,61% |
| Nearest neighbor | 0,08 | 0,03 | 0,00 | 0,00 | 11,30 | 8,10 | 28,32% |

*p< 0.1, **p< 0.05, ***p< 0.001
Source: Migration and remittances household survey in Senegal, 2009.

**Table A6:** Sensitivity Analysis by using Mantel-Haenszel Bounds in urban area(**children living in non-migrant households**)

| Gamma (Γ) | Q_mh+ | Q_mh- | p_mh+ | p_mh- |
|---|---|---|---|---|
| **School attendance_dummy** | | | | |
| 1 | 1,31 | 1,31 | 0,09* | 0,09* |
| 1.1 | 0,58 | 2,05 | 0,28 | 0,02** |
| 1.2 | -0,04 | 2,72 | 0,51 | 0,00*** |
| 1.3 | 0,58 | 3,35 | 0,28 | 0,00*** |
| 1.4 | 1,15 | 3,93 | 0,12 | 0,00*** |
| 1.5 | 1,69 | 4,47 | 0,05* | 0,00*** |
| 1.6 | 2,18 | 4,97 | 0,01** | 0,00*** |
| 1.7 | 2,65 | 5,45 | 0,00*** | 0,00*** |
| 1.8 | 3,10 | 5,91 | 0,00*** | 0,00*** |
| 1.9 | 3,52 | 6,34 | 0,00*** | 0,00*** |

| | | | | |
|---|---|---|---|---|
| 2 | 3,92 | 6,75 | 0,00*** | 0,00*** |

**Paid activity_dummy**

| | | | | |
|---|---|---|---|---|
| 1 | 0,96 | 0,96 | 0,17 | 0,17 |
| 1.1 | 0,77 | 1,15 | 0,22 | 0,12 |
| 1.2 | 0,60 | 1,33 | 0,27 | 0,09* |
| 1.3 | 0,45 | 1,49 | 0,33 | 0,07* |
| 1.4 | 0,31 | 1,65 | 0,38 | 0,05* |
| 1.5 | 0,17 | 1,79 | 0,43 | 0,04** |
| 1.6 | 0,05 | 1,93 | 0,48 | 0,03** |
| 1.7 | -0,07 | 2,06 | 0,53 | 0,02** |
| 1.8 | -0,18 | 2,18 | 0,57 | 0,01** |
| 1.9 | -0,24 | 2,30 | 0,59 | 0,01** |
| 2 | -0,14 | 2,42 | 0,56 | 0,01** |

**Non paid activity_dummy**

| | | | | |
|---|---|---|---|---|
| 1 | 2,25 | 2,25 | 0,01** | 0,01** |
| 1.1 | 2,54 | 1,97 | 0,01** | 0,02** |
| 1.2 | 2,81 | 1,71 | 0,00*** | 0,04** |
| 1.3 | 3,06 | 1,47 | 0,00*** | 0,07* |
| 1.4 | 3,30 | 1,26 | 0,00*** | 0,10 |
| 1.5 | 3,52 | 1,06 | 0,00*** | 0,14 |
| 1.6 | 3,74 | 0,88 | 0,00*** | 0,19 |
| 1.7 | 3,94 | 0,70 | 0,00*** | 0,24 |
| 1.8 | 4,14 | 0,54 | 0,00*** | 0,29 |
| 1.9 | 4,32 | 0,39 | 0,00*** | 0,35 |
| 2 | 4,50 | 0,24 | 0,00*** | 0,40 |

**Other activities**

| | | | | |
|---|---|---|---|---|
| 1 | 0,64 | 0,64 | 0,26 | 0,26 |
| 1.1 | 1,33 | -0,05 | 0,09* | 0,52 |
| 1.2 | 1,96 | 0,53 | 0,02** | 0,30 |
| 1.3 | 2,55 | 1,11 | 0,01** | 0,13 |
| 1.4 | 3,09 | 1,65 | 0,00*** | 0,05* |
| 1.5 | 3,59 | 2,15 | 0,00*** | 0,02** |
| 1.6 | 4,07 | 2,62 | 0,00*** | 0,00*** |
| 1.7 | 4,51 | 3,06 | 0,00*** | 0,00*** |
| 1.8 | 4,94 | 3,48 | 0,00*** | 0,00*** |
| 1.9 | 5,34 | 3,88 | 0,00*** | 0,00*** |
| 2 | 5,72 | 4,26 | 0,00*** | 0,00*** |

Gamma : odds of differential assignment due to unobserved factors
Q_mh+ : Mantel-Haenszel statistic (assumption: overestimation of treatment effect)
Q_mh- : Mantel-Haenszel statistic (assumption: underestimation of treatment effect)
p_mh+ : significance level (assumption: overestimation of treatment effect)
p_mh- : significance level (assumption: underestimation of treatment effect)
*$p < 0.1$, **$p < 0.05$, ***$p < 0.001$
Source: Migration and remittances household survey in Senegal, 2009.

**Table A7**: The Probability to receiveremittances in rural area (**children living in non-migrant households**)

| Dependant variable=Treatment | Coef. | Odds ratio. | Coef. Std. err. | Z |
|---|---|---|---|---|
| Gender of household head | 1,96 | 7,07 | 0,21 | 9,10*** |
| Age of household head | -0,08 | 0,92 | 0,03 | -2,64*** |
| Age of household head squared | 0,00 | 1,00 | 0,00 | 3,00*** |
| Size of household | 0,05 | 1,06 | 0,01 | 5,56*** |
| Study years of household head | -0,04 | 0,96 | 0,03 | -1,52 |
| **Index of wealth (ref=quantile 1)** | | | | |
| Quantile 2 | -0,48 | 0,62 | 0,51 | -0,95 |
| Quantile 3 | -0,23 | 0,80 | 0,49 | -0,46 |
| Quantile 4 | -1,00 | 0,37 | 0,49 | -2,03** |
| **Constant** | 1,30 | 3,66 | 0,99 | 1,31 |
| **Observation** | | 1352 | | |

Standard errors in parentheses
*p< 0.1. **p< 0.05. ***p< 0.001
Source: Migration and remittances household survey in Senegal, 2009.

**Figure A4:** The Propensity Score Histogram of Matched individuals in rural area (**children living in non-migrant households)**
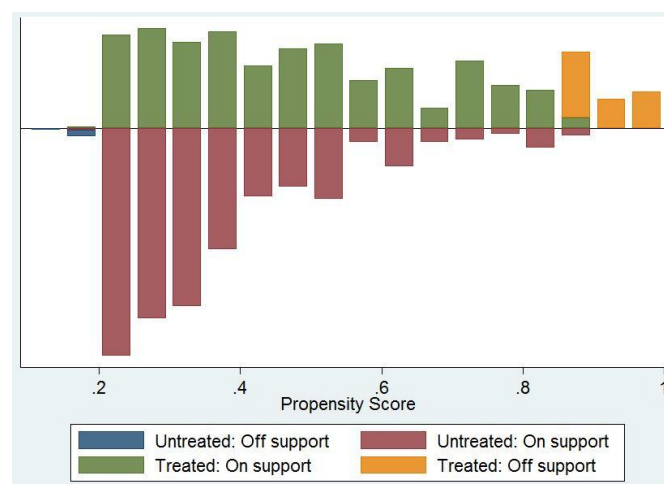


Source: Migration and remittances household survey in Senegal, 2009.

**Table A8 :** PSM balancing test in rural area  (**children living in non-migrant households**)

| Matching method | Pseudo R2 Before matching | Pseudo R2 After Matching | P > Chi2 Before matching | P > Chi2 After matching | Mean Standardized Bias before matching | Mean Standardized bias after matching | Total percentage of bias reduction |
|---|---|---|---|---|---|---|---|
| Kernel (Gaussian) | 0,13 | 0,01 | 0,00 | 0,46 | 32,70 | 5,70 | 82,57% |
| Nearest neighbor | 0,13 | 0,01 | 0,00 | 0,03 | 32,70 | 5,70 | 82,57% |

*$p< 0.1$, **$p< 0.05$, ***$p< 0.001$
Source: Migration and remittances household survey in Senegal, 2009.

**Table A9:** Sensitivity Analysis by using Mantel-Haenszel Bounds in rural area(**children living in non-migrant households**)

| Gamma (Γ) | Q_mh+ | Q_mh- | p_mh+ | p_mh- |
|---|---|---|---|---|
| **School attendance_dummy** | | | | |
| 1 | 5,05 | 5,05 | 0,00*** | 0,00*** |
| 1.1 | 4,22 | 5,89 | 0,00*** | 0,00*** |
| 1.2 | 3,47 | 6,65 | 0,00*** | 0,00*** |
| 1.3 | 2,77 | 7,36 | 0,00*** | 0,00*** |
| 1.4 | 2,13 | 8,02 | 0,02** | 0,00*** |
| 1.5 | 1,54 | 8,63 | 0,06* | 0,00*** |
| 1.6 | 0,98 | 9,21 | 0,16 | 0,00*** |
| 1.7 | 0,46 | 9,76 | 0,32 | 0,00*** |
| 1.8 | -0,04 | 10,28 | 0,52 | 0,00*** |
| 1.9 | 0,39 | 10,77 | 0,35 | 0,00*** |
| 2 | 0,83 | 11,24 | 0,20 | 0,00*** |
| **Paid activity_dummy** | | | | |
| 1 | 0,54 | 0,54 | 0,30 | 0,30 |
| 1.1 | 0,27 | 0,80 | 0,39 | 0,21 |
| 1.2 | 0,03 | 1,05 | 0,49 | 0,15 |
| 1.3 | -0,17 | 1,28 | 0,57 | 0,10 |
| 1.4 | 0,04 | 1,49 | 0,48 | 0,07* |
| 1.5 | 0,23 | 1,69 | 0,41 | 0,05* |
| 1.6 | 0,41 | 1,87 | 0,34 | 0,03** |
| 1.7 | 0,58 | 2,05 | 0,28 | 0,02** |
| 1.8 | 0,74 | 2,22 | 0,23 | 0,01** |
| 1.9 | 0,90 | 2,38 | 0,18 | 0,01** |
| 2 | 1,04 | 2,54 | 0,15 | 0,01** |
| **Non paid activity_dummy** | | | | |
| 1 | 2,87 | 2,87 | 0,00*** | 0,00*** |
| 1.1 | 3,34 | 2,40 | 0,00*** | 0,01** |
| 1.2 | 3,78 | 1,98 | 0,00*** | 0,02** |
| 1.3 | 4,18 | 1,59 | 0,00*** | 0,06* |

| | | | | |
|---|---|---|---|---|
| 1.4 | 4,56 | 1,24 | 0,00*** | 0,11 |
| 1.5 | 4,92 | 0,91 | 0,00*** | 0,18 |
| 1.6 | 5,26 | 0,60 | 0,00*** | 0,27 |
| 1.7 | 5,58 | 0,31 | 0,00*** | 0,38 |
| 1.8 | 5,89 | 0,04 | 0,00*** | 0,48 |
| 1.9 | 6,18 | 0,01 | 0,00*** | 0,50 |
| 2 | 6,46 | 0,25 | 0,00*** | 0,40 |
| **Other activities** | | | | |
| 1 | 3,51 | 3,51 | 0,00*** | 0,00*** |
| 1.1 | 4,34 | 2,68 | 0,00*** | 0,00*** |
| 1.2 | 5,09 | 1,93 | 0,00*** | 0,03** |
| 1.3 | 5,79 | 1,24 | 0,00*** | 0,11 |
| 1.4 | 6,44 | 0,60 | 0,00*** | 0,27 |
| 1.5 | 7,05 | 0,00 | 0,00*** | 0,50 |
| 1.6 | 7,62 | 0,44 | 0,00*** | 0,33 |
| 1.7 | 8,16 | 0,96 | 0,00*** | 0,17 |
| 1.8 | 8,67 | 1,45 | 0,00*** | 0,07* |
| 1.9 | 9,15 | 1,92 | 0,00*** | 0,03** |
| 2 | 9,61 | 2,36 | 0,00*** | 0,01** |

Gamma : odds of differential assignment due to unobserved factors
Q_mh+ : Mantel-Haenszel statistic (assumption: overestimation of treatment effect)
Q_mh- : Mantel-Haenszel statistic (assumption: underestimation of treatment effect)
p_mh+ : significance level (assumption: overestimation of treatment effect)
p_mh- : significance level (assumption: underestimation of treatment effect)
*$p < 0.1$, **$p < 0.05$, ***$p < 0.001$
Source: Migration and remittances household survey in Senegal, 2009.

**Table A10**: The Probability to receiveremittances forboys (**children living in non-migrant households**)

| Dependant variable=Treatment | Coef. | Odds ratio. | Coef. Std. err. | Z |
|---|---|---|---|---|
| Gender of household head | 1,36 | 3,90 | 0,16 | 8,67 |
| Age of household head | -0,11 | 0,90 | 0,03 | -3,64 |
| Age of household head squared | 0,00 | 1,00 | 0,00 | 4,01 |
| Size of household | 0,04 | 1,04 | 0,01 | 4,39 |
| Study years of household head | 0,01 | 1,01 | 0,02 | 0,87 |
| **Index of wealth (ref=quantile 1)** | | | | |
| Quantile 2 | 0,41 | 1,51 | 0,22 | 1,84 |
| Quantile 3 | 0,41 | 1,50 | 0,24 | 1,72 |
| Quantile 4 | 0,08 | 1,09 | 0,26 | 0,32 |
| **Region of residence (ref=Dakar)** | | | | |

| | | | | |
|---|---|---|---|---|
| Matam_dummy | 1,09 | 2,96 | 0,25 | 4,32 |
| Diourbel_dummy | 1,06 | 2,89 | 0,24 | 4,37 |
| Louga_dummy | 0,76 | 2,13 | 0,27 | 2,83 |
| Saint louis_dummy | 0,49 | 1,63 | 0,28 | 1,73 |
| Thies_dummy | 0,70 | 2,02 | 0,28 | 2,53 |
| Kaolack_dummy | 0,91 | 2,48 | 0,29 | 3,09 |
| Other regions_dummy | 1,01 | 2,75 | 0,26 | 3,85 |
| **Constant** | 0,20 | 1,23 | 0,86 | 0,24 |
| **Observation** | | 1434 | | |

Standard errors in parentheses
 *p< 0.1. **p< 0.05. ***p< 0.001
Source: Migration and remittances household survey in Senegal, 2009.


**Figure A5:** The Propensity Score Histogram of Matched individuals for boys(**children living in non-migrant households)**
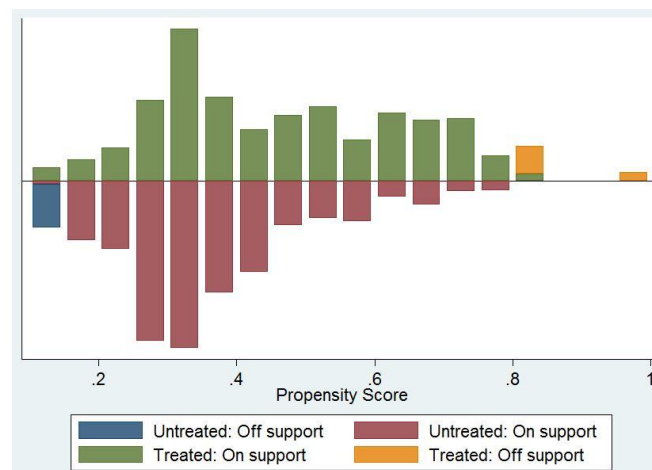


Source: Migration and remittances household survey in Senegal, 2009.

**Table A11 :**PSM balancing test for boys  (**children living in non-migrant households**)

| Matching method | Pseudo R2 Before matching | Pseudo R2 After Matching | P > Chi2 Before matching | P > Chi2 After matching | Mean Standardized Bias before matching | Mean Standardized bias after matching | Total percentage of bias reduction |
|---|---|---|---|---|---|---|---|
| Kernel (Gaussian) | 0,09 | 0,01 | 0,00 | 0,95 | 14,40 | 3,60 | 75% |
| Nearest neighbor | 0,09 | 0,01 | 0,00 | 0,58 | 14,40 | 5,70 | 60,42% |

 *p< 0.1, **p< 0.05, ***p< 0.001
Source: Migration and remittances household survey in Senegal, 2009.

**Table A12:** Sensitivity Analysis by using Mantel-Haenszel Boundsfor boys(**children living in non-migrant households**)

| Gamma (Γ) | Q_mh+ | Q_mh- | p_mh+ | p_mh- |
|---|---|---|---|---|
| **School attendance_dummy** | | | | |
| 1 | 3,92 | 3,92 | 0,00*** | 0,00*** |
| 1.1 | 3,09 | 4,76 | 0,00*** | 0,00*** |
| 1.2 | 2,33 | 5,53 | 0,01** | 0,00*** |
| 1.3 | 1,63 | 6,24 | 0,05* | 0,00*** |
| 1.4 | 0,98 | 6,90 | 0,16 | 0,00*** |
| 1.5 | 0,38 | 7,51 | 0,35 | 0,00*** |
| 1.6 | 0,06 | 8,09 | 0,47 | 0,00*** |
| 1.7 | 0,59 | 8,64 | 0,28 | 0,00*** |
| 1.8 | 1,09 | 9,16 | 0,14 | 0,00*** |
| 1.9 | 1,56 | 9,65 | 0,06* | 0,00*** |
| 2 | 2,01 | 10,11 | 0,02** | 0,00*** |
| **Paid activity_dummy** | | | | |
| 1 | 0,41 | 0,41 | 0,34 | 0,34 |
| 1.1 | 0,14 | 0,68 | 0,44 | 0,25 |
| 1.2 | -0,11 | 0,92 | 0,54 | 0,18 |
| 1.3 | -0,02 | 1,15 | 0,51 | 0,12 |
| 1.4 | 0,19 | 1,37 | 0,43 | 0,09* |
| 1.5 | 0,38 | 1,57 | 0,35 | 0,06* |
| 1.6 | 0,57 | 1,76 | 0,29 | 0,04** |
| 1.7 | 0,74 | 1,94 | 0,23 | 0,03** |
| 1.8 | 0,90 | 2,11 | 0,18 | 0,02** |
| 1.9 | 1,06 | 2,27 | 0,14 | 0,01** |
| 2 | 1,21 | 2,42 | 0,11 | 0,01** |
| **Non paid activity_dummy** | | | | |
| 1 | 2,26 | 2,26 | 0,01** | 0,01** |
| 1.1 | 2,67 | 1,87 | 0,00*** | 0,03** |
| 1.2 | 3,04 | 1,51 | 0,00*** | 0,07* |
| 1.3 | 3,38 | 1,18 | 0,00*** | 0,12 |
| 1.4 | 3,71 | 0,87 | 0,00*** | 0,19 |
| 1.5 | 4,01 | 0,59 | 0,00*** | 0,28 |
| 1.6 | 4,30 | 0,33 | 0,00*** | 0,37 |
| 1.7 | 4,58 | 0,08 | 0,00*** | 0,47 |
| 1.8 | 4,84 | -0,10 | 0,00*** | 0,54 |
| 1.9 | 5,09 | 0,12 | 0,00*** | 0,45 |
| 2 | 5,33 | 0,32 | 0,00*** | 0,37 |
| **Other activities** | | | | |
| 1 | 3,11 | 3,11 | 0,00*** | 0,00*** |
| 1.1 | 3,90 | 2,33 | 0,00*** | 0,01** |
| 1.2 | 4,62 | 1,61 | 0,00*** | 0,05* |
| 1.3 | 5,28 | 0,96 | 0,00*** | 0,17 |
| 1.4 | 5,90 | 0,35 | 0,00*** | 0,36 |

| | | | | |
|---|---|---|---|---|
| 1.5 | 6,48 | 0,09 | 0,00*** | 0,46 |
| 1.6 | 7,03 | 0,62 | 0,00*** | 0,27 |
| 1.7 | 7,54 | 1,11 | 0,00*** | 0,13 |
| 1.8 | 8,03 | 1,58 | 0,00*** | 0,06* |
| 1.9 | 8,49 | 2,02 | 0,00*** | 0,02** |
| 2 | 8,93 | 2,45 | 0,00*** | 0,01** |

Gamma : odds of differential assignment due to unobserved factors
Q_mh+ : Mantel-Haenszel statistic (assumption: overestimation of treatment effect)
Q_mh- : Mantel-Haenszel statistic (assumption: underestimation of treatment effect)
p_mh+ : significance level (assumption: overestimation of treatment effect)
p_mh- : significance level (assumption: underestimation of treatment effect)
*$p< 0.1$, **$p< 0.05$, ***$p< 0.001$
Source: Migration and remittances household survey in Senegal, 2009.

**Table A13**: The Probability to receiveremittances for girls (**children living in non-migrant households**)

| Dependant variable=Treatment | Coef. | Odds ratio. | Coef. Std. err. | Z |
|---|---|---|---|---|
| Gender of household head | 1,30 | 3,68 | 0,15 | 8,47 |
| Age of household head | -0,11 | 0,90 | 0,03 | -3,86 |
| Age of household head squared | 0,00 | 1,00 | 0,00 | 3,98 |
| Size of household | 0,06 | 1,06 | 0,01 | 5,91 |
| Study years of household head | -0,01 | 0,99 | 0,02 | -0,63 |
| **Index of wealth (ref=quantile 1)** | | | | |
| Quantile 2 | 0,05 | 1,05 | 0,22 | 0,20 |
| Quantile 3 | 0,38 | 1,46 | 0,23 | 1,65 |
| Quantile 4 | -0,14 | 0,87 | 0,25 | -0,57 |
| **Region of residence (ref=Dakar)** | | | | |
| Matam_dummy | 0,04 | 1,04 | 0,25 | 0,18 |
| Diourbel_dummy | 0,56 | 1,74 | 0,24 | 2,35 |
| Louga_dummy | -0,11 | 0,90 | 0,27 | -0,41 |
| Saint louis_dummy | 0,25 | 1,28 | 0,27 | 0,94 |
| Thies_dummy | 0,13 | 1,13 | 0,25 | 0,50 |
| Kaolack_dummy | 0,20 | 1,22 | 0,28 | 0,72 |
| Other regions_dummy | -0,05 | 0,95 | 0,26 | -0,18 |
| **Constant** | 1,17 | 3,22 | 0,83 | 1,42 |
| **Observation** | 1366 | | | |

Standard errors in parentheses

*p< 0.1.**p< 0.05.***p< 0.001
Source: Migration and remittances household survey in Senegal, 2009.

**Figure A5:** The Propensity Score Histogram of Matched individuals for girls (**children living in non-migrant households)**
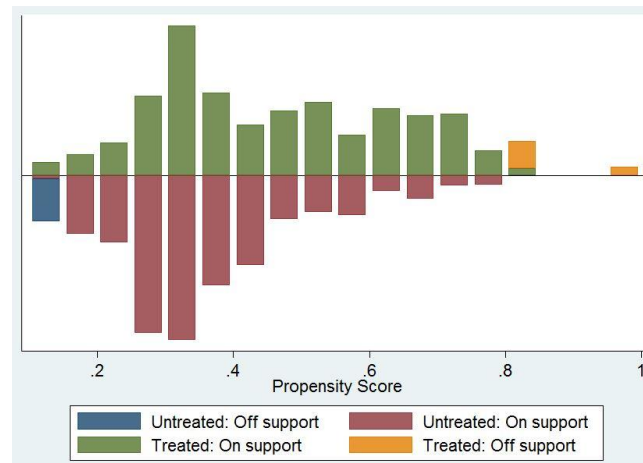


Source: Migration and remittances household survey in Senegal, 2009.

**Table A14 :**PSM balancing test for girls  (**children living in non-migrant households**)

| Matching method | Pseudo R2 Before matching | Pseudo R2 After Matching | P > Chi2 Before matching | P > Chi2 After matching | Mean Standardized Bias before matching | Mean Standardized bias after matching | Total percentage of bias reduction |
|---|---|---|---|---|---|---|---|
| Kernel (Gaussian) | 0,10 | 0,00 | 0,00 | 0,99 | 15,60 | 2,80 | 82,05% |
| Nearest neighbor | 0,10 | 0,00 | 0,00 | 0,89 | 15,60 | 4,1 | 73,72% |

*p< 0.1, **p< 0.05, ***p< 0.001
Source: Migration and remittances household survey in Senegal, 2009.

**Table A15:** Sensitivity Analysis by using Mantel-Haenszel Bounds for girls(**children living in non-migrant households**)

| Gamma (Γ) | Q_mh+ | Q_mh- | p_mh+ | p_mh- |
|---|---|---|---|---|
| **School attendance_dummy** | | | | |
| 1 | 2,38 | 2,38 | 0,01** | 0,01** |
| 1.1 | 1,56 | 3,21 | 0,06* | 0,00*** |
| 1.2 | 0,80 | 3,97 | 0,21 | 0,00*** |
| 1.3 | 0,11 | 4,66 | 0,45 | 0,00*** |
| 1.4 | 0,41 | 5,31 | 0,34 | 0,00*** |
| 1.5 | 1,01 | 5,92 | 0,16 | 0,00*** |
| 1.6 | 1,56 | 6,49 | 0,06* | 0,00*** |
| 1.7 | 2,09 | 7,02 | 0,02** | 0,00*** |

| Gamma | Q_mh+ | Q_mh- | p_mh+ | p_mh- |
|---|---|---|---|---|
| 1.8 | 2,58 | 7,53 | 0,00*** | 0,00*** |
| 1.9 | 3,05 | 8,01 | 0,00*** | 0,00*** |
| 2 | 3,50 | 8,46 | 0,00*** | 0,00*** |
| **Paid activity_dummy** | | | | |
| 1 | 1,24 | 1,24 | 0,11 | 0,11 |
| 1.1 | 1,06 | 1,44 | 0,15 | 0,08* |
| 1.2 | 0,88 | 1,62 | 0,19 | 0,05* |
| 1.3 | 0,73 | 1,78 | 0,23 | 0,04** |
| 1.4 | 0,58 | 1,94 | 0,28 | 0,03** |
| 1.5 | 0,45 | 2,09 | 0,33 | 0,02** |
| 1.6 | 0,33 | 2,23 | 0,37 | 0,01** |
| 1.7 | 0,21 | 2,36 | 0,42 | 0,01** |
| 1.8 | 0,10 | 2,49 | 0,46 | 0,01** |
| 1.9 | 0,00 | 2,61 | 0,50 | 0,00*** |
| 2 | -0,10 | 2,73 | 0,54 | 0,00*** |
| **Non paid activity_dummy** | | | | |
| 1 | 2,50 | 2,50 | 0,01** | 0,01** |
| 1.1 | 2,90 | 2,11 | 0,00*** | 0,02** |
| 1.2 | 3,27 | 1,75 | 0,00*** | 0,04** |
| 1.3 | 3,61 | 1,42 | 0,00*** | 0,08* |
| 1.4 | 3,94 | 1,12 | 0,00*** | 0,13 |
| 1.5 | 4,24 | 0,85 | 0,00*** | 0,20 |
| 1.6 | 4,53 | 0,59 | 0,00*** | 0,28 |
| 1.7 | 4,80 | 0,34 | 0,00*** | 0,37 |
| 1.8 | 5,06 | 0,12 | 0,00*** | 0,45 |
| 1.9 | 5,32 | -0,10 | 0,00*** | 0,54 |
| 2 | 5,56 | 0,05 | 0,00*** | 0,48 |
| **Other activities** | | | | |
| 1 | 1,46 | 1,46 | 0,07* | 0,07* |
| 1.1 | 2,25 | 0,67 | 0,01** | 0,25 |
| 1.2 | 2,98 | -0,05 | 0,00*** | 0,52 |
| 1.3 | 3,64 | 0,59 | 0,00*** | 0,28 |
| 1.4 | 4,26 | 1,20 | 0,00*** | 0,11 |
| 1.5 | 4,84 | 1,77 | 0,00*** | 0,04** |
| 1.6 | 5,39 | 2,31 | 0,00*** | 0,01** |
| 1.7 | 5,90 | 2,81 | 0,00*** | 0,00*** |
| 1.8 | 6,38 | 3,29 | 0,00*** | 0,00*** |
| 1.9 | 6,84 | 3,74 | 0,00*** | 0,00*** |
| 2 | 7,28 | 4,17 | 0,00*** | 0,00** |

Gamma : odds of differential assignment due to unobserved factors
Q_mh+ : Mantel-Haenszel statistic (assumption: overestimation of treatment effect)
Q_mh- : Mantel-Haenszel statistic (assumption: underestimation of treatment effect)
p_mh+ : significance level (assumption: overestimation of treatment effect)
p_mh- : significance level (assumption: underestimation of treatment effect)
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.001$
Source: Migration and remittances household survey in Senegal, 2009.