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REMITTANCES AND HOUSEHOLD EXPENDITURE BEHAVIOUR: EVIDENCE FROM SENEGAL*

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Abstract:

We use different econometric techniques, from propensity score matching to multinomial treatment methods, to assess the impact of internal and external remittances on several household budget shares in Senegal. When only considering the average impact of remittances on the household expenditure behaviour, we find an overall productive use of remittances. However, the impact of remittances disappears when the marginal spending behaviour is considered, i.e., households do not show a different consumption pattern with respect to their remittance status. The marginal spending behaviour therefore suggests that, in the decision on how to allocate expenditure, remittances are treated just as any other source of income.

JEL Classification: D10, F24, O15

Key words: remittances; household expenditure behaviour; propensity score matching; multinomial treatment regression; Senegal.

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1. Introduction

The main objective of this paper is to contribute and extend the debate on whether remittances impact economic development and, in particular, on how remittances are spent or used by the recipient households. The literature presents three views on how remittances are used, which depends on how they are perceived by the recipient household. The first view, which is part of the permanent income hypothesis, is that remittances are transitory income and therefore are spent, at the margin, in more ‘productive’ activities like human and physical capital. If this is the case, then remittances should have a long-term impact on growth and development of the receiving country. The second view is that remittances are compensatory income and therefore spent more on consumption rather than investment goods. While this could result in generating domestic production perhaps, it can also lead to an indirect effect on inflation in a number of developing countries (Narayan *et al.*, 2011). The final view regards remittances as just any other source of income and therefore no difference in the expenditure behaviour emerges from the households’ remittance status.

We conduct the analysis using migration and remittance data from a much-neglected region in migration research, Africa. More precisely, we use the data from Senegal, which has recently become one of the leading out-migration (both internal and international) countries in sub-Saharan Africa. The survey data, collected in 2009, was part of the African Migration Project, led by the World Bank. The data allows us to identify households with at least one current migrant (‘migrant household’ hereafter) and households receiving remittances (‘recipient households’ hereafter). We assume that each household has to allocate its expenditure on several commodities and we want to understand whether receiving remittances has any impact on the household decision. We are able to identify four types of goods: food, durable goods, education, and other type of items such as expenditure on funerals, engagements and weddings.¹

The remittance analysis is based on three types of households: non-recipients; internal recipients (remittances received from within Senegal) and external recipients (remittances received from international destinations). The reason for considering the origin of remittances is not only because internal and external migrants might have different motivations for

¹ The data has information on investment as well as expenditure on housing and land, but since there are large percentage of zeros in the expenditure on these items—about 70 per cent and 90 per cent respectively – we couldn’t use them in our empirical analysis. The reason for such a large number of zeros could be because of no consumption in those categories, but also because the survey is not able to capture infrequent expenditure. This usually occurs when the period considered by the survey is not long enough and does not capture different expenditure periodicity.

remitting to their families but those families who receive external remittances might perceive, treat and use them in a different way than those receiving internal remittances (Azizi, 2018a).² In fact, several empirical studies have found that internal and external remittances affect differently the consumption behaviour of households in terms of consumed and investment goods. For instance, Adams (1996) finds that internal remittances have an equalizing impact on income distribution while external remittances have the opposite effect (see also Clément, 2011; Adams and Cuecuecha, 2010b; Adams *et al.*, 2008b; Castaldo and Reilly, 2007).

Migrant and recipient households are not randomly selected – characteristics associated with a particular household rather than their status of being a remittance recipient can potentially have an impact on their expenditure behaviour. As we could not find a suitable instrument in the data to correct the bias, we use propensity score matching (PSM) to evaluate the impact of receiving a “treatment”, i.e., receiving remittances, on household expenditure behaviour, at the average level.³ The propensity score matching shows that internal transfers do not have a strong impact on household expenditure decision whereas external transfers negatively affect the expenditure on food while the effect on education expenditure is positive. It therefore shows that external remittances are used in more productive activities like investment in human capital rather than on consumption.

The PSM results provide us with a benchmark against which it is possible to evaluate the Working-Leser model, which relates budget shares linearly to the logarithm of total household expenditure. For the Working-Leser model, we carry out the estimates using the Multinomial Treatment Regression (MTR). We employ this method because of the potential bias coming from the selection of unobservables. It confirms that external remittances have a negative effect on food expenditure and a strong positive effect on education expenditure, at the average level. Moreover, receiving internal remittances has a positive effect on both food and education which does not emerge from the PSM analysis.

Additionally, the Working-Leser model allows us to compute marginal budget shares and elasticities for the different types of goods. When we explore household consumption decision looking at the marginal behaviour, we do not find any significant difference in how households allocate their expenditure. We also find that different types of recipient households perceive expenditure items in quite similar ways, i.e. in terms of necessity, normal or luxury

² It should be pointed out here that the objective of our paper is not to study the motivations of remittances but the use of remittances by the recipients. For a recent paper on motivations, see Azizi (2017).

³ McKenzie *et al.* (2010) show that when it is not possible to identify a good instrumental variable, propensity score matching performs comparatively well.

goods. The demand elasticities and marginal consumption results show that remittances do not change the household expenditure behaviour, i.e., remittances are treated just like any other income.

The rest of the paper is structured as follows. Section 2 contains a brief outlook on Senegal and its emergence as an important emigration country while Section 3 presents the relevant literature on the relation between remittances and household consumption patterns. Section 4 describes the dataset used in this study and Section 5 presents the propensity score matching techniques and the Working-Leser model. Section 6 discusses and compares the empirical findings and the last section concludes the paper.

2. Senegal: a brief background

Sub-Saharan Africa (SSA) is becoming an important emigration region. The rate of migration from Africa has evolved dramatically in early 2000s, with the growth rate in net migration was over 275% between 2000 and 2005 (Naudé, 2010). The stock of emigrants reported in 2013 for the SSA region was 23.2 million or 2.5 per cent of population (World Bank, 2016). The relatively high rate of outmigration is due to the interplay of different factors: political and economic instability, violent conflicts, climate change and deterioration of the environment, which include desertification and rainfall related problems.

In comparison to the neighbouring states, Senegal experiences a good level of freedom and democracy both in political institutions and society, though an exception to the overall stability is represented by the Casamance conflict in the South of the country, during the 1980s. The conflict led to intense refugee outflows due to human right abuses. Also, Senegal has experienced a number of social, economic and political crises: the devaluation of the Franc CFA in 1994 and the high level of unemployment in the same period are expressions of the difficulties faced by the country.⁴ Moreover, at the beginning of 2000s poverty affected almost half of the population (Cisse, 2011).

Several rainfall shocks have occurred in the whole Sahelian region in the past 50 years. The drought in the 1970s and 1980s had strong consequences for the economy and forced the population of the most affected areas to move within and outside the country. Even though there was a slight improvement in rainfall during the 1990s, a severe rainfall deficit occurred again in 2002 (Sarr, 2007) and the prospects for the future do not seem encouraging.

⁴ 50 per cent devaluation of the CFA franc against the French franc.

Senegal experiences both internal and external migration. Internal movements, especially from rural to urban regions, are the predominant form of migration. Shortage of food in the rural areas, adverse climate conditions and the search of economic and employment opportunities explain internal migration, which involves around 13 per cent of the Senegalese population with Dakar, Thies and Diourbel as the primary regions of destination (ANSD: RGPH-III, 2002). In terms of external migration, approximately 5 per cent of the population resides outside Senegal. West African Countries are the principal destinations, attracting 53.4 per cent of Senegalese migrants. In Europe, France is the first preferred destination followed by Italy, Spain and Germany.

As a consequence of the migration trends within and outside the country, the amount of workers' remittances to Senegal increased considerably between 2000 and 2010. The real size of those transfers is unknown because of the different informal channels used to send them to the family left behind.⁵ The available official figures show that remittances quadrupled in less than a decade: from \$305 million to \$1,288 million between 2001 and 2008. The global financial crisis in 2008 slightly affected those monetary flows resulting in a decline of 8 percentage points. Nevertheless, migrants' transfers accounted for 9 per cent of GDP in 2009 compared to 6 per cent in 2001. A survey conducted in 2007 by the African Development Bank, which covers both formal and informal transfers, estimates that remittances to Senegal accounted for 19 per cent of the GDP in 2009. The larger proportion of transfers are generated in the European Union (52 per cent) mostly from France, Italy and Spain (Cisse, 2011).

Regular remittances are a new phenomenon and more and more households, especially in the rural areas, depend on those transfers to satisfy various daily needs. The second Senegalese Household Survey (ANSD: ESAM II, 2004) shows that the funds received from abroad have increased the average per capita expenditure of recipient households by almost 60 per cent compared to those households who do not receive remittances. It seems that the larger proportion of remittances goes to current consumption (Cisse, 2011; Some, 2009); and at the national level those transfers have reduced poverty by almost one-third (ANSD: ESAM II, 2004).

3. Literature review

The household is the first unit which takes decision on the use of remittances and therefore, in essence, it determines the role remittances play in the development process of the

⁵ Sending them through post, intermediaries or migrants carrying cash themselves.

receiving country. Remittances are received under imperfect information, uncertainty and with different regularity (Seshan, 2012; Chami *et al.*, 2005) and therefore how they are perceived by the households is not straightforward. Based on the previous empirical studies, the impact of remittances on household expenditure decision has been interpreted mainly according to three different views, discussed in the Introduction above, which show that it is the way households perceive transfers which makes their use more or less productive. Recent studies interpret remittances as a transitory income and conclude for a positive effect of remittances on different types of investment goods: productive activities, housing, education and health.

Cox-Edwards and Ureta (2003), for example, analyse how different types of income – remittances and income from other sources – affect the household decision on children’s schooling level in El Salvador. They use a 1997 household survey of 14,286 individuals between the ages of 6 and 24 and conclude that the source of income does matter in the household decision for the investment in schooling: remittances have a larger positive effect on school retention both in urban and rural areas, even if the impact is stronger in the urban area. A positive impact of remittances on child education is also supported by Kifle (2007) in the case of Eritrea. He used 125 remittance receiving households with young members between the ages of 7 and 20 years and found that recipient households spend a significant proportion of remittances on child education. Also, Mansour *et al.*, (2011), in the context of Jordan, conclude for positive contributions of remittances on human capital accumulation of relatively young people. Another empirical evidence of the strong link between remittances and education is found in Azizi (2018b). Using data from 122 developing countries over the period 1990-2015 he shows that international remittances have a positive effect on school enrolment, completion rate and quality of education with some stronger effects for girls. Moreover, he finds that international remittances raise health expenditure, reduce the depth of food deficit and result in lower prevalence of stunting.

Using data from the Philippines, Yang (2008) examines how household expenditure behaviour responds to a favourable exchange rate shock when external remittances are received. In particular, the paper looks at the expenditure pattern of 1646 households before and after the 1997 Asian financial crisis. The positive income shock, caused by the appreciation of the migrant’s currency against the Philippine peso, raises the expenditure on education. Receiving more remittance income is associated with a positive effect on the ownership of various types of durable goods, hours worked in self-employment and investment in the capital-intensive enterprises like transportation, communication and manufacturing. The exchange rate shock most likely relaxed the credit constraints faced by the households, providing them with

the necessary resources to start new business activities (see also Woodruff and Zenteno, 2004). In a study based on 14 states in Mexico, Taylor and Mora (2006) control for different migrant destinations and therefore for potentially different sources of remittances. The main focus of their work was to look at the household marginal spending behaviour among three different types of households: those without migrants, those with internal migrants and finally the households with international migrants. They find differences in the expenditure behaviour among the three types of households. In particular, compared to non-migrant households, those with international migrants show a considerably large marginal spending for investment while those with internal migrants spend more on services, health and housing. Their findings support the view of a productive use of remittances. The same conclusion is reached by Adams and Cuecuecha (2010a) who also take into account different sources of remittances. Using a nationally-representative household survey in Guatemala, they find that at the margin households receiving both internal and external remittances spend more on human capital and investment goods - like education and housing - and less on food. Musumba *et al.* (2015), using data from Ethiopia, Uganda and Kenya, show that remittances are more likely to be spent on education and savings in Ethiopia and Uganda than in Kenya. Their study stresses on the importance of frequency of communication between senders and recipients in the remittance amounts and allocation. Finally, Aggarwal *et al.* (2011) explores another potential channel through which remittances might have a positive effect on recipient countries' development. Using remittance flows from 109 countries over the period 1975-2007 they find a positive link between international remittances and financial sector development: remittances are positively associated with bank deposits and credit.

A more pessimistic view on how remittances are spent at the household level argues that transfers are used more on consumption rather than investment goods and they do not have any positive effect on development. This conclusion is strongly supported by Chami *et al.* (2005) who define remittances as compensatory transfers for poor economic performance.⁶ Their empirical analysis reveals that remittances are negatively correlated with GDP growth and therefore those flows of money do not appear to be a source for economic development but rather may cause some behavioural changes at the household level: recipients reduce their labour supply and labour market participation. In another paper, Adams and Cuecuecha

⁶ However, their empirical approach was challenged by Catrinescu *et al.* (2009) who, using the same data as Chami *et al.* (2005), showed that omitted variable bias was partially responsible for their results. In particular, controlling for political institutions in the receiving country, Catrinescu *et al.* showed a positive, albeit small, effect of remittances on investment and therefore on GDP growth.

(2010b) find that in Indonesia remittances affect positively the marginal expenditure of one key consumption good – food – while the marginal expenditure on housing, considered an investment good, gets reduced. This finding contradicts what the same authors find in the similar study on Guatemala. They argue that contradictory results could be explained by the fact that households in the two countries receive different amount of transfers: the level of remittances received by the Guatemalan households is higher than those in Indonesia. In addition, the recipients in the latter case are much poorer. This explains why in Guatemala households receiving remittances are able to devote more of their marginal expenditure to investment goods, while in Indonesia remittances are spent mostly on the consumption of basic goods. Also, Clément (2011) supports the idea that remittances are not used in a productive way. He shows that in Tajikistan international remittances significantly increase the household consumption level but have a negative impact on investment expenditures. However, the effect of internal remittances is not clear as they affect two investment goods in opposite directions: domestic transfers reduce expenditure on housing and agriculture but increase spending on health. No effect of remittances is found on other key investment variables such as education. He justifies this finding with the fact that health outcome is a short-term priority while education and agriculture represent long-term investments. He concludes that internal remittances help households to achieve a basic level of consumption. Finally, no link between migration and productive investment is found by Zhu *et al.* (2014) in rural China. They conclude that remittances, generated by circular or repeated migration, are predominantly used for consumption purposes.

Another way to look at remittances is to consider them fungible and therefore just as any other source of income. If a euro of income of remittances is treated by the household as a euro of wage income then migrant's transfers do not produce any change in how the household allocate its expenditure. A number of empirical studies show that remittances do not have a differentiated impact on household expenditure behaviour, concluding that income is just income wherever it is generated. For example, Adams *et al.* (2008a) arrive at the same conclusion in their comparative study on household marginal spending behaviour in Ghana. Using the 2005/2006 Ghana Living Standards Survey, they investigate on a wide range of consumption and investment goods to capture any significant effect of remittances on household expenditure decision but it seems that remittance income is treated just like any other source of income. Similar results are obtained by Castaldo and Reilly (2007) for Albania and Ang *et al.* (2009) for the Philippines. However, Tabuga (2007) using the Philippines data

finds mixed results. He shows that remittances are used for consumption purposes but they are also invested on education and housing.

A possible explanation for the existence of that wide range of empirical findings could be the difference in countries income level and perhaps in investment opportunities. It seems reasonable to think that remittances in middle-income countries are treated differently than in countries with a very low income level. In the latter case transfers are perhaps used as any other source of income without any behavioural change in the way in which households decide to allocate their expenditure. Moreover, Brown and Leaves (2011) suggest that duration and intensity of migration as well as the structure of the economic activity within the community play a significant role in the decision on how to use remittances.

4. Data

We investigate household expenditure behaviour using data from a recent Migration and Remittance Household Survey in Senegal.⁷ This survey is part of the African Migration Project (AMP) conducted in Sub-Saharan Africa by the African Development Bank and the World Bank during 2009 and 2010.⁸ The Africa Migration Survey defines migrant as “a person who used to live in a household in the country in which the interview is being conducted but left before the interview to live abroad, or in another village or urban area within the country, for at least six months”. Remittances include both external (cross-border) and internal (within-country) transfers of resources (both monetary and in-kind) sent by migrant workers to their families.

The survey is representative at the national level and provides information on members and household characteristics, expenditure, migration and remittances. The data file contains 1,953 households of which 713 are without any migrants, 523 have internal migrants only, 561 have external migrants and 156 have both categories of migrants.

As the focus of this study is on the impact of remittances on household expenditure behaviour, we use the following groups: remittance recipients (which is further divided into

⁷ We do not have any information on earnings which is why we conduct our analysis on household expenditure. This is in line with most demand studies since household income can be measured with error whereas information on expenditure seems more reliable (see Adams and Cuecuecha, 2010b; Adams *et al.*, 2008a). Individuals may be adverse in saying exactly how much they earn and moreover it is more volatile and affected by certain life events while spending is maintained at a more constant level over time. Therefore, spending seems to be a better representation of an individual's average income.

⁸ The financial crisis is likely to have affected the international remittance flows to Senegal, which might have affected households' expenditure behaviour over time. However, note that the objective of our paper is the analysis of the difference between the expenditure behaviour of recipient and non-recipient households, and not how the expenditure changes over time.

internal and external recipients) and non-recipients. After excluding households with missing information, our sample contains 1,945 households: 1,002 remittance recipients (out of which 329 are internal recipients and 673 are external recipients) and 943 non-recipients.⁹

The survey collected detailed information on different types of household expenditure. We aggregate them considering the following categories: expenditure on food, durables, education, health and other goods. As explained in the introduction, ‘housing and land’ and ‘investment’ are excluded from the empirical analysis given the large number of zeroes for those categories. The information on household expenditure is collected with attention to the different frequency of consumption. The survey provides weekly expenditure for some items (e.g. food) while monthly and half-yearly for others (e.g. durable goods). As the objective of this work is to understand the impact of remittances on household expenditure decision and the question on the amount of remittances received refers to the previous year, we aggregate each type of expenditure to obtain annual values. Table 1 presents a description of what each category of expenditure contains. Table 2 shows how much, on average, each type of household devotes to the different expenditures. It also includes a z-test performed to investigate whether differences in the means of the budget share devoted to a particular group of expenditure exist between the different types of households. The reported p-values indicate that the null hypothesis of equal means between recipient households versus those who are non-recipient has to be rejected for durables, education and health. Recipient households spend less on durables and more on education and health.

5. Methodology

The Engel curve approach is generally adopted to analyse the impact of remittances on household expenditure patterns. The main challenge of this approach is to address the concern linked to the endogeneity of remittances. The usual way to deal with the endogeneity is to use the instrumental variable approach. The literature provide us with a large number of potential instruments to address the endogeneity of remittances. Some of those instruments are related to economic conditions in the remittance-sending countries, e.g., per capita GDP, unemployment rate and real interest rate (see Aggarwal et a. 2011 and Azizi, 2018b). These instruments have the potential of working well for the group of households receiving remittances from external migrants because the economic conditions of the countries where

⁹ Among the recipient households, 946 have a migrant in the household. The migrant and recipient households overlap but do not coincide.

remittances are generated do not affect the outcome variables in the destination country. The problem we face in using those instruments is that our study focuses on both the external as well as internal transfers. The main issue in finding a good instrument for those households receiving remittances within Senegal is that the information on economic conditions of sending and receiving region overlap. Instruments related to the sending country, i.e. Senegal, are very likely to be correlated with the outcome variables, making them invalid. Cost of remittances (e.g. numbers of branches of Western Union and post offices) could be a valid alternative in our case but that that information is not available at the municipally level in Senegal. Due to data limitation the identification of a suitable instrument is not possible in our case.¹⁰ McKenzie *et al.* (2010) and McKenzie and Sasin (2007) provide evidence that when a good instrument is not available, among the non-experimental methods, propensity score matching performs comparatively well, whereas a poor instrument considerably increases the bias. We therefore employ propensity score matching (PSM) as an alternative approach and implement various matching methods to check the robustness of our results (see Clément, 2011; Equivel, Huerta-Pineda, 2007 and Bertoli and Marchetta, 2014).

The basic idea of the PSM is to estimate the average treatment effect related to the receipt of remittances on the outcome of interest – average treatment effect on the treated (ATT). In particular, we compare the average expenditure behaviour of those households receiving remittances with those who do not receive remittances, matching the two groups of households according to similar characteristics. The difference in behaviour will then be attributed to the existence of remittances.

The method consists of two stages. The first stage involves the estimation of the propensity score which represents the probability of receiving the treatment conditional on observed covariates. Given that the participation to the treatment is expressed as a dichotomous variable, the estimation of the propensity score uses logit or probit models. The second stage

¹⁰ A valid instrument has to be (i) relevant in explaining the probability of receiving remittances and (ii) exogenous to the household expenditure behaviour. As argued by McKenzie and Sasin (2007), finding a suitable instrument, which is strongly correlated with the receipt of remittances and has no direct impact on the household expenditure patterns, is a challenging task. We constructed several variables but all of them failed to be adequate instruments as they were insignificant in explaining the probability of receiving remittances. We tried the average level of rainfall by region and district for the period 1990-2009; level of unemployment in rural-urban areas in 1994-1995; amount of remittances received in 1992 by regional level; percentage of internal and external migration by region for several years; level of migration by ethnic group in 2004. These variables were constructed using information from the Climate Change Knowledge Portal (World Bank) and *The Agence Nationale De La Statistique et De La Demographie* (ANSD). None of them proved to be a suitable instrument. A possible explanation is that these were at an aggregated level. Unfortunately we were not able to find information at village or municipality levels which will provide more variability and conditions at the local level which are more likely to affect the probability of receiving remittances.

matches household receiving remittances with non-recipients based on their propensity score. The matching estimators ensure that treated and comparison units with propensity scores sufficiently close are matched. The methodology is presented in detail in Appendix 1.

A key step in the implementation of the PSM is related to the selection of the covariates. In the identification of the variables for the estimation of the propensity score we follow Bertoli and Marchetta (2014) including only pre-treatment household characteristics and excluding all those variables which could have been affected by the treatment. For example, given that in the context of developing countries, migration is driven by men, treated households tend to be disproportionately female-headed. Differently, untreated female-headed households could be just the result of widowhood. Therefore, it is misleading to compare treated households with a group of households whose expenditure choice reflects this permanent negative shock. We exclude as explanatory variables those related to the household head and even measures of asset holdings as they could be endogenous to the treatment (see Bertoli, 2010). In fact, the objective of the propensity score is to serve as a balancing score and not to maximize the fit of the model.

We again follow, as much as possible, Bertoli and Marchetta (2014) in defining the variables related to household composition and schooling for the migrant households. Those characteristics are constructed using the information of all household members including current migrant(s). Table 3 shows the difference in characteristics between including and excluding migrants in the household composition and schooling. For example, we notice that migrants are positively selected on education within the households; in fact, the years of schooling increases when migrants are considered. This proves the importance of having information on all household members in order to implement a correct econometric analysis, as it helps compare the two different types of households: recipients and non-recipients.

Several matching methods are used: The *nearest neighbour* consists in searching for each treated unit the closest control unit in terms of propensity score. Then the difference for each pair of matched units is computed and the ATT is obtained as average of all these differences. The method is implemented with replacement allowing for the untreated households to be used more than once as a match.¹¹ The *nearest five neighbours* and the *nearest ten neighbours* are the generalization of this method allowing the use of five and ten counterfactuals, respectively, for each treated unit. The *radius caliper* estimator consists in

¹¹ If we do not allow replacement, it is more likely to get bad matches as some of the high-score treated households will be matched to low-score non-treated. Lower average quality matching will increase the bias.

matching each treated unit with those control units whose propensity score falls into a neighbourhood of the propensity score of the treated unit. The caliper defines the dimension of the neighbour (see Dehejia and Wahba, 2002). We fix the caliper at 0.01.¹² The *kernel* method matches each treated unit with a weighted average of all control units and finally the *mahalanobis-metric* matches on the covariates: each treated is matched to a control unit who is the closest in terms of distance in covariates.

Each of the methods introduced above present advantages and drawbacks in terms of trade-off between quality and quantity of the matches. Because none of them is superior to another and their performance depends on the data used in the research, their joint implementation can be used as robustness check. Moreover, in our study we conduct separate analysis with respect to the origin of remittances. The exclusive treatments considered are: (i) receiving remittances; (ii) receiving internal remittances and (iii) receiving external remittances. The households participating in one of these treatments are matched one at a time with those who do not receive remittances.

The propensity score matching methods estimate the average impact of receiving remittances on different household expenditures. That gives some insights into the role of migration and remittances on the different types of expenditure but unfortunately it does not allow us to capture whether relevant differences exist at the marginal expenditure behaviour among households receiving and not receiving remittances. The marginal budget shares can be easily calculated implementing the Working-Leser model.

A general specification of the Working-Leser model for our particular purpose can be expressed as:

$$Y_{ij} = \alpha_i + \beta_i \log \exp_j + \gamma_i X_j + \theta_i R_{dj} + u_{ij} \quad (1)$$

where Y_{ij} is the budget share in good i for household j , X_j includes the same household characteristics used to generate the propensity score in the matching process, u_{ij} is the idiosyncratic shock with mean zero and constant variance which captures the unknown variation in the i^{th} budget share for the j^{th} household and R_{dj} is a vector of mutually exclusive binary variables capturing whether or not the household j receives remittances from one destination instead of another.¹³ The exclusive dummy variable is identified in the following

¹² We also tried 0.05, the results do not change.

¹³ The use of binary measures for whether or not households receive remittances is a common approach followed by Adams and Cuecuecha (2010a), Castaldo and Reilly (2007), Zarate-Hoyos (2004). It is justified by the fact that monetary values for remittances may be affected by measurement errors.

categories: receiving internal remittances only and receiving remittances from abroad only; receiving no remittances represents the base group for the empirical analysis. The parameter of interest is θ_i which shows the effect of the different treatments on the relevant budget share.

Those impacts can be compared with the results obtained from the matching methods.

The Working-Leser model could be easily estimated using a simple OLS analysis. However, the drawback of OLS method is that it does not account for the endogeneity of remittances reflecting migrant's earnings and unobservable individual and household characteristics that may also affect the migration decision. Dep and Trivedi (2006) and Dep (2009) propose an estimation framework, the Multinomial Treatment Regression (MTR), which fits our case when the source of remittances is considered. The model is composed of an outcome equation and a selection equation linked via observed and unobserved characteristics. The selection equation, which in our specification is identified as receiving remittances, models the generating process of the treatment variable and follows a mixed multinomial logit distribution. The probability of observing household j receiving remittances R_d is:

$$\Pr(R_{dj} | z_j, l_j) = \frac{\exp(z_j' \alpha_j + \delta_d l_{jd})}{1 + \sum_{k=1}^D \exp(z_j' \alpha_k + \delta_d l_{jk})} \quad (2)$$

The likelihood of receiving remittances from destination d depends on a set of household characteristics z_j and a latent factor l_{jd} which represents the unobserved household heterogeneity affecting the probability of receiving remittances from destination d .

Under this setting, the outcome equation, modelled in the Working-Leser framework can be rewritten as:

$$Y_{ij} = \alpha_i + \beta_i \log \exp_j + \gamma_i X_j + \theta_i R_{dj} + \lambda_d l_{jd} + u_{ij} \quad (3)$$

The parameters λ_d are selection terms which reflect the correlation between the unobservable determinants of receiving remittances (compared to non-receiving) and the budget share in good i . The model is estimated using maximum simulated likelihood based on Halton Sequences using the “*mtreatreg*” command in STATA.¹⁴ The nonlinear form of the multinomial equation allows the joint model for remittance status and budget share in good i

¹⁴ See Deb (2009) for more detail on “*mtreatreg*”. Deb and Trivedi (2006) suggest that in order to remove the simulation bias, the number of simulation draws should be higher than the square root of the number of observations. Given that we have 1919 observations in our sample, we perform 100 draws. The model also requires that the covariances between errors of different remittances status be fixed ($\delta_{dk}=0 \forall d \neq k$) and that $\delta_{dd}=0 \forall d$ which normalizes the choice of each remittance equation.

to be identified even if the variables in the two equations are identical (i.e. $x_j=z_j$). Given that we were not able to identify an instrument suitable for our case, we rely only on the nonlinear functional form of the remittance status equation.

As the Working-Leser model relates budget shares linearly to the logarithm of total household expenditure, it allows us to easily derive marginal budget shares and elasticities (see Clément, 2011).¹⁵ Therefore, for studying whether behavioural changes exist at the marginal level, we interact the log of total expenditure with the mutually exclusive dummy variables controlling for the different remittance statuses. The Working-Leser model expressed in equation (3) becomes:

$$Y_{ij} = \alpha_i + \beta_i \log \exp_j + \gamma_i X_j + \theta_i R_{dj} + \beta_i^* R_{dj} \log \exp_j + \lambda_d l_{jd} + u_{ij} \quad (4)$$

It is possible to compute marginal budget shares and elasticities for each remittance status, e.g. receiving them from internal and external migrants (see Appendix 2).

6. Results

6.1 Estimates from PSM

Table 4 contains the summary statistics of the explanatory variables used in the empirical analysis, including information about the household members who are currently abroad. Differences exist in the household size as well as the composition of the two types of households: recipient vs non-recipient. The size of the household is much larger for those household receiving remittances compared to the one who do not. Moreover, the presence of children and elderly is higher for the recipient households.

The estimation of the propensity scores, which are computed for the five different types of households using the logit model,¹⁶ reveals the effect of each covariate on the probability to be in one of the treatment which is presented as a binary outcome. Table 5 shows the logistic regressions for each treatment. Most of the explanatory variables have the expected sign. For example, the presence of elderly and children above 5 years of age positively affect the probability of being in a recipient household.¹⁷ Then, on the one hand, higher average level of schooling of the household members positively increases the probability of receiving one of

¹⁵ The chosen functional form displays several advantages. It provides a good statistical fit to a wide range of commodities; the slope is free to change with the expenditure level and it conforms to the criterion of additivity ($\sum C_{ij} | \exp_j = 1$) (where $\sum C_{ij}$ indicates the sum of each item consumed by household j).

¹⁶ These are migrant, recipient, migrant and recipient, internal recipient only and external recipient only.

¹⁷ We only consider children above 5 years old because the number of new offspring could be affected by the treatment.

the treatments, while on the other hand having a member with college education decreases the probability of the household to be an external recipient.

Overall, we find robust results across the different methods of matching for the various types of expenditures. Propensity score methods focus on common support of scores and Fig. 1 shows that only a very small portion of units are outside of the common support. However, the kernel estimator performs better in terms of bias reduction in each treatment setting. We check whether matching on each probability to receive the treatment balances our regressors. Table 6 shows the standardized bias¹⁸ for the p-score before and after the matching, together with the achieved percentage of reduced bias which is above 99 per cent for each treatment considered. Finally, the quality of the matching is shown in Figs 2 and 3. We plot the distribution of the propensity scores for treated and untreated households before and after the matching by type of treatment. The graphs illustrate the improvement of post-matching propensity scores and visually indicate that the matching was successful.¹⁹

The effect on the treated (ATT) using the different matching estimators are reported in Table 7. According to the t-statistics, remittance recipient households allocate differently their expenditure on food, education and health. Of the recipient households, internal remittances do not change household behaviour while receiving external remittances versus no remittances impacts negatively the proportion of expenditure on food and positively the expenditure on education. These results give some positive signs that remittances are used for productive purposes, though they need to be interpreted with caution. Given the potential selection bias linked to unobservables, we further conduct the analysis using the Working-Leser model with MTR²⁰.

6.2 The Working-Leser Model: Multinomial Treatment Regression

Using the Multinomial Treatment Regression (MTR) model to estimate jointly the functional form expressed in equations (2) and (3), we compare the effect of remittances on different budget shares with the matching estimates. Through this method we try to overcome the potential issue of endogeneity related to remittances which we were not able to address

¹⁸ The standardized bias is the difference of the sample means in the treated and untreated subsamples as a percentage of the square root of the average of the sample variances in the treated and untreated groups

¹⁹ This shows that the balancing property of the model is not an issue. “When this does not occur, so that balancing is not fully achieved, one should find another specification of the propensity-score” (G. Cerulli, 2015 p. 140).

²⁰ We have also run estimates for the Working-Leser model using a simple OLS which confirms, on the one hand, the impact of receiving external remittances on food (negative) and education (positive) and on the other hand, the very weak impact of internal remittances on the different household budget shares. Given the very close findings between the OLS and the PSM estimates, for conciseness, the OLS estimates are not presented. However, they are available upon request.

with the PSM. Estimation with the selection equation (2), expressed in a multinomial form, is reported in Table 8²¹ ²² while Table 9 shows the estimation of our outcome variables as expressed in equation (3) which includes the log of total annual expenditure as extra covariate. The mutually exclusive remittance statuses are expressed as dummy variables and their effect are jointly estimated with the household characteristics. In particular, the corrected estimates of the budget share equations suggest that receiving internal remittances positively affects the expenditure on food (more than 8 per cent) and education (around 2 per cent), which the PSM estimates does not capture. However, receiving external remittances confirms its negative impact on food and positive impact on education. Moreover, the MTR captures a positive effect of external remittances on other goods. The positive effect of remittances on expenditure on education is supported by the literature (Adams and Cuecuecha ,2010a; Musumba et al., 2015). Remittances serve to overcome household credit-constrains with positive effect on school enrolment, attendance and completion rate (Azizi, 2018b; Bouoiyour and Miftah, 2016).

The rest of Table 9 shows the impact of household characteristics on each type of expenditure considered. For example, we find that the share of women in the household is not relevant in the way the budget share is allocated across different types of household expenditures. It is rather average years of schooling that plays an important role in the expenditure decision. The composition of the household is important for understanding how the expenditure is allocated. As expected, the presence of elderly in the household affect negatively the expenditure on education and positively the budget share allocated to health. The presence of children, however, increases the expenditure on food and education. Households living in a rural location spend 2.4 per cent more on food: we expected to find the contrary impact and it may depend on the low productivity of the soil due to rainfall shocks. Instead, those households living in rural areas spend more on other expenditures, which includes engagements, weddings and funerals due possibly to the fact that in rural areas traditions are stronger.

The coefficients corresponding to the logarithm of total expenditure allow us to compute the marginal budget shares and expenditure elasticities of the commodities considered. On average, as total annual expenditure increases, households spend 7 per cent less

²¹ The routine “MTREATREG” does not provide marginal effects for the multinomial treatment equation. Given that the point estimates are almost identical to those obtained from a standard Multinomial Logit, we report the average marginal effects of the standard Multinomial Logit Model.

²² The effect of each covariate on the probability of receiving remittances for the different remittance statues resulting from the Mixed Multinomial Logit model are very similar, in terms of coefficient size and level of significance, to the estimates derived by the logistic regression implemented to compute the propensity score.

on food, 6 per cent less on durables and 1 per cent less on education, while its impact on the budget share devoted to health and other goods is positive and strongly significant. As the total annual expenditure increases, households spend 1 per cent more on health and 3 per cent more on other type of goods. The marginal budget shares and elasticities for each category of goods considered are computed using eqs. (A2.4) and (A2.5) in the Appendix, and they are reported in Table 10. The figures reveal that for one Franc CFA increase in the household's budget, expenditure on food rises by 0.27 of a Franc and on durables by 0.53 of a Franc. In addition, the expenditure increases by 0.04 and 0.09 of a Franc, respectively, on education and health and 0.16 of a Franc on other expenditures. Overall, at the margin, households devote more of their expenditure on food and durables.

The estimates for expenditure elasticities suggest that food, durables and education are necessity goods while the other commodities are luxury items. We find that education is perceived by the Senegalese households as more important than other types of expenditures. It is possible that after a certain age or school level, education becomes a luxury expenditure, though it is difficult to determine the cut-off point at which that happens. But, in general, the fact that education is a necessity good (elasticity is less than one) means that households realize the value of human capital accumulation as an investment for a better life in the future.

After interacting the log of total expenditure with the dummies for the remittance status, as expressed in equation (4), we run again the MTR²³ and compute the marginal spending behaviour and elasticities. The results are reported in Table 10. In terms of marginal budget shares and elasticities for each category of expenditure the source of remittances does not seem to be relevant in explaining the household behaviour at the margin. In fact, not only the estimates for the marginal budget shares and elasticities show some little difference in how recipient households allocate their expenditure, but a two-tailed test reveals that these differences are not even significant.

In summary, when we only consider the average impact of remittances on the household production behaviour, we find signs of a productive use of remittances to education. However, the effect of remittances disappears when we perform a further investigation interacting the log of expenditure with the sources of remittances. First, the interaction terms are insignificant, and second, we find no significant differences in the marginal budget shares and elasticities among the different remittance recipient households.

²³ Given that the interaction terms are insignificant and the rest our controls behave as shown in Table 9, we do not present the estimates of equation (4) here but these are available upon request.

Even if some differences exist between PSM and MTR estimation methods in the average expenditure, when we focus on the marginal spending behaviour and elasticities, after interacting the log of total expenditure with the dummies for the remittance status, the MTR does not reveal any significant impact of remittances on household consumption. Table 10 shows that the two-tailed test is below 1.64 (level of significance at 10 per cent) for each category of expenditure considered by the remittance status.

7. Conclusions

Migrant's transfers can potentially play an important role in developing countries and it is important to understand how recipient households perceive and use them. The question on what remittances represent for the households is still a topic of debate. The way remittances are spent – on consumption or investment goods – is strictly determined by the context of the analysis. We contribute to the existing debate by investigating the impact of remittances on household expenditure behaviour in Senegal. The Migration and Remittances Household Survey conducted in 2009 allowed us to identify three types of households: non-recipients, internal recipients and external recipients. It is important to consider households according to their remittance status because migrants' transfers could differ not only in their amount but also with respect to their origin and where transfers originate can affect how they are perceived by the receiving households.

We considered five types of expenditure: food, consumption and durable goods, education, health and other types of expenditure. The empirical analysis was conducted using propensity score matching techniques and the average treatment effect (receiving remittances) was estimated by matching treated households with those not treated that are similar on the basis of their observable characteristics which are not affected by the treatment. This methodology performs comparatively well when a good instrument is not available. Among the different types of remittances, the matching estimators showed that external remittances have the stronger effect on the household expenditure behaviour. Food and education are the budget shares in which the average difference between treated and non-treated households is significant. Those receiving external transfers spend on average less on food and more on education. These results give signal of a productive use of remittances.

We also compared the propensity score matching estimates with the Working-Leser model which allowed us to extend the analysis to the expenditure behaviour at the margin. We use multinomial treatment regression (MTR) methods relying on non-linearity of the

remittance equation only and found that those households who receive remittances, internally or externally, spend more on education which can be interpreted as a way to invest in the future generations. The impact of remittances on food is ambiguous: positive if remittances are received internally and negative if received externally. It is difficult to interpret the impact of remittances on food given that we aggregate different varieties in one category. Households have different food preferences depending also on the age of household members and it is possible that the decrease (increase) of consumption of some more expensive items in favour (to the detriment) of others reflect preferences in taste and nutrition. In terms of the impact of remittances on marginal spending behaviour we cannot conclude for a strong difference in consumption behaviour among the different households' remittance status in Senegal. It seems that in the decision on how to allocate expenditure, remittances are treated just as any other source of income in the sense that recipient households do not identify remittances for a specific purpose. This result does not support the view that remittances make act as a valve for development but it does not mean that migrants' transfers cannot be used in a productive way. Poverty and disparities in income per capita among developing countries help explain why households use remittances for different purposes. This last argument is supported by Adams *et al.* (2008a) who explain why they find different results in Ghana and Guatemala: low income-countries perhaps value income from remittances just as wage income but it could be possible that in the long run, after the household is able to provide a minimum level of basic commodities, the role and perception of remittances change. This suggests that remittances can play a role in the development process only if there is a common effort to ensure some minimum standard of living among the whole population. We believe that better quality of information and an environment (or institutions and local governments) which stimulates investment, e.g., higher incentives for education, better infrastructure, lower uncertainty, can perhaps result in a more productive use of transfers.

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Table 1- Description of the expenditure categories

Category	Description
Food	cereals, legumes, oilseeds, tubers, vegetables, fruit, meat etc.
Durables	clothing, footwear, cost of mobile phone, internet, luxury goods, utilities, appliances, vehicles, computer, electronic goods.
House& Land*	house, land, home improvement, rent, mortgage, loan repayment
Investment*	productive assets, setting a business, open a store, farming equipment.
Education	books, school supplies, uniforms, registration fees.
Health	doctor fees, lab fees, hospitalization, prescription.
Other goods	include expenditure on wedding, engagement, funerals.

*The categories house & land and investment are excluded from the empirical analysis because of the low percentage of households with positive expenditure.

Table 2 – Average budget shares for each commodity by remittance status

	Food	Durables	Education	Health	Other
No remittances	0.34	0.80	0.05	0.07	0.13
Remittances	0.33	0.73	0.06	0.08	0.13
P-value	0.26	0.04***	0.00***	0.03**	0.62

Notes: P-values show the level of significance at which we can reject the hypothesis of equal means between the sample proportion of remittance-receiver and non-receiver households; *** p<0.01, ** p<0.05, * p<0.1

Table 3: Characteristics of migrant households, including and excluding migrants

	Migrant members	
	Excluded	Included
HH size	10.581	12.384
Average age of working members	33.150	32.961
No of working female members	3.203	3.571
No of working age members	5.386	7.109
No. of children (5-15 years old)	3.222	3.228
No. of elderly (>65)	0.436	0.454
Average years of schooling	3.154	3.605
Having at least a member with college	0.105	0.164
N	1239	1239

Notes: (1) Sampling weights used to compute all descriptive statistics. (2) Household with migrants also includes those households who do not receive remittances from their migrant members.

Table 4: Descriptive statistics by type of household

	Non-recipient	Recipient
Ethnicity: Woloff	0.475	0.611
Ethnicity: Pular	0.312	0.207
HH size	8.734	12.452
No. of working age members	4.858	6.511
Average working age members	32.998	32.842
Female share (>15)	0.295	0.301
Elderly (>65)	0.209	0.420
Children (5-15)	0.783	0.871
Average years of schooling	3.720	3.636
Having at least a member with college	0.136	0.165
Rural location	0.437	0.561
Region: Dakar	0.339	0.213
Region: Dioubel	0.039	0.147
Region: Fatick	0.045	0.069
Region: Kaolack	0.120	0.180
Region: Kolda	0.061	0.045
Region: Louga	0.032	0.078
Region: Matam	0.072	0.040
Region: St-Louis	0.034	0.050
Region: Tambacounda	0.040	0.022
Region: Thies	0.178	0.145
Region: Ziguinchor	0.041	0.009
N	943	1002

Notes: (1) Sampling weights used to compute all descriptive statistics. (2) Members currently abroad are included in the construction of the variables.

Table 5: Estimation of the propensity score, logit model (logit marginal effects)

	Recipient	Recipient: internal remittances	Recipient: external remittances
Ethnicity: Woloff	0.093*** (0.034)	0.024 (0.033)	0.127*** (0.038)
Ethnicity: Pular	0.080** (0.040)	0.015 (0.041)	0.114** (0.045)
HH size	0.003 (0.004)	-0.008* (0.005)	0.008** (0.004)
No. of working age members	0.052*** (0.008)	0.046*** (0.009)	0.046*** (0.009)
Average working age members	0.008*** (0.002)	0.006*** (0.002)	0.007*** (0.003)
Female share (>15)	0.141 (0.088)	-0.063 (0.096)	0.218** (0.095)
Elderly (>65)	0.126*** (0.026)	0.075*** (0.028)	0.139*** (0.029)
Children (5-15)	0.093*** (0.034)	0.088*** (0.032)	0.064* (0.036)
Average years of schooling	0.020*** (0.004)	0.009** (0.005)	0.022*** (0.005)
Having at least a member with college	-0.093** (0.042)	-0.012 (0.044)	-0.124*** (0.042)
Rural location	0.049 (0.032)	0.057* (0.031)	0.039 (0.036)
Regional controls	yes	yes	yes
Wald chi2 (21)	251.78***	150.79***	227.15***
Pseudo-R2	0.1068	0.1123	0.1242
Log likelihood	-1203.358	-645.497	-9611302
Observations	1,945	1,272	1,616

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

Notes: The regional controls included are: Dakar, Dioubel, Fatick, Kaolack, Kolda, Louga, Matam, St-Louis, Tambacounda, Thies and Ziguinchor.

Table 6: Balancing test for the propensity score matching – Kernel estimator

Pscore for each treatment		Treated	Control	%bias	%reduct bias	t-test	p>t	R=V(T)/V(C)
Recipient	Unmatched	.58211	44403	79.6		17.56	0.000	0.93
	Matched	.57151	.57108	0.2	99.7	0.06	0.954	1.00
Internal recipient	Unmatched	.34888	.22717	82.0		13.07	0.000	1.18
	Matched	.34756	.34709	0.3	99.6	0.04	0.969	1.00
External recipient	Unmatched	.50872	.35061	87.1		17.39	0.000	1.18*
	Matched	.5011	50057	0.3	99.7	0.05	0.958	1.00

Notes: Before/after difference-in-mean test for the estimated propensity-score.

Table 7 Estimates of ATT by type of treatment: recipient; internal recipient; external recipient

	Food	Durables	Education	Health	Other
RECIPIENT					
Nearest neighbor	-0.042*** (0.014)	-0.083 (0.081)	0.012** (0.005)	0.012* (0.007)	0.002 (0.010)
Five Nearest neighbor	-0.028** (0.012)	-0.036 (0.051)	0.007* (0.004)	0.008 (0.006)	-0.002 (0.008)
Ten Nearest neighbor	-0.030*** (0.011)	-0.040 (0.047)	0.009** (0.004)	0.008 (0.006)	0.000 (0.008)
Radius Caliber (0.01)	-0.033*** (0.012)	-0.035 (0.048)	0.009** (0.004)	0.008 (0.006)	-0.001 (0.008)
Kernel	-0.031*** (0.011)	-0.039 (0.045)	0.008** (0.004)	0.008 (0.006)	-0.001 (0.008)
Mahalanobis-metric	-0.054*** (0.013)	-0.023 (0.068)	0.007 (0.004)	0.002 (0.007)	0.001 (0.009)
INTERNAL RECIPIENT					
Nearest neighbor	0.000 (0.020)	-0.260 (0.107)	-0.008 (0.007)	0.016* (0.008)	0.005 (0.013)
Five Nearest neighbor	-0.009** (0.015)	-0.092 (0.059)	-0.002 (0.005)	0.009 (0.008)	0.008 (0.011)
Ten Nearest neighbor	-0.005 (0.015)	-0.057 (0.051)	-0.001 (0.005)	0.006 (0.007)	0.004 (0.010)
Radius Caliber (0.01)	-0.012 (0.015)	-0.054 (0.051)	0.004 (0.005)	0.004 (0.007)	0.005 (0.010)
Kernel	-0.014 (0.015)	-0.055 (0.052)	0.004 (0.005)	0.009 (0.007)	0.004 (0.010)
Mahalanobis-metric	-0.018 (0.019)	-0.053 (0.108)	0.006 (0.005)	0.008 (0.008)	0.009 (0.012)
EXTERNAL RECIPIENT					
Nearest neighbor	-0.043*** (0.016)	-0.023 (0.040)	0.010 (0.006)	-0.003 (0.008)	-0.004 (0.011)
Five Nearest neighbor	-0.041*** (0.013)	-0.037 (0.054)	0.013** (0.005)	0.004 (0.007)	-0.009 (0.009)
Ten Nearest neighbor	-0.041*** (0.013)	-0.055 (0.051)	0.011** (0.005)	0.006 (0.006)	-0.006 (0.009)
Radius Caliber (0.01)	-0.043*** (0.013)	-0.051 (0.050)	0.010** (0.005)	0.007 (0.006)	-0.007 (0.009)
Kernel	-0.043*** (0.012)	-0.047 (0.049)	0.010** (0.005)	0.007 (0.006)	-0.006 (0.009)
Mahalanobis-metric	-0.068*** (0.015)	-0.016 (0.059)	0.011** (0.005)	-0.004 (0.008)	0.003 (0.010)

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

Notes: The common support option is chosen; the bandwidth for the Radius Caliber is fixed at 0.01. Consistent estimates are obtained even if we choose a larger bandwidth (e.g 0.05).

Table 8: Mixed Multinomial Logit for remittance status (marginal effects –first step)

VARIABLES	Non-recipient	Internal recipient	External recipient
Ethnicity: Woloff	-0.100*** (0.034)	-0.025 (0.023)	0.125*** (0.034)
Ethnicity: Pular	-0.089** (0.041)	-0.031 (0.026)	0.120*** (0.041)
HH size	-0.001 (0.004)	-0.009*** (0.003)	0.011*** (0.003)
No. of working age members	-0.055*** (0.009)	0.026*** (0.006)	0.029*** (0.007)
Average working age members	-0.008*** (0.002)	0.003 (0.002)	0.005** (0.002)
Female share (>15)	-0.133 (0.089)	-0.119* (0.067)	0.252*** (0.086)
Elderly (>65)	-0.129*** (0.026)	0.018 (0.018)	0.112*** (0.025)
Children (5-15)	-0.096*** (0.035)	0.061*** (0.022)	0.035 (0.004)
Average years of schooling	-0.020*** (0.005)	0.001 (0.003)	0.019*** (0.004)
Having at least a member with College	0.088** (0.042)	0.025 (0.033)	-0.113*** (0.035)
Rural location	-0.047 (0.032)	0.036 (0.022)	0.011 (0.030)
Regional controls	yes	yes	yes
Observations	1,945	1,945	1,945
Wald chi-sq	343.5	343.5	343.5
Pseudo R-sq	0.100	0.100	0.100

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

Notes: The regional controls included are: Dakar, Dioubel, Fatick, Kaolack, Kolda, Louga, Matam, St-Louis, Tambacounda, Thies and Ziguinchor.

Table 9: Selectivity-corrected estimates of budget share equations – Working-Leser model

VARIABLES	Food	Durables	Education	Health	Other
Internal recipient	0.086*** (0.019)	-0.066 (0.044)	0.026*** (0.006)	-0.013 (0.008)	-0.010 (0.012)
External recipient	-0.103*** (0.018)	-0.058 (0.056)	0.019*** (0.006)	-0.013 (0.009)	0.050*** (0.012)
Log of tot exp	-0.069*** (0.006)	-0.233*** (0.049)	-0.011*** (0.003)	0.013*** (0.004)	0.035*** (0.005)
Ethnicity: Woloff	0.017 (0.011)	0.095** (0.045)	-0.013** (0.005)	0.007 (0.006)	0.003 (0.008)
Ethnicity: Pular	0.016 (0.013)	0.051 (0.043)	-0.007 (0.006)	0.007 (0.008)	0.002 (0.010)
HH size	0.002* (0.001)	0.007 (0.005)	0.001 (0.000)	-0.001* (0.001)	-0.000 (0.001)
No. of working age members	0.001 (0.001)	0.002 (0.003)	-0.001* (0.000)	0.001* (0.000)	-0.001 (0.001)
Average working age members	0.001 (0.001)	0.002 (0.003)	-0.001* (0.000)	0.001* (0.000)	-0.001 (0.001)
Female share (>15)	0.022 (0.030)	0.084 (0.101)	-0.011 (0.013)	0.008 (0.016)	-0.015 (0.025)
Elderly (>65)	0.006 (0.009)	0.000 (0.029)	-0.007** (0.004)	0.017*** (0.005)	-0.001 (0.007)
Children (5-15)	0.021* (0.012)	-0.019 (0.039)	0.027*** (0.005)	-0.005 (0.007)	-0.013 (0.009)
Average years of schooling	-0.004*** (0.002)	0.017*** (0.006)	0.005*** (0.001)	-0.002* (0.001)	-0.005*** (0.001)
Having at least a member with College	-0.006 (0.014)	0.039 (0.047)	0.007 (0.006)	0.004 (0.008)	0.011 (0.010)
Rural location	0.024** (0.011)	-0.205*** (0.033)	-0.003 (0.004)	0.020*** (0.006)	0.051*** (0.009)
Regional controls	yes	yes	yes	yes	yes
Lnsigma	-2.251*** (0.123)	-0.327* (0.196)	-2.697*** (0.047)	-2.329*** (0.046)	-2.165*** (0.067)
Lambda internal recipient	-0.107*** (0.016)	-0.009 (0.007)	-0.026*** (0.005)	0.022*** (0.005)	0.018** (0.008)
Lambda external recipient	0.101*** (0.019)	0.057** (0.026)	-0.004 (0.005)	0.018** (0.007)	-0.080*** (0.012)
Observations	1,945	1,945	1,945	1,945	1,945

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

Notes: The regional controls included are: Dakar, Dioubel, Fatick, Kaolack, Kolda, Louga, Matam, St-Louis, Tambacounda, Thies and Ziguinchor

Table 10: Marginal budget shares and elasticities after selectivity correction

	Food	Durables	Education	Health	Other
Marginal budget share - No remittances	0.272 (0.006)	0.533 (0.049)	0.042 (0.003)	0.094 (0.004)	0.165 (0.005)
Marginal budget share - Internal remittances	0.255 0.016	0.540 0.096	0.040 0.006	0.092 0.011	0.178 0.014
<i>Two-tailed test (internal vs no remittances)</i>	<i>-0.943</i>	<i>0.053</i>	<i>-0.170</i>	<i>-0.135</i>	<i>0.832</i>
Marginal budget share- External remittances	0.261 0.013	0.527 0.093	0.043 0.006	0.089 0.009	0.156 0.011
<i>Two-tailed test (external vs no remittances)</i>	<i>-0.682</i>	<i>-0.055</i>	<i>0.192</i>	<i>-0.431</i>	<i>-0.775</i>
Elasticity - No remittances	0.810 0.023	0.697 0.095	0.784 0.060	1.180 0.071	1.292 0.051
Elasticity - Internal remittances	0.759 0.049	0.706 0.125	0.763 0.106	1.160 0.136	1.393 0.111
<i>Two-tailed test (internal vs no remittances)</i>	<i>-0.316</i>	<i>0.041</i>	<i>-0.009</i>	<i>-0.011</i>	<i>0.106</i>
Elasticity- External remittances	0.779 0.038	0.689 0.122	0.809 0.116	1.123 0.112	1.216 0.084
<i>Two-tailed test (external vs no remittances)</i>	<i>-0.682</i>	<i>-0.055</i>	<i>0.192</i>	<i>-0.431</i>	<i>-0.775</i>

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

Figure 1: common support

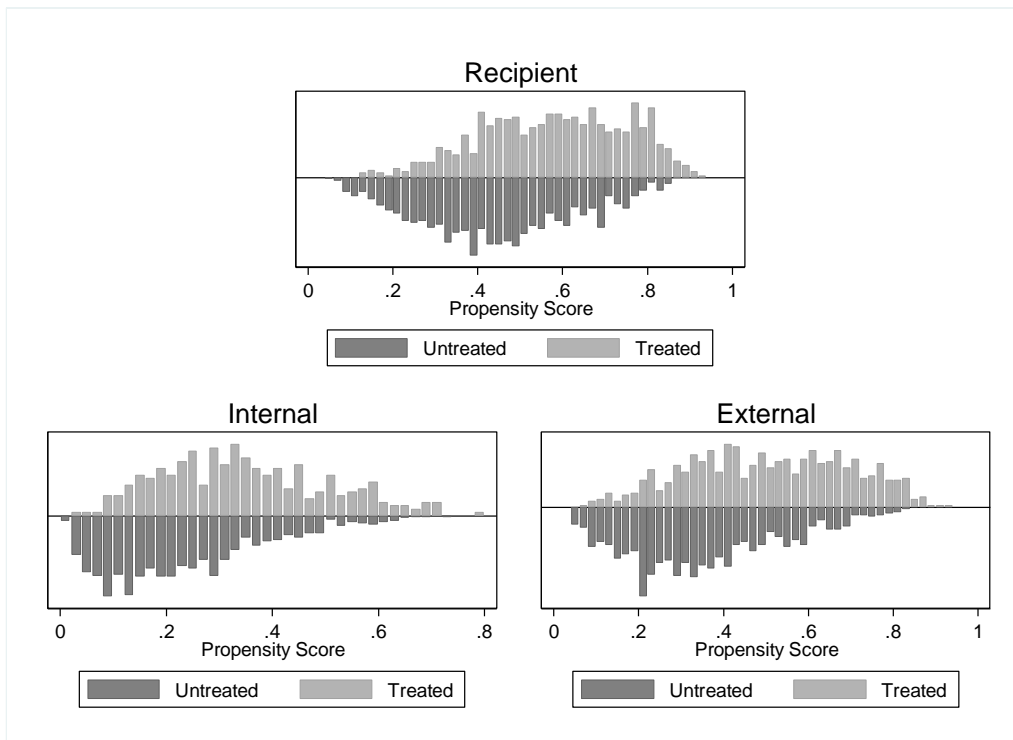


Figure 2: Distribution of the propensity score for treated and untreated before and after matching

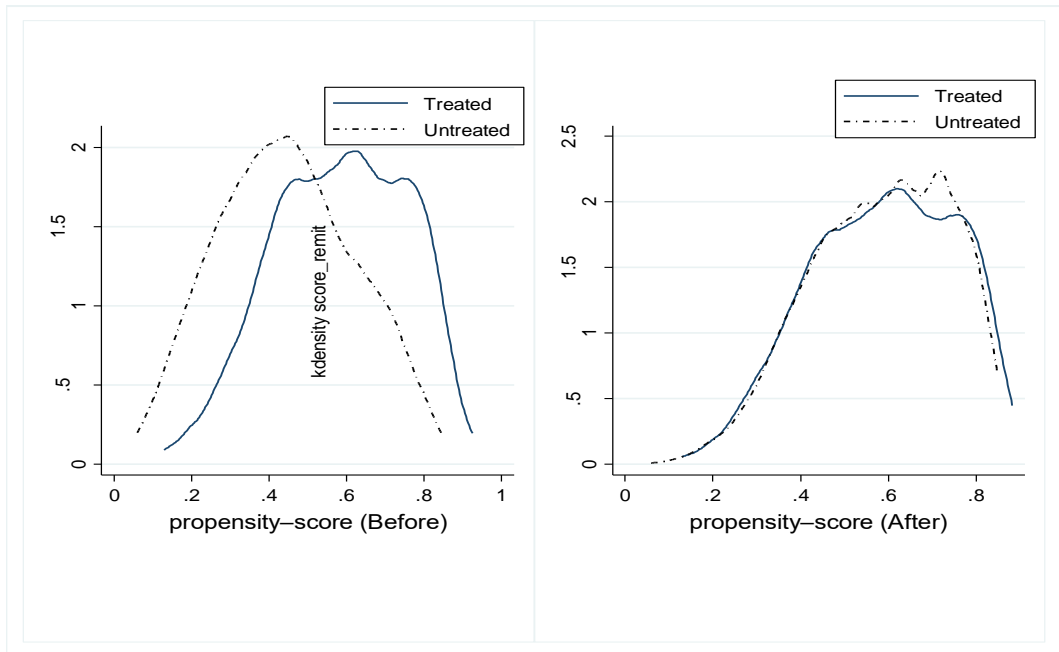
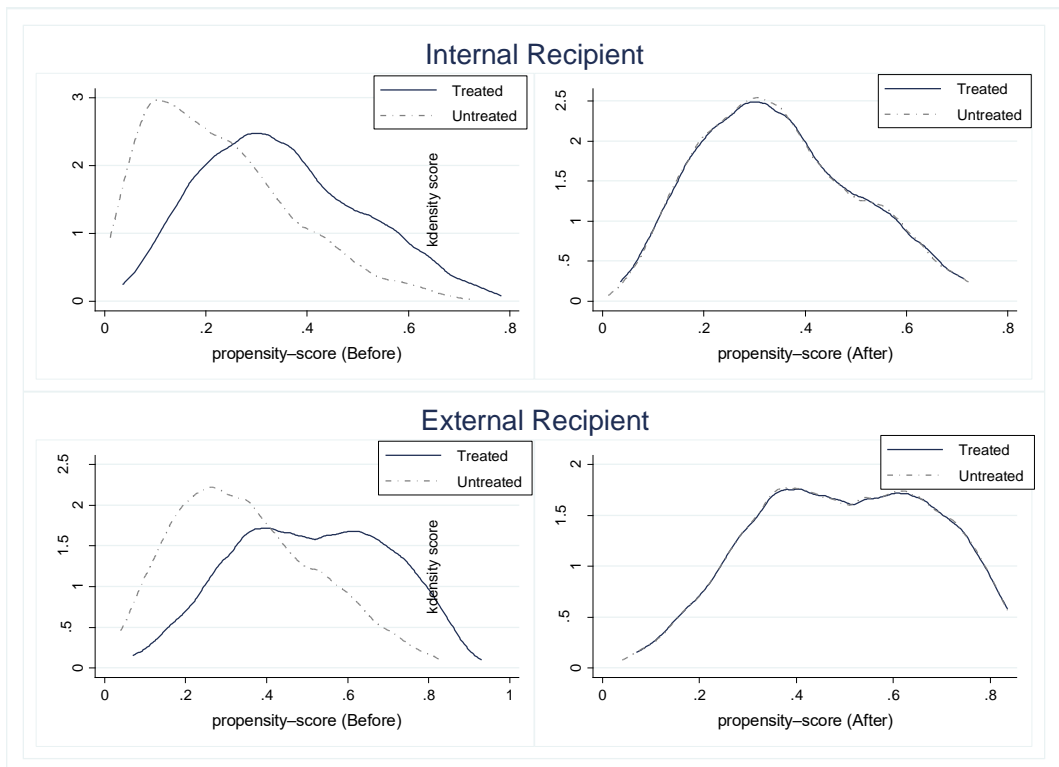


Figure 3: Distribution of the propensity score for treated and untreated before and after matching by type of household recipient



APPENDIX 1

The treatment is expressed through a dummy variable D_j equal to one if household j receives remittances and zero if it does not. Let Y_{ij1} and Y_{ij0} indicate the outcome variables representing the budget share in good i for household j in the presence and absence of treatment, respectively. The budget share in good i for household j is expressed as $Y_{ij} = c_{ij}/exp_j$; where c_{ij} is the consumption in good i for family j and exp_j indicates the total household expenditure. The treatment effect is the difference in the relevant outcome for unit j between the situation in which the treatment occurs and the one in which it does not occur.

$$\Delta Y_{ij} = E(Y_{ij1} | R = 1) - E(Y_{ij0} | R_j = 1) \quad (\text{A1.1})$$

The problem is that we do not observe the same unit under the two different states: we can estimate $E(Y_{ij1}|R_j=1)$ and $E(Y_{ij0}|R_j=0)$ but not their counterfactuals $E(Y_{ij1}|R_j=0)$ and $E(Y_{ij0}|R_j=1)$. Propensity score matching represents a solution to the potential bias coming from the unobservability of the counterfactual outcomes.

The methodology consists in generating a single index value – the propensity score – which summarizes the pre-treatment characteristics of each subject and makes it possible the matching between those who receive the treatment and those who do not. The propensity score, which can be expressed as $P(X) = P(R_j=1|X)$, represents the probability of receiving the treatment conditional on observed covariates. As suggested by Rosenbaum and Rubin (1983, 1985), the use of the propensity score reduces the dimensionality of the matching which becomes a problem when there are n-vectors of covariates. The comparison between treated and not treated units, on the basis of observable characteristics, assumes that assignment to the treatment is random and unobservables play no role in the treatment assignment (Dehejia and Wahba, 2002). The propensity score matching methods expect that given a set of observable variables X , the outcome of interest is independent of the treatment participation. This condition is known as *conditional independence assumption* and it requires that only those covariates which are not affected by receiving remittances should be included in the model. The conditional independence assumption is expressed as:

$$(Y_{ij1}, Y_{ij0}) \perp R_j | P(X_j) \quad (\text{A1.2})$$

A further requirement is the *common support* or *overlap condition* which states that individuals with the same characteristics have equal positive probability to receive or not the treatment.

$$0 < \Pr(R_j = 1) | P(X_j) < 1 \quad (\text{A1.3})$$

These assumptions (A1.2) and (A1.3) ensure that observations with the same propensity score must have the same distribution of observable characteristics independently of the treatment status. This implies that the exposure to the treatment is random. Following that it is possible to express the counterfactual as:

$$E(Y_{ij0} | R_j = 1, P(X_j)) = E(Y_{ij0} | R_j = 0, P(X_j)) \quad (\text{A1.4})$$

And finally, the PSM estimator for the average treatment effect on the treated (ATT) is simply “the mean difference in the outcomes over the common support, appropriately weighted by the propensity score distribution of participants” (Caliendo and Kopeining, 2008, p. 4):

$$\Delta Y_{ij} = E(Y_{ij1} | R_j = 1, P(X_j)) - E(Y_{ij0} | R_j = 0, P(X_j)) \quad (\text{A1.5})$$

Given that the participation to the treatment is expressed as a dichotomous variable, the estimation of the propensity score over a set of covariates uses logit or probit models. Empirical studies have adopted several matching methods and we are going to perform and compare the most widely used. Overall, the matching estimators ensure that treated and comparison units with propensity score sufficiently close are matched.

APPENDIX 2

Using the functional form described as (1) in the text:

$$Y_{ij} = \alpha_i + \beta_i \log \exp_j + \gamma_i X_j + \theta_i R_j + \lambda_d l_{jd} + u_{ij} \quad (\text{A2.1})$$

The marginal budget share for good i and household j is defined as follows:

$$mbs_{ij} = \frac{\partial c_{ij}}{\partial \exp_j} \quad (\text{A2.2})$$

From equation (A2.1), the partial derivative of the budget share with respect to the total consumption is given by:

$$\frac{\partial Y_{ij}}{\partial \exp_j} = \frac{\exp_j \frac{\partial c_{ij}}{\partial \exp_j} - c_{ij} \frac{\partial \exp_j}{\partial \exp_j}}{\exp_j^2} = \frac{\beta_i}{\exp_j} \quad (\text{A2.3})$$

Solving for $\frac{\partial c_{ij}}{\partial \exp_j}$ in equation (A2.3) we find:

$$mbs_{ij} = \beta_i + \frac{c_{ij}}{\exp_j} = \beta_i + Y_{ij} \quad (\text{A2.4})$$

Eq. (A2.4) can be calculated after estimating equation (A2.1).

Using the definition of elasticity, the expenditure elasticity of good i for household j is given by the following expression:

$$e_{ij} = (\beta_i + Y_{ij}) \frac{1}{Y_{ij}} = \frac{\beta_i}{Y_{ij}} + 1 \quad (\text{A2.5})$$

The model with interaction terms becomes:

$$Y_{ij} = \alpha_i + \beta_i \log \exp_j + \gamma_i X_j + \theta_i R_j + \beta_i^* R_j \log \exp_j + \lambda_d l_{jd} + u_{ij} \quad (\text{A2.6})$$

Our focus here is on the vector β_i^* ²⁴ which allows us to compute marginal budget shares and expenditure elasticities for the three household remittances status. In particular, the marginal

²⁴ For simplicity, we use the same notation for the two different sources of remittances.

budget shares and demand elasticities for those who receive remittances (from internal or external sources) are:

$$mbs_{ij} = \beta_i + \beta_i^* + Y_{ij} \quad (\text{A2.7})$$

$$e_{ij} = \frac{\beta_i + \beta_i^*}{Y_{ij}} + 1 \quad (\text{A2.8})$$

Eqs (A2.4) and (A2.5) apply for those who do not receive remittance.