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**Remittances and household expenditure patterns in Tajikistan:  
A propensity score matching analysis**

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*Cahiers du GREThA  
n°2011-09*

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**Transferts de fonds et structure de la dépense des ménages au Tadjikistan : une analyse de propensity score matching**

**Résumé**

*L'objectif de cet article est d'évaluer l'impact des transferts de fonds sur la structure de la dépense des ménages au Tadjikistan. Plus spécifiquement, cette étude utilise les techniques de 'propensity score matching' et les applique aux données de l'enquête ménages 'Tajikistan Living Standards Measurement Survey' de 2003. Les résultats obtenus ne font pas état d'une utilisation productive des transferts de fonds dans la mesure où ni les transferts internes, ni les transferts externes n'ont d'effet positif sur les dépenses d'investissement. Les transferts de fonds et les migrations sont alors interprétés comme des stratégies de court terme qui aident les ménages vulnérables à atteindre un niveau de consommation de base.*

**Mots-clés :** transferts de fonds, structure de la dépense, propensity score matching, analyse de sensibilité, Tadjikistan.

**Remittances and household expenditure patterns in Tajikistan: A propensity score matching analysis**

**Abstract**

*The object of this article is to assess the impact of remittances on household expenditure patterns in Tajikistan. More specifically, the paper applies propensity score matching methods to the 2003 Tajikistan Living Standards Measurement Survey. The results do not provide evidence of a productive use of remittances since neither internal nor external remittances have a positive effect on investment expenditures. Migration and remittances are therefore interpreted in terms of short-term coping strategies that help dependent households to achieve a basic level of consumption*

**Keywords:** remittances; expenditure patterns; propensity score matching; sensitivity analysis, Tajikistan.

**JEL: O12, O15**

<p><b>Reference to this paper:</b> CLEMENT Matthieu, "Remittances and household expenditure patterns in Tajikistan: A propensity score matching analysis", <i>Cahiers du GREThA</i>, n° 2011-09 <a href="http://ideas.repec.org/p/grt/wpegrt/2011-09.html">http://ideas.repec.org/p/grt/wpegrt/2011-09.html</a>.</p>
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## 1. Introduction

McKenzie and Sasin (2007) present the main issues related to the analysis of migration and remittances. Among the relevant issues, they argue that researchers need to determine whether remittances are spent on consumption or investment and whether migrant families spend more on health and education. On a pessimistic view, receiving households tend to spend remittances on consumption rather than investment. By examining the relevant literature on this question, Chaumi *et al.* (2003) identify three stylized facts supporting this statement. The first is that “a significant proportion, and often the majority, of remitted funds are spent on consumption”. The second stipulates that “a significant, though generally smaller, part of remittances does go into uses that we can classify as saving or investment”. Third, “the household saving and investment that are done using remittances are not necessarily productive in terms of the overall economy” (Chaumi *et al.* 2003, p. 8-9). However, the majority of recent studies dealing with the microeconomic impact of remittances take a more optimistic view. “At the microeconomic level, remittances allow poor recipient households to increase their savings, spend more on consumer durables and human capital, and improve children’s health and educational outcomes. Remittances should thus be welcomed, encouraged, and facilitated” (Fajnzylber and Lopez 2008, p. 2).

Historically Tajikistan has been the poorest republic in the Soviet Union and still remains the poorest country in the ECA region. With a poverty line equal to US\$ 2.15 per day, the poverty headcount reaches 64 % in 2003, as opposed to 54 % in Kyrgyz (2001), 45 % in Moldova (2002), 37 % in Armenia (2001), 23 % in Georgia (2002) and 22 % in Azerbaijan (2001) (World Bank 2005a). A number of studies underline the major role of internal and external remittances in coping with the social consequences of the transition process (Olimova and Bosc 2003, World Bank 2005a, Kireyev 2006, Mughal 2006, Jones *et al.* 2007, ILO 2010). World Bank (2005a) explains that migration and remittances have significantly contributed to the high rate of poverty reduction observed between 1999 and 2003. As in most other former Soviet Union countries, domestic private transfers are widespread and operate as a means of mitigating vulnerability and poverty. As an illustration, Robinson and Guenther (2007) show that households with migrant members in rural and mountainous areas are less likely to be poor because associated remittances contribute to income diversification. However, Tajikistan differs from other FSU countries because of the extent of international remittances. The civil war that lasted from 1992 to 1997 generated a first wave of migration that can be described as ‘defensive’. Since the mid 1990s, labour migration has replaced defensive migration (Jones *et al.* 2007). The Tajik population is the youngest population of all FSU countries and the severe economic crisis that followed the civil conflict has prompted many young people to find job opportunities abroad (Jones *et al.* 2007). From a macroeconomic perspective, workers’ remittances and compensation of employees accounted for approximately 49.6% of the GDP in 2008 (World Bank World Development Indicators), meaning that Tajikistan ranks top in the world.<sup>1</sup>

The object of this article is to analyse how households spend remittances in Tajikistan. In other words, its purpose is to assess the impact of internal and external remittances on household expenditure patterns. To the best of the author’s knowledge, no study has so far

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<sup>1</sup> By comparison, these proportions are 31.4% in Moldova, 27.0% in Lesotho, 24.5% in Lebanon, 21.5% in Honduras, 11.4% in Guatemala and 11.2% in Philippines.

dealt with this issue in the specific case of Tajikistan, though many similar studies have been carried out on other countries. Unlike other studies, which tend to adopt an Engle curve framework, this paper uses an alternative methodology. More specifically, it applies a propensity score matching analysis designed to evaluate the impact of a 'treatment' (i.e. receiving remittances) by constructing a counterfactual group describing the situation of households' receiving remittances before they receive them. The methodology is applied to data drawn from the 2003 Tajikistan Living Standards Measurement Survey (TLSS).

The article is structured as follows. The first section provides a survey of the empirical literature dealing with the effect of remittances on the structure of household expenditures. The second section presents propensity score matching techniques. The third section describes the data. We discuss the results produced by the propensity score analysis in the fourth part and we test the sensitivity of these results to unobserved characteristics in the fifth part.

## **2. Remittances and household expenditure patterns: Literature review**

Adams (2007) argues that the impact of remittances on the structure of household expenditures is often viewed pessimistically. Yet recent empirical studies contradict this negative statement, particularly those dealing with the impact of remittances on education and health.

Based on an analysis of a household survey in the Philippines, Tabuga (2007) provides mixed evidence of the impact of remittances. It was found that a significant proportion of transfers from abroad is spent on conspicuous consumption such as consumer goods or leisure, but also that these remittances increase education and housing expenditures. Furthermore, households receiving remittances spend less on tobacco and alcohol. Castaldo and Reilly (2007) emphasize that Albanian households receiving international remittances tend to spend more on durable goods and utilities than other households and less on food consumption. In other words, they devote a higher proportion of their expenditures to investment type-goods. However, the receipt of internal remittances has no significant impact on expenditure patterns. In the same way, Taylor and Mora (2006) find that external remittances tend to be productively spent in Mexico. The share of a household budget devoted to investment is higher in households with migrants than in otherwise similar households without migrants, while the proportion of consumption expenditures is lower. This result is congruent with the findings outlined in a study by Zarate-Hoyos (2004). Acosta *et al.* (2008) provide a comparative analysis of seven Latin-American countries (Mexico, El Salvador, Guatemala, Peru, Nicaragua, Jamaica and Dominican Republic). The results provide strong evidence of the productive use of international remittances. Remittances decrease the budget share devoted to food consumption in all the countries studied with the exception of Jamaica, whereas they significantly increase the share of health expenditures in six countries (with the exception of Nicaragua). The results are more uncertain for educational expenditures. A significant and positive impact of remittances from abroad on households' education expenditures is found for El Salvador, Guatemala and Peru but not for Mexico, Nicaragua, Jamaica and the Dominican Republic. The absence of a significant influence of remittances on education expenditures is also highlighted by Cattaneo (2010) in the case of Albania. The low attainment rates characterizing the Albanian education system may be symptomatic of low returns for education, generating limited incentives for investments in education. The income supplement derived from remittances may therefore be channelled into more productive investments, such as land or other agricultural inputs. However, many studies

applied to significantly different contexts provide evidence for the view that remittances and migration have a positive effect on education expenditures. For instance, Kifle (2007) shows that in Eritrea, households receiving international remittances tend to spend more on education than households that do not receive international remittances. Cardona Sosa and Medina (2006) find a similar result for Colombian households. According to Adams (2005), households spend remittances productively in Guatemala (housing, education, health) and a significant proportion of remittances is assigned to education. At the margin, households receiving internal or external remittances spend respectively 45% and 58% more on education than households that do not receive internal or external remittances. When considering health expenditures, the literature appears to be more unanimous than for education in assessing the beneficial impact of remittances. Many studies applied to Mexico show that external remittances have a positive impact on households' health expenditures (Amuedo-Dorantes *et al.* 2007, Amuedo-Dorantes and Pozo 2009, Valero-Gil 2009). Cardona Sosa and Medina (2006) also find a positive effect of remittances from abroad on health expenditures in Colombian households. Finally, gender issues are an important issue to consider in assessing remittances. Guzman *et al.* (2008) show that households in Ghana that are headed by women show different expenditure patterns than male-headed families. Households headed by women tend to spend remittances more on education and health than households headed by men.

The empirical analysis presented in this paper is in line with the previous studies outlined above. It is applied to Tajikistan, the country with the highest level of international remittances and where domestic private transfers are also widespread. To the best of the author's knowledge, no study has so far carried out an analysis of the impact of remittances on household expenditure patterns in Tajikistan.

### **3. Propensity Score Matching**

Empirical studies analysing the impact of remittances on expenditure patterns adopt an Engel curves framework (Taylor and Mora 2006, Tabuga 2007, Castaldo and Reilly 2007, Valero-Gil 2009). The general idea is to estimate Engel curves equations in which the budget share of a certain commodity is a function of total expenditures and to include remittance variables.<sup>2</sup> This paper uses an alternative method. Following a study by Esquivel and Huerta-Pineda (2007) of the impact of remittances on poverty, a propensity score matching analysis is carried out. Its chief purpose is to quantify the average effect related to the receipt of remittances by matching remittance-receiving households with households with similar characteristics that do not receive remittances. The PSM approach is now widely used because it helps to reduce the bias inherent in the nonobservability of counterfactual outcomes.

#### **3.1. The evaluation problem**

*Denote by  $D_i$  a dummy variable equal to one if individual  $i$  is a treated individual (i.e. a household receiving remittances) and zero if not.  $Y_{i1}$  and  $Y_{i0}$  are the outcome variables describing household expenditure patterns for unit  $i$  conditional on the presence and absence*

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<sup>2</sup> Most of these studies adopt the Working-Leser specification (Working 1943, Leser 1963), which states that the budget share of a given item is a function of the logarithm of total expenditures. One of the advantages of the Working-Leser specification is that it satisfies the adding-up restriction, which states that when the budget share of one commodity increases, another share must be reduced to maintain the budget constraint of the household.

of treatment respectively. The treatment effect for individual  $i$  measures the difference between the relevant outcome indicator with the treatment and the relevant outcome indicator without the treatment. It is given by:

$$\Delta Y_i = E(Y_{i1}/D_i = 1) - E(Y_{i0}/D_i = 1) \quad (1)$$

While the post-treatment outcome is observed, its value in the absence of treatment (i.e. the counterfactual) is not. In household surveys, it is impossible to simultaneously observe someone in two different states. Consequently, the components  $E(Y_{i1}/D_i = 1)$  and  $E(Y_{i0}/D_i = 0)$  are observable outcomes, whereas  $E(Y_{i1}/D_i = 0)$  and  $E(Y_{i0}/D_i = 1)$  are non-observable outcomes. By filling in the missing data on the counterfactual, propensity score matching provides a potential solution to the evaluation problem. It was introduced by Rosembaum and Rubin (1983, 1985) and is defined as “an algorithm that matches treated and non participants on the basis of the conditional probability of participation (the propensity score), given the observable characteristics” (Essama-Nssah 2006, p. 5). In other words, it aims to construct a comparison group with non-treated units that are comparable to treated units on the basis of observable characteristics.

More specifically, propensity score matching methods are based on the *conditional independence assumption*, which states that the outcome in the untreated state is independent of treatment participation conditional on a particular set of observable characteristics, denoted  $X$  (Rosenbaum and Rubin 1983). This assumption is equivalent to the absence of selection bias based on unobservable heterogeneity (Heckman and Robb 1985) and can be expressed as:

$$(Y_{i0}, Y_{i1}) \perp D_i / X_i \quad (2)$$

It means that, given  $X_i$ , the outcomes of non-treated units can be used to approximate the counterfactual outcome of treated units in the absence of treatment.

$$E(Y_{i0} / D_i = 1, X_i) = E(Y_{i0} / D_i = 0, X_i) \quad (3)$$

Rosenbaum and Rubin (1983) show that it is possible to condition participation on the propensity score denoted  $P(X)$  rather than on observable characteristics  $X$ . The propensity score represents the probability of treatment conditional on a vector of observable characteristics and may be interpreted as the one-dimensional summary of the set of observable variables. It is expressed as:

$$P(X_i) = \Pr\{D_i = 1/X_i\} \quad (4)$$

The estimation of the counterfactual is:

$$E[Y_{i0} / D_i = 1, P(X_i)] = E[Y_{i0} / D_i = 0, P(X_i)] \quad (5)$$

Finally, the average treatment effect for individual  $i$  is measured by:



$$\Delta Y_i = E[Y_{i1} / D_i = 1, P(X_i)] - E[Y_{i0} / D_i = 0, P(X_i)] \quad (6)$$

The heart of the approach lies in the estimation of propensity scores. Common practise uses the predicted probabilities of being in the treatment group or in the non-treatment group derived from dichotomous logit or probit models including covariates X.

### 3.2. Matching estimators

Once propensity scores are estimated, a matching estimator needs to be selected that describes how comparison units relate to treated units. According to Dehejia and Wahba (2002, p. 153), “matching on the propensity score is essentially a weighting scheme, which determines what weights are placed on comparison units when computing the estimated treatment effect”. The average treatment effect may be expressed as follows:

$$\Delta \bar{Y} = \frac{1}{T} \sum_{i=1}^T \left[ Y_{i1} - \sum_{j=1}^C W(i, j) Y_{ij0} \right] \quad (7)$$

Where  $Y_{i1}$  is the post-treatment outcome of treated unit  $i$ ,  $Y_{ij0}$  is the outcome of the  $j^{\text{th}}$  non-treated unit matched to the  $i^{\text{th}}$  treated unit,  $T$  is the total number of treated units,  $C$  is the total number of non-treated units and  $W(i,j)$  is a positive valued weight function. Different types of parametric and non-parametric weights are given in the propensity score matching literature. Four matching methods are used in this paper.<sup>3</sup> First, for each treated case, the *nearest-neighbour matching* assigns a weight equal to one to the nearest comparison unit in terms of propensity score. The method is implemented with replacement, creating the possibility of matching a given comparison unit to more than one treated unit. Second, this matching method is generalized to the *nearest five neighbours matching*, which takes the average outcome measure of the closest five comparison units as the counterfactual for each treated case. Third, the *radius caliper matching* estimator imposes a tolerance level (the caliper) on the maximum distance between propensity scores. The mean of all comparison units within the caliper is then used. In this study, the caliper is fixed at 0.05. Fourth, the *Kernel estimator* matches each treated unit to a weighted sum of comparison units, with the greatest weight assigned to units with closer scores (Heckman *et al.* 1998), according to equation (8):

$$W(i, j) = \frac{K\left(\frac{p_i - p_j}{h}\right)}{\sum_{j \in \{D=0\}} K\left(\frac{p_i - p_j}{h}\right)} \quad (8)$$

With  $p_i$  the propensity score of treated unit  $i$ ,  $p_j$  the propensity score of comparison unit  $j$  and  $h$  a bandwidth parameter (fixed at 0.06). Kernel-based matching sometimes uses all comparison units (for example the Gaussian kernel), while others use comparison units with propensity scores  $p_j$  within a fixed bandwidth from  $p_i$  (for example Epanechnikov kernel). In this article, the Gaussian kernel estimator is used.

<sup>3</sup> The PSMATCH2 Stata module is used. See Leuven and Sianesi (2003).

## 4. Data description

The data are drawn from the 2003 Tajikistan Living Standards Measurement Survey (TLSS).<sup>4</sup> The survey is based on a stratified random probability sample, with the sample stratified according to oblast and urban/rural settlements and with the share of each stratum in the overall sample in proportion to its share in the total number of households as recorded in the 2000 census. The sample includes 4,160 households and is designed to be representative of national and regional levels and for both urban and rural areas. The data collected provide detailed information on a wide range of topics such as migration, income, expenditure, education, health, agriculture, etc.

Generally speaking, remittances can be defined as the money sent from one place or person to another. This paper uses a broad definition of remittances by including all private monetary transfers received by households from persons who do not live in the household (relatives living elsewhere, friends, neighbours). Among these transfers, the TLSS survey draws a distinction between domestic transfers and transfers from abroad.<sup>5</sup> In TLSS data, household expenditures include seven broad categories of expenditure items defined as food, non food, education, health, rent and utilities, agriculture and transfers to other households. Food and non food expenditures refer to consumption, while the five remaining categories are classified as investment expenditures.

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<sup>4</sup> By analysing the 2007 survey, a problem of data collection is found in the module “Transfers from another household”. When the donor lives in Tajikistan, the amount of money transferred by the donor is not registered. In other words, the monetary component of transfers is only considered for transfers from abroad but not for domestic transfers. This is the reason why the 2003 survey is used.

<sup>5</sup> A distinction needs to be drawn between two components of domestic transfers. The first component includes all services and transfers operated through proximity social networks (neighbours and community). These consist mainly of non monetary transfers and were already institutionalized under the Soviet system. The second component involves remittances associated with internal migration. The extent of domestic migration has increased significantly with the economic crisis but remains relatively moderate in Tajikistan. The 2003 Tajikistan Living Standards Measurement Survey suggests that approximately 11% of Tajiks are domestic migrants in the sense that they were born outside their current place of residence (Jones *et al.* 2007). Surprisingly, internal migration is mainly towards rural areas where access to a private plot may help to lower social risks. Dushanbe is the only city with net migration inflows.



**Table 1: Key figures on remittances.**

	All remittances		External remittances		Internal remittances	
	Proportion of beneficiaries (%)	Average amount *	Proportion of beneficiaries (%)	Average amount *	Proportion of beneficiaries (%)	Average amount *
All	19,09	47,36	10,12	59,53	9,40	32,08
Rural	17,84	47,61	10,11	60,55	7,92	29,92
Urban	21,25	47,01	10,13	57,76	11,97	34,56

Note: Annual amount (Somon) per capita.

Source: TLSS, 2003.

Table 1 provides some indications of the extent of remittances in Tajikistan. In the country as a whole, 19.1% of households receive remittances.<sup>6</sup> For households that receive remittances, these transfers account for 32.5% of their total income. These figures confirm the significant dependence of Tajik families on remittances. The proportion of households receiving domestic remittances is 9.4%. Even if the extent of international remittances is significant in Tajikistan, domestic private transfers are thus also widespread. As noted by Clément (2008), the magnitude of internal remittances is observed in most former Soviet Union countries and was already widespread during the Soviet period, confirming the role of private transfers and social networks as a means of mitigating vulnerability, particularly in a context of economic transition.

However, Tajikistan differs from other former Soviet Union countries because of its significant dependence on external remittances. Table 1 shows that more than 10% of households received remittances from abroad in 2003. Of course, the magnitude of international remittances is closely related to international migration. Though not designed to study migration, the TLSS indicates that nearly 20% of households had at least one member who has lived abroad for three months or more over the period 1998-2003. According to World Bank (2005b) estimations, the principal destination of Tajik migrants is Russia (83%), followed by Kazakhstan (14%) and Kyrgyzstan (2%). The development of international migration and consequent remittances are closely linked to the economic and social crisis of the 1990s. The breakdown of economic activity that followed the collapse of the Soviet system, the increase of poverty and the civil war have lead many Tajik families to send at least one member abroad in search of an alternative source of income.

Generally speaking, internal remittances are proportionally more designed to help urban households (12% as opposed to 8% in rural areas), and the average amount is also significantly higher in urban areas. One plausible interpretation is that social networks through which domestic transfers tend to be channelled are stronger and more institutionalized in cities. Curiously, the proportion of households benefiting from external remittances is not higher in urban areas than in rural areas. It might have been predicted that migration and international transfers are facilitated by the proximity of transport

<sup>6</sup> When non monetary transfers are included, the proportion reaches more than 35%.

infrastructures (airport, railway) and by financial institutions through which remittances from abroad are channelled. It appears that when making the decision to send one member abroad, rural households consider that the costs of accessing financial and transport infrastructures are more than compensated by the benefits derived from remittances.

**Table 2: Average budget shares (%) for non-remittances and remittance-receiving households.**

	Households with remittances	Households without remittances	Difference	Two-sample t-statistic
<b>Consumption</b>	<b>0,8243</b>	<b>0,8205</b>	<b>0,0038</b>	<b>0,71</b>
Food	0,6846	0,6805	0,0041	0,68
Non food	0,1397	0,1400	-0,0003	-0,07
<b>Investment</b>	<b>0,1757</b>	<b>0,1795</b>	<b>-0,0038</b>	<b>-0,71</b>
Rent and utilities	0,0565	0,0676	-0,0111	-3,81***
Education	0,0444	0,0435	0,0009	0,29
Health	0,0570	0,0458	0,0112	2,94***
Agriculture	0,0146	0,0197	-0,0051	-3,21***
Other	0,0032	0,0029	0,0003	0,49

\* Significant at 10%; \*\* Significant at 5%; \*\*\* Significant at 1%.  
Source: TLSS, 2003.

Table 2 presents the budget shares of seven expenditure categories respectively for households receiving remittances, households that do not receive remittances and for all households. The main components of the mean budget are food and non food consumption, which account for 82%. Investment expenditures are limited (18%) and are mainly devoted to rent and utilities, health and education. The share of health and education expenditures in household budgets is relatively low. Altogether these account for approximately 10% of total household expenditures.

Households that receive remittances tend to spend more on consumption than households that do not receive remittances. However, the difference is not statistically significant. Investment categories indicate that households that receive remittances spend relatively less on productive expenditures such as rent, utilities and agriculture. Health expenditures tend nevertheless to increase significantly with the receipt of private transfers. This result may suggest that migration and remittances act as a coping strategy to mitigate health risks. For education and other expenditures, there is no significant difference between the two categories of households. At length, these basic descriptive statistics provide mixed evidence and support neither the optimistic view that remittances are spent on investments rather than on consumption nor a more pessimistic view.

## 5. Results

### 5.1. Estimation of propensity scores

The estimation of propensity scores is a key step in applying PSM analysis. Propensity scores are estimated respectively for total remittances, external remittances and internal remittances. The dependent variables are dummy variables that take value 1 when a household receives remittances (total, external or internal) and 0 if not. The propensity scores are a one-dimensional summary of a set of socioeconomic characteristics. The covariates relate to household characteristics (household size, proportion of children and of the elderly, area of residence and oblast of residence), characteristics of household head (age, sex, matrimonial status, education, occupational status) and place of residence (urban/rural, Dushanbe).<sup>7</sup> Table 3 presents the binary logistic regressions used to estimate the propensity scores related to total remittances, external remittances and internal remittances. The explanatory power of the logit model for total remittances is satisfactory since the percentage of well-predicted cases is 82.5% and the McFadden and Nagelkerke pseudo R<sup>2</sup> are respectively above 10% and 15%. The percentage of well-predicted observations even exceeds 90% when distinctively external and internal remittances are considered separately. Nevertheless, the explanatory power is noticeably higher for external remittances with a McFadden pseudo R<sup>2</sup> reaching more than 21%, as opposed to 5.5% for internal remittances.

The influence of explanatory variables suggests a number of observations. As expected, the most significant determinant of remittances is the international migration variable, which is a dummy equal to 1 if at least one member of the household lived abroad for three months or more between 1998 and 2003. It has a strong impact on external remittances but also on internal remittances. The probability of receiving remittances depends positively on the proportion of elderly members within the household. This result indicates that sending remittances is a strategy for coping with significant dependence and for generating alternative sources of income. Nevertheless, the proportion of children has no significant influence on the receipt of remittances (both internal and external remittances). Male-headed households receive significantly less remittances than female-headed households, *ceteris paribus*. This result confirms the role of transfers as a means of mitigating dependence. But when considering distinctly external and internal remittances, a significant impact of the gender of the household head is not observed. Geographic location is also an important determinant of the receipt of remittances. As highlighted by previous descriptive statistics, urban households receive proportionally more remittances (and particularly more internal remittances) than rural households. Furthermore, households living in Sogdian and Khatlon oblasts tend to receive more domestic remittances than households living in Dushanbe, *ceteris paribus*.<sup>8</sup> When remittances from abroad are considered, it appears that households living in Gbao benefit more from external remittances than other households. The strong dependency of Gbao households on private transfers was already underlined by World Bank (2005a). These results show that living in the capital is not a decisive factor for triggering migration. A

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<sup>7</sup> Complementary explanatory variables dealing with access to infrastructures (community variables) and households assets (land, durables, etc.) were included. But matching estimators perform less with these alternative specifications when the two criteria discussed below are considered.

<sup>8</sup> The territory of the Republic of Tajikistan is divided into four administrative regions: the oblasts of Sogdian and Khatlon, the Gorno-Badakhshan-Autonomous Oblast (GBAO) and the Region of Republican Subordination (RRS). In this last administrative division, the TLSS isolate the city of Dushanbe, distinguishing five regions in total.

plausible interpretation could be that living in the capital offers a greater diversity of income-generating activities (more opportunities on the formal labour market, informal activities, access to credit, etc.) and reduces the need for receiving private transfers.

**Table 3: Logit regression for remittances receipt.**

	Total remittances		External remittances		Internal remittances	
	Coef.	t	Coef.	t	Coef.	t
<b>Constant</b>	-0,6968	-1,34	-4,2967	-5,05***	0,1711	0,30
<b>Household characteristics</b>						
Household size	-0,0214	-1,15	0,0299	1,32	-0,0704	-2,63***
Proportion of children	0,0355	0,14	0,0390	0,11	0,0696	0,23
Proportion of elderly	0,8736	3,22***	0,7327	1,79*	0,8020	2,51**
International migration	1,8605	16,97***	2,4998	17,52***	0,5862	3,87***
Urban area	0,3374	2,89***	0,2149	1,29	0,3561	2,52**
<i>Oblast</i>						
Gbao	0,7742	4,13***	1,1116	4,28***	0,2338	0,94
Sogdian	0,3210	2,03**	0,1234	0,52	0,3768	2,04**
Khatlon	0,3662	2,11**	-0,2683	-0,98	0,6879	3,44***
RRS	0,0579	0,31	-0,0253	-0,10	0,0208	0,09
<b>Household's head characteristics</b>						
Male	-0,4021	-2,42**	-0,3501	-1,49	-0,3268	-1,63
Age	-0,0373	-1,96**	0,0300	0,98	-0,0655	-3,00***
Age squared	0,0002	1,51	-0,0002	-0,78	0,0004	2,13**
Couple	-0,1410	-0,84	-0,2209	-0,93	-0,0633	-0,31
<i>Head's education</i>						
Secondary education	0,2136	1,63	0,4652	2,52**	-0,0932	-0,58
Post graduate education	0,0943	0,58	0,0249	0,10	0,0403	0,21
<i>Head's occupational status</i>						
Non agricultural worker	-0,5749	-4,81***	-0,4131	-2,49**	-0,6325	-4,24***
Agricultural worker	-0,4319	-3,20***	-0,2215	-1,24	-0,5852	-3,28***
N	3993		3993		3993	
Pseudo R <sup>2</sup> McFadden	0,117		0,212		0,055	
Pseudo R <sup>2</sup> Nagelkerke	0,169		0,262		0,072	
Percent correct	82,5%		91,7%		90,6%	
LR test (prob.)	430,5 (0,000)***		487,8 (0,000)***		135,6 (0,000)***	

\* Significant at 10%; \*\* Significant at 5%; \*\*\* Significant at 1%.

Source: TLSS, 2003.

A consideration of the characteristics of household heads indicates that the influence of age appears to be uncertain. The relation between the age of the head of the household and total remittances is linear and negative. For internal remittances, this relation takes the shape of a U-curve. In other words, young households and elderly households tend to receive relatively more domestic remittances. This corroborates the previous conclusion that migration and remittances operate as a coping strategy for reducing dependence. However, the effect of the age of the household head on external remittances is not significant. The educational level of the household head only has a weak influence on remittances, whereas the occupational status of the household head is an important factor. Households with a head in agricultural or non-agricultural sectors receive fewer remittances compared to households headed by an unoccupied head. In other words, remittances are a means of compensating for a low level or lack of earned income.

## 5.2. Average treatment effects

The average treatment effects estimated with Gaussian kernel matching for total remittances, external remittances and internal remittances are presented in Tables 4a, 4b and 4c respectively. Treatment effects for kernel matching are reported because this estimator is particularly useful for the purposes of bias reduction.<sup>9</sup> Table A1 in the appendix presents two criteria to measure the performance of the matching procedure: (i) t-tests for equality of means in the treated and control groups, both before and after matching, and (ii) the standardised bias before and after matching, and the achieved percentage reduction in bias. These balancing tests show that propensity score matching using the Gaussian kernel estimator removes most of the bias between the treatment and non-treatment groups. After matching, the two groups have non-significant different means for all the covariates included in the models. As can be seen, the proportion of bias reduction for each covariate is almost systematically greater than 50% for total remittances, external remittances and internal remittances.<sup>10</sup>

Total remittances tend to increase the share of the household budget devoted to consumption and decrease in the same proportion the proportion of investment expenditures. The difference for treated and control groups is above 0.3 percentage points but is not statistically significant. In other words, the results indicate indeterminacy in the way households spend remittances. For consumption, this indeterminacy is confirmed both for food consumption expenditures and non-food consumption expenditures. When considering investment categories, the matching procedure shows conflicting results. Expenditures on rent and utilities decrease significantly with remittances, which could support the idea that remittances are spent in a non-productive way. However, expenditures on health increase significantly with the receipt of remittances. For other investment categories such as education or agriculture, there is no significant effect of remittances.

**Table 4a: Average treatment effects (total remittances), Gaussian kernel matching estimator.**

	Budget shares		Difference (ATT)	Two-sample t-statistic
	Treated group	Control group		
<b>Consumption</b>	<b>0,8226</b>	<b>0,8196</b>	<b>0,0030</b>	<b>0,56</b>
Food	0,6841	0,6794	0,0047	0,81
Non-food	0,1385	0,1402	-0,0017	-0,44
<b>Investment</b>	<b>0,1774</b>	<b>0,1804</b>	<b>-0,0030</b>	<b>-0,56</b>
Rent and utilities	0,0546	0,0672	-0,0126	-5,17***
Education	0,0431	0,0416	0,0015	0,52
Health	0,0609	0,0519	0,0090	2,14**
Agriculture	0,0157	0,0165	-0,0008	-0,61
Other	0,0031	0,0032	-0,0001	-0,16

\* Significant at 10%; \*\* Significant at 5%; \*\*\* Significant at 1%.

Source: TLSS, 2003.

<sup>9</sup> The results of other matching estimators (nearest neighbour, five-nearest neighbours and radius caliper) are reported in the appendix (table A2). The results for these alternative estimators are relatively similar to the Gaussian kernel matching estimator.

<sup>10</sup> Matching only increases the bias for Sogdian (total remittances) and the proportion of elderly people (external remittances). The percentage of bias reduction is also less than 50% for age and age squared when considering internal remittances.

**Table 4b: Average treatment effects (external remittances), Gaussian kernel matching estimator.**

	Budget shares		Difference (ATT)	Two-sample t-statistic
	Treated group	Control group		
<b>Consumption</b>	<b>0,8288</b>	<b>0,8117</b>	<b>0,0171</b>	<b>2,41**</b>
Food	0,6790	0,6650	0,0140	1,81*
Non-food	0,1498	0,1467	0,0031	0,51
<b>Investment</b>	<b>0,1712</b>	<b>0,1883</b>	<b>-0,0171</b>	<b>-2,41**</b>
Rent and utilities	0,0587	0,0640	-0,0053	-1,50
Education	0,0414	0,0442	-0,0028	-0,70
Health	0,0503	0,0573	-0,0070	-1,38
Agriculture	0,0182	0,0193	-0,0011	-0,56
Other	0,0026	0,0035	-0,0009	-1,25

\* Significant at 10%; \*\* Significant at 5%; \*\*\* Significant at 1%.

Source: TLSS, 2003.

**Table 4c: Average treatment effects (internal remittances), Gaussian kernel matching estimator.**

	Budget shares		Difference (ATT)	Two-sample t-statistic
	Treated group	Control group		
<b>Consumption</b>	<b>0,8182</b>	<b>0,8262</b>	<b>-0,0080</b>	<b>-1,08</b>
Food	0,6881	0,6892	-0,0011	-0,14
Non-food	0,1301	0,1370	-0,0069	-1,33
<b>Investment</b>	<b>0,1818</b>	<b>0,1738</b>	<b>-0,0080</b>	<b>1,08</b>
Rent and utilities	0,0513	0,0669	-0,0156	-4,74***
Education	0,0441	0,0401	0,0040	1,05
Health	0,0693	0,0484	0,0209	3,33***
Agriculture	0,0135	0,0157	-0,0022	-1,43
Other	0,0036	0,0027	0,0009	1,00

\* Significant at 10%; \*\* Significant at 5%; \*\*\* Significant at 1%.

Source: TLSS, 2003.

Although the analysis of total remittances suggests relatively ambiguous results, significant disparities are highlighted when external and internal remittances are considered separately. External remittances are clearly devoted to consumption expenditures. The difference in budget shares for consumption between the treated and control groups is above 1.7 percentage points and is significant at 1% level. This result suggests a pessimistic view since external remittances are designed to increase non-productive expenditures (consumption) rather than productive expenditures (investment). Transfers from abroad therefore have to be interpreted as a short-term coping strategy in a context of significant vulnerability. This highlights the importance of international migration in helping dependent households to achieve a basic level of consumption.

Results for internal remittances highlight a significantly different logic. No significant difference in the proportion of consumption and investment expenditures is found between the



treatment and control groups. In other words, there is uncertainty about the productive orientation of domestic transfers. At a more disaggregated level, internal remittances tend to decrease the proportion of expenditures devoted to investments in agriculture and housing. Furthermore, they have no significant impact on education and other expenditures. This could be construed as evidence of a non-productive use of internal remittances, in the same way as external remittances. However, a strong and positive effect on health expenditures is observed. The receipt of domestic transfers induces a 2.1 percentage point increase of the budget share of health expenditures. The positive influence of internal remittances on health expenditures corroborates the findings of many studies applied to other contexts (Amuedo-Dorantes *et al.* 2007, Acosta *et al.* 2008, Valero-Gil 2009).

The use of domestic private transfers for health expenditures suggests that improving health outcomes is a short-term priority that comes before more long-term investments such as education or agriculture. Compared to other former Soviet Union countries, Tajikistan displays poor health outcomes. As an illustration, the infant mortality rate (under 5 years old) was 74‰ in 2005, while life expectancy was just 64. Like many transition countries, Tajikistan suffered a deterioration of its public health system during the 1990s. For instance, the number of hospital beds per 1,000 people declined from less than 11 in 1990 to 5.9 in 2005. The low level of public health spending has led households to raise their private expenditures to cope with health problems. The ratio of private to public health expenditures has risen from 3.3 in 2000 to above 3.6 in 2004 (World Bank World Development Indicators). Internal remittances thus appear to be a crucial means of compensating for the disengagement of the public authorities in terms of healthcare provision. Domestic transfers appear ultimately to be less unproductive than external transfers but are still devoted to short-term priorities such as health expenditures.

Contrary to a number of studies (Adams 2005, Cardona and Sosa 2006, Kifle 2007), the empirical analysis carried out as part of this study found that remittances (both internal and external) have no positive impact on education expenditures, but rather an undetermined effect. A parallel can be drawn with the study by Cattaneo (2010) for Albania referred to above. As in Albania, the poor quality of the Tajik education system may create disincentives to school attendance and school enrolment. As noted by World Bank (2008), the poor quality of education in Tajikistan is primarily explained by inadequate and damaged infrastructures (broken windows, lack of electricity and heating, lack of water connection, etc.), but also by a lack of qualified teachers. These issues are particularly salient in rural areas. The low level of public spending on education as a percentage of GDP explains these inefficiencies and the existence of disincentive effects is confirmed by the decrease of school enrolment and school attendance (World Bank 2005a, 2008). For instance, the basic secondary school gross enrolment rate was 102.1% in 1990 and fell to 73.5% in 2000 (World Bank 2008). However, the situation has improved since the beginning of the 2000s, to such an extent that the gross enrolment rate reached 81.8% in 2005.

## **6. Sensitivity analysis: Rosenbaum bounds**

Following Duvendack and Palmer-Jones (2011), we propose to test the sensitivity of matching estimates to unobserved heterogeneity. Indeed, matching procedures are based on the conditional independence assumption which states that selection in the treatment group is only based on observable characteristics. As underlined by Becker and Caliendo (2007, p. 1), 'checking the sensitivity of the estimated results with respect to deviations from this identifying assumption has become an increasingly important topic in the applied evaluation



literature'. We carry out a sensitivity analysis using the Rosenbaum bounds method (Rosenbaum, 2002). The purpose of this procedure is to determine if the average treatment effect may be modified by unobserved variables, thus creating a hidden bias.

Let us assume that the treatment probability is:

$$P_i = P(X_i, u_i) = P(D_i = 1 / X_i, u_i) = F(\beta X_i + \gamma u_i) \quad (9)$$

Where  $X_i$  are the observed covariates,  $u_i$  is an unobserved covariate,  $\gamma$  is the effect of  $u_i$  on the treatment selection and  $F$  is the logistic distribution. Let us now define the ratio of the odds that a treated case  $i$  has the unobserved characteristic to the odd that the control case  $j$  has it:

$$\frac{P_i / (1 - P_i)}{P_j / (1 - P_j)} = \frac{\exp(\beta X_i + \gamma u_i)}{\exp(\beta X_j + \gamma u_j)} \quad (10)$$

As implied by matching procedure,  $i$  and  $j$  have the same covariates, which implies:

$$\frac{P_i / (1 - P_i)}{P_j / (1 - P_j)} = \exp[\gamma(u_i - u_j)] \quad (11)$$

If the unobserved variable has no influence on the probability of treatment ( $\gamma = 0$ ) or if the unobserved variable is the same for the treated and the non treated cases ( $u_i = u_j$ ), the odds ratio is equal to one, indicating the absence of hidden bias linked to unobservable variables. Sensitivity analysis assesses how much the treatment effect is modified by changing the values of  $\gamma$  and  $u_i - u_j$ . Assuming that  $\Gamma = e^\gamma$ , Rosenbaum (2002) identifies the following bounds on the odds ratio:

$$\frac{1}{\Gamma} \leq \frac{P_i / (1 - P_i)}{P_j / (1 - P_j)} \leq \Gamma \quad (12)$$

$\Gamma = 1$  ( $\gamma = 0$ ) means that no hidden bias exists whereas increasing values of  $\Gamma$  imply an increasing influence of unobserved characteristics in the treatment selection. Rosenbaum bound method uses matching estimates to calculate confidence intervals of the treatment effect, for different values of  $\Gamma$ . As explained by Duvendack and Palmer-Jones (2011) if the lowest  $\Gamma$  producing a confidence interval that includes zero is small (i.e. less than two), it is likely that such an unobserved characteristic exists and therefore that the estimated treatment effect is sensitive to unobservables.

**Table 5: Rosenbaum bounds sensitivity analysis. Treatment = total remittances receipt.**

	$\Gamma$	Hodges-Lehmann point estimates		95% confidence intervals	
		Minimum	Maximum	Minimum	Maximum
Food	1	0,0139	0,0139	0,0025	0,0249
	1,2	0,0018	0,0255	<b>-0,0100</b>	<b>0,0363</b>
	1,4	<b>-0,0086</b>	<b>0,0351</b>	-0,0206	0,0460
	1,6	-0,0176	0,0433	-0,0299	0,0543
Non food	1	-0,0137	-0,0137	-0,0206	-0,0066
	1,2	-0,0210	-0,0061	<b>-0,0277</b>	<b>0,0012</b>
	1,4	<b>-0,0269</b>	<b>0,0003</b>	-0,0334	0,0082
	1,6	-0,0318	0,0062	-0,0384	0,0142
Rent and utilities	1	-0,0255	-0,0255	-0,0292	-0,0216
	2	-0,0386	-0,0077	-0,0414	-0,0017
	3	-0,0442	-0,0005	<b>-0,0466</b>	<b>0,0128</b>
	4	<b>-0,0475</b>	<b>0,0055</b>	-0,0499	0,0242
	5	0,0498	0,0109	-0,0521	0,0341
Education	1	-0,0122	-0,0122	-0,0153	-0,0090
	1,2	-0,0155	-0,0088	-0,0184	-0,0053
	1,4	-0,0181	-0,0058	-0,0210	-0,0018
	1,6	-0,0203	-0,0028	<b>-0,0232</b>	<b>0,0014</b>
	1,8	-0,0222	-0,0001	-0,0249	0,0042
	2	<b>-0,0238</b>	<b>0,0024</b>	-0,0263	0,0067
	3	-0,0290	0,0119	-0,0313	0,0177
Health	1	-0,0168	-0,0168	-0,0252	-0,0096
	1,2	-0,0256	-0,0092	-0,0329	-0,0023
	1,4	-0,0322	-0,0031	<b>-0,0376</b>	<b>0,0041</b>
	1,6	<b>-0,0363</b>	<b>0,0022</b>	-0,0410	0,0106
	1,8	-0,0394	0,0075	-0,0424	0,0171
Agriculture	1	-0,0097	-0,0097	-0,0107	-0,0083
	1,2	-0,0108	-0,0082	-0,0119	-0,0065
	1,4	-0,0118	-0,0067	-0,0127	-0,0046
	1,6	-0,0126	-0,0051	-0,0132	-0,0027
	1,8	-0,0130	-0,0037	-0,0136	-0,0008
	2	-0,0133	-0,0020	<b>-0,0140</b>	<b>0,0013</b>
	3	<b>-0,0149</b>	<b>0,0054</b>	-0,0157	0,0099
	4	-0,0159	0,0113	-0,0165	0,0155
Other	1	-0,0026	-0,0026	-0,0026	-0,0025
	2	-0,0028	-0,0019	-0,0031	-0,0018
	3	-0,0033	-0,0017	-0,0035	-0,0014
	4	-0,0035	-0,0012	-0,0040	-0,0003
	5	-0,0040	-0,0004	<b>-0,0046</b>	<b>0,0014</b>
	6	<b>-0,0044</b>	<b>0,0009</b>	-0,0050	0,0030

Notes: Rosenbaum bounds are calculated using the command rbounds in Stata. See Gangl (2004). The critical values corresponding to the lowest value of  $\Gamma$  that produces a confidence interval that encompasses zero are in bold.

Source: TLSS, 2003.

Table 5 reports the results of Rosenbaum procedure for our different outcome variables when the treatment variable is total remittances receipt and the matching estimator is

Gaussian kernel.<sup>11</sup> These results show that robustness to hidden bias varies significantly across the different outcomes.

For the share of food and non food consumption expenditures, the lowest value of  $\Gamma$  producing a 95% confidence interval encompassing zero is 1.2. This value means that the unobserved characteristic  $u_i$  would have to increase the odds ratio by less than 20% before it would bias the estimated impact. When considering Hodges-Lehmann point estimates the critical  $\Gamma$  reaches 1.4. These relatively low values imply that the treatment effects for consumption expenditures are thus sensitive to unobserved characteristics. The sensitivity analysis produces more mixed results when considering investment expenditures. For education, the critical values of  $\Gamma$  are 1.6 (95% confidence interval) and 2 (Hodges-Lehmann point estimates) and for health expenditures, 1.4 and 1.6. For the other categories of investment, critical values are higher. When considering Hodges-Lehmann point estimates, they reach 4 for rent and utilities, 3 for agriculture and 6 for other expenditures. We conclude that the average treatment effect estimated for these categories are robust to the presence of unobserved characteristics.

With the exception of these last three categories, the impact of remittances on households' expenditures seems to be rather sensitive to hidden bias if we consider, as Duvendack and Palmer-Jones (2011), that critical values less than 2 indicate a high sensitivity to unobservables. But this pessimistic conclusion has to be qualified at two levels. First, the degrees of sensitivity highlighted in this analysis are close to those identified in other studies in social sciences. Watson (2005) reports several studies that identify critical values of  $\Gamma$  which are close to ours (between 1.1 and 2.2) and argues that such values cannot be compared to those obtained in medicine sciences (which often exceed 5). Aakvik (2001) explains that a critical  $\Gamma$  of 2 is a very large number. It states that the estimated impact would be biased only if an unobserved variable caused the odds ratio to differ between receiving and non-receiving households by 100%. Second, such a sensitivity analysis describes a "worst-case scenario" insofar as it only shows how our treatment effect estimations could be altered by hidden biases, but it does not indicate if these biases exist (Aakvik, 2001; Becker and Caliendo, 2007).

## **7. Conclusion**

The purpose of this article was to analyze the impact of internal and external remittances on household expenditure patterns in Tajikistan. Contrary to previous studies dealing with other contexts, an Engle curve framework was not used. Instead propensity score matching techniques were applied to provide an unbiased estimation of a treatment-effect. More specifically, this methodology is designed to reduce the evaluation bias linked to the nonobservability of the counterfactual, i.e. a situation in which households benefit from remittances before they receive them. Propensity score matching methods enable measurements of the average treatment effect by matching non-treated cases to treated cases that are similar on the basis of observable socioeconomic characteristics. The matching analysis implemented in this study is satisfactory when considering balancing tests. However, Rosenbaum bounds indicate that the estimated effects of remittances on household expenditure patterns are rather sensitive to unobserved characteristics.

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<sup>11</sup> The sensitivity analysis was also implemented for the two other treatment variables (internal and external remittances receipt). The subsequent results are close to those obtained for total remittances.

The empirical analysis sheds light on four aspects. First, the results do not corroborate the idea of a productive use of remittances since neither internal nor external remittances have a positive effect on investment expenditures. Second, external remittances are shown to be significantly unproductive since they contribute to a significant increase of household consumption levels. It is estimated that receiving transfers from abroad increases the share devoted to consumption expenditures by 1.7 percentage points and decreases the share of investment expenditures by the same proportion. Third, the results are more ambiguous in the case of internal remittances. Among the investment categories, domestic transfers tend to reduce housing and agriculture expenditures and significantly increase health expenditures. Fourth, remittances have no significant effect on households' education expenditures. The interpretation given in this paper was that the poor quality of the education system in Tajikistan creates disincentives to school attendance and school enrolment.

As argued by Adams (2007), until recently, researchers provided a pessimistic analysis of the way remittances were spent by households. This idea is expressed by Chami et al. (2003) who assert that remittances are rather spent on consumption rather than investment expenditures and are not necessarily productive to the economy as a whole. Yet, the recent empirical studies discussed in this article and applied to diverse contexts show that remittances may be productive by increasing investment expenditures (Zarate-Hoyos 2004, Adams 2005, Taylor and Mora 2006, Acosta et al. 2008). As our main conclusions suggest, our study is rather in line with the pessimistic view and gives evidence of an unproductive use of remittances (particularly external remittances). For instance, the absence of impact of remittances on education expenditures contradicts the conclusions of several authors (Adams 2005, Cardona Sosa and Medina 2006, Kifle, 2007). The positive effect of remittances on health expenditures is the only result that is clearly in line with previous contributions (Adams 2005, Cardona Sosa and Medina 2006, Acosta et al. 2008).

The favourable evolutions of public spending on education and health in Tajikistan since the beginning of the 2000s may lead us to be more optimistic about the effect of remittances on households' expenditure patterns. Public education spending per capita increased from 5.5US\$ in 2003 to 17.7US\$ in 2007, while public spending on health increased from 2.1US\$ to 6.7US\$ (World Bank 2008). These trends could strengthen the productive use of remittances. On the one hand, the increase of public health expenditures could reduce the share of household expenditures aimed at improving health outcomes. The idea is that public health expenditures could replace private health expenditures and shift the use of household remittances towards long-term investments such as education or agriculture. On the other hand, the increase of public education expenditures could improve the quality of the education system and thus decrease disincentives. Households should therefore be encouraged to invest in their children's education. The recent increase of enrolment rates noted above may provide support to this favourable evolution.

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## Appendix

Table A1: Balancing tests for propensity score matching, Gaussian kernel estimator.

	Sample	% bias	% reduction in bias	t-test (prob.)
<b>Total remittances</b>				
Household size	Unmatched	-3,0		-0,74
	Matched	0,8	74,3	0,14
Proportion of children	Unmatched	-14,5		-3,52***
	Matched	0,1	99,3	0,02
Proportion of elderly	Unmatched	16,5		4,37***
	Matched	0,3	97,9	-0,06
International migration	Unmatched	69,7		19,57***
	Matched	2,3	96,7	0,36
Urban area	Unmatched	10,5		2,53**
	Matched	0,2	98,2	0,04
Gbao	Unmatched	10,0		2,49**
	Matched	0,4	95,8	0,07
Sogdian	Unmatched	2,3		0,54
	Matched	2,3	-3,7	0,44
Khatlon	Unmatched	-11,7		-2,74***
	Matched	-1,6	86,3	-0,31
RRS	Unmatched	3,7		0,89
	Matched	-1,4	62,1	-0,25
Male	Unmatched	-25,5		-6,45***
	Matched	-2,0	92,3	-0,34
Age	Unmatched	10,1		2,47**
	Matched	0,6	93,7	0,11
Age squared	Unmatched	11,6		2,83***
	Matched	0,6	94,5	0,11
Couple	Unmatched	-22,9		-5,72***
	Matched	-2,1	91,0	-0,37
<i>Head's education</i>				
Secondary education	Unmatched	3,4		0,81
	Matched	1,2	65,5	0,22
Post graduate education	Unmatched	-10,1		-2,37**
	Matched	-1,5	84,8	-0,30
<i>Head's occupational status</i>				
Non agricultural worker	Unmatched	-26,0		-6,10***
	Matched	-3,0	88,5	-0,58
Agricultural worker	Unmatched	-14,5		-3,38***
	Matched	-0,7	95,1	-0,14
<b>External remittances</b>				
Household size	Unmatched	29,6		5,44***
	Matched	0,4	98,6	0,05
Proportion of children	Unmatched	-18,0		-3,05***
	Matched	-3,5	80,6	-0,47
Proportion of elderly	Unmatched	4,7		0,82
	Matched	6,0	-29,5	0,81
International migration	Unmatched	118,0		25,13***
	Matched	0,4	99,6	0,05
Urban area	Unmatched	-2,6		-0,46
	Matched	0,7	72,3	0,10
Gbao	Unmatched	29,1		5,79***
	Matched	9,0	69,0	1,07
Sogdian	Unmatched	-2,3		-0,39
	Matched	-0,2	89,3	-0,03
Khatlon	Unmatched	-34,1		-5,43***
	Matched	-6,5	81,1	-0,93
RRS	Unmatched	19,4		3,65***
	Matched	-1,6	91,6	-0,20
Male	Unmatched	-17,4		-3,19***
	Matched	-8,6	50,2	-1,09

Age	Unmatched	23,7		4,08***
	Matched	6,6	72,1	0,87
Age squared	Unmatched	21,3		3,69***
	Matched	6,5	69,7	0,85
Couple	Unmatched	-15,1		-2,74***
	Matched	-6,7	55,7	-0,84
<i>Head's education</i>				
Secondary education	Unmatched	12,6		2,19**
	Matched	1,8	86,0	0,23
Post graduate education	Unmatched	-16,4		-2,71***
	Matched	-3,5	78,8	-0,48
<i>Head's occupational status</i>				
Non agricultural worker	Unmatched	-30,5		-5,14***
	Matched	-3,2	89,4	-0,44
Agricultural worker	Unmatched	-7,2		-1,24
	Matched	-1,9	74,2	-0,24
<b>Internal remittances</b>				
Household size	Unmatched	-32,1		-6,00***
	Matched	-5,6	82,6	-0,78
Proportion of children	Unmatched	-11,4		-2,23**
	Matched	-1,3	88,2	-0,18
Proportion of elderly	Unmatched	22,5		5,03***
	Matched	2,7	88,0	0,32
International migration	Unmatched	12,9		2,48**
	Matched	1,5	88,1	0,20
Urban area	Unmatched	22,6		4,24***
	Matched	3,6	84,0	0,49
Gbao	Unmatched	-10,7		-1,88*
	Matched	-1,9	82,7	-0,27
Sogdian	Unmatched	4,8		0,90
	Matched	0,2	95,0	0,03
Khatlon	Unmatched	7,8		1,46
	Matched	1,0	86,8	0,14
RRS	Unmatched	-14,5		-2,52**
	Matched	-2,3	84,0	-0,34
Male	Unmatched	-28,9		-5,72***
	Matched	-5,2	82,1	-0,66
Age	Unmatched	-2,6		-0,51
	Matched	-1,6	38,4	-0,21
Age squared	Unmatched	1,5		0,30
	Matched	-0,9	44,5	-0,11
Couple	Unmatched	-27,0		-5,28***
	Matched	-5,4	80,1	-0,70
<i>Head's education</i>				
Secondary education	Unmatched	-6,5		-1,20
	Matched	-1,7	74,2	-0,23
Post graduate education	Unmatched	-2,6		-0,48
	Matched	0,4	86,6	0,05
<i>Head's occupational status</i>				
Non agricultural worker	Unmatched	-18,1		-3,27***
	Matched	-2,7	84,8	-0,38
Agricultural worker	Unmatched	-18,9		-3,31***
	Matched	-3,4	82,1	-0,49

\* Significant at 10%; \*\* Significant at 5%; \*\*\* Significant at 1%.

Source: TLSS, 2003.

**Table A2: Average treatment effects (total, external and internal remittances), Nearest-neighbour, five nearest-neighbours and radius caliper estimators.**

	Nearest neighbour		Five nearest-neighbours		Radius caliper	
	ATT	t	ATT	t	ATT	t
<b>Total remittances</b>						
<b>Consumption</b>	<b>0,0081</b>	<b>1,07</b>	<b>0,0042</b>	<b>0,71</b>	<b>0,0030</b>	<b>0,58</b>
Food	0,0119	1,43	0,0047	0,76	0,0048	0,84
Non-food	-0,0037	-0,64	-0,0005	-0,13	-0,0017	-0,45
<b>Investment</b>	<b>-0,0081</b>	<b>-1,07</b>	<b>-0,0042</b>	<b>-0,71</b>	<b>-0,0030</b>	<b>-0,58</b>
Rent and utilities	-0,0142	-3,77***	-0,135	-4,88***	-0,0125	-5,17***
Education	0,0046	1,24	0,0014	0,45	0,0014	0,49
Health	0,0029	0,46	0,0088	1,93*	0,0089	2,14**
Agriculture	-0,0023	-1,31	-0,0009	-0,72	-0,0008	-0,65
Other	0,0009	1,27	0,0001	0,0233	-0,0001	-0,18
<b>External remittances</b>						
<b>Consumption</b>	<b>0,0142</b>	<b>1,39</b>	<b>0,0224</b>	<b>2,91***</b>	<b>0,0170</b>	<b>2,39**</b>
Food	0,0050	0,46	0,0151	1,79*	0,0138	1,78*
Non-food	0,0091	1,18	0,0072	1,12	0,0031	0,54
<b>Investment</b>	<b>-0,0142</b>	<b>-1,39</b>	<b>-0,0224</b>	<b>-2,91***</b>	<b>-0,0170</b>	<b>-2,39**</b>
Rent and utilities	-0,0029	-0,60	-0,0068	-1,73*	-0,0051	-1,49
Education	0,0053	0,98	-0,0022	-0,49	-0,0027	-0,68
Health	-0,0172	-2,06**	-0,0139	-2,38**	-0,0070	-1,39
Agriculture	0,0022	0,87	0,0012	0,60	-0,0010	-0,54
Other	-0,0016	-1,27	-0,0006	-0,74	-0,0009	-1,21
<b>Internal remittances</b>						
<b>Consumption</b>	<b>-0,0124</b>	<b>-1,30</b>	<b>-0,0126</b>	<b>-1,56</b>	<b>-0,0077</b>	<b>-1,05</b>
Food	-0,0116	-1,10	-0,0053	-0,61	-0,0006	-0,07
Non-food	-0,0008	-0,11	-0,0072	-1,28	-0,0071	-1,37
<b>Investment</b>	<b>0,0124</b>	<b>1,30</b>	<b>0,0126</b>	<b>1,56</b>	<b>0,0077</b>	<b>1,05</b>
Rent and utilities	-0,0187	-3,62***	-0,0151	-4,21***	-0,0156	-4,74***
Education	0,0010	0,21	0,0060	1,47	0,0038	0,99
Health	0,0274	3,47***	0,0218	3,27***	0,0209	3,34***
Agriculture	0,0007	0,34	-0,0014	-0,82	-0,0022	-1,48
Other	0,0019	1,96**	0,0013	1,52	0,0008	0,99

\* Significant at 10%; \*\* Significant at 5%; \*\*\* Significant at 1%.

Source: TLSS, 2003.

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