The Effects of Remittances on Poverty at the Household Level in Bolivia: A Propensity Score Matching Approach

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Resumen

En los últimos años, Bolivia ha experimentado un fenómeno creciente de migración. Muchos miembros de los hogares han migrado para buscar mejores oportunidades e incrementar su ingreso de su hogar. En esta investigación, nuestro objetivo es explorar los efectos de las remesas sobre los niveles de pobreza de los hogares bolivianos. Para ello empleamos micro datos de la Encuesta de Hogares de 2008 del Instituto Nacional de Estadística (INE). Calculamos estimadores de *propensity score matching* para corregir el posible sesgo debido a factores heterogéneos en la muestra. Luego, estimamos el Efecto Promedio de Tratamiento sobre los Tratados para comparar el nivel de pobreza entre los hogares que reciben remesas y los que no las reciben. Los resultados muestran que las remesas tienen un efecto positivo sobre la reducción de la pobreza en hogares urbanos, mientras que no tienen ningún efecto sobre los hogares rurales.

Palabras clave: Remesas, pobreza, *propensity score matching*, Bolivia.

Abstract

In the last few years, Bolivia has experienced a growing migration phenomenon. Many household members migrate from their homes in order to look for better opportunities and to improve their household income. In this paper, we aim to explore the effects of remittances on Bolivian household poverty levels. We use micro data from the 2008 Household Survey, conducted by the National Institute of Statistics (INE). We calculate propensity score matching estimators in order to address the potential bias due to heterogeneous factors in the sample. Then, we estimate the average treatment effect on the treated to compare the poverty level between households which receive and do not receive remittances. Results show that remittances have a positive effect on reducing urban households' poverty level, whereas there is no effect on rural households' poverty.

Keywords: Remittances, poverty, propensity score matching, Bolivia.

1. Introduction

From 2002 and 2007, remittances have grown 117% in the Latin America and Caribbean region (World Bank, 2008). In the same way, during the last few years remittances have grown rapidly and became one of the main sources of international inflows in Bolivia (World Bank, 2012). Meanwhile, households'

poverty has been one of the main concerns for Bolivian policymakers. Although there have been some improvements in poverty during the last few years, it is still a main concern for Bolivians. Therefore, it is important to analyze the possible links between remittances and poverty in Bolivia and determine the effects of remittances on poverty.

Through this paper we aim to analyze the effects of remittances on households' poverty levels. Although some authors study the effect of remittances on poverty for other countries (i.e. Adams, 1991; López-Cordova, 2006; Taylor et al., 2005), to our concern there is little literature about this topic for Bolivia. Additionally, in this paper we propose a study based on the propensity score matching approach in order to account for sample heterogeneity and possible bias due to confoundedness factors.

First, based on a propensity score we match remittance-receiving households with non-remittance-receiving households. Second, after the balancing property is satisfied and non-remittance-receiving households are matched to remittance-receiving households, we estimate the difference in poverty means between similar remittance-receiving households and non-remittance-receiving households; if a difference in poverty means exist, it can be attributed to remittances.

The paper is organized as follows. In section 2 we review some theoretical and empirical issues regarding the effects of remittances on poverty. After, in section 3 we present a brief description of the behavior of remittances in Bolivia. In section 4 we describe the data used in this paper, followed by the methodology in section 5. Results are presented in section 6 and finally we conclude.

2. Theoretical and Empirical Issues

Remittances represent a non-labor income. In turn, these transfers may affect households' living standards. In the literature, there has been a wide debate about whether remittances reduce or increase households' poverty levels. Some authors argue that due to high international migration costs, remittances have no effect on poor households. However, other studies for developing economies show that there seems to be a positive effect of remittances on poverty.

In the neoclassical migration theory, migration is a way to optimally allocate production factors to benefit sending and receiving countries. However, under this theory the effects of migration are reduced because of factor price equalization. Workers in countries with a surplus of labor and low-wage jobs will migrate to countries with labor shortages and high wages. Thus, countries with migrants will increase their labor scarcity and host countries will have lower labor shortages. This will result in the convergence of wages and the incentives to migrate would end. In such a case the effect of remittances would be null. Nevertheless, in the neoclassical migration theory workers do not transfer part of their income to their households; therefore remittances are not considered (de Haas, 2010).

In order to minimize the restrictions of the neoclassical migration theory, the New Economics of Labor Migration (NELM) consider remittances as an important factor for migration (Stark and Bloom, 1985). According to Taylor (1996; 1999), households perceive migration as a strategy to diversify the income portfolio in order to improve their total income, whereby remittances represents a positive impact on migrant-sending households. Furthermore, Stark (1980) considers that remittances can be the household's strategy to overcome labor market constraints. This allows households to improve their welfare through investment in productive activities.

There are mixed hypotheses of whether remittances alleviate households' poverty. Some researchers argue that remittances act as an additional non-labor income for recipient household members. In that case,

remittances would increase the household's income and reduce its probability of being in poverty (i.e. Esquivel and Huerta-Pineda, 2007; Chukwuone et al., 2012).

On the other hand, other researchers argue that remittances replace the labor income that migrants would have contributed to the household income if they had not emigrated (i.e. Cox-Edwards and Rodriguez-Oreggia, 2008). Therefore, remittances would have a neutral effect on households' income, whereby the effect on household's poverty would be null or less clear.

Some authors find that receiving remittances depends on households' socioeconomic conditions. Adams and Page (2005) find for a set of developing countries that migrants do not come from the poorer strata of their countries because of high international migration costs. Also, Kapur (2004) argues that migrants do not come from the poorest households. Therefore, remittances alleviate transitory poverty and improve household living standards[1].

Many researchers have looked for the direct effect of remittances on alleviating poverty by analyzing different sets of countries. Results show that, in general, remittances help in reducing countries' poverty rates. Adams and Page (2005), with a dataset of 71 developing countries, find a relationship between remittances and poverty. Their research suggests that an increase of 10% in remittances (as a proportion of the country's GDP) leads to a reduction of 2.1% in the population living under poverty. For a sample of 33 African countries, Anyanwu and Erhijakpor (2010) express that a 10% increase in remittances reduces poverty by 2.9%. Acosta et al. (2008), using a dataset of 11 Latin American countries, finds that a 1 percentage point increase in remittances as a percentage of GDP reduces moderate and extreme poverty by 0.37% and 0.29%, respectively. The IMF (2005), with panel data of 101 countries, finds that on average, the share of people living in poverty decreases less than 0.5 percentage point due to a 2.5 percentage-point increase in the remittance/GDP ratio.

Other authors, using micro data, address the impact of remittances on poverty at a country level. Adams (1991) finds for the Egyptian case that the number of poor rural households decreases in 9.8% when households' income includes remittances. López-Cordova (2006), for the Mexican case, finds that a one percentage point increase in rural households that receive remittances significantly reduces the rural population living below the minimum living standards. Also, Adams (2004) finds that the squared poverty gap (measure of poverty severity) in Guatemala is reduced by 18.8% when international remittances are included in household income. Wodon et al. (2003) conclude that in Guerrero and Oaxaca, Mexico, the remittance-receiving population living in poverty is lower by 2 percentage points due to this non-labor income. Taylor et al. (2005) find that an increase in 10 percent of international migrant remittances reduces rural Mexican poverty by 0.77% in the headcount measure[2].

Also, there are studies that measure the impact of external macroeconomic shocks to remittance-receiving households. Yang (2008) study the effect of currency depreciations for the case of Philippine. He finds that when a migrant's currency appreciates against the Philippine peso, remittance-receiving households accumulate human capital and entrepreneurship. These results suggest a positive effect of remittances when the migrant's currency appreciates against the remittance-receiving households' currency.

Remittance-receiving households are not randomly assigned and confounding factors may bias their effect on poverty. To avoid this problem some authors use Propensity Score Matching Estimators (i.e. Cox-Edwards and Rodriguez-Oreggia, 2008; Esquivel and Huerta-Pineda, 2007). With this type of method, sample heterogeneity is addressed and robust estimators are obtained in order to determine the effect of

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1 Transitory poverty is a temporary state caused by a drop in living standards.

2 Headcount measure is the incidence of poverty and consists of the share of the population living below the poverty line.

remittances on poverty. This method addresses sample heterogeneity with robust estimators, which makes it possible to determine the effect of remittances on poverty.

Using Propensity Score Matching estimators and a national household survey for Mexico, Esquivel and Huerta-Pineda (2007) find that receiving remittances reduces household probability of being in food-based poverty and capability-based poverty by 6 and 8 %, respectively. Chukwuone et al. (2012) find for the Nigerian case that the reception of international remittances reduces households' probability of being in poverty by nearly 100%. Jimenez and Brown (2008), using self-selection models and propensity score matching estimators, find for Tonga that the improvement of income by remittances contributes to alleviating households' poverty.

Other authors study the effect of remittances on variables that are correlated with poverty. Cox-Edwards and Rodriguez-Oreggia (2008) use a propensity score matching approach to determine the effect of remittances on households' labor participation in Mexico. They find that on average remittances have no effects on households' labor participation.

To our concern, there is little literature aiming to determine the effects of remittances in Bolivian households' poverty levels. Lazarte-Alcala et al (2012), instrumenting rural households' income and controlling by socio-demographic characteristics, find that remittances have a positive effect on rural households' diversification income and reduce the probability that the rural household engages in farm activities.

The research uses micro data at the household level which allow us to determine the effects of remittances on Bolivian households' income poverty levels. We use matching estimators to address sample heterogeneity and compare remittance-receiving households with non-remittance-receiving households. The matching approach consists of constructing counterfactuals. Remittance-receiving households' poverty levels are compared with statistically equal non-remittance-receiving households' poverty levels except for remittances. Therefore, if a difference in poverty means exists, it can be attributed to remittances.

3. Remittance Trend

According to the World Bank, from 1981 to 2008, Bolivian remittances have increasingly become an important transfer from abroad as a percentage of GDP. In particular, in 1996 remittances represented 0.18% as a share of GDP, while in 2004 and 2006 they represented 2.40% and 6.96%, respectively. As can be seen in graph 1, remittances have grown exponentially since 1996. See Appendix 1.

Also, in 2006 remittances represented an even larger income for the country than tourism revenues and foreign direct investment, whereby remittances became an important transfer for the country. In 2008, remittances were about twice foreign direct investment and quadrupled the tourism revenues.

4. Data

The dataset used in this paper was obtained from the 2008 Encuesta de Hogares (EH or Household Survey) conducted by the National Institute of Statistics (INE). This survey sampled 15,030 individuals living in rural and urban areas on the topics of demographics, housing, health, education, employment, income, and expenditures. Furthermore, the survey is cross-sectional data and helpful for the purposes of this paper; it contains information about whether a household member receives remittances and other household poverty characteristics.

This survey records the official measure of poverty in terms of a poverty line defined as the value of a set of goods and services needed to cover basic needs (INE, 2008). Thus, if the per capita household income is below the poverty line the household is poor. This information is expressed as a dummy variable, where 1 means the household is poor and 0 otherwise. Also, it is important to mention that the per capita income is divided into labor income and non-labor income. The non-labor income consists of social security income such as retirement income, property income as rental housing, transfers such as remittances[3] and government transfers as Renta Dignidad[4].

The 15,030 individuals are grouped into 3,940 households. 59.14% are in urban areas and 40.86% are in rural areas. Remittance-receiving households represent 9.64% of the sample; 10.82% are in urban areas while 7.95% are in rural areas. Of all households, 51.07% are poor, 37.51% are urban and 70.68% are rural.

Table 1. Sample Distribution of Households by Region, Remittance-Receiving Status and Poverty Condition

	Urban (%)	Rural (%)	All households (%)
Receive remittances	10.82	7.95	9.64
Do not receive remittances	89.18	92.05	90.36
Poor	37.51	70.68	51.07
Not poor	62.49	29.32	48.93

Furthermore, the survey makes it possible to identify 2,951 male and 989 female household heads. It can be seen that the household head tends to be male in both urban and rural areas. However, this role for women is lower in rural areas.

Table 2. Sample Distribution of Household Head by Region and Gender

	Urban	Rural	Total
Men	1,677	1,274	2,951
Women	653	336	989

Average basic statistics are shown in Table 3. As can be seen, households in Bolivia tend to have four members at both urban and rural levels. Also, these members are divided equally into both genders: men and women. In addition, the household head is married, and in remittance-receiving households is approximately 49 years and 11 months old, while the non- remittance-receiving household head is 46 years and 7 months old (in households receiving remittances the head of the family is usually older).

Moreover, rural households concentrate household heads with low levels of education, tend to be of indigenous origin and to be poor[5]. Nevertheless, rural non-remittance-receiving households tend to be poorer than remittance-receiving households. In the same way, non-remittance-receiving households are poorer than remittance-receiving households at the urban level. At the national level, most household

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3 The survey defines remittances as the monetary or in-kind transfers received from households or other people living outside the country. The World Bank defines remittances as the sum of personal transfers and compensation of employees (which includes wages in kind). This suggests that the World Bank remittance data shown in graph 1 and 2 are consistent –with a similar definition– to the data captured by the Bolivian survey.

4 This transfer is received by adults over 60 years old and consists of approximately 340 USD per year. However, if the receiver has another transfer such as a retirement state pension the amount is reduced to approximately 250 USD per year.

5 The survey collects data on whether individuals consider whether they belong to an indigenous group.

heads tend to have a low level of education[6]. Additionally, urban households tend to have a non-indigenous origin and are less poor than rural households.

Table 3. Composition of Household Head Sample by Region and Remittance-Receiving Status

	Remittances	No-Remittances	Remittances	No-Remittances	Remittances	No-Remittances
HH Head characteristics						
Age	49.92368	46.55955	47.26190	44.63859	55.16406	49.25304
	(16.29484)	(15.69906)	(16.72733)	(15.04497)	(14.05881)	(16.19851)
Male	0.5921053	0.7657303	0.5674603	0.7382098	0.6406250	0.8043185
	(0.4920913)	(0.423601)	(0.4964141)	(0.4397148)	(0.4817026)	(0.3968583)
Married	0.5263158	0.6994382	0.5277778	0.5500481	0.9765625	0.9089069
	(0.4999653)	(0.4585668)	(0.5002213)	(0.4976086)	(0.1518829)	(0.2878386)
Low level of education	0.6789474	0.6994382	0.5277778	0.5062560	0.9609375	0.8738192
	(0.4674965)	(0.458)	(0.500)	(0.5000812)	(0.194505)	(0.3321651)
Medium level of education	0.0868421	0.1247191	0.1269841	0.1669875	0.0078125	0.0654521
	(0.2819748)	(0.3304465)	(0.3336178)	(0.3730545)	(0.0883883)	(0.2474054)
High level of education	0.2315789	0.1752809	0.3412698	0.2824832	0.015625	0.0249663
	(0.4223975)	(0.3802606)	(0.4750793)	(0.4503155)	(0.1245069)	(0.1560749)
HH Characteristics						
Poor	0.3710526	0.5255618	0.2380952	0.3917228	0.6328125	0.7132254
	(0.4837234)	(0.4994163)	(0.4267653)	(0.4882528)	(0.4839323)	(0.4524081)
Household members	3.786842	3.817697	3.761905	3.786333	3.835938	3.861673
	(2.228228)	(2.062979)	(2.070197)	(1.901667)	(2.518521)	(2.269881)
Men members	1.744737	1.849438	1.706349	1.815688	1.820313	1.896761
	(1.359264)	(1.282219)	(1.24694)	(1.2071069)	(1.559495)	(1.379703)
Women members	2.018421	1.954213	2.019841	1.947064	2.015625	1.964238
	(1.415026)	(1.309135)	(1.435049)	(1.239725)	(1.380314)	(1.401047)
Child dependency ratio	0.5588399	0.5698139	0.5114218	0.4960208	0.6583333	0.6801715
	(0.7593071)	(0.7080124)	(0.6996148)	(0.6261224)	(0.8663605)	(0.8029618)
Aged dependency ratio	0.1227185	0.0859414	0.1032624	0.0663611	0.1635417	0.1152236
	(0.3471166)	(0.2912681)	(0.3238703)	(0.2550402)	(0.3898392)	(0.3362656)
Indigenous self-denomination	0.5631579	0.6314607	0.4325397	0.4865255	0.8203125	0.8346829
	(0.496649)	(0.4824764)	(0.4964141)	(0.4999387)	(0.3854355)	(0.3715919)
Number of rooms in the house	3.147368	2.657303	3.305556	2.869105	2.835938	2.360324
	(1.724989)	(1.615108)	(1.859049)	(1.751868)	(1.379132)	(1.346611)
N	380	3,560	252	2,078	128	1,482

Notes: Standard errors in parentheses.
Child dependency ratio. Number of children in the HH/Number of HH's members between 15 and 65 years old.
Aged dependency ratio. Number of HH's members older than 65/ Number of HH's members between 15 and 65 years old.

5. Empirical Approach: Propensity Score Matching Method

As stated above, in the dataset we can observe remittance-receiving households and non-remittance-receiving households. However, a simple comparison of these two groups may lead to bias estimators because of a possible identification problem; unobserved determinants of poverty may be correlated with receiving remittances. Some authors use instrumental variables to overcome this problem; however, it is difficult to determine and test a correct instrument. So, in order to address potential bias due to unobserved heterogeneity we use propensity matching estimators introduced first by Rosenbaun and Rubin (1983).

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6 Low level of education: primary education or less.
Medium level of education: education up to high school.
High level of education: education above high school.

In this type of method each treated observation (remittance-receiving household) is matched to a fixed number of control observations (non-remittance-receiving household) based on a propensity score. With this approach we are able to calculate robust estimators in order to determine the effects of remittances on households' poverty levels. Basically, this method makes it possible to construct counterfactuals to find out what would happen to a remittance-receiving household's poverty level if the household does not receive remittances.

In matching estimators, two important assumptions are made: conditional independence assumption (CIA) (unconfoundedness) and common support. P_i^1 is referred as the value of P if the household head receives remittances and P_i^0 otherwise for the receiving remittances households. Then the two assumptions can be formally expressed as

$$(P_i^1, P_i^0)_{T_i} \mid X_i \text{ ; and}$$

$$(1)$$

$$0 < P(T_i = 1 \mid X_i) < 1$$

$$(2)$$

where T is a dummy variable indicating remittance-receiving remittance household (T=1, receiving remittance) and X is a set of socio-demographic variables.

The CIA implies that given the set of observables covariates X that are not affected by the treatment (receiving remittances), the potential outcomes P are orthogonal to treatment assignment (Khandker et al. 2010), which allows for selection on observables. The common support assumption sets of each remittance-receiving household can be matched to a corresponding non-remittance-receiving household in order to construct the counterfactual. Once these assumptions are made, the average treatment effect between T=1 and T=0 can be calculated.

Nevertheless, there are some computational problems due to dimensionality. To avoid these problems, Rosenbaum and Rubin (1983) propose constructing a statistical comparison group by estimating a propensity score (the probability of the observations to receive remittances) given the set of covariates X. On the basis of the propensity score, remittance-receiving and non-remittance-receiving groups are matched. Then, the assumptions of conditional independence and common support imply

$$(P_i^1, P_i^0)_{T_i} \mid P(X_i) \text{ ; and}$$

$$(3)$$

$$0 < P(T_i = 1 \mid P(X_i)) < 1$$

$$(4)$$

where $P(X_i)$ is the propensity score or the probability of the observations to receive remittances given X. This method of matching is known as propensity score matching. Basically, what this method implies is that if receiving remittances is independent to the observables covariates X_i, then it must be independent to $P(X_i)$. With this, the dimensionality problem is reduced to one dimension. There are no problems in the matching, as Dehejia and Wahba (1999) found, because observations with the same propensity score have the same distribution of the vector of covariates X.

The propensity score is calculated using a probit model subject to all the observable covariates that may determine receiving remittances. We estimate each observation (T=1 and T=0) probability to receive remittances and then test for the balancing property $(\hat{P}(X \mid T = 1) = (\hat{P}(X \mid T = 0))$. As suggested by

Heckman et al. (1997), and Becker and Ichino (2002), some observations of the control group with weak common support are dropped in order to make inferences of causality. If the balancing property is not satisfied, then another specification of higher order terms and interactions of covariates are included in the probit model, until the balancing property is satisfied.

Once the propensity scores are estimated and the balancing property is satisfied, we estimate a univariate nonparametric regression to obtain the average treatment effect on the treated (ATT) between the remittance-receiving households and the non-remittance-receiving households, which can be defined as

$$ATT = E\Delta_{iTi} = 1 = EP_i^1 - P_{i\ Ti}^0 = 1 = EP_{i\ Ti}^1 = 1 - EP_{i\ Ti}^0 = 1 \qquad (5)$$

We use three types of matching criteria in order to obtain robust ATT. First, we use a nearest-neighbor matching criterion, which matches remittance-receiving households with the closest propensity score of non-remittance-receiving households. Then, we use a kernel matching criterion, which uses a weighted average for non-remittance-receiving households to construct the counterfactual match for each remittance-receiving household (Khandker, et.al. 2010). Finally, we use a stratification criterion in order to match treated observations with control observations. This type of matching criterion separates observations into different strata and then matches similar observations within each stratum.

Finally, it is important to note that the variance for the treatment effect in propensity score matching is estimated incorrectly (Heckman, et al. 1998). Nevertheless, correcting this problem is straightforward by bootstrapping the standard errors (Efron and Tibshirani, 1993; Horowitz, 2003). Therefore, bootstrapped standard errors with 100 replications are estimated for the treatment effect for two matching criteria, kernel and stratification.

6. Results

6.1 Propensity Score
As mentioned before, we estimate households' propensity score or the probability of receiving remittances using a probit model. Following Becker and Ichino (2002), based on the propensity score, we stratify individuals into blocks of common support. Like other authors, we use socio-demographic variables to estimate the propensity score (i.e. Cox-Edwards and Rodriguez-Oreggia, 2009; Esquivel and Huerta-Pineda, 2007). The set of covariates included in the probit model is shown in Table 4.

Probit model estimations considering sampling weights are shown in Table 5. We estimated three different models: at the national level and at the urban and rural levels. As can be seen, households with a male household head have on average a probability of receiving remittances that is 9% lower than households with a female household head. This may be attributed to the fact that on average female heads receive remittances from their husbands; of the household heads who received remittances from their partner, 73.47% were female.

Results show that the household head's level of education plays an important role in receiving remittances. At the national level, on average, households whose head has a high level of education tend to have a probability of receiving remittances 1.8% higher than those whose head has a low level of education. When the sample is divided into urban and rural areas the effect is similar. This could be attributed to the fact that in Bolivia receiving remittances may be correlated with household's income level: high-income households are correlated with high-educated household heads which can lead to an endogenous problem. On the other hand, this may not apply when the household head is medium educated; on average households with medium educated heads tend to have a probability to receive remittances of 3.13% lower than households whose heads have a low level of education.

The child dependency ratio has a low effect on the probability to receive remittances. However, it seems to be a more important socio-demographic characteristic for receiving remittances in the urban areas than in rural.

Table 4. Variable Definition

HH Head Characteristics	
Age	HH Head age
Age squared	HH Head age squared
Male	=1 if male, =0 otherwise
Married	=1 if married, =0 otherwise
Low level of education	=1 if HH Head has low level of education, =0 otherwise
Medium level of education	=1 if HH Head has medium level of education, =0 otherwise
High level of education	=1 if HH Head has high level of education, =0 otherwise
HH Characteristics	
HH Members	Number of members in the HH
Child dependency ratio	Number of children/number of members in working age
Indigenous self-denomination	=1 if the HH is considered indigenous
Number of rooms	Number of rooms in the HH
Rural	=1 if HH is in a rural area, =0 otherwise

Table 5. Probit Model for Remittance Receptions (Marginal Effects: dy/dx)

	National	Urban	Rural
HH Head Characteristics			
Age	-0.0035991***	-0.0055727***	0.0025332***
	(0.00007)	(0.00009)	(0.00012)
Age squared	0.0000433***	0.0000584***	-0.00000887***
	(0.00000)	(0.00000)	(0.00000)
Male	-0.0902068***	-0.0858967***	-0.1046018***
	(0.00059)	(0.00070)	(0.00114)
Married	0.01416***	0.0072324***	0.0234652***
	(0.00041)	(0.00054)	(0.00056)
Medium level of education	-0.0313135***	-0.0308908***	-0.0456391***
	(0.00048)	(0.00059)	(0.00075)
High level of education	0.0182589***	0.0189884***	0.0193702***
	(0.00055)	(0.00062)	(0.00189)
HH Characteristics			
HH Members	0.0020495***	0.0018228***	0.0035773***
	(0.00010)	(0.00014)	(0.00013)
Child dependency ratio	0.0089637***	0.01432***	0.0035146***
	(0.00028)	(0.00037)	(0.00038)
Indigenous self-denomination	-0.0092509***	-0.0101366***	-0.0057293***
	(0.00038)	(0.00046)	(0.00064)
Number of rooms	0.0150214***	0.0170634***	0.0136246***
	(0.00012)	(0.00015)	(0.00018)
Rural	-0.0152209***	-	-
	(0.00040)	-	-
Pseudo R2	0.0566	0.0511	0.0904
N	3,940	2,330	1,610

Notes: Standard errors in parentheses. Base outcome: Low level of education. *** p<1%.

Indigenous self-denomination has a negative effect with the probability of receiving remittances. Although the effect is low, it seems to be a more important fact in urban areas than in rural. In urban areas, indigenous households tend to have on average a probability to receive remittances of 1% lower than non-indigenous households.

Finally, the number of rooms in the house has a positive effect with the probability of receiving remittances. The effect is bigger in the urban areas than in the rural. At the national level, on average the probability of receiving remittances increases in 1.5% per room in the house.

Results show that contrary to what other studies find for other countries (Esquivel and Huerta-Pineda, 2007), receiving remittances may be not correlated with low income households. More educated and non-indigenous households and bigger houses increase the probability to receive remittances.

6.2 **Balancing Check**

As mentioned before, once the propensity score is estimated observations are stratified into blocks. The distribution of blocks at the national, urban and rural levels are shown in table 6. See Appendix 2.

In order to check the balancing property, an additional test of the computational program is proposed. We estimate t-test for the equality of means of covariates within estimated propensity score blocks for the three samples: national, urban and rural. T-statistics from the estimations are shown Table 7. As can be seen, the null hypothesis of equality of means in the covariates of the propensity score is accepted in most of the cases, which in addition to the computational test show a good balancing within each block. This means that, on average, treatment and control groups within each block have similar socio-demographic characteristics, except for the fact that the treatment group receives remittances while the control group does not.

Table 7.1 T-statistics for the Equality of the Means of Covariates within Estimated Propensity Score Blocks. Remittance-Receiving HH and Non-Remittance-Receiving HH. National

	Block 1	Block 2	Block 3	Block 4	Block 5
HH Head Characteristics					
Age	-0.1535	-3.4512*	0.5181	2.1616*	0.0766
Age squared	-0.5233	-3.3893*	0.5444	1.8212	-0.005
Male	-	-0.6141	1.5834	1.2151	0.7888
Married	0.7641	0.4915	-0.0189	-0.2659	1.4402
Low level of education	1.3566	-0.3796	0.2511	-0.0425	0.1584
Medium level of education	-0.8875	0.6424	-0.743	0.5417	-
High level of education	-1.6065	-0.0336	0.0953	0.0272	-0.5092
HH Characteristics					
HH Members	2.2776*	0.2734	0.0717	0.8425	-1.8154
Child dependency ratio	1.3871	2.5197*	-1.7956	-0.0382	-2.7923*
Indigenous self-denomination	1.207	-0.0145	0.274	0.4097	0.1584
Number of rooms in the house	-1.1729	-2.1345*	0.9259	0.9117	-0.7422
Rural	1.7626	-0.3462	-0.4255	0.2848	-

Note: * denotes 5% or lower level of significance.

Table 7.2 T-statistics for the Equality of the Means of Covariates within Estimated Propensity Score Blocks Remittance-Receiving HH and Non-Remittance-Receiving HH. Urban

	Block 1	Block 2	Block 3	Block 4	Block 5
HH Head Characteristics					
Age	0.991	-1.3511	0.7987	1.7668	0.0766
Age squared	0.6922	-1.3936	0.7769	1.373	-0.005
Male	-	-0.0359	1.1634	0.873	0.7888
Married	0.9197	0.9062	-0.2556	0	1.4402
Low level of education	1.1345	0.4179	0.5285	0	0.1584
Medium level of education	-0.4799	0.1404	-1.1328	0.5598	-
High level of education	-1.8837	-0.5644	0.0234	0.052	-0.5092
HH Characteristics					
HH Members	2.2883*	0.1925	-0.0041	1.0301	-1.8154
Child dependency ratio	1.7945	1.0705	-2.3954*	0.3246	-2.7923*
Indigenous self-denomination	0.7258	0.3352	0.6896	-0.0272	0.1584
Number of rooms in the house	-0.8398	-1.5734	0.6989	1.1092	-0.7422
Rural	1.7626	-0.3462	-0.4255	0.2848	-

*Note: * denotes 5% or lower level of significance.*

Table 7.3 T-statistics for the Equality of the Means of Covariates within Estimated Propensity Score Blocks Remittance-Receiving HH and Non-Remittance-Receiving HH. Rural

	Block 1	Block 2	Block 3	Block 4	Block 5
HH Head Characteristics					
Age	-2.0137*	-3.5867*	-0.1427	1.4327	0.0766
Age squared	-2.1649*	-3.3565*	-0.0246	1.4784	-0.005
Male	-	-0.8342	1.0705	1.2457	0.7888
Married	-0.3452	-0.2689	0.3724	-0.803	1.4402
Low level of education	-0.7557	-1.7578	-0.2524	-0.7294	0.1584
Medium level of education	0.6396	1.2063	0.9017	-	-
High level of education	0.435	1.2444	-0.2914	0.5039	-0.5092
HH Characteristics					
HH Members	0.7902	0.2772	0.1076	-0.3468	-1.8154
Child dependency ratio	0.1252	2.5108*	0.1138	-0.581	-2.7923*
Indigenous self-denomination	0.0475	-0.2902	-0.4331	1.1126	0.1584
Number of rooms in the house	-0.8638	-1.4007	0.5393	-0.2151	-0.7422
Rural	1.7626	-0.3462	-0.4255	0.2848	-

*Note: * denotes 5% or lower level of significance.*

6.3 Effect of Remittances on Poverty

Once the balancing property is satisfied we can find the effect of receiving remittances on households' poverty. Basically, if remittance-receiving and non-remittance-receiving households are similar in socio-demographic characteristics except for remittances, then a difference in means in poverty between these two groups can be attributed to remittances.

Three matching criteria are used to determine similar observations or counterfactuals for each remittance-receiving household and to obtain robust estimates of the effect of remittances on poverty. First, we use nearest neighbor matching. This criterion searches the closest unit(s) in the non-remittance-receiving group for each remittance-receiving observation based on the estimated propensity score. Then, we use Kernel matching criterion. Nonparametric matching estimators such as Kernel consider a weighted average for all observations in the non-remittance-receiving group to construct the counterfactual match for each observation in the remittance-receiving group. Finally, we use stratification matching criterion which partitions the common support into intervals (or strata) where treatment and control groups are very similar except for remittances under common support.

After similar non-remittance-receiving observations are matched to remittance-receiving observations the ATT is calculated. Table 8 shows the ATT for national, urban and rural areas with the three types of matching criteria.

Table 8. Propensity Score Matching Estimators

	Nearest Neighbor				Kernel				Stratification			
	Treated	Control	ATT	|t|	Treated	Control	ATT	|t|	Treated	Control	ATT	|t|
National Remittances	347	325	-0.151 (0.039)	3.86	347	3,306	-0.138 (0.027)	5.16	347	3,306	-0.116 (0.026)	4.5
Urban Remittances	235	231	-0.135 (0.044)	3.11	235	1,994	-0.148 (0.028)	5.24	235	1,990	-0.13 (0.032)	4.013
Rural Remittances	112	106	-0.076 (0.064)	1.18	112	1,328	-0.083 (0.048)	1.712	112	1,301	-0.094 (0.05)	1.878

Note: Standard errors in parentheses.
Bootstrapped standard errors (100 replications) for Kernel and Stratification criterion.

Results show that at the national level, on average, there is 13% less probability to be in poverty for remittance-receiving households. If we consider only urban areas, the effect is significant and similar to the national level. Nevertheless, there seems to be no effect of remittances on poverty when the sample is restricted to rural areas. As proposed before, receiving remittances tends to depend on the household's income. Therefore, the effect of remittances on rural poor households may be limited or null. Other studies, such as Kapur (2004) and Adams and Page (2005), suggest that the effects of remittances on poor households are limited due to the high costs of international migration. Even though remittances are poor-friendly, because receiving remittances is correlated with the household's income there seems to be no effect of remittances on rural households.

7. Conclusions

This paper contributes to the literature of remittances and poverty by studying the direct effect between remittances and poverty at a household level in Bolivia. We use micro data collected in 2008 by the National Institute of Statistics (INE). Within the data, we can observe remittance-receiving households and non-remittance-receiving households and their poverty levels. Nevertheless, a simple comparison between these two groups can lead to bias estimators due to a possible identification problem; some unobserved determinants of poverty may be correlated with receiving remittances. To address this potential problem we use a propensity score matching approach.

We match similar non-remittance-receiving households to each remittance-receiving household based on a set of covariates. Results show that, on average, there is an effect of remittances on poverty at the national level. However, when the sample is divided into urban and rural areas, there seems to be no effect of remittances on rural poor households. As suggested by Adams and Page (2005) and Kapur (2004), this may

be due to the high costs of international migration; rural poor households cannot afford to send household members outside Bolivia in order to receive remittances. Therefore, even if remittances are seen as poor-friendly, there is no effect on poverty in very poor households located in rural areas.

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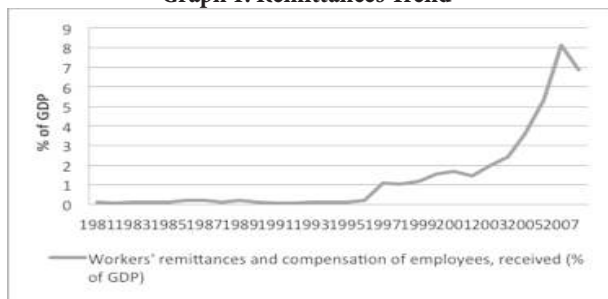
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Appendix 1: Remittances Evolution

Graph 1. Remittances Trend

Source: World Bank Data

Graph 2. Remittances, FDI and Tourism Inflows

Source: World Bank Data

Appendix 2: Balancing Check

Table 6.1 The Distribution of Remittance-Receiving HH and Non-Remittance-Receiving HH within Each Block. National

Blocks	No remittances	Remittances	Total
1	793	34	827
2	1,402	120	1,522
3	931	140	1,071
4	173	51	224
5	7	2	9
Total	3,306	347	3,653

Table 6.2 The Distribution of Remittance-Receiving HH and Non-Remittance-Receiving HH within Each Block. Urban

Blocks	No remittances	Remittances	Total
1	1,178	87	1,265
2	686	109	795
3	124	36	160
4	6	3	9
Total	1,994	235	2,229

Table 6.3 The Distribution of Remittance-Receiving HH and Non-Remittance-Receiving HH within Each Block. Rural

Blocks	No remittances	Remittances	Total
1	551	14	565
2	465	46	511
3	271	38	309
4	41	14	55
Total	1,328	112	1,440