

# Remittances and Labor Force Participation in Mexico: An Analysis Using Propensity Score Matching

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**Summary.** — About 2.5 million Mexicans migrated to the United States during 1997–2002, and 1.6 million of them sent remittances to their families. Did recipients change their labor force status in response to these remittances? This question has been examined before. Unlike the previous studies, we separate persistent from sporadic remittances, and we use propensity score matching to measure differences in behavior. We find limited evidence of labor force participation effects of persistent remittances, which is broadly consistent with remittances being an integral part of household's income generation strategy.

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## 1. INTRODUCTION

This paper focuses on the impact of *persistent* remittances on labor force participation of household members staying in Mexico. Mexico offers a rich case for studying migration, with a continuous flow of migrants, especially to the United States, and an inflow of remittances that currently accounts for the second source of foreign exchange, only after oil, and that surpasses foreign direct investment and tourism (Banco de Mexico, 2007).

The link between remittances and labor force participation has been examined before for Mexico and other countries, but our methodology differs from previous ones in three important respects. First, we focus on *persistent* remittances rather than casual or sporadic remittances, because we expect persistent remittances to be more likely to alter behavior among recipients. Casual remittances, on the other hand, may be driven by specific circumstances among recipients, including labor force status.<sup>1</sup> Second, we employ a *Propensity Score Matching* method to calculate the average treatment effects of persistent remittances on men and women labor force participation decisions. This method requires a rich database, which is provided by the National Quarterly Employment Survey (ENET 2002).<sup>2</sup> Indeed, with a sample size close to 200 thousand observations, this survey has enough depth and texture for applying this type of methodology.

Our comparison of recipients to similar individuals across households of the same location and characteristics provides limited evidence of remittances effects on labor force participation. This contrasts with the findings reported in studies that directly compare the behavior of recipients with that of non-recipients.<sup>3</sup>

The paper is organized as follows. In Section 2, we present a brief review of the theoretical and empirical issues regarding the impact of remittances on the labor force participation, followed by a description of the data in Section 3, and the methodology in Section 4. In Section 5, we report the average

differences in labor force participation after matching recipients with the “adjusted” control group. Finally, some conclusions and considerations are drawn.

## 2. THEORETICAL AND EMPIRICAL ISSUES

In the neoclassical model of labor supply, individuals allocate time to market work and non-market activities, maximizing utility subject to a budget constraint. This budget constraint is determined by the individual market wage, the individual time budget, and the individual's non-labor income. An important concept underlying the labor force participation decision is the notion of the reservation wage. This reservation wage indicates how much extra earnings the individual would require to be induced to give up one unit of leisure, when he or she is not working at all.

Given all other variables, an increase in the reservation wage, would reduce the probability that an individual participates in the labor force. One of the determinants of the reservation wage is non-labor income, which for an individual is a function of her own assets and the amount of income of other household members. The higher is the level of income of the rest of the household, the higher is the reservation wage of the individual, and the lower is the probability that he or she participates in the labor force.

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Many researchers have looked at remittances as an additional non-labor income for recipient household members, and hypothesized that the presence of remittances would lead to a *reduction* in labor force participation among recipient household members. We call this view, “discouraged participation.”

Alternatively, remittances can be seen as the income contributions of a household member that works in another country, and rather than assume that remittances are additional income, we hypothesize that remittances replace the income that the migrant worker would have contributed to the household if he/she had stayed in Mexico. If in fact the emigrant worker remits an amount that replaces his/her previous contribution to the rest of the household, remittances income should not alter the labor force participation decision of other household members. This would be a case where remittances have a “neutral effect” on participation. If, on the other hand, the amount remitted by the migrant member of the household differs significantly from his/her pre-migration contribution, then recipients reservation wages would change and so would labor force participation. Canales (2007) uses data from ENIGH 2002<sup>4</sup> to support the view that remittances basically compensate recipient households for lower Mexico-based earned wages.

Attempts to measure the effect of remittances have led to mixed results. Rodriguez and Tiongson (2001) and Funkhouser (1992), using data for Manila and Managua, respectively, conclude that remittances reduce labor force participation. Funkhouser (1992) also finds an increase in self-employment, although both effects are small. Gubert (2002), with data from Mali, shows that remittances help agricultural households adopt new technology, but have no impact on production. She suggests that remittances act as insurance, which is not available otherwise, and that the availability of insurance reduces work effort.

Using aggregate data for 20 countries, Drinkwater, Levine, and Lotti (2003) consider the hypothesis that remittances are seen as welfare payments, and thus could lead to higher unemployment rates. Yet, they find that remittances income (measured as ratio to GDP) have a non-significant effect on unemployment. Hanson (2005) studies the regional labor market effect of Mexican out migration. He finds that higher migration states show a reduction in working-age population during 1990–2000, and that wages in high migration states are higher in 2000 compared to those in lower migration states in a range between 6% and 9%. This study, however, does not isolate the effect of remittances on labor force participation of those staying behind.

A limitation in many studies based on micro data is that they estimate the effect of remittances, comparing the behavior of recipients with that of non-recipients, and conditioning on exogenous characteristics. However, if remittances are not randomly assigned, confounding factors may bias the estimation of their effect on any outcomes. In an effort to avoid such bias, Amuedo-Dorantes and Pozo (2005), in a study on Mexico, instrument remittances with information on the *per capita* count of Western Union offices<sup>5</sup> in the state during the previous year. They find no clear evidence of employment reduction in response to remittances income. Airola (2005) uses the same data set used by Amuedo and Pozo, but focuses on participation among the heads of households, and does find a negative effect of remittances on hours worked. Yet, we believe that the Airola (2005) analysis suffers from confoundedness, as he compares work patterns of recipient and non-recipient heads of households using Mexican data. We know that households with remittances typically have members living abroad, and that the migration of household members likely changes the

role of various individuals within households, particularly the assigned head of household. Survey responses typically identify a household head, but we do not know if the same person was identified as head before migration. Arguably, headship is endogenous to migration, and Airola (2005) measured differences in participation due to remittances is unlikely to capture differences across otherwise similar heads of households. Acosta (2006) uses selection correction techniques and, based on data for El Salvador, finds that remittances are negatively related to child labor and adult female labor supply, while on average adult male labor force participation remains unaffected.

In a recent study, Funkhouser (2006) uses longitudinal data from the 1998 and 2001 Living Standard Measurement Surveys in Nicaragua to examine the impact of the emigration of household members on the household labor market integration and poverty. By controlling for the initial situation of the household, his analysis provides an estimate of the effect migration and remittances that is not possible with the cross-sectional approach used in the previous studies. He finds that households from which an emigrant left had a reduction in members, a reduction in working members, a reduction in labor income relative to similar households, and also a reduction in poverty. He finds no major effect of emigration or remittances on the work status of individuals aged 18–62 in 1998, but teenagers that entered working age during 1998–2001 were less likely to work if they lived in a household from which someone emigrated. In short, as researchers have reduced the bias or confoundedness problem, the evidence on the effect of remittances on labor force participation has shown negligible or no effects.

Although we do not have the luxury of longitudinal data to examine the Mexican case, we use a matching technique to go beyond a simple comparison of recipient and non-recipients of persistent remittances. The methodology consists of the following steps: First, we identify individuals in households that receive persistent remittances from household members that migrated in the last five years. Second, we find non-recipient individuals that—given their household and location characteristics—are “equally likely” to have received persistent remittances. Finally, we compare labor force participation behavior of recipients with that of their appropriate comparison group, that is, non-recipients with the same probability of being a recipient. We find limited evidence of labor force participation effects of persistent remittances.

### 3. DATA

Our data are obtained from the Migration Module applied to the National Quarterly Employment Survey (ENET) in the fourth quarter of 2002. This survey sampled urban and rural households, with national representation of the population living in private homes in the Mexican territory, and applied a special questionnaire geared to evaluate the size of migration flows and the specifics of the migration flows to the United States. The questionnaire establishes if a member of the household migrated to the United States during 1997–2002; if these migrants went to the United States for work purposes or for non-work purposes; if they sent remittances; and if the remittances were persistent (once a month, once every three months, two or three times a year, or once a year) as opposed to sporadic (only once or other answers).

The survey records the usual demographic characteristics of all household members in 2002, and the labor market status of household members above 12 years of age. Some of these household members are return migrants and their characteris-

Table 1. *Households with migrants to United States during 1997–2002 by region*

	Urban	Rural	Total
<i>Households with migrants to United States during 1997–2002</i>			
% of all households	5.68	14.02	7.56
<i>Households with remittances as a% of households with migrants to United States during 1997–2002</i>			
All remittances	66.0	80.4	72.0
Persistent remittances <sup>a</sup>	52.1	69.8	59.5

<sup>a</sup> Household receives remittances once a month, once every three months, once a year, or two to three times a year.

Table 2. *Sample distribution by region and sex. Men and women ages 12–65 (working-age population)*

	Urban	Rural	Total
Men	78,475	15,057	93,532
Women	87,113	15,730	102,843
Total	165,588	30,787	196,375

Source: ENET 2002.

tics are recorded directly. The survey also includes information from 3589 individuals representing household members that migrated to the United States in the last five years (1997–2002), and are still in the United States. For them, the survey records some basic demographic variables such as their position relative to the head of household, their age and sex.

This survey does not record the amount remitted or the pre-migration contribution of migrant workers to their corresponding households, two variables that would be very useful to test a number of hypotheses.<sup>6</sup> The survey provides valuable information on labor market status at the individual level, including hours of work and wages. This affords an estimation of household labor income. However, because there is no information on non-labor income or remittances amount, we do not have a way of creating a household income variable that can be appropriately comparable across recipient and non-recipient households. We use schooling as a key indicator of potential income, and household location as a key determinant of labor market conditions.<sup>7</sup>

We use the full data set to characterize each household in terms of its location (state, and rural *versus* urban), its size including migrants, the incidence of migrants to the United States during 1997–2002, and if they sent remittances to the household regularly or irregularly. Any effects on the reservation wage of family members staying behind would be more likely, if the remittances received are persistent and recent. We find that 7.6% of all households sent migrants to the United States during 1997–2002, and that 72% of those with emigrants to United States received remittances, and 59.5% did so persistently (Table 1). We focus on the population aged 12–65 and examine their labor force participation patterns in the fourth quarter of 2002, and in particular, the effect of remittances income on participation. Our sample is large, with a total of 196,375 observations of individuals age 12–65, equally divided between men and women. The sample is about 30% rural (see Table 2).

#### 4. METHODOLOGY

We do observe some households that receive persistent remittances and others that do not. However, a simple and direct comparison of these two groups of households leads to an

identification problem, because the presence of persistent remittances may be correlated with unobserved determinants of participation among these household members. We follow Rosenbaum and Rubin (1983, 1984) and perform propensity score matching to pair individuals that receive persistent remittances with other individuals that are like them, except for remittances. We estimate the probability of receiving persistent remittances as a function of individual and household characteristics, rank recipient and non-recipient individuals by their propensity score, pair individual members of recipient households, and non-recipients with similar propensity scores, and calculate the average difference in labor force participation across them.

We are interested in comparing the labor force participation of individuals exposed to no treatment  $T = 0$  (no persistent remittances) and labor force participation of individuals exposed to treatment  $T = 1$  (receives persistent remittances). Since only one of these two outcomes is observed for each type of individuals, we estimate the average treatment on the treated (ATT), that is, the difference in labor force participation between those treated and those with the same probability of being treated.<sup>8</sup>

Propensity score matching reduces the problem to a single dimension. First, we estimate the propensity score, or the individual probability of receiving the treatment given the observed covariates using a probit model. A critical feature of this methodology is that the propensity score has to satisfy the “balancing property,” that is, observations with the same value of the Score must have the same distribution of observable characteristics irrespective of treatment status. This allows the use of the propensity score as a univariate summary of all observed covariates. Any standard probability model can be used to estimate the propensity score. Second, to estimate the treatment effect, one has to address the problem that the probability of treatment conditional on the value of covariates is a continuous variable, with the probability of observing two units with exactly the same value of the Score being in principle zero. Various methods have been proposed in the literature to overcome this problem. In this paper, we present results using nearest neighbor and kernel estimators. The nearest-neighbor matching estimator sorts all records by the estimated propensity score, and then searches forward and backward for the closest control unit(s). If for a treated unit forward and backward matches happen to be equally good, this program randomly draws either the forward or backward matches. Kernel estimators compare the outcome of each treated unit to the average outcome of a group of non-treated individuals where the weight of each individual in the comparison group is proportional to the individual’s closeness to that in the comparison group. Results with kernel estimators are similar to those with near neighbor estimates.

##### (a) *Characterizing the working-age population with and without persistent remittances*

We identified three household characteristics that are significant factors in the probability of persistent remittances at the household level. The first factor is *location*. There are ample differences in the incidence of remittances between rural and urban zones, and across states within urban or rural zones. In rural Guanajuato, 44% of working-age individuals received persistent remittances during 1997–2002. In urban Michoacán, the urban region with the highest incidence of persistent remittances, less than 10% of working-age individuals belong to households that receive them. On the other hand, in Baja California Sur (urban or rural) less than 1% of working-age

individuals live in households with persistent remittances.<sup>9</sup> The second factor is *household potential work force*—measured by the numbers of members 12 or older (including migrants). Each additional member aged 12 or older increases the household's probability of receiving remittances by 2 points. This effect seems to operate through the effect of potential work force on the probability that a household will have a migrant.<sup>10</sup> The third factor is a proxy for household *wealth*, the highest level of schooling in the household. We find a negative correlation between household schooling and persistent remittances.

The procedure we use is due to Becker and Ichino (2002), and estimates the propensity score (pscore) of the treatment on a list of covariates using a probit model and stratifies individuals in blocks according to the pscore. Since we are interested in the effect of persistent remittances on *individual's* labor force participation, our propensity score matching pairs recipient with non-recipient *individuals* that have the same probability of being a member of a household that receives persistent remittances, and the same observed characteristics that influence labor force participation (sex, age, schooling, and marital status). For applications of the same method to other questions see Black and Smith (2003), Heckman, Ichimura, and Todd (1997), Heckman, Ichimura, Smith, and Todd (1998), Lechner (2002), McKenzie, Gibson, and Stillman (2006), Smith and Todd (2003).

Male labor force participation rates are about twice as high as that of women, and the gender differential is larger in rural areas compared to that of urban areas. Given the large differences in labor outcomes by region and gender, we first considered four separate models (urban males, urban females, rural males, and rural females) using dummies for sets of states in each model.<sup>11</sup> As indicated above, we checked that the balancing property was satisfied, or that observations with the same value of the Score had the same distribution of observable characteristics irrespective of treatment status. Whenever the balancing property was not satisfied we re-estimated the probit using a less parsimonious specification of the pscore. However, the specification that satisfied the balancing property required

further parceling of the data. We ultimately subdivided the urban models into three separate models for males and three separate models for females, and the rural models in two separate models for males and two separate models for females.<sup>12</sup> The states included in the various models differ in terms of the average incidence of persistent remittances, and as shown in Figures 1, 2, and 3, there is a geographical pattern where central states are typically characterized by higher incidence than peripheral states. We calculate separate propensity score for each of the 10 models.<sup>13</sup> Table 3 shows what states are represented in each of these 10 models.

(i) *Propensity score models: our final specification divided the full sample of 196,375 observations in 10 models as follows*

<sup>14</sup>Model 1: Urban women in state sets 1 and 2 includes a dummy for state set 1 (relatively high incidence of remittances).

Model 2: Urban women state set 3 (medium incidence of remittances).

Model 3: Urban women state set 4, 5, and 6, no dummy for state sets (low incidence of remittances).

Model 4: Urban men state set 1 (relatively high incidence of remittances).

Model 5: Urban men state sets 2, 3, and 4, no dummy for sets (medium incidence of remittances).

Model 6: Urban men in state sets 5 and 6, no dummy for sets (low incidence of remittances).

Model 7: Rural women in state sets 1, 2, and 3, dummy for set 1 and dummy for set 2 (relatively high incidence of remittances).

Model 8: Rural women in state sets 4, 5, and 6, dummy for set 4 and dummy for set 5 (low incidence of remittances).

Model 9: Rural men in state sets 1, 2, and 3, dummy for set 1 and dummy for set 2 (relatively high incidence of remittances).

Model 10: Rural men in state sets 4, 5, and 6, dummy for set 5 (low incidence of remittances).



Figure 1. *Urban women: Model 1, pink—high incidence of remittances; Model 2, green—medium incidence of remittances; Model 3, blue—low incidence of remittances.*



Figure 2. *Urban men: Model 4, pink—high incidence of remittances; Model 5, green—medium incidence of remittances; Model 6, blue—low incidence of remittances;*



Figure 3. *Rural Men and rural women: Models 7, 9: orange—high migration states; Models 8, 10: blue—low migration states.*

These models represent populations of men and women in various states of urban or rural Mexico, as shown in Figures 1, 2, and 3. Urban female recipients are examined in models 1–3, where model 1 captures for high probability of treatment women located in the center of the country. Urban male recipients are examined in models 4–6, where model 4 captures high probability of treatment men located in Michoacán. Rural males and females are examined in models 7–10. The division between low and high probability of treatment results in the same division of states for rural men and women. The high incidence of treatment is in the center of the country.

The analysis proceeds with the estimation of a common probit equation for each model to obtain the propensity score. The set of covariates includes all the key factors affecting both remittances and labor force participation.

(ii) *Propensity score covariates: our final specification included the following covariates to obtain the propensity score*

Age: Individual age in years.

Age squared: Individual age squared.

Schooling: Years of completed schooling.

Table 3. *Data partition in 10 models*Table 3—*Continued*

State	Individuals in recipient HH	Urban set	State	Individuals in recipient HH	Urban set
Urban women			<i>Model 6</i>		
<i>Model 1</i>			Chiapas	0.013	5
Michoacán de Ocampo	0.098	1	Baja California	0.012	5
Guanajuato	0.078	2	Nuevo León	0.011	5
San Luis Potosí	0.071	2	Distrito Federal	0.008	5
Aguascalientes	0.069	2	México	0.006	5
Morelos	0.063	2	Yucatán	0.005	6
Durango	0.058	2	Baja California Sur	0.004	6
Nayarit	0.058	2	Quintana Roo	0.003	6
Zacatecas	0.057	2	Tabasco	0.001	6
<i>Model 2</i>			Campeche	0.000	6
Querétaro	0.044	3	Rural women		
Guerrero	0.042	3	<i>Model 7</i>		
Hidalgo	0.042	3	Guanajuato	0.472	1
Oaxaca	0.039	3	Zacatecas	0.326	2
<i>Model 3</i>			San Luis Potosí	0.224	2
Jalisco	0.035	4	Durango	0.208	3
Puebla	0.031	4	Aguascalientes	0.188	3
Chihuahua	0.029	4	Morelos	0.143	3
Tlaxcala	0.028	4	Michoacán	0.142	3
Coahuila	0.027	4	Nayarit	0.125	3
Sonora	0.025	4	<i>Model 8</i>		
Veracruz	0.021	4	Jalisco	0.167	4
Sinaloa	0.021	4	Querétaro	0.142	4
Tamaulipas	0.020	4	Sinaloa	0.114	4
Colima	0.020	4	Hidalgo	0.107	4
Tabasco	0.001	4	Chihuahua	0.086	5
Chiapas	0.019	5	Oaxaca	0.085	5
Baja California	0.017	5	Baja California	0.082	5
Nuevo León	0.013	5	Puebla	0.076	5
México	0.009	5	Sonora	0.060	5
Distrito Federal	0.008	5	Campeche	0.057	5
Yucatán	0.009	6	Tamaulipas	0.053	6
Quintana Roo	0.005	6	Coahuila	0.052	5
Baja California Sur	0.004	6	Chiapas	0.045	6
Campeche	0.001	6	Guerrero	0.044	5
Urban men			México	0.041	6
<i>Model 4</i>			Tlaxcala	0.037	6
Michoacán de Ocampo	0.084	1	Nuevo León	0.036	6
<i>Model 5</i>			Colima	0.034	6
San Luis Potosí	0.068	2	Veracruz	0.028	6
Guanajuato	0.066	2	Tabasco	0.017	6
Aguascalientes	0.061	2	Quintana Roo	0.013	6
Durango	0.056	2	Yucatán	0.012	6
Zacatecas	0.052	2	Baja California Sur	0.002	6
Nayarit	0.052	2	Rural men		
Morelos	0.051	2	<i>Model 9</i>		
Oaxaca	0.040	3	Guanajuato	0.386	1
Guerrero	0.039	3	Zacatecas	0.315	2
Querétaro	0.038	3	San Luis Potosí	0.204	3
Hidalgo	0.036	3	Aguascalientes	0.191	3
Puebla	0.027	4	Durango	0.169	3
Sinaloa	0.026	4	Michoacán	0.138	3
Veracruz	0.025	4	Nayarit	0.123	3
Chihuahua	0.024	4	Morelos	0.116	3
Coahuila	0.022	4	<i>Model 10</i>		
Tlaxcala	0.021	4	Jalisco	0.116	4
Sonora	0.020	4	Sinaloa	0.111	4
Colima	0.017	4	Querétaro	0.111	4
Tamaulipas	0.015	4			

(continued on next page)

Table 3—Continued

State	Individuals in recipient HH	Urban set
Hidalgo	0.092	4
Oaxaca	0.065	5
Puebla	0.058	5
Sonora	0.058	5
Chihuahua	0.056	5
Baja California	0.056	5
Campeche	0.053	5
Coahuila	0.045	5
Guerrero	0.037	5
Chiapas	0.037	6
Colima	0.034	6
Tlaxcala	0.033	6
México	0.028	6
Nuevo León	0.024	6
Tamaulipas	0.019	6
Tabasco	0.012	6
Veracruz	0.009	6
Quintana Roo	0.007	6
Yucatán	0.004	6
Baja California Sur	0.002	6

Marital status: Dummy = 1 if individual has never married.

Number of children less than six in the household.

Number of individuals in the working-age population in the household: Number of individuals aged 12 or older in the household. This number includes migrants even if they are still in the United States.

Household schooling: Maximum years of schooling observed in the household (members include USA migrants for the 1997–2002 period).

Dummies for sets of states: All models except for 2 and 4 represent more than one set of states. Whenever we have more than one set of states, we estimate the model with dummies for sets of states, although these dummies are not always significant.

We do not use household headship as an exogenous variable because it is likely to be endogenous to migration. Headship can reflect the change in the organization of the household induced by migration and remittances.

In Tables 4A and 4B, we summarize key variables within each of the 10 models and we show mean values for the treated, the corresponding matched control group, and all con-

Table 4A. Urban models

	Model 1			Model 4		
	Women with high incidence of remittances			Men with high incidence of remittances		
	Receives persistent remittances	Matched controls	All controls	Receives persistent remittances	Matched controls	All controls
% in the labor force	0.35	0.34	0.42	0.75	0.73	0.75
HH members older than 12	4.69	3.98	3.79	5.19	4.59	3.91
Individual schooling	7.09	8.71	8.67	6.61	6.97	8.59
Individual age	31.40	27.24	33.29	28.47	26.63	31.77
% single	0.38	0.47	0.39	0.50	0.59	0.44
HH members bellow 6	0.41	0.42	0.34	0.34	0.34	0.34
HH schooling	9.79	10.49	11.55	9.67	9.45	11.15
Number of observations	1538	3365	16,838	202	191	1870
	Model 2			Model 5		
	Women with medium incidence of remittances			Men with medium incidence of remittances		
	Receives persistent remittances	Matched controls	All controls	Receives persistent remittances	Matched controls	All controls
% in the labor force	0.39	0.38	0.40	0.71	0.64	0.78
HH members older than 12	5.07	4.51	3.93	4.83	4.08	3.75
Individual schooling	7.32	8.49	8.36	7.69	9.53	8.98
Individual age	31.15	28.71	31.91	29.93	25.70	33.40
% single	0.41	0.51	0.40	0.51	0.61	0.40
HH members bellow 6	0.25	0.22	0.30	0.34	0.31	0.36
HH schooling	10.75	10.90	11.37	10.42	11.22	11.52
Number of observations	423	703	8091	1877	9931	38,944
	Model 3			Model 6		
	Women with low incidence of remittances			Men with low incidence of remittances		
	Receives persistent remittances	Matched controls	All controls	Receives persistent remittances	Matched controls	All controls
% in the labor force	0.41	0.36	0.41	0.71	0.68	0.75
HH members older than 12	4.62	3.90	3.70	5.15	4.50	3.77
Individual schooling	7.65	9.67	8.67	8.38	9.51	9.28
Individual age	31.95	26.92	33.26	32.17	27.82	31.98
% single	0.38	0.50	0.36	0.46	0.59	0.42
HH members bellow 6	0.33	0.32	0.33	0.20	0.15	0.32
HH schooling	10.44	11.32	11.58	10.96	11.12	11.60
Number of observations	959	6060	47,630	163	519	24,235

Table 4B. *Rural models*

	Model 7			Model 9		
	Women with high incidence of remittances			Men with high incidence of remittances		
	Receives persistent remittances	Matched controls	All controls	Receives persistent remittances	Matched controls	All controls
% in the labor force	0.30	0.28	0.30	0.76	0.78	0.84
HH members older than 12	4.96	4.54	3.88	5.10	4.66	3.99
Individual schooling	5.88	6.15	5.36	5.78	6.32	5.38
Individual age	30.75	28.24	33.88	29.26	27.51	33.96
% single	0.39	0.46	0.36	0.53	0.59	0.39
HH members bellow 6	0.53	0.53	0.42	0.51	0.47	0.53
HH schooling	8.22	8.07	8.07	8.30	8.33	8.03
Number of observations	975	952	2246	754	752	2141
	Model 8			Model 10		
	Women with low incidence of remittances			Men with low incidence of remittances		
	Receives persistent remittances	Matched controls	All controls	Receives persistent remittances	Matched controls	All controls
% in the labor force	0.30	0.29	0.29	0.75	0.70	0.82
HH members older than 12	5.05	4.66	4.01	5.21	4.76	4.06
Individual schooling	5.36	5.89	5.53	5.75	6.67	5.86
Individual age	32.98	30.51	32.28	31.76	26.55	32.04
% single	0.35	0.43	0.35	0.50	0.62	0.44
HH members bellow 6	0.34	0.35	0.48	0.30	0.33	0.47
HH schooling	8.20	8.05	8.38	8.31	8.31	8.30
Number of observations	696	823	9898	529	849	9819

trols.<sup>15</sup> An examination of each subset included in Tables 4A and 4B indicates that recipients belong to households with a relatively large potential work force, compared to the rest of the population of the same sex and region. The potential work force is the number of individuals 12 or older, which includes migrants in the United States, who are identified as household members by respondents to the questionnaire. Matched individuals in the control group are also characterized by households with a relatively larger potential work force. Individuals in recipient households are younger, more likely to be single, have less schooling in urban areas, and more schooling in rural areas. Matched individuals in the control group are also younger, more likely to be single, less schooled in rural areas and more schooled in urban areas relative to the rest of the population. The variable “household schooling,” which we use as proxy for wealth, indicates that, when compared to the rest of the population, individuals in recipient households and matched controls also belong to lower schooled households within urban areas, and belong to relatively higher schooled households within rural areas. This table also shows that labor force participation among men recipients is typically lower than that of a non-random sample of non-recipients, difference that drives the econometric comparison of recipients and non-recipients in a cross section.

## 5. RESULTS

We turn to the effect of persistent remittances on labor force participation, estimated separately for each of the 10 models; these are shown in Table 5. If we define the treatment as remittances from household members that migrated in the last five years, we reject the hypothesis of effects on labor force participation.

When individuals in remittances recipient households are paired with non-recipient households with otherwise similar propensity scores, the estimated effects of remittances are insignificant except for women in the urban areas of model 3. The results for rural men are not robust to the choice of matching estimator. The estimated differences are insignificant with near neighbor and radius matching, and significant and negative under kernel matching. We find no significant differences for urban men and rural women, a result generally consistent with the “neutral participation” view, which sees remittances as a replacement of the income flows that emigrant workers would have contributed to the household, and predicts that the presence of remittances income should not alter the labor force participation decision of members left behind.

In the case of urban women, we reject the hypothesis of differences in two models and find a positive difference in model 3, suggesting that women in urban states with relatively low migration tradition and low incidence of persistent remittances have higher rates of participation as a result of remittances. The estimated effect is 4.5 points higher participation rate, a large difference given the average participation rate of women in the 40% range. The fact that this effect is present for women and not for men in these states reduces the likelihood that the explanation could be based in emigrant workers remitting amounts significantly below the emigration-associated income-loss for the rest of the household. Something seems to alter the labor force participation decision for women and not for men in this case.

Since all our recipients are the members of households with migrants in the United States, we examined separately the effect of migration from that of remittances. That is, we evaluated separately two hypotheses; (a) labor force participation responds to the removal of a household member from the home due to migration to the United States and (b) labor force

Table 5. *Estimated effects of persistent remittances on individual labor force participation rates using propensity score matching*

Propensity score model	Total sample # Obs	ATT estimator nearest-neighbor matching common support comparison				ATT estimator with kernel matching common support comparison			
		Treatment	Controls	ATT <sup>a</sup>	<i>t</i>	Treatment	Controls	ATT <sup>a</sup>	<i>t</i>
Urban women model 1	22,152	1,538	3,365	0.001	0.078	1,538	20,203	-0.012	-0.938
Urban women model 2	10,099	423	703	0.023	0.695	423	8,794	0.009	0.394
Urban women model 3	54,862	959	6,060	0.046	2.359	959	53,690	0.045	3.266
Urban men model 4	2,392	202	191	-0.008	-0.171	202	2,061	0.013	0.443
Urban men model 5	50,839	1,877	9,931	-0.003	-0.227	1,877	48,877	-0.001	-0.084
Urban men model 6	25,244	163	519	-0.025	-0.534	163	24,754	-0.014	-0.496
Rural women model 7	4,193	975	952	-0.004	-0.156	975	3198	-0.001	-0.071
Rural women model 8	11,537	696	823	-0.009	-0.370	696	10,721	0.007	0.383
Rural men model 9 <sup>b</sup>	3,752	754	752	-0.029	-1.159	754	2,893	-0.038	-2.285
Rural men model 10 <sup>b</sup>	11,305	529	849	-0.026	-0.947	529	10,668	-0.044	-2.811

Note: For definitions of sub samples of states, see Table 3.

<sup>a</sup> ATT means average treatment effect on the treated.

<sup>b</sup> Tests for these two models result in negative but insignificant coefficients under radius matching.

participation responds to persistent remittances from household members working in the United States. The total effect of remittances is the combined effect of the two. Labor force participation may respond to the removal of a household member from the home if household members are complements or substitutes in the labor market. If the migrant was the employer of other household members, there may be a negative effect, and if the migrant leaves a job that another household member may be invited to fill, there may be a positive effect.

To test these two hypotheses we redefined the treatment and the comparison group in each case.<sup>16</sup> In the interest of brevity we do not report details on these results, except to say that we found migration to have significant effects on labor force participation in three of the ten models. In the case of models 3 and 5, which apply to urban areas, we found positive effects, and in the case of model 9 we found a negative effect. The effect of remittances and the combined effect of migration and remittances turn out to be insignificant in models 5 and 9. On the other hand, the effect of remittances among migrant household members is significant only in model 3. This indicates that testing our original hypothesis on a more restrictive sample—that of households with migrants, leads to the same result. In short, persistent remittances are found to increase labor force participation in the case of urban women in low migration states. We are still left with no simple explanation for this result. One possibility is that remittances improve female household members' labor market opportunities through the establishment of family enterprises in urban areas with low incidence of migration.

## 6. FINAL COMMENTS

This paper contributes to the literature on migration and remittances by studying the impact of persistent remittances on labor force participation of household members staying behind. We use a survey applied to Mexican households in 2002. We do observe some households that receive persistent remittances and others that do not, but a direct com-

parison of them leads to an identification problem because the presence of persistent remittances may be correlated with unobserved determinants of participation among these household members. To overcome this potential bias, we use propensity score matching to find a comparison group for individuals in persistent-remittances-recipient households.

Once we control for household location, size, and wealth, and we take care of individual characteristics typically linked to labor force participation decisions, we find no systematic differences in labor force behavior associated to remittances. The evidence presented is consistent with remittances having a "neutral effect" on participation—where persistent remittances flows are an integral part of a household strategy to generate income, and the emigrant worker is a member of the household who is remitting to replace his/her lost contribution to the household due to emigration.

There is on subgroup for which we find some difference in participation associated to remittances income. The estimated effect for women in the urban areas of sub-sample 3 is positive, suggesting that women in these states (relatively low migration tradition) have higher rates of participation as a result of remittances. The estimated effect is a 5-point higher participation rate. A possible explanation is that remittances improve female household members labor market opportunities, possibly through the establishment of family enterprises.

Observed behavior of remittance-recipient households is consistent with a model in which migrants are household members attempting to replace their pre-migration contributions to the household, without altering significantly the income levels of recipient households. This is not to say that migration and remittances have no effect on recipient households, because those that receive remittances have more diversified sources of income, and remittances can act as insurance.<sup>17</sup> However, if, as suggested by the findings here, the flow of persistent remittances basically replaces lost income, with no significant surplus to alter labor supply price, or to be invested, policy makers must re-think their strategies to foster business creation among migrant families.

## NOTES

1. For example, [Yang and Choi \(2007\)](#) find that remittances from overseas respond to income shocks experienced by Philippine households. Changes in income are found to lead to the changes in remittances in the opposite direction, consistent with an insurance motivation.
2. ENET refers to Encuesta Nacional de Empleo Trimestral, a quarterly employment survey with national coverage, which is collected with a migration module for the first, and only, time in 2002. The survey offers statistical information on employment and aims at improving research on labor market conditions.
3. See, e.g., [Rodriguez and Tiongson \(2001\)](#) and [Funkhouser \(1992\)](#).
4. ENIGH stands for Income-Expenditure National Household Survey.
5. According to the Survey by [IADB \(2003\)](#) only about 20% of remittances are received through Western Union offices.
6. Estimates based on the 2002 ENIGH as reported by [Amuedo-Dorantes and Pozo \(2005\)](#) indicate that average levels of non-labor income among remittances recipient households reach 941 pesos per month (just above a monthly minimum wage), while average non-labor incomes among non-recipient household reach 657 pesos per month. The same paper reports that average *per capita* remittances among 12–64 year olds in recipient households are 520 pesos per month (std = 710). [Zarate-Hoyos \(2004\)](#) uses ENIGH 89 to examine consumption patterns of recipient households *versus* non-recipient and reports an average amount of remittances for recipient households of \$476 per month—the equivalent of a monthly minimum wage.
7. Evidence from other countries suggests that the cross-household dispersion of remittances received is narrower than that of household income (see, e.g., [Cox Edwards and Ureta \(2003\)](#)). If remittances lift poorer households up in the income distribution, and in so doing increase the reservation wage of the corresponding members, relative to non-recipients, we can expect some negative effects of remittances on labor force participation among poorer households and little or no effect of remittances on labor force participation of high-income households. However, we were unable to test for differential effects by educational level in our empirical work.
8. See [Ichino and Mealli \(2005\)](#).
9. Baja California del Sur migrants are often commuter migrants who cross US-Mexico border on a daily basis. They may not see their earnings as remittances.
10. The link between household size and migration is also highlighted in [Funkhouser \(2006\)](#).
11. We defined state-sets dummies, after testing for differences in single-state coefficients. Urban areas were classified into six sets from high to low incidence of persistent remittances as follows. URB\_1: Michoacán; URB\_2: Guanajuato, San Luis, Aguascalientes, Morelos, Durango, Nayarit, Zacatecas; URB\_3: Querétaro, Guerrero, Oaxaca, Hidalgo; URB\_4: Jalisco, Puebla, Chihuahua, Tlaxcala, Coahuila, Sonora, Veracruz, Sinaloa, Sonora, Tamaulipas, Colima, Tabasco; URB\_5 Chiapas, Baja California Norte, Nuevo León, Distrito, Mexico; and URB\_6: Baja California Sur, Quintana Roo, Tabasco, Campeche, Yucatan. Similarly, rural households were classified in six different state sets, also from high to low incidence of persistent remittances: RUR\_1: Guanajuato; RUR\_2: Zacatecas; RUR\_3: San Luis, Aguascalientes, Durango, Michoacán, Morelos, Nayarit; RUR\_4: Jalisco, Querétaro, Sinaloa, Hidalgo; RUR\_5: Oaxaca, Chihuahua, Baja California Norte, Puebla, Sonora, Campeche, Coahuila, Guerrero; and RUR\_6: Tamaulipas, Tlaxcala, Mexico, Colima, Nuevo León, Veracruz, Tabasco, Quintana Roo, Yucatan, Baja California Sur, Chiapas. Detail on the incidence of persistent remittances by state set is offered in Table 3.
12. See [Tables 4A and 4B](#) for a comparison of means of observables across the various samples.
13. Results are available from the authors upon request.
14. Number of observations and mean values of variables within each model are reported in [Tables 4A and 4B](#).
15. We use analytical random draws standard errors, as the bootstrap variance estimator has been proved to be invalid for nearest neighbor matching ([Abadie & Imbens, 2006](#)).
16. In the case of hypothesis (a) the treatment is defined as “household member migrated to USA between 1997 and 2002” and the comparison group is defined as “no household member migrated to USA in the period 1997–2002”. In the case of hypothesis (b) the treatment is defined as “individual received persistent remittances from a member in the USA” and the comparison group is “individual did not receive persistent remittances although one of the household members migrated to USA between 1997 and 2002.”
17. See for example [Yang and Choi \(2007\)](#).

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