



## The impact of remittances on domestic tourism in Mexico

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### ARTICLE INFO

#### Keywords:

Remittances  
Domestic tourism  
Consumption  
Treatment  
Multi-treatment  
Mexico

### ABSTRACT

In this paper we use data from the National Household Income and Expenditure Survey for the years 2010, 2012, 2014 and 2016 to evaluate the impact of internal and international remittances on Domestic Tourism Consumption in Mexico. Using treatment and multi-treatment techniques, the results of this research show that the reception of remittances has a positive impact on tourism spending. In fact, the probability that a household will spend on domestic tourism doubles if it receives international remittances compared to internal remittances. Overall, these results allow us to suggest policy measures aimed at promoting mechanisms that encourage migrants to channel remittances toward local tourism consumption.

### Introduction

Growth in migration and tourism are two of the most significant aspects of globalization. Both phenomena involve the movement of people and monetary resources; however, little research is currently being carried out on the migration-tourism nexus. Migration itself creates an international labor market which leads to a flow of income that is transferred back to the migrants' countries of origin in the form of remittances.<sup>1</sup> In 2015, the World Bank estimated that the total amount of remittances ascended to US \$580 billion, with 75.5% of this being sent to developing countries (World Bank, 2016). The relationship between international remittances and developing countries is significant, and this monetary flow has increased at an extraordinary rate from 2005 to 2015.<sup>2</sup> Additionally, international tourism remains the world's largest and fastest growing economic sector, accounting for 30% of the world's service exports and nearly 7% of the total global exports of goods and services (WTTC, 2017). Also, International tourism arrivals have grown by 29.5% internationally since 2010 (UNWTO, 2017).

Remittances sent home by migrants to developing countries are a key issue in economic development. This increase in monetary transfers has motivated many social researchers to study the effects remittances have in both origin and destination countries (Adams, 2011; Adams & Cuecuecha, 2013; Azizi, 2018). The basis for many studies is to find out if remittances influence the economic development of migrant-sending countries (Adams, 2011; Azizi, 2017; De Haas, 2010; Genç, 2013). In addition, several studies have suggested that there is no automatic mechanism through which remittances help to improve the economic development of origin regions (Clément, 2011; Yang, 2011). Beyond their quantitative importance, the possible impact of remittances should be viewed in

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<sup>1</sup> Remittances generally refers to monetary and in-kind transfers sent to households by migrants working outside of their birthplace. (Adams & Cuecuecha, 2013; BBVA Bancomer Foundation & CONAPO, 2017).

<sup>2</sup> The flow of remittances to developing countries grew 125% during this period (World Bank, 2017).

terms of their use in a diverse context, since they can have multiplier effects on the local economy and even impact tourism dynamics (Cerón & Mora, 2014; Docquier, Rapoport, & Salomone, 2012; Manic, 2017).

This paper aims to evaluate the impact of internal and international remittances on Domestic Tourism Consumption (DTC) in Mexico and attempts to answer the following two questions: do received remittances increase DTC in Mexico?, and is there a differential impact on DTC according to the different types of remittances (internal versus international) received? The answers to these questions contribute to the scarce literature on the remittances-tourism nexus. A fundamental aspect in studying the effects of remittances on development in origin countries is the effect these resources have on the expenditure patterns of remittance-receiving households (RRH). The impact of remittances on development can be identified through increasing human capital, improving health indicators and decreasing poverty levels (Adams & Page, 2005; Docquier et al., 2012; Yang, 2011). In addition, remittances can generate impacts on different productive and recreational activities that, in turn, trigger greater multiplier effects of development, such as tourism (Kumar, 2014; Marschall, 2017a).

Many economic decisions involve a problem of self-selection. This means that the analyzed units have the possibility of deciding whether or not to participate in different events that impact their standard of living (Heckman, 1979). Therefore, analyzing the effect of remittances on DTC is subject to the challenge of selection bias, which means households receiving remittances might have some characteristics which are different from households not receiving remittances. To address this issue, this paper employs propensity score matching (PSM) (Imbens, 2000; Rosenbaum & Rubin, 1983) and inverse probability weighting (IPW) (Horvitz & Thompson, 1952; Lopez & Gutman, 2017), two methodologies that allow us to obtain unbiased estimates of the effects of remittances on DTC. By implementing PSM we seek to study the impacts of internal and international remittances on DTC, and by implementing the IPW technique we analyze the possibility that there is a differentiated effect between receiving international or internal remittances on DTC.

Although PSM and IPW are not the only two methodologies that allow us to correct the selection bias problem (e.g. differences-in-differences, instrumental variables or regression discontinuity (Angrist & Pischke, 2009; Imbens & Wooldridge, 2007)), given the nature of the available data and the purpose pursued by this research, we considered them as the best option. To implement the aforementioned methodologies, we used the National Survey of Household Income and Expenditures (ENIGH, its Spanish acronym) for 2010, 2012, 2014 and 2016. The survey contains information about households, including the individuals' socioeconomic backgrounds, sources of income, and expenses (INEGI, 2014).

This research is important for several reasons. First, Mexico receives more remittances than any other country in Latin America by far and is ranked fourth in the world (World Bank, 2016). Furthermore, tourist arrivals peaked at US \$39.3 million with receipts of around US \$21.3 billion in 2017 compared to US \$11.9 billion in 2010, with visitor arrivals of 23.3 million (BANXICO, 2018). Secondly, although there are some studies that examine the migration-tourism relationship (Balli, Balli, & Louis, 2016; Timcák, Jablonská, & Ondrejová, 2017), there are very few studies that also analyze the remittances-tourism nexus (Kumar, 2014; Kumar, Naidu, & Kumar, 2011; Reyes, Mata, Gijón-Cruz, Cruz, & López, 2009). Third, this paper is the first to implement two treatment effects methodologies to evaluate the impact of remittances on DTC and is also the first to use a multi-treatment technique to estimate the differentiated impact between receiving international and internal remittances on DTC. Lastly, understanding this issue is also important in the context of Mexican policymaking because it allows us to suggest measures aimed at promoting development in remittance-receiving communities through the multiplier effects generated by these resources, including the expansion of domestic tourism.

The results found when implementing PSM show evidence that receiving remittances (both internal and international) has a positive impact on DTC. In fact, the probability that a household will spend on domestic tourism doubles if it receives international remittances compared to internal remittances. These findings are robust across alternative matching algorithms and are consistent over the years. On the other hand, when using IPW to identify if there is a differentiated effect between receiving internal or international remittances, the estimates did not show statistically significant evidence, suggesting that the effect of remittances on DTC is not differentiated by type of remittances.

The rest of the paper is structured as follows. The next section contains a review of relevant literature. The methods and data used in the empirical study are examined in Section 0. Section 0 reports and discusses the results generated. The conclusions along with the policy recommendations and potential future developments are presented in Section 0.

## Literature review

### *The migration - tourism nexus*

In a world with high mobility of people, both migration and tourism are its main manifestations. The tourism-migration relationship has been the core of some articles in economics and tourism academic journals (Dwyer, Seetaram, Forsyth, & King, 2014; Marschall, 2017a; Timcák et al., 2017). The topics addressed in these studies focus on how migration-related population movements have influenced their origin and destination countries (Balli et al., 2016; UNWTO, 2009).

According to the World Tourism Organization (2009), the relationship between migration and tourism is circular, i.e. in both directions (Williams & Hall, 2000). On one hand, when family members decide to travel to a foreign country, they generally create networks and gain knowledge that enables them to migrate (Timcák et al., 2017; UNWTO, 2009). In other words, tourism encourages migration (Gheasi, Nijkamp, & Rietveld, 2011; Haug, Graham, & Mehmetoglu, 2007; O'Reilly, 2003). On the other hand, migrants who leave their communities have a strong desire to return home and visit their families and friends (Dwyer et al., 2014; Gheasi et al., 2011; Massidda, Etzo, & Piras, 2014). Studies by Marschall (2017a, 2017b) for South Africa, Timcák et al. (2017) for the European

Union, Dwyer et al. (2014) and Huong and King (2002) for Australia, Feng and Page (2010) for New Zealand, and Balli et al. (2016) for the OECD countries, have all investigated the temporary home visits of transnational migrants to their origin countries to discover the primary determinants for their travel.

Conversely, family members in origin countries also want to visit their migrant relatives living in host countries (Balli et al., 2016; Feng & Page, 2010; Genç, 2013; Leitão & Shahbaz, 2012; O'Reilly, 2003), which generates an entirely new inbound touristic demand (Etzo, 2016; Massidda et al., 2014; Seetaram, 2012). Massidda et al. (2014) suggest that the presence of an intense migration in Italy is not only the result of visits to friends and relatives, but extends to inbound tourism, such as holiday or business. More recently, Etzo (2016) revealed that the stock of immigrants in Japan represents an important determinant in inbound tourism flows. Thus, migration affects not only outbound tourism, but also inbound tourism. Studies by Oigenblick and Kirschenbaum (2002) and Forsyth, Dwyer, Seetaram, and King (2012) found that migration had a positive impact on tourism demand in host countries.

The impacts analyzed in the recent investigations focus on the origin of migration and tourism in several countries (Balli et al., 2016; Gheasi et al., 2011; Massidda et al., 2014; Timcák et al., 2017); the increasing outbound and inbound demand (Dwyer, Forsyth, King, & Seetaram, 2010; Etzo, 2016; Leitão & Shahbaz, 2012; Massidda et al., 2014; Seetaram, 2012); and the ties and benefits that migration engenders, such as the flow of remittances to home countries (Cerón & Mora, 2014; Kumar, 2014; Marschall, 2017a).

#### *The link between remittances and tourism*

The role of migrant communities in the development of sending countries is gradually being recognized (Adams, 2011; Gheasi et al., 2011), especially because of remittances flows, but also due to their impact on the process of sociocultural transformation through the introduction of new consumption patterns which are reflected in the large amounts of money spent by migrants in their origin countries (Mora & Arellano, 2016; Perelló, 2011).

Remittances and tourism can have a positive effect on the development of sending countries (Kumar, 2014; Kumar et al., 2011; Taylor & Mora, 2006; Woodruff & Zenteno, 2007). Kumar (2014) studied the effects of remittances and tourism on Kenya's economic growth, showing that tourism receipts have a marginal net negative impact in the short-run, but a positive effect in the long-run. Remittances, on the other hand, have a net positive effect in the short-run, but a negative effect in the long-run. The author concludes that Kenya needs to link tourism and remittances, at least from the macroeconomic management perspective. In a similar study performed in Vanuatu, Kumar et al. (2011) proved that remittances have a positive and statistically significant effect on the long-run growth of the economy while tourism expansion is not statistically significant.

In Mexico, some studies have documented how remittances drive tourism activities by increasing revenues and promoting the creation of better touristic destinations (Cerón & Mora, 2014; García & Sánchez, 2008; Reyes et al., 2009). For example, Cerón and Mora (2014) found that migrant households spend part of their remittances on tourism activities. The authors noted that most remittance recipient households belong to the lower-income segments of the population. Thus, remittances encourage the low-income population to travel, which increases inbound tourism. However, Cerón and Mora's (2014) study has some limitations, including the use of a single wave of the ENIGH, and the fact that no differentiated effects are identified by type of remittances (internal and international)—both factors which have been overcome in this investigation. García and Sánchez (2008) examine the process through which remittances stimulate the transformation of the urban image of local towns in Michoacán, which constitutes the basis for their touristic potential. Results from investigations carried out by Cohen and Rodríguez (2005) and Gullette (2009) show that remittances invested in Oaxaca's tourism industry in local projects have had little influence over migration rates. Lastly, a case study in the state of Oaxaca compares the economic impacts of international family remittances versus nostalgia tourism earnings (Reyes et al., 2009). The author found that nostalgia tourism has specific impacts, including encouraging local production (livestock, commerce and services), while remittances raise households' consumption and living standards.

#### *Tourism and remittances research using PSM*

The PSM methodology allows estimating the effect of a treatment (intervention) applied to an objective group (households, individuals, etc.)—when the treatment is not randomly assigned—on one or more outcome variables (Imbens, 2000; Rosenbaum & Rubin, 1983). In this research, remittances are considered as the treatment, where the treated group is made up of remittance receiving households and the control group of all those that do not receive remittances.

Within the set of research that implements PSM to analyze the effects of remittances on development variables such as poverty or inequality, the following studies are important to mention. Démurger and Wang (2016), who analyze whether receiving internal remittances has any effect on rural households in China; the authors find a positive impact on the consumption behavior and investment expenses, yet they do not find favorable effects in education. In Africa, Franssen and Mazzucato (2014) investigate the effect of international remittances on poor and rich households of Burundi, finding that, for the first group of households, remittances have a positive impact on their standards of living and food security conditions, while for the second group, remittances improve their access to financial services.

In Mexico, Cox-Edwards and Rodríguez-Oreggia (2009) find evidence that international remittances sent to Mexican households limit their participation in the labor force, a result that is consistent with the fact that remittances are an integral part of the income generation strategy of households. In another study, Esquivel and Huerta-Pineda (2007) evaluate the effect of international remittances on three categories of poverty: food-based, capabilities-based and assets-based. The authors find that international remittance receiving households are less likely to be poor compared to those that do not receive remittances.

Finally, within the reviewed literature, it was possible to identify some studies that use the PSM technique to analyze the effects of

tourism on certain outcome variables (Blackman, Naranjo, Robalino, Alpizar, & Rivera, 2014; Falk, 2017; Yang, Tan, & Li, 2019). Yang et al. (2019) analyze the impact of the demand for tourists purchasing timeshares compared to those staying in hotels on the satisfaction of their respective trips, with the authors finding no significant differences among tourists in the United States. Falk (2017) concludes that lift-linkages or expansions in ski areas in Austria raise the number of overnight stays of tourists by 12% compared to areas that previously did not have these combinations of connected slopes. Finally, Blackman et al. (2014) find that hotels that are certified in the Blue Flag Beach program in Costa Rica have greater incentives to increase their investment compared to those that do not get certified since the tourist consumption is more attractive for certified hotels.

## Data and methods

### Data sources

The database for this paper comes from the ENIGH for the years 2010, 2012, 2014 and 2016.<sup>3</sup> The main objective of this survey is to identify the amount, structure and distribution of income and expenditure within each household. It also allows us to obtain information about every individual in the household, such as their roles (head, spouse, etc.), economic activities, as well as socio-economic characteristics (age, gender, schooling level, occupation, etc.) (INEGI, 2014). The survey is representative on both national and urban/rural levels. Once all sources of income are identified, it is possible to classify each household's remittance-receiving condition.<sup>4</sup>

As is mentioned above, only DTC was considered in this research, and according to the Tourism Satellite Account of Mexico, this concept represents the consumption of resident visitors within the country of reference, in our case Mexico (INEGI, 2013). As such, the items considered as domestic tourism expenditures included foreign transport, railway transport, air transport, freeway fees, vehicles rental, tourist packages, lodging, accommodation and tours.

Data on remittances includes transfers of three types: (1) money (cash); (2) non-food goods; and (3) food items. Most remittances come in cash; however, although less representative, there are also non-food goods and food remittances. While non-food goods and food remittances are less important in absolute terms, including them in the analysis is crucial because it allows us to more accurately approximate the total flow of remittances received by a household. In this research, each RRH—both internal or international—is assumed to receive exactly the amount reported in the ENIGH.

### Descriptive statistics

Table 1 presents a detailed explanation of the variables used in this paper. The variables *sex of household head*, *age of household head*, *marital status*, *years of completed schooling*, *employed*, *area of residence*, *household size*, *minors*, *home ownership status*, *government transfers*, *indigenous housing*, *sewer system*, *piped water service*, *cooking fuel*, *traditional region*, *north region*, *center region* and *south-southeast region* are used as independent variables in econometric estimations, while the variable *tourist expenses*, which identifies if the household spent on domestic tourism, is used as the outcome variable.

The statistics presented in Table 2 allow the identification of interesting differences between six groups of households.<sup>5</sup> The purpose of showing these average values is to illustrate the contrasts that exist in some of our interest variables among the groups of households analyzed. Of the 126,447 households in the sample, 29.12% spend on DTC as opposed to 70.88% that do not. 6790 households (5.37%) receive international remittances, and almost 30% of these spend on DTC (2021). Similarly, 23,908 (18.91%) receive internal remittances, and 7143 (5.65%) receive internal remittances and spend on tourism.<sup>6</sup> With regard to human capital, it is worth highlighting that households receiving international remittances (IRRH) have, on average, the lowest level of schooling (5.82) in contrast with the highest level (10.07), which corresponds to the households spending on DTC. An important point to note is that the level of schooling is higher in households receiving internal remittances and spending on tourism than international ones spending on tourism.

The data from Table 2 also shows that although the number of households receiving internal remittances (InRRH) is greater than the number of IRRH, these resources account for a much larger share of the monthly per capita income in the second group compared to the first one (60.70% vs 31.40%). For households that do not spend on DTC, remittances make up 8.69% of the monthly per capita income versus 6.69% of that for households spending on DTC. On average, when compared to the other five groups, IRRH have fewer working heads of households (62.39%) and are less likely to live in urban areas (46.04%). Finally, the household socio-demographic characteristics also include: household size (averaging 3.71 and 3.56 for IRRH and InRRH, respectively; and 3.74 for the whole sample); age of the household head (53.60, 52.61 and 48.78 years, respectively); and male-headed household (58.23%, 58.00% and

<sup>3</sup> The number of households in the sample for the years 2010, 2012, 2014 and 2016 was 27,655; 9002; 19,479 and 70,311, respectively. For more details about the differences in the sample size of the survey see <https://www.inegi.org.mx/programas/enigh/nc/2016/default.html>.

<sup>4</sup> In 2010, the number of households receiving internal (InRRH), international (IRRH) and not-receiving (NRRH) remittances was 4863; 1267 and 21,525. For 2012, those numbers were 1888; 507 and 6607. In 2014, the numbers were 3662; 888 and 14,929. Finally, for 2016, those figures were 13,495; 4128 and 52,688 respectively.

<sup>5</sup> See the headings of Table 2. For more details on descriptive statistics, see Annex 3.

<sup>6</sup> Since we are interested in working with three mutually exclusive groups of households, in all the tables RRH that receive transfers from internal and international sources were considered solely as IRRH. We proceeded in this way because the literature indicates that entering the international labor market entails higher transaction costs (Massey et al., 1993).

**Table 1**

Variable definition.

Source: Own elaboration based on ENIGH 2010, 2012, 2014 and 2016 data.

Variable name	Definition
Tourist expenses	A binary variable that takes the value 1 if the household spent on domestic tourism and 0 otherwise.
Sex of household head	A binary variable that takes the value 1 if the household head is male and 0 if female.
Age of household head	Age of household head (in years).
Marital status	A binary variable that takes the value 1 if the household head is married or in union and 0 otherwise.
Years of completed schooling	Years of completed schooling of the household head.
Employed	A binary variable that takes the value 1 if the household head is currently working and 0 otherwise.
Area of residence	A binary variable that takes the value 1 if the household is located in an urban area and 0 if it is located in a rural area.
Household size	Number of members in the household.
Minors	A binary variable that takes the value 1 if the household has members under 12 years and 0 otherwise.
Home ownership status	A binary variable that takes the value 1 if own and 0 otherwise.
Government transfers	A binary variable that takes the value 1 if any member in the household receive government transfers and 0 otherwise.
Indigenous housing	A binary variable that takes the value 1 if any member in the household speaks an indigenous language and 0 otherwise.
Sewer system	A binary variable that takes the value 1 if the household has a sewer system and 0 otherwise.
Piped water service	A binary variable that takes the value 1 if the household has piped water inside the dwelling and 0 otherwise.
Cooking fuel	A binary variable that takes the value 1 if the household uses gas to cook or heat food and 0 otherwise.
Traditional region	A binary variable that takes the value 1 if the household is located in Aguascalientes, Colima, Durango, Guanajuato, Jalisco, Michoacán, Nayarit, San Luis Potosí or Zacatecas, and 0 otherwise.
North region	A binary variable that takes the value 1 if the household is located in Baja California, Baja California Sur, Coahuila, Chihuahua, Nuevo León, Sinaloa, Sonora or Tamaulipas, and 0 otherwise.
Center region	A binary variable that takes the value 1 if the household is located in Morelos, Querétaro, Tlaxcala, Puebla, Hidalgo, Ciudad de México or Estado de México, and 0 otherwise.
South-southeast region	A binary variable that takes the value 1 if the household is located in Campeche, Chiapas, Guerrero, Oaxaca, Quintana Roo, Tabasco, Veracruz or Yucatán, and 0 otherwise.

74.32%).

### Methodology

The basic idea is to assume that receiving remittances is like a “treatment,” meaning that what we want to measure is the impact of that treatment on an outcome variable. To achieve this, it is necessary to estimate the difference in the outcome variable, i.e. DTC attributed to the fact of receiving remittances. First, we compare the probability of RRH versus not-receiving remittances households (NRRH) engaging in DTC. Next, we extend the analysis to a multi-treatment model, comparing the probability of carrying out DTC between INRRH, IRRH and NRRH.

#### Propensity score matching (PSM) for a binary treatment

One way to estimate the difference between RRH and NRRH on DTC is through the standard approach of matching [Rubin \(1973\)](#). According to this approach, for each household  $i$ , with  $i = 1, 2, \dots, N$ , the treatment effect,  $\Delta_i$ , can be defined as the difference between “treated” and “untreated”:

$$\Delta_i = Y_{1i} - Y_{0i} \quad (1)$$

where  $Y_{1i}$  and  $Y_{0i}$  denote the potential outcomes for treated and non-treated households, respectively. For each household  $i$ , it is only possible to observe one result, while the other is counterfactual scenario that cannot be obtained from the data.

Following [Ghalib, Malki & Imai \(2015, p. 91\)](#), Eq. (1) needs to be modified in such a way as to allow estimating the average treatment effect on the treated,  $ATT$ , which can be expressed formally as:

**Table 2**

Mean values for selected variables.

Source: Own elaboration based on ENIGH 2010, 2012, 2014 and 2016 data.

Variables	Total households	Households spending on DTC	Households not spending on DTC	Households receiving international remittances	Households receiving international remittances and spending on DTC	Households receiving internal remittances	Households receiving internal remittances and spending on DTC
Observations	126,447	36,826	89,621	6790	2021	23,908	7143
Monthly household income (pesos)	15,627	23,434	12,420	12,896	16,881	13,553	18,920
Monthly per capita income (pesos)	5206	7923	4090	4229	5400	4523	6051
Remittances as percent of monthly per capita income (percentage)	7.81	6.69	8.69	60.70	55.40	31.40	31.17
<b>Household head characteristics</b>							
Sex of household head	0.74	0.75	0.74	0.58	0.60	0.58	0.60
Age of household head	48.79	47.53	49.30	53.60	52.31	52.61	48.78
Marital status	0.71	0.71	0.71	0.68	0.70	0.57	0.59
Years of completed schooling	8.12	10.07	7.32	5.82	6.78	7.28	9.09
Employed	0.79	0.81	0.78	0.62	0.67	0.64	0.71
<b>Household characteristics</b>							
Area of residence	0.68	0.76	0.65	0.46	0.51	0.69	0.76
Household size	3.74	3.69	3.75	3.71	3.86	3.56	3.71
Minors	0.48	0.45	0.50	0.48	0.48	0.46	0.47
Home ownership status	0.63	0.60	0.65	0.72	0.70	0.63	0.58
Government transfers	0.32	0.23	0.35	0.48	0.44	0.37	0.29
Indigenous housing	0.11	0.10	0.12	0.07	0.06	0.11	0.10
Sewer system	0.92	0.95	0.91	0.91	0.92	0.93	0.95
Piped water service	0.69	0.79	0.66	0.65	0.67	0.69	0.77
Cooking fuel	0.80	0.85	0.78	0.76	0.78	0.79	0.84
<b>Regional characteristics</b>							
Traditional region	0.25	0.27	0.25	0.54	0.57	0.27	0.31
North region	0.26	0.26	0.26	0.16	0.15	0.25	0.24
Center region	0.20	0.20	0.21	0.13	0.12	0.18	0.18
South-southeast region	0.26	0.25	0.26	0.16	0.16	0.28	0.27

Note 1: See Table 1 for variable definitions.

Note 2: Income data are in constant values (December 2010 = 100).

$$ATT = E(\Delta | D = 1) = E(Y_1 | D = 1) - E(Y_0 | D = 1) \tag{2}$$

where *ATT* measures the difference between the expected outcome with and without treatment for those households that received the treatment and *D* is an indicator variable of the state (*D* = 1 when the treatment was received and *D* = 0 when it was not). Eq. (2) has the problem of unobservability, that is, without additional assumptions it is not possible to estimate the term  $E(Y_0 | D = 1)$ , the hypothetical outcome that would have been obtained if the treated households had not received the treatment. Eq. (2) can be expressed as follows:

$$E(Y_1 | D = 1) - E(Y_0 | D = 0) = ATT - [E(Y_0 | D = 0) - E(Y_0 | D = 1)] \tag{3}$$

where the terms  $E(Y_1 | D = 1)$  and  $E(Y_0 | D = 0)$  can be estimated, but these do not provide the *ATT*. Moreover, this effect can only be identified when the bias is zero, that is, when  $E(Y_0 | D = 1) = E(Y_0 | D = 0)$ . However, when working with non-experimental data, this condition generally does not hold, since the variables that determine the participation decision also contribute to explain the outcome variable. Therefore, the outcome for treated households will be different even in the absence of the treatment, leading to a self-selection bias problem.

To obtain unbiased estimates of the *ATT*, the literature suggests implementing propensity score matching (PSM) (Abadie & Imbens, 2011; Rosenbaum & Rubin, 1983; Rubin, 1973). This method requires two fundamental assumptions: *exogeneity of the treatment* and *overlap*.

The exogeneity assumption implies that the difference in potential outcomes—with and without treatment—is due only to the implementation of the treatment conditional on a covariates vector *X*. Moreover, the set of covariates that make up this vector is not affected by the treatment and it is assumed that it has been totally captured in the model, meaning that there are no omitted variables. Formally, this assumption is defined as follows:

$$\{Y_0, Y_1\} \perp D | \mathbf{X} \tag{4}$$



The overlap assumption rules out the perfect predictability of participation conditional on the vector  $\mathbf{X}$ , and guarantees that all households with the same characteristics within the sample have a positive probability of being treated or untreated (Ghalib et al., 2015, p. 93):

$$0 < P(D = 1 | \mathbf{X}) < 1 \tag{5}$$

Instead of conditioning in the vector  $\mathbf{X}$ , the *ATT* can be estimated using PSM, which allows solving the dimensionality problem that arises when  $\mathbf{X}$  has too many components. The propensity score suggested by Rosenbaum and Rubin (1983) is defined as a function that estimates the probability of receiving the treatment given the vector of covariates  $\mathbf{X}$ , previously observed:

$$\tau(\mathbf{X}) = P(D = 1 | \mathbf{X}) \tag{6}$$

In other words,  $\mathbf{X}$  is being summarized into a single number  $\tau$ . This number can be estimated using a probit or logit model, which allows predicting the probability that a household has received internal or international remittances based solely on its own characteristics. As shown by Rosenbaum and Rubin (1983), the propensity score resulting from the estimation of Eq. (6) satisfies the exogeneity assumption, which implies in this case that potential outcomes are independent of the treatment conditional on the propensity score  $\tau(\mathbf{X})$ . If, in the same way, the overlap assumption is satisfied, then it is ensured that all households with the same characteristics in the sample have a positive probability of being treated or untreated. Therefore, the PSM estimator of *ATT* is selection-bias free:

$$ATT^{PSM} = E_{\tau(\mathbf{X})|D=1} [E(Y_1 | D = 1, \tau(\mathbf{X})) - E(Y_0 | D = 1, \tau(\mathbf{X}))] \tag{7}$$

There are several matching algorithms that are used to estimate the *ATT* (Becker & Ichino, 2002; Cameron & Trivedi, 2010). In this study, we report the results for three of them: *nearest neighbour*, *kernel* and *radius* matching. The above allow us to compare the results and at the same time test the robustness of the estimated impacts.

*Inverse probability weighting for multiple treatments*

To estimate the impact of receiving remittances on the probability of a household doing DTC but distinguishing between IRRH and InRRH, it is necessary to broaden the basic idea of the propensity score to allow an analysis with multiple treatments, that is to say, a situation in which we observe, for each household, a level of treatment  $D = t$ , where  $t \in T = \{0, 1, \dots, K\}$  for  $K > 1$  levels of treatment (Hirano & Imbens, 2004; Imbens, 2000).

As with binary treatments, the problem of self-selection bias also applies here. To be able to identify the treatment impacts, let us suppose that the outcome variable for each treatment level is independent of the treatment, conditional on the set of covariates  $\mathbf{X}$ . Formally,

$$Y(t) \perp D(t) | \mathbf{X} \quad \forall t \in T \tag{8}$$

with  $D(t) = 1$  if the household received the treatment  $D = t$ , and  $D(t) = 0$  if the household received another treatment. Note that this assumption, commonly known as weak unconfoundedness, is less strong than the unconfoundedness assumption imposed in the binary case.

Therefore, the generalized propensity score (GPS) is the conditional probability of receiving a particular level of treatment  $D = t$  given  $\mathbf{X}$ :

$$\tau(t, \mathbf{X}) = P(T = t | \mathbf{X}) \quad \forall t \in T \tag{9}$$

It is possible to estimate the GPS with an appropriate model for the available data. In our case, we have a control group (households that did not receive remittances), and two levels of treatment—internal and international remittances ( $K = 2$ ). Then, using a discrete choice model is the most obvious, and, given that there is no natural order in the three options, the multinomial logit model seems to be the most appropriate.

Instead of using the matching method applied in the binary treatment case, one common approach for estimating causal effects with multiple treatments uses the inverse probability of treatment assignment as weights. Formally, this methodology is known as *Inverse Probability Weighting* (Feng, Zhou, Zou, Fan, & Li, 2011; Imbens, 2000; McCaffrey et al., 2013).<sup>7</sup> The weighted sample can be considered as the sample of potential results, replacing the observed sample.

For each treatment level  $t_k \in T = \{0, 1, \dots, K\}$ , the counterfactual result  $Y(t_k)$  can be obtained as:

$$E[Y(t_k)] = E \left[ \frac{D(t_k)Y_i}{\tau(t_k, \mathbf{X}_i)} \right] = \frac{1}{N} \left( \sum_{i=1}^N \frac{D(T_i = t_k)Y_i}{\tau(t_k, \mathbf{X}_i)} \right) \tag{10}$$

that is, weight the observed results with treatment  $t_k$ , weighted by the probability of having observed  $t_k$  given the characteristics  $\mathbf{X}_i$  for each observation.

To estimate the *ATT*, it is necessary to consider the following: 1) define for which pair of treatment levels  $t_1, t_2 \in T$  we want to contrast the results and, 2) set the treatment level that is going to be considered as the starting point. For example, contrasting the potential results under treatments  $t_1$  and  $t_2$  for those households receiving treatment  $t_2$  is given as (Frölich, 2004; Lechner, 2001; McCaffrey et al., 2013; Wooldridge, 2010):

<sup>7</sup> The original idea of *Inverse Probability Weighting* can be found in Horvitz and Thompson (1952).

$$ATT^{GPS} = E_{\tau(t_2, \mathbf{X})|D=t_2} [E(Y(t_2)|D = t_2, \tau(t_2, \mathbf{X})) - E(Y(t_1)|D = t_2, \tau(t_2, \mathbf{X}))] \quad (11)$$

The first term on the right side of Eq. (11) can be easily obtained since  $Y(t_2)$  is observed for those households receiving treatment  $t_2$ ; there is no need to be conditional on the GPS and it can be computed directly:

$$E(Y(t_2)|D = t_2, \tau(t_2, \mathbf{X})) = \frac{1}{N_2} \left( \sum_{i=1}^N D(T_i = t_2) Y_i \right) \quad (12)$$

where  $N_2$  denotes the number of observations that received treatment  $t_2$ . The second term of Eq. (11) is not observable, however it can be estimated from the results for  $Y(t_1)$  of those households receiving treatment  $t_1$  under the aforementioned assumptions, re-weight these with the GPS ratio of the two treatments to ensure that the distribution of the characteristics in the sample receiving treatment  $t_1$  is comparable with that receiving treatment  $t_2$ :

$$E(Y(t_1)|D = t_2, \tau(t_2, \mathbf{X})) = \frac{1}{N_2} \left( \sum_{i=1}^N \frac{\tau(t_2, \mathbf{X}_i)}{\tau(t_1, \mathbf{X}_i)} D(T_i = t_1) Y_i \right). \quad (13)$$

## Results

The previous section describes the methodology used to control the self-selection bias problem in the sample. As we will discuss in this section, statistically significant impacts indicate that differences between treated and untreated households are not due to chance but are attributable to treatment participation (receiving national or international remittances).

### Results using propensity score matching

First, we will share the probit results for the propensity score model to investigate the impacts of receiving remittances on DTC (Tables 3 and 4).<sup>8</sup> The results of the probit models include the main determinants of receiving remittances used in literature (Islas & Moreno, 2011; Pardo & Dávila, 2017; Yang, 2011). A household with a female head is more likely to receive remittances (both national and international), which reflects the evidence that historically, Mexican men have been more likely to migrate than women, fact that is especially important within the context of the country's patriarchal culture. Also, those homes with an older head of household are more likely to receive remittances, suggesting that an important motivation for sending remittances is altruism. In contrast, the probability of receiving remittances decreases with the years of completed schooling of the household head. Marital status has a different behavior when analyzing the determinants of receiving internal or international remittances; being married increases the probability of receiving international remittances and decreases the probability of receiving internal remittances.

There is evidence that households living in rural areas are more likely to receive international remittances than those in urban areas; however, this factor is not significantly associated with the probability of receiving internal remittances. The probability of receiving internal or international remittances is positively associated with the number of minors in the household, which indicates that one additional child left behind increases remittances sent home. All other things being equal, households receiving government transfers are more likely to receive remittances than households not receiving them. Finally, the relation between indigenous housing and receiving international remittances is negative and significant.

Based on the regression results of the probit models in Tables 3 and 4, and with tests showing that both groups (control and treatment) are balanced,<sup>9</sup> the *ATT* and *t*-statistics for InRRH and IRRH were calculated, as shown in Tables 5A and 5B. The dependent variable, *tourist expenses*, is a binary variable that takes the value 1 if the household spent on domestic tourism and 0 otherwise. Considering this, it should be noted that we are estimating the impact of receiving remittances on the probability of engaging in or increasing DTC.

The first row of Tables 5A and 5B shows the impact of international remittances on DTC. The results with the three matching algorithms show that receiving remittances has a positive impact on DTC. These findings are robust across alternative matching algorithms and are consistent over the years. For 2016, the probability increases from 5.08 to 6.26 percentage points (pp hereafter). The *ATT* for 2014 range from 5.40 to 7.38 pp. For 2012, the probability increases in a range of 4.42 to 6.47 pp. Finally, for 2010, the probability increases in a range of 2.63 to 3.76 pp. The *t* critical value confirms that most of these results are statistically significant at 1%. These findings show that there is an important difference in tourism spending behavior across both groups. IRRH showed a much higher probability engaging in DTC than did NRRH.

Tables 5A and 5B also reflect the impact of receiving internal remittances on DTC. The results show that receiving internal remittances has a positive and statistically significant impact on the probability of doing DTC. Depending on the matching method used, the probability increases on average by 3.11 pp (nearest neighbour), 2.84 pp (kernel) and 3.07 pp (radius).

Overall, these results are consistent with previous studies which argue that remittances and tourism can have a positive effect on economic development (Adams & Page, 2005; Azizi, 2018; Cerón & Mora, 2014; Kumar, 2014; Kumar et al., 2011; Lázaro, Escobar,

<sup>8</sup> The command employed in STATA ("psmatch2") uses a probit model by default to compute the Propensity Score Matching (PSM) first stage scores (Leuven & Sianesi, 2003). However, to check the robustness, Tables 3 and 4 were replicated using a logit model. The outcomes did not show significant differences when compared to the original estimation, which confirms the robustness of the results.

<sup>9</sup> Covariates imbalance test and overall imbalance test are shown in Annex 1.



**Table 3**

Results of probit model on the determinants of receiving international remittances.

Source: Own elaboration based on ENIGH 2010, 2012, 2014 and 2016 data.

Variables	2010	2012	2014	2016
	Marginal effects			
Sex of household head	−0.0410 (−7.68)***	−0.0393 (−6.29)***	−0.0283 (−7.90)***	−0.0340 (−14.25)***
Age of household head	−0.00004 (−0.34)	0.0001 (0.73)	0.0001 (0.70)	0.0001 (1.59)
Marital status	0.0232 (4.17)***	0.0137 (2.16)**	0.0190 (4.78)***	0.0215 (8.20)***
Years of completed education	−0.0020 (−6.07)***	−0.0021 (−4.08)***	−0.0025 (−8.04)***	−0.0018 (−9.18)***
Employed	−0.0270 (−7.13)***	−0.0011 (−0.20)	−0.0113 (−3.62)***	−0.0157 (−7.15)***
Area of residence	−0.0291 (−8.65)***	−0.0249 (−5.52)***	−0.0317 (−10.70)***	−0.0324 (−18.48)***
Household size	−0.0016 (−1.73)*	0.000007 (0.00)	−0.0029 (−3.32)***	−0.0006 (−1.15)
Minors	0.0069 (1.86)*	0.0061 (1.02)	0.0084 (2.47)***	0.0045 (2.05)**
Home ownership status	−0.0040 (−1.13)	0.0076 (1.59)	−0.0008 (−0.27)	−0.0003 (−0.18)
Government transfers	0.0059 (1.70)*	0.0120 (2.35)**	0.0061 (2.03)**	0.0089 (4.58)***
Indigenous housing	−0.0139 (−2.76)***	−0.0128 (−2.06)**	−0.0166 (−3.51)***	−0.0147 (−4.93)***
Traditional region	0.0363 (8.55)***	0.0396 (7.27)***	0.0268 (7.53)***	0.0356 (15.96)***
North region	0.0019 (−0.37)	−0.0037 (−0.56)	−0.0004 (−0.09)	0.0022 (0.86)
Center region	0.0006 (0.14)	0.0002 (0.03)	−0.0048 (−1.18)	−0.0191 (−6.81)***
Sewer system	0.0037 (0.80)	−0.0041 (−0.68)	0.0032 (0.66)	0.0097 (3.20)***
Piped water service	−0.0091 (−2.44)**	0.0050 (0.94)	0.0064 (1.98)**	0.0008 (0.38)
Cooking fuel	0.0069 (1.72)*	0.0125 (2.19)**	−0.0019 (−0.53)	0.0007 (0.31)

\*\*\*significant at 1%, \*\*significant at 5% and \*significant at 10%.

Note 1: Numbers in parentheses are z scores.

Note 2: The probit model was estimated using robust standard errors and expansion factors.

Ramírez, Nájera, & Rabadán, 2018; Mora & Arellano, 2016; Woodruff & Zenteno, 2007). However, they contrast with the findings of Reyes et al. (2009) and García and Sánchez (2008), which argue that remittances generate local dependence and can affect the cultural heritage and traditions of Mexican towns.

### Results using inverse probability weighting

In this section we provide the results of the multi-treatment analysis using Inverse Probability Weighting.<sup>10</sup> As noted above, the purpose of this analysis is to study the possibility of having a differentiated effect between receiving international or internal remittances on DTC. It is important to highlight that: 1) no study was found that analyzed the remittances-tourism relationship by implementing a multi-treatment analysis; and 2) the IPW methodology broadens the analysis of the PSM technique by allowing the InRRH and IRRH to represent different treatment levels. Thus, the results presented below can be considered as pioneering in academic literature, especially in Mexico.

Table 6 presents the *ATT* for the multiple levels of treatment. The first row shows the *ATT* between InRRH and the control group (NRRH). The results indicate that receiving internal remittances has a positive and statistically significant impact on DTC, ranging from a minimum of 3.21 (in 2016) to a maximum of 4.71 pp (in 2010). The second row reveals a similar impact between IRRH and the control group, however, the magnitude of the effect is higher, from 4.03 to 8.29 pp. All these effects are consistent over the years. Overall, these outcomes reinforce those found using the PSM methodology.

Finally, the third row shows the *ATT* between IRRH and InRRH. The estimated effect indicates that for 2010, 2012 and 2016, receiving internal remittances, compared to receiving international remittances, has a negative impact on the probability of DTC,

<sup>10</sup> The results of the multinomial logit model on the determinants of receiving national or international remittances are shown in Annex 2.

**Table 4**  
Results of probit model on the determinants of receiving internal remittances.  
Source: Own elaboration based on ENIGH 2010, 2012, 2014 and 2016 data.

Variables	2010	2012	2014	2016
	Marginal effects			
Sex of household head	-0.0765 (-7.91)***	-0.0904 (-5.61)***	-0.0993 (-10.37)***	-0.0848 (-14.70)***
Age of household head	0.0015 (5.29)***	0.0009 (1.88)*	0.0012 (4.12)***	0.0010 (5.58)***
Marital status	-0.0487 (-4.90)***	-0.0418 (-2.51)**	-0.0323 (-3.26)***	-0.0413 (-6.87)***
Years of completed education	-0.0013 (-1.71)*	-0.0050 (-3.76)	-0.0032 (-3.89)***	-0.0037 (-7.41)***
Employed	-0.0987 (-11.67)***	-0.1179 (-8.01)***	-0.0809 (-8.93)***	-0.0909 (-15.87)***
Area of residence	0.0114 (1.12)	0.0131 (0.96)	0.0102 (1.09)	0.0008 (0.17)
Household size	-0.0028 (-1.23)	-0.0040 (-1.06)	-0.0072 (-3.02)***	-0.0028 (-1.89)*
Minors	0.0322 (3.55)***	0.0371 (2.43)**	0.0334 (3.64)***	0.0403 (7.19)***
Home ownership status	-0.0354 (-4.59)***	-0.0304 (-2.35)**	-0.0137 (-1.81)*	-0.0330 (-7.11)***
Government transfers	0.0120 (1.30)	0.0410 (2.75)***	0.0146 (1.69)*	0.0198 (3.88)***
Indigenous housing	0.0299 (2.71)***	-0.0183 (-1.02)	-0.0157 (-1.32)	-0.0028 (-0.39)
Traditional region	0.0294 (2.84)***	-0.0071 (-0.44)	-0.0088 (-0.93)	-0.0267 (-4.68)***
North region	0.0179 (1.69)*	-0.0253 (-1.57)	-0.0604 (-6.26)***	-0.0549 (-9.92)***
Center region	-0.0402 (-4.24)***	-0.0383 (-2.34)**	-0.0613 (-6.20)***	-0.0657 (-10.90)***
Sewer system	0.0123 (0.94)	0.0289 (1.52)	0.0296 (2.05)**	0.0104 (1.26)
Piped water service	0.0096 (1.06)	0.0254 (1.65)*	-0.0158 (-1.71)*	0.0042 (0.75)
Cooking fuel	-0.0002 (-0.02)	-0.0119 (-0.71)	-0.0109 (-1.05)	-0.0012 (-0.19)

\*\*\*significant at 1%, \*\*significant at 5% and \*significant at 10%.

Note 1: Numbers in parentheses are z scores.

Note 2: The probit model was estimated using robust standard errors and expansion factors.

**Table 5A**  
Average treatment-on-treated effect (ATT) and t-statistics for 2010 and 2012.  
Source: Own elaboration based on ENIGH 2010 and 2012 data.

Dependent variable	Matching algorithm							
	2010			2012				
	Nearest neighbour	Kernel	Radius	Nearest neighbour	Kernel	Radius		
International remittances								
Dummy for DTC <sup>a</sup>	3.30 pp (1.73)*	3.28 pp (1.91)*	2.63 pp (1.87)*	3.76 pp (2.60)***	7.20 pp (2.37)**	6.21 pp (2.36)**	4.42 pp (1.99)**	6.47 pp (2.73)***
Internal remittances								
Dummy for DTC	4.20 pp (4.03)***	4.50 pp (4.91)***	4.08 pp (5.33)***	4.30 pp (5.51)***	2.80 pp (1.68)*	2.83 pp (1.92)*	2.59 pp (2.08)**	2.90 pp (2.26)**

Note 1: Numbers in parenthesis are t scores.

Note 2: 1% t critical value is 2.57 (\*\*\*significant at 1%), 5% t critical value is 1.96 (\*\*significant at 5%), 10% t critical value is 1.64 (\*significant at 10%).

Note 3: pp means percentage points.

Note 4: The first column of each year corresponds to the ATT computed using expansion factors.

<sup>a</sup> 0 = the household not made any kind of DTC, 1 = the household made any kind of DTC.

**Table 5B**

Average treatment-on-treated effect (ATT) and *t*-statistics for 2014 and 2016.

Source: Own elaboration based on ENIGH 2014 and 2016 data.

Dependent variable	Matching algorithm							
	2014			2016				
	Nearest neighbour	Kernel	Radius	Nearest neighbour	Kernel	Radius		
International remittances								
Dummy for DTC <sup>a</sup>	7.50 pp (3.33)***	6.42 pp (3.22)***	5.40 pp (3.27)***	7.38 pp (4.21)***	5.40 pp (5.28)***	6.26 pp (6.89)***	5.08 pp (6.69)***	5.83 pp (7.52)***
Internal remittances								
Dummy for DTC	4.00 pp (3.39)***	2.85 pp (2.73)***	2.36 pp (2.70)***	2.71 pp (3.03)***	2.20 pp (3.66)***	2.24 pp (4.16)***	2.33 pp (5.20)***	2.36 pp (5.20)***

Note 1: Numbers in parenthesis are *t* scores.

Note 2: 1% *t* critical value is 2.57 (\*\*\*significant at 1%), 5% *t* critical value is 1.96 (\*\*significant at 5%), 10% *t* critical value is 1.64 (\*significant at 10%).

Note 3: pp means percentage points.

Note 4: The first column of each year corresponds to the ATT computed using expansion factors.

<sup>a</sup> 0 = the household not made any kind of DTC, 1 = the household made any kind of DTC.

**Table 6**

Average treatment-on-treated effect (ATT) and *z*-statistics for multiple levels of treatment.

Source: Own elaboration base on ENIGH 2010, 2012, 2014 and 2016 data.

Treatment vs control	Dependent variable: dummy for DTC			
	2010	2012	2014	2016
Internal vs non-receiving	4.71 pp (6.24)***	3.41 pp (2.75)***	3.32 pp (3.90)***	3.21 pp (7.34)***
International vs non-receiving	7.81 pp (3.44)***	8.29 pp (2.55)**	4.03 pp (1.81)*	5.95 pp (5.80)***
Internal vs international	-2.70 pp (-0.98)	-5.06 pp (-1.18)	1.94 pp (0.67)	-1.81 pp (-1.34)

Note 1: Numbers in parenthesis are *z* scores. \*\*\*, \*\*, \*: significant at 1%, 5% and 10% respectively.

Note 2: pp means percentage points.

however none of these findings are statistically significant. This result suggests that the effect of remittances on DTC is not differentiated by type of remittances.

As mentioned at the beginning of this section, no study was found within the literature that employed a multi-treatment analysis to identify the effects of receiving remittances on DTC, making it difficult to compare the results reported in this section with previous works. Although there are some similarities with the findings reported by several studies in the remittances-and-development literature (Adams, 2011; Adams & Cuecuecha, 2013; Azizi, 2018, 2017; Mora & Arellano, 2016; Woodruff & Zenteno, 2007), they do not argue that remittances can drive local development and improve the well-being of recipient households by promoting recreational and entertainment activities (such as those associated with tourism) which undoubtedly increases the living standards of Mexican people.

### Concluding remarks

Using information from a national cross-sectional household survey in Mexico from four different years (2010, 2012, 2014 and 2016), this study analyses the impact of remittances on DTC. Very few studies have attempted to analyze the effect that remittances have on tourism spending patterns, however, in countries like Mexico (one of the top recipients of remittances worldwide), it is essential to analyze if remittances can act as a mechanism that boosts different activities, one of which could be the tourism. Two methodologies were used to estimate the impacts of remittances on DTC: Propensity Score Matching (PSM) and Inverse Probability Weighting (IPW), both of which allow controlling the problem of self-selection bias that arises when working with non-experimental data. PSM was used to perform a bi-treatment analysis, while IPW was implemented to perform a multi-treatment analysis, allowing us to estimate the effects of remittances on DTC, but differentiating between IRRH and InRRH.

Based on the PSM analysis, there is a significant positive impact on the probability of carrying out DTC as a result of receiving remittances. In other words, remittance-receiving households were seen to fare better compared to non-remittance-receiving households. The extent of the difference across both groups varies depending on the matching algorithm used. Some of the most important results derived from the propensity score analysis include the following: first, when using the *nearest neighbour* algorithm, the probability that a household will spend on DTC as a result of receiving international remittances increases on average by 5.54 pp,

and by 3.11 pp from receiving internal remittances; second, when using the two other matching algorithms (*kernel* and *radius*), the probability increases on average by 5.12 pp, and by 2.95 pp because of receiving international or internal remittances, respectively. Overall, these findings allow us to conclude that remittances increase tourism spending in Mexico, confirming the results of academics who have found that remittances are an important mechanism through which migrant-sending countries improve their economic development.

On the other hand, through the use of the multi-treatment analysis it was possible to confirm the results obtained using the PSM methodology, as well as verify that there are no differentiated effects by type of remittances when including them simultaneously in the analysis as a different level of treatment—an interesting and novel exercise absent in previous literature. When NRRH were considered as the control group, a positive impact on the probability of doing DTC was found both for InRRH as well as IRRH. In the first case, the probability increases on average by 3.66 pp, while in the second case it increases on average by 6.52 pp. The multi-treatment analysis becomes more interesting when we study the possibility that there is a differentiated effect between InRRH and IRRH, and specifically if receiving international remittances (compared to receiving internal remittances) has a greater effect on DTC. The results show that there is no such difference, which suggests that the impact of remittances on DTC is not differentiated by the type of remittance.

Despite the limitations in the PSM and IPW methodologies applied to cross-sectional data, such as the possible bias arising from unobservable factors, the findings of this study provide solid evidence regarding the impact of remittances on DTC. They also underscore the importance of suggesting policy measures aimed at linking remittances and tourism to economic growth, thereby allowing us to map out a solid path toward economic and local development.

The study also provides unprecedented information that can help to promote mechanisms that encourage migrants to channel remittances toward tourism activities when they arrive to their origin communities. This does not imply that remittances must be used forcibly in actions that encourage tourism, since it is evident that they can be equally beneficial in different types of expenditures, such as education, health and housing. The intention of this recommendation is not to substitute, but rather to complement the benefits associated with remittances, and in this way improve the wellbeing of remittance-receiving families by participating in tourism activities.

Although this research presents novel findings, some limitations are also identified. One of these limitations was the inability to estimate remittances' accumulated effects due to the limitations in the data. However, as far as we know, in Mexico there is no panel database that collects information on remittances and tourism expenses at the household level. In this regard, we highly recommend that in the future data be generated from surveys with two or more follow-up waves to analyze the dynamic effects of remittances on tourism consumption. Another limitation is that the effects of remittances on DTC were only estimated as changes in the probability that a household will or will not carry out these types of expenses. However, we are certain that the findings obtained offer a clear and robust initial approach to studying the tourism-remittances nexus. In the future, a good practice would be to include different outcome variables in the analysis (e.g., the total amount of tourism expenses incurred or the proportion that this amount represents within total household expenditures). A third limitation of this paper is the impossibility to incorporate the effects of remittances on Outbound Tourism Consumption; unfortunately, the data contained in the ENIGH do not allow for estimating said effect. Therefore, and in line with the above comments, we advocate strongly for the creation of databases which compile this kind of information. Taking all the above into consideration, the conclusions of this work cannot and should not be taken as definitive and are subject to improvement through the implementation of different methodologies and the use of novel data sources.

## Acknowledgements

The authors gratefully acknowledge the valuable comments of Edwin van Gasteren and three anonymous reviewers that have greatly helped to improve this paper.

## Appendix 1

Covariates imbalance testing for 2014.

Variable	Sample <sup>a</sup>	Mean		t-Statistics	p-Value
		Treated	Control		
Sex of household head	U	0.57995	0.75321	−11.62	0.000***
	M	0.57995	0.58840	−0.36	0.718
Age of household head	U	53.948	48.233	10.63	0.000***
	M	53.948	55.074	−1.34	0.180
Marital status	U	0.6610	0.7105	−3.17	0.002***
	M	0.6610	0.6537	0.32	0.745
Years of completed education	U	5.5248	8.4348	−16.95	0.000***
	M	5.5248	5.3063	1.04	0.299
Employed	U	0.6340	0.7970	−11.68	0.000***
	M	0.6340	0.6239	0.44	0.659
Area of residence	U	0.4775	0.7425	−17.52	0.000***
	M	0.4775	0.4859	−0.36	0.722

Household size	U	3.6239	3.7809	-2.44	0.015**
	M	3.6239	3.6075	0.18	0.860
Minors	U	0.4729	0.4928	-1.15	0.249
	M	0.4729	0.4606	0.52	0.601
Home ownership status	U	0.7049	0.6197	5.13	0.000***
	M	0.7049	0.7049	0.00	1.000
Government transfers	U	0.4910	0.3057	11.66	0.000***
	M	0.4910	0.5197	-1.21	0.226
Indigenous housing	U	0.0676	0.1049	-3.57	0.000***
	M	0.0676	0.0698	-0.19	0.851
Traditional region	U	0.5496	0.2446	20.49	0.000***
	M	0.5496	0.5383	0.48	0.634
North region	U	0.125	0.2327	-7.49	0.000***
	M	0.125	0.1329	-0.50	0.620
Center region	U	0.1430	0.1913	-3.59	0.000***
	M	0.1430	0.1559	-0.76	0.444
Sewer system	U	0.9043	0.9357	-3.69	0.000***
	M	0.9043	0.9015	0.20	0.841
Piped water service	U	0.6588	0.7140	-3.55	0.000***
	M	0.6588	0.6616	-0.13	0.900
Cooking fuel	U	0.7421	0.8023	-4.38	0.000***
	M	0.7421	0.7393	0.14	0.892

Note: The t-statistics tests equality of the two samples before and after matching. The null states that the mean of a covariate in the control and treated group are equal (i.e. well balanced). Of the 17 covariates, 16 are not balanced before matching. All covariates are well balanced after matching. All computations are performed using the “pstest” function available on Stata. Similar results were obtained for 2010, 2012 and 2016. \*\*\* and \*\* refer to 1% and 5% rejection of the null hypothesis, respectively.

<sup>a</sup> U: unmatched; M: matched.

Overall imbalance testing.

Sample	Mean bias	Pseudo R <sup>2</sup>	LR	Bias
2010				
Unmatched	28.0	0.150	1546.54	112.6
Matched	3.2	0.004	13.76	14.7
2012				
Unmatched	24.5	0.123	480.56	101.1
Matched	2.8	0.006	8.32	18.2
2014				
Unmatched	27.3	0.136	985.37	110.8
Matched	2.3	0.002	4.75	10.3
2016				
Unmatched	23.7	0.115	3600.49	97.1
Matched	2.1	0.002	17.20	9.1

Note: The pseudo R<sup>2</sup> falls after matching indicating the covariates are jointly well balanced. The function “pstest” has been implemented to produce this table.

Appendix 2

Results of multinomial logit model on the determinants of receiving national or international remittances.

Source: Own elaboration based on ENIGH 2010, 2012, 2014 and 2016 data.

Base outcome: (0) control group					
	Variables	2010	2012	2014	2016
Coefficients					
(1) Households receiving national remittances	Sex of household head	-0.6599 (-9.71)***	-0.6736 (-6.42)***	-0.7966 (-11.48)***	-0.6586 (-16.62)***
	Age of household head	0.0099 (4.85)***	0.0059 (1.84)*	0.0090 (4.03)***	0.0069 (5.42)***
	Marital status	-0.2654 (-3.72)***	-0.2316 (-2.12)**	-0.1714 (-2.35)**	-0.2228 (-5.36)***
	Years of completed education	-0.0129 (-2.43)**	-0.0368 (-4.21)***	-0.0292 (-4.80)***	-0.0289 (-8.47)***
	Employed	-0.7818 (-13.14)***	-0.7704 (-8.12)***	-0.6269 (-9.59)***	-0.6688 (-17.13)***

	Area of residence	-0.0195 (-0.27)	0.0103 (0.12)	-0.0334 (-0.48)	-0.0965 (-2.85)***
	Household size	-0.0303 (-1.83)*	-0.0330 (-1.32)	-0.0702 (-3.92)***	-0.0278 (-2.72)***
	Minors	0.2431 (3.72)***	0.2585 (2.56)**	0.2725 (3.97)***	0.2887 (7.38)***
	Home ownership status	-0.2682 (-4.91)***	-0.1919 (-2.28)**	-0.1085 (-1.94)*	-0.2354 (-7.35)***
	Government support	0.1143 (1.73)*	0.3034 (3.11)***	0.1284 (2.03)**	0.1668 (4.75)***
	Indigenous household	0.1735 (2.19)**	-0.1535 (-1.28)	-0.1649 (-1.85)*	-0.0500 (-1.00)
	Traditional region	0.3206 (4.39)**	0.0736 (0.69)	0.0237 (0.34)	-0.0792 (-2.02)**
	North region	0.1231 (1.64)	-0.1744 (-1.64)	-0.4505 (-6.35)***	-0.3723 (-9.91)***
	Center region	-0.2922 (-4.34)***	-0.2515 (-2.29)**	-0.4487 (-5.99)***	-0.4720 (-11.08)***
	Sewer system	0.1142 (1.19)	0.1725 (1.37)	0.2278 (2.15)**	0.1014 (1.78)*
	Piped water service	0.0398 (0.62)	0.1830 (1.81)*	-0.0942 (-1.38)	0.0344 (0.88)
	Cooking fuel	0.0238 (0.31)	-0.0476 (-0.43)	-0.0850 (-1.10)	0.0008 (0.02)
(2) Households receiving international remittances	Sex of household head	-1.4811 (-8.90)***	-1.4370 (-8.09)***	-1.2141 (-9.38)***	-1.2024 (-17.94)***
	Age of household head	0.0019 (0.55)	0.0065 (1.10)	0.0048 (1.16)	0.0063 (2.76)***
	Marital status	0.7272 (4.17)***	0.4409 (2.17)**	0.6586 (4.54)***	0.6181 (8.16)***
	Years of completed education	-0.0716 (-6.47)***	-0.0806 (-4.67)***	-0.1010 (-8.76)***	-0.0630 (-10.78)***
	Employed	-1.0155 (-9.25)***	-0.3117 (-1.84)*	-0.5955 (-5.26)***	-0.6420 (-10.47)***
	Area of residence	-0.8890 (-8.68)***	-0.7482 (-5.33)***	-1.1483 (-10.80)***	-0.9643 (-18.91)***
	Household size	-0.0617 (-2.17)**	-0.0250 (-0.39)	-0.1315 (-4.02)***	-0.0342 (-2.11)**
	Minors	0.3144 (2.67)***	0.3254 (1.61)	0.3854 (3.04)***	0.2391 (3.74)***
	Home ownership status	-0.2068 (-1.87)*	0.2049 (1.35)	-0.0361 (-0.35)	-0.0515 (-0.98)
	Government support	0.1826 (1.72)*	0.4272 (2.77)***	0.2404 (2.26)**	0.2941 (5.37)***
	Indigenous household	-0.4603 (-2.86)***	-0.4364 (-2.23)**	-0.6381 (-3.70)***	-0.4646 (-5.22)***
	Traditional region	1.1560 (8.76)***	1.2469 (7.50)***	0.9360 (7.39)***	0.9960 (15.33)***
	North region	-0.0782 (-0.46)	-0.2055 (-0.96)	-0.1823 (-1.18)	-0.0535 (-0.72)
	Center region	-0.0599 (-0.42)	-0.0676 (-0.32)	-0.3074 (-1.99)**	-0.7148 (-7.85)***
	Sewer system	0.1548 (1.10)	-0.0719 (-0.41)	0.1975 (1.19)	0.2875 (3.35)***
	Piped water service	-0.2399 (-2.12)**	0.2044 (1.26)	0.2052 (1.83)*	0.0371 (0.65)
	Cooking fuel	0.2083 (1.70)*	0.3594 (2.12)**	-0.0680 (-0.53)	0.0325 (0.49)

\*\*\*significant at 1%, \*\*significant at 5% and \*significant at 10%.

Note 1: Numbers in parentheses are z scores.

Note 2: The multinomial logit model was estimated using robust standard errors and expansion factors.



### Appendix 3

Descriptive statistics.

Source: Own elaboration based on ENIGH 2010, 2012, 2014 and 2016 data.

Variables	Total households		Households receiving international remittances		Households receiving international remittances and spending on DTC		Households receiving international remittances		Households receiving international remittances and spending on DTC	
	Mean/(std. dev.)	[Min/ max]	Mean/(std. dev.)	[Min/ max]	Mean/(std. dev.)	[Min/ max]	Mean/(std. dev.)	[Min/ max]	Mean/(std. dev.)	[Min/ max]
Household head characteristics										
Sex of household head	0.74 (0.44)	[0, 1]	0.58 (0.49)	[0, 1]	0.60 (0.49)	[0, 1]	0.58 (0.49)	[0, 1]	0.60 (0.49)	[0, 1]
Age of household head	48.79 (15.92)	[12, 105]	53.6 (17.27)	[14, 105]	52.31 (16.93)	[17, 105]	52.61 (17.71)	[12, 105]	48.78 (16.92)	[16, 97]
Marital status	0.71 (0.46)	[0, 1]	0.68 (0.47)	[0, 1]	0.70 (0.46)	[0, 1]	0.57 (0.50)	[0, 1]	0.59 (0.49)	[0, 1]
Years of completed schooling	8.12 (5.03)	[0, 23]	5.82 (4.47)	[0, 23]	6.78 (4.94)	[0, 23]	7.28 (5.01)	[0, 23]	9.09 (5.29)	[0, 23]
Employed	0.79 (0.41)	[0, 1]	0.62 (0.48)	[0, 1]	0.67 (0.47)	[0, 1]	0.64 (0.48)	[0, 1]	0.71 (0.45)	[0, 1]
Household characteristics										
Area of residence	0.68 (0.47)	[0, 1]	0.46 (0.50)	[0, 1]	0.51 (0.50)	[0, 1]	0.69 (0.46)	[0, 1]	0.76 (0.43)	[0, 1]
Household size	3.74 (1.89)	[1, 21]	3.71 (2.04)	[1, 21]	3.86 (2.02)	[1, 21]	3.56 (1.98)	[1, 19]	3.71 (1.91)	[1, 19]
Minors	0.48 (0.50)	[0, 1]	0.48 (0.50)	[0, 1]	0.48 (0.50)	[0, 1]	0.46 (0.50)	[0, 1]	0.47 (0.50)	[0, 1]
Home ownership status	0.63 (0.48)	[0, 1]	0.72 (0.45)	[0, 1]	0.70 (0.46)	[0, 1]	0.63 (0.48)	[0, 1]	0.58 (0.49)	[0, 1]
Government transfers	0.32 (0.47)	[0, 1]	0.48 (0.50)	[0, 1]	0.44 (0.50)	[0, 1]	0.37 (0.48)	[0, 1]	0.29 (0.45)	[0, 1]
Indigenous housing	0.11 (0.31)	[0, 1]	0.07 (0.25)	[0, 1]	0.06 (0.24)	[0, 1]	0.11 (0.31)	[0, 1]	0.10 (0.30)	[0, 1]
Sewer system	0.92 (0.27)	[0, 1]	0.91 (0.29)	[0, 1]	0.92 (0.27)	[0, 1]	0.93 (0.26)	[0, 1]	0.95 (0.23)	[0, 1]
Piped water service	0.69 (0.46)	[0, 1]	0.65 (0.48)	[0, 1]	0.67 (0.47)	[0, 1]	0.69 (0.46)	[0, 1]	0.77 (0.42)	[0, 1]
Cooking fuel	0.80 (0.40)	[0, 1]	0.76 (0.42)	[0, 1]	0.78 (0.41)	[0, 1]	0.79 (0.40)	[0, 1]	0.84 (0.37)	[0, 1]
Regional characteristics										
Traditional region	0.25 (0.44)	[0, 1]	0.54 (0.50)	[0, 1]	0.57 (0.50)	[0, 1]	0.27 (0.45)	[0, 1]	0.31 (0.46)	[0, 1]
North region	0.26 (0.44)	[0, 1]	0.16 (0.36)	[0, 1]	0.15 (0.36)	[0, 1]	0.25 (0.43)	[0, 1]	0.24 (0.43)	[0, 1]
Center region	0.20 (0.40)	[0, 1]	0.13 (0.33)	[0, 1]	0.12 (0.32)	[0, 1]	0.18 (0.39)	[0, 1]	0.18 (0.38)	[0, 1]
South-southeast region	0.26 (0.44)	[0, 1]	0.16 (0.37)	[0, 1]	0.16 (0.36)	[0, 1]	0.28 (0.45)	[0, 1]	0.27 (0.44)	[0, 1]

Note: See Table 1 for variable definitions.

### Appendix 4. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.annals.2019.03.002>.

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