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# Immigrant Networks and Remittances: Cheaper together?

## Abstract

We estimate the causal effects of immigrant networks on individuals' remittance sending behavior for migrants from many different countries residing in Spain. Our methodology addresses typical issues that arise when estimating network effects: reverse causality, common unobserved factors, and self-selection. In particular, we instrument the size of networks by predicting the number of migrants in each location using the location's accessibility by distinct methods of transportation and information about how migrants from each country initially arrived in Spain. Our findings show that immigrants from above-average remitting countries remit more if they live in larger networks. For a subset of countries that receive large remittance flows from Spain, we show that migrants in larger networks are less likely to use most expensive remittance channels, and that cost spreads between the most expensive and cheapest remittance service provider are lower for countries characterized by stronger networks. Our results suggest that network effects could boost policy efforts to lower remittance prices.

*JEL classification:* F24, J61, F22, O15, A14

*Keywords:* immigrant networks, remittances, migration, Spain

# 1 Introduction

Immigrants from the same country of origin tend to reside geographically close to each other. These so-formed networks seem to explain to an important extent why migrants from the same background who live in the same city or neighborhood make similar decisions, for instance regarding occupations (Patel and Vella [2013]) or human capital accumulation (Borjas [1995]). One important migrant-specific decision that moves billions of dollars around the globe each year is how much remittances to send.<sup>1</sup> There are four direct reasons why living surrounded by others from the same country of origin could affect individuals' remittance choices: (i) Migrant communities can help to maintain ties with the home country thus increasing individuals' desire to remit, (ii) migrant communities can help to establish ties with the host country thus decreasing the desire to remit, (iii) peer pressure from network members and fear of ostracism – as suggested by Chort, Gubert, and Senne [2012] – could also induce network members to remit more, and (iv) living surrounded by many co-nationals, in particular if they remit much, might lower effective remittance prices via sharing of information about cheaper ways of sending money home and/or via increased competition among remittances service providers in these locations.<sup>2</sup>

The current paper estimates the causal effects of immigrant networks on individuals' remittance sending behavior and finds them to be positive and significant. Our data come from the Spanish Migrant Survey 2007, a unique database that includes detailed information about remittances sent and migrants' place of residence. Among developed countries, Spain experienced relatively late one of the most sudden migrant inflows. Between 1998 and 2007, Spain – a country of 45 million (2007) – welcomed more than five million im-

migrants from all five continents, and it became the fifth country in the world in terms of remittance outflows.<sup>3</sup> Figure A-1 in the Appendix displays this evolution. In 2008, and as a consequence of the severe economic crisis, the inflow of immigrants to Spain abruptly decreased, and from 2009 onwards the number of foreigners fell, as departures from Spain exceeded arrivals. Only in 2015 did the net flow of migration become positive again, and the number of foreigners stabilized at around 4,5 million (as of July 2017; Spanish National Statistics Institute - INE).

Our findings show that immigrants from above-average remitting countries remit more if they live in larger networks. We test for various mechanisms of network effects but find no evidence that they significantly alter migrants' labor market outcomes (employment, wages), nor that they affect return intentions or the desire for family reunifications. We do however find that migrants from above-average remitting countries who live in larger networks are more likely to use bank transfers for sending remittances compared to migrants from other countries or those living in smaller networks. This suggests that: i) large networks of individuals who remit a lot might be better at sharing information about more convenient remittance channels (bank transfers compared to money orders in post offices or agencies), and/or ii) in locations with large networks more banks might find it optimal to open branches. If any of this implies cost savings for migrants, it could explain why when living in larger networks, they remit more. In line with this hypothesis, for a subset of important remittance receiving countries for which data is available (so called corridor countries), we find that due to network effects migrants are less likely to use the most expensive remittance channel for their country. Our results hence suggest that network effects could boost policy efforts by the World Bank to lower remittance prices

(“Project Greenback”).<sup>4</sup>

Our methodology addresses the following issues that arise when estimating network effects:

(i) Reverse causality: when trying to test how any group average affects an individual’s behavior, the individual’s behavior simultaneously affects the group average. Following Borjas [1995] we define remittance behavior at the country of origin level such that an individual’s actions have no effect on the group average. (ii) Common unobserved factors: if negative income shocks in some destination countries or better economic conditions in certain locations cause individuals in the same network to remit more, independently of network effects. For instance, Mohapatra, Joseph, and Ratha [2012], Clarke and Wallsten [2003], or Yang and Choi [2007] provide evidence on increased remittance flows after natural disasters and weather shocks in migrants’ countries of origin. Our regressions include a full set of country and location dummies which address the potential influence of common unobserved factors. (iii) Self-selection: the same unobservable individual characteristics that lead individuals to live close to their peers might also drive their other decisions (Borjas [1998]). To address the issue of self-selection we instrument the size of networks following Gonzalez and Ortega [2012]. In particular, our instrument predicts the number of migrants residing in each location by combining information on how migrants from each country initially arrived in Spain, with each location’s accessibility by different means of transportation.

To the best of our knowledge, the existing literature on the effects of migrant networks on remittances considers only endogenously-formed social networks and focuses on specific migrant groups. For instance, in the case of Mexican migrants in the US, Amuedo-

Dorantes and Pozo [2006] find that larger social networks of more friends in the city of destination reduce income risks and hence remittances sent. Roberts and Morris [2003] also focus on Mexican migrants in the US, finding that migrants who obtained jobs through networks and who have access to larger networks remit more. The authors thus interpret remittances as a fee for accessing employment networks. Mazzucato [2009] analyzes how networks in countries of origin and destination provide ways of monitoring behavior that allows for remittances and so-called “reverse” remittances (services to migrants provided by family and friends in the country of origin) to serve as risk pooling devices. Maggard [2004] differentiates between four types of networks formed by friends, family, other-ethnicity-based networks in the country of destination, and community networks in the country of origin, and she finds the first (last) type of network to have positive (negative) effects on remittances sent. The study by Chort, Gubert, and Senne [2012] considers Senegalese migrants in France and Italy and defines networks as a combination of relationships, family members in countries of destination, and migrants’ participation in home-country associations. The authors find that network effects on remittances are only present when controlling for the value individuals assign to these networks. There also exists an important number of studies on migrant networks and remittances in other disciplines. For instance, one of the first studies on this topic by Philpott [1968] published in an anthropology journal finds that in networks of migrants from Montserrat in Britain, remittance obligations are effectuated by means of social control. Within the sociology literature, Mahmud [2015] confirms social relations to strongly determine remittance behavior of Bangladeshi migrants in Japan. Another anthropological study by Åkesson [2011] looks at migrants and residents in Cape Verde and highlights how social networks affect remittances and vice versa. None of these studies however addresses

the before-mentioned problem of self-selection, and given that all consider rather specific groups of immigrants it is unclear if and how these results extend to migrants from other countries of origin.

Our study is also related to two other strands of literature on: (i) the effect of immigrant networks on other outcomes and (ii) other determinants of remittance sending behavior besides networks. Regarding the former, many studies attempt to address the typical challenges of estimating network effects. The before-mentioned paper by Borjas [1995] finds that intergenerational transmission of human capital depends to a large extent on the average human capital of an individual's ethnicity, and that part of this effect is explained by geographical proximity to others of the same ethnicity. In his paper, the author addresses the problem of reverse causality by using national averages for human capital by ethnicity. By using neighborhood fixed effects he deals with the issue of locations' unobserved factors. However, self-selection and unobserved factors of ethnicities remain un-addressed. A couple of subsequent studies have used exogenous variation brought about by refugee placement policies to deal with self-selection; see for instance Aslund and Fredriksson [2009] for network effects on welfare use in Sweden, Damm [2009] for effects on migrants' wages in Denmark, and Beaman [2012] for non-monotonic network effects on migrants' labor market outcomes in the US. The paper by Munshi [2003] proposes an alternative approach. Instrumenting the number of individuals in the migrant network by past rainfall in the origin community, the author finds that Mexicans within larger networks are more likely to be employed and to have higher paying jobs.

However, none of the above-mentioned methods is applicable to our question because

remittances are sent by all types of immigrants (including but not restricted to refugees) from very different countries of origin (including but not restricted to countries with high employment shares in agriculture). More generally applicable methods are those proposed in Bertrand, Luttmer and Mullainathan [2000] and in the before-mentioned paper by Patel and Vella [2013]. The latter define networks in Metropolitan Statistical Areas (MSAs) by country of origin and occupation, and they instrument networks by historical networks ten years ago. Bertrand, Luttmer and Mullainathan [2000] postulate that network effects are present if individuals replicate the behavior of their group when living surrounded by many peers. They find that individuals from language groups with high average welfare use are more likely to live on welfare when residing in larger networks. The authors instrument network size– the relative share of a language group in an area (Public Use Microdata Areas -PUMAs) – by the size of the same network at a higher level of aggregation (MSAs).<sup>5</sup> While these last two papers propose more general methods, their application requires strong assumptions about present networks not being predetermined by historical ones in the first case, and selection effects not being equally strong at higher levels of aggregation in the second.

We define network effects following Bertrand, Luttmer and Mullainathan [2000] but propose a different instrument for networks that relies on the exogenous variation in the accessibility of Spanish provinces by different means of transportation combined with information on how migrants from each country initially arrived in Spain. This instrument results particularly suitable for a country like Spain that can be reached by several means of transportation, and where immigration is a relatively recent phenomenon. As time passes, migrants who tend to be more mobile than natives, are likely to move around the



country weakening the power of this instrument.

Our paper is also related to the literature on individuals' remittance sending behavior which has mostly focused on testing migrants' motives for sending money home. Rapoport and Doquier [2006], in a comprehensive survey of the empirical and theoretical literature, distinguish between individual (altruism, exchange, strategy) and household motives (insurance, inheritance).<sup>6</sup> Empirical results for the predominance of either motive are mixed, but literature has established some clear determinants for sending remittances. How much to remit seems to be positively related to migrants' income and ties with the country of origin and negatively with new bonds formed in and with the host country. Studies for Germany by Dustmann and Mestres [2010] and Sinning [2011] find that immigrants planning to stay longer in the host country send fewer remittances. Positive effects of higher income on remittances have been found for migrants from very different countries such as Botswana (Lucas and Stark [1985]), Nicaragua and El Salvador (Funkhouser [1995]) or Turkey, Greece, Yugoslavia, Italy, and Spain (Merkle and Zimmermann [1992]). A recent paper by Joseph, Nyarko and Wang [2018] considers remittance sending behavior of migrants in the United Arab Emirates over time. The authors find that individuals send more remittances as their earnings increase, but only if such earnings increases are observable in countries of origin. In line with most of these findings, in our estimations we also observe that income and return intentions are positively related to the amount of remittances sent.

To the best of our knowledge the current paper is the first to estimate the causal effect of networks on individuals' remittance sending behavior in the context of many different

origin countries. In the spirit of findings in literature on the effect of migrant networks on trade flows (e.g. Herander and Saavedra [2005] or Peri and Requena-Silvente [2010]), we also find evidence for macroeconomic effects of networks. For a subset of countries that receive large remittance flows from Spain (corridor countries), we find on average lower cost spreads between the most expensive and cheapest provider for countries characterized by stronger networks. This suggests that networks might enhance competition by attracting new providers and/or pressuring existing providers. The remainder of the paper is organized as follows. Section 2 presents the methodology used. Section 3 describes our data. In Section 4 we present and discuss our results, and Section 5 concludes.

## 2 Methodology

As mentioned before, estimating network effects, or addressing the question if individuals replicate the behavior of those around them, is not a straight-forward task. To illustrate the difficulties that arise, let us first consider a rather “naive” approach that regresses individual behavior on average behavior of co-nationals living close by

$$R_{ijk} = \overline{R_{j,k}}\alpha + X_i\beta + \gamma_j + \delta_k + \epsilon_{ijk}, \quad (2.1)$$

where  $R_{ijk}$  denotes remittances of individual  $i$  currently residing in municipality  $j$  from country of origin  $k$ , and  $\overline{R_{j,k}}$  is the mean quantity remitted by individuals from the same country of origin who live in the same municipality.  $X_i$  denotes individual characteristics,  $\gamma_j$  and  $\delta_k$  are municipality and country dummies respectively, and  $\epsilon_{ijk}$  are standard errors

which we cluster at the country-municipality level. However, depending on the size of the immigrant group in the municipality, individual  $i$ 's remittance behavior will affect  $\bar{R}_{j,k}$  which hence cannot be used as an independent variable.

An improvement of the model above, as proposed by Borjas [1995], aggregates outcomes by country of origin at the national level, obtaining so-called “cultures.” For countries with a significant representation in the host country, these “cultures” are unlikely to be affected by an individual’s actions. The effect of “cultures” on individual’s remittance sending behavior can be estimated as follows:

$$R_{ijk} = \bar{R}_k \alpha + X_i \beta + \gamma_j + \epsilon_{ijk}, \quad (2.2)$$

where  $\bar{R}_k$  is the mean quantity remitted by individuals from country  $k$ . However, given that  $\bar{R}_k$  only varies at the country level, fixed effects  $\delta_k$  cannot be included in this regression. This implies that we are unable to control for other unobserved characteristics of countries that might influence individuals’ remittance sending behavior (e.g. cultural aspects like generosity, strength of family ties, etc.).<sup>7</sup>

Alternatively, one could also aggregate the behavior of all migrants at the municipality level, independently of their country of origin, and estimate:

$$R_{ijk} = \bar{R}_j \alpha + X_i \beta + \delta_k + \epsilon_{ijk}, \quad (2.3)$$

where  $\bar{R}_j$  is the mean quantity remitted by migrants in municipality  $j$ . In this regression

in turn we need to exclude  $\gamma_j$  and are hence unable to control for other unobserved characteristics of municipalities that might influence individuals' remittance sending behavior (e.g. local labor markets, welfare policies implemented by the municipality, etc.).

To be able to control for unobserved factors at both the country and municipality level, we need average behavior to vary along both dimensions, while at the same time we have to avoid running into the reverse causality problem present in Equation 2.1. Bertrand, Luttmer and Mullainathan [2000]'s definition of network effects is able to achieve this. The authors consider that network effects are present if individuals imitate the average group behavior when residing in locations with a strong presence of their peers. In line with this idea we define network effects as follows:

$$\text{Network effects}_{jk} = \overline{\overline{R_k}} \times \text{Rep}_{j,k},$$

where  $\overline{\overline{R_k}} = \overline{R_k} - \overline{R}$  denotes the difference between average remittances of individuals from country  $k$  and average remittances by any migrant in Spain ( $\overline{R}$ ), and  $\text{Rep}_{j,k}$ , denotes the relative representativeness of individuals from country  $k$  in municipality  $j$ . In particular, this last term is defined as the natural logarithm of the relative representativeness of individuals from country  $k$  in municipality  $j$ :

$$\text{Rep}_{j,k} = \ln \left( \frac{\text{Pop}_{j,k} / \text{Pop}_j}{\text{Pop}_k / \text{Pop}} \right).$$

Depending on a country's average remittance sending behavior or remittance "culture" and the representativeness of individuals from this country in a certain municipality, we

can distinguish four different cases for network effects displayed below:

		$\ln \left( \frac{Pop_{j,k}/Pop_j}{Pop_k/Pop} \right)$	
		$> 0$	$< 0$
$\overline{\overline{R_k}}$	$> 0$	Network effects $_{jk} > 0$	Network effects $_{jk} < 0$
	$< 0$	Network effects $_{jk} < 0$	Network effects $_{jk} > 0$

We hence estimate positive network effects if individuals from above-average (below-average) remitting countries who live in municipalities where their country group is over-represented (underrepresented) remit relatively more than individuals from these same countries living in smaller (larger) networks; i.e. where they are underrepresented (over-represented). When presenting our results, we will analyze which of these subgroups drives the aggregate effect.

Note that the current specification of network effects has the advantage of allowing us to differentiate individuals along two dimensions: (i) the representativeness of their country in their municipality, as well as (ii) their country's average remittance sending behavior. To highlight why this is important, consider an alternative specification that interacts representativeness with the average remittance sending behavior of the country ("culture") instead of its difference with the national average. Under such a specification, individuals from countries that remit little and who live in very large networks could be assigned the exact same value for network effects as individuals from countries that remit much but

who live in somewhat smaller (though still overrepresented) networks. We would thus only be able to distinguish individuals by the representativeness of their country of origin in their municipality. However, for network effects to operate, imitation plays a crucial role, and it depends on the average behavior of co-nationals. Hence, we also want to differentiate individuals by “culture.”

On the other hand, without the logarithmic transformation of our variable for representativeness, individuals from countries that remit much who live in small networks could be assigned the exact same value for network effects as individuals from somewhat lower (though still above average) remitting countries living in larger networks. Only specifications such as the one proposed by Bertrand, Luttmer and Mullainathan [2000] allow us to clearly distinguish between how individual’s remittance sending behavior is affected by (i) the representativeness of an individual’s country of origin in his or her municipality and (ii) “culture”, i.e. average remittances sent by co-nationals. Put otherwise, it allows us to account for “who” is being imitated and “what” is being imitated. While subtracting the national average from the average remittance sending behavior of a country is a monotone transformation, the same cannot be said about the logarithmic transformation of our variable for representativeness. Hence, we make sure that our main results are robust to an alternative specification that considers representativeness without the logarithmic transformation.

To estimate the effect of networks on individual’s remittance sending behavior, we thus

rewrite our model in the following way:

$$R_{ijk} = (\overline{\overline{R_k}} \times Rep_{j,k})\alpha + X_i\beta + \gamma_j + \delta_k + Rep_{j,k}\theta + \epsilon_{ijk}. \quad (2.4)$$

We do not include the non-interacted term,  $\overline{\overline{R_k}}$ , by itself because it is captured by country fixed effects.

However, if we were to estimate Equation 2.4 by ordinary least squares the problem of self-selection and in particular differential self-selection by migrants’ “cultures” would still persist. Specifically, such an OLS estimation of network effects would be subject to a positive bias if among individuals from countries where average remittances are high, those who remit more decided to reside in municipalities with many co-nationals. On the other hand, a negative bias would be present in an OLS estimation of Equation 2.4 if among individuals from countries where average remittances are low, those who remit more decided to reside in municipalities with many co-nationals. To clearly isolate network effects on remittance sending behavior from effects arising from residential self-selection, we estimate Equation 2.4 using instrumental variables.

## 2.1 Instrumenting for network effects

We follow Gonzalez and Ortega [2012], and we predict the number of migrants from each country that settle in each location by considering how accessible the location is by different modes of transportation, and how migrants from different countries initially arrived in Spain. For Spain, data on the accessibility of municipalities is not available, and hence

our instrument is constructed at a higher level of aggregation, provinces.

We distinguish between four modes of physical accessibility: by air and land, and for sea access we further differentiate between regular boats and makeshift rafts.<sup>8</sup> To define accessibility  $a_{p,m}$  for each province  $p$  and mode  $m$ , we use information on the share of international arrivals in province  $p$  by plane and boat. For accessibility by land (car, bus, or train)  $a_{p,land}$ , we consider the distance from province  $p$ 's capital city to the French border. We normalize this distance dividing it by 1,055km, the maximum distance between the French border and a Spanish mainland province (Cadiz). To assess a province's accessibility by makeshift rafts, we consider if it has a coast line that can be reached by such rafts (i.e. Spain's Mediterranean coast and the Canary islands). Note that as each province is assigned its share of boat and air travel passengers and its relative distance to the French border, the sum across all provinces equals one:  $\sum_p a_{p,m} = 1 \forall m = \text{air, land, boat}$ . In a second step, we calculate the share of all individuals born in country  $k$  who used each mode of transportation when initially entering Spain for the first time ( $e_{k,m}$ ). By construction, for any country  $k$  these terms also add up to one across all four modes of transportation, i.e.  $\sum_m e_{k,m} = 1 \forall k$ ;  $m = \text{air, land, boat, makeshift raft}$ .

Finally, for all modes but makeshift rafts, we multiply the two terms,  $a_{p,m}$  and  $e_{k,m}$ , and we add these three terms, together with a product composed of an indicator for accessible coast line and arrivals by makeshift rafts. This way we obtain a measure for the overall degree of accessibility of each province from the point of view of each country of origin:

$$\lambda_{p,k} = a_{p,land}e_{land,k} + a_{p,air}e_{air,k} + a_{p,boat}e_{boat,k} + D_{p,coast}e_{raft,k}.$$



To predict the number of migrants from each country in each province, we multiply the degree of accessibility ( $\lambda_{p,k}$ ) by the number of foreign-born individuals from country  $k$  residing in Spain ( $FB_k$ ):

$$Pop_{p,k} = \lambda_{p,k} FB_k. \quad (2.5)$$

This predictor assigns more migrants from Europe who tend to initially enter Spain by bus or car to landlocked provinces, while Southern provinces with coastlines are assigned more immigrants from Africa. Finally, we assign more migrants from Latin America to regions with important international airports.<sup>9</sup>

### 2.1.1 Adjustment: Tourism

Spain is one of the most important tourist destinations in the world. In 2007, almost 60 million tourists visited the country. These movements of individuals potentially bias our accessibility measures. Hence, in order to obtain a better predictor for the representativeness of migrants in each municipality, we adjust our instrument for individuals who could actually be tourists. Under the assumption that preferred transportation modes for individuals from different countries are similar for tourists and immigrants, – with the clear exception of makeshift rafts – our adjustment also uses  $e_{k,m}$ , the share of individuals born in country  $k$  who initially entered Spain using each mode of transportation  $m$ .<sup>10</sup> Data on the number of tourists are only available for each autonomous region which represent a higher level of aggregation than provinces, and we hence combine the measure  $e_{k,m}$  with the share of tourists arriving by each mode of transportation in each autonomous region

$t_{r,m}$ .<sup>11</sup> Similar to how we estimated  $\lambda_{p,k}$  (the share of migrants at the province level) we then estimate the share of tourists from each country of origin in each autonomous region:

$$\rho_{r,k} = t_{r,land}e_{land,k} + t_{r,air}e_{air,k} + t_{r,boat}e_{boat,k}.$$

In a second step, we predict where immigrants would reside if all of them were tourists, by multiplying the term  $\rho_{r,k}$  with  $FB_k$ , the foreign-born population from country  $k$ :

$$Ptr_{r,k} = \rho_{r,k}FB_k,$$

and we use this term to adjust our initial instrument.

We then estimate our main model by a two-step IV procedure that circumvents the problem of self-selection present in Equation 2.4 and that includes the correction of our initial instrument for tourism. The first step estimates:

$$\overline{\overline{R}}_k \times Rep_{j,k} = (\overline{\overline{R}}_k \times Prep_{p,k})\alpha + (\overline{\overline{R}}_k \times Ptr_{r,k})\kappa + X_i\beta + \gamma_j + \delta_k + Prep_{p,k}\theta + Ptr_{r,k}\omega + \epsilon_{ijk}$$

$$Rep_{j,k} = (\overline{\overline{R}}_k \times Prep_{p,k})\alpha + (\overline{\overline{R}}_k \times Ptr_{r,k})\kappa + Prep_{p,k}\theta + Ptr_{r,k}\omega + X_i\beta + \gamma_j + \delta_k + \epsilon_{ijk} \quad (2.6)$$

where

$$Prep_{p,k} = \ln \left( \frac{Ppop_{p,k}/Pop_p}{Pop_k/Pop} \right)$$

uses the predicted number of individuals from each country of origin in each province as specified in Equation 2.5.<sup>12</sup> We expect the predicted representativeness of migrants in each province to be positively correlated with the representativeness of migrants in each

municipality, and we expect a negative correlation with the predicted number of tourists.

The second step of the estimation uses the predicted representativeness at the municipality level and the predicted interaction term in our main regression:

$$R_{ijk} = \widehat{\overline{R_k}} \times Rep_{j,k} \alpha + X_i \beta + \gamma_j + \delta_k + \widehat{Rep_{j,k}} \theta + \epsilon_{ijk}. \quad (2.7)$$

Equation 2.7 represents our baseline specification.

The validity of our instrument relies on the fact that migrants' initial arrival mode in Spain is determined by geographical factors which are independent of remittance sending behavior.<sup>13</sup> In particular, our instrument combines migrants' arrival modes with the accessibility of each province by different modes of transportation. Given that the latter is approximated by the relative distance to France but also by shares of arrivals by plane and boat in each province, there could exist some concern that our measure of accessibility reflects economic opportunities which also determine remittance sending behavior. However, we cannot think of any reason that over the course of many years such opportunities would be systematically related to how immigrants from a certain country initially arrive in Spain. Note that province fixed effects in our first step estimation capture any difference in economic opportunities across provinces. One might still be concerned that even arrival modes could be endogenous. For instance, if family members of migrants who send more remittances can subsequently afford to arrive in Spain via more expensive means of transportation (plane vs car). However, country of origin fixed effects in our first stage estimation control for this. Finally, some individuals chose to send remittances via others

instead of bank transfers or money orders in post offices or agencies. If sending money via others were systematically linked to higher or lower remittances and also to certain modes of transportation this could threaten the validity of our instrument. However, we show that i) very few individuals choose this remittance channel and ii) results are robust to excluding individuals who report to send money via others or countries where this practice is more wide-spread.

## 3 Data

### 3.1 Data bases

For our analysis we use data from the Spanish National Immigrant Survey (“Encuesta Nacional de Inmigrantes”), a unique survey carried out in 2007. The survey interviewed 15,465 foreign-born citizens who were living in Spain at the time of the interview, and who had been (or intended to stay) in Spain for at least one year. The survey asked questions about a wide variety of aspects, among others: socio-demographic characteristics, labor market activity, contacts with Spanish civil society and contacts with the society of origin.<sup>14</sup> We have information on migrants’ municipality of residence and the mode of transportation they used when they first arrived in Spain. Of particular interest for our analysis, the survey also asked about the amount of remittances and how remittances were sent.

We rely on the Spanish Town Hall Census for data on the number of individuals from

each country of origin in each municipality. The Census is an administrative register that contains information on all individuals residing in a municipality. Its main advantage is its accuracy regarding the number of immigrants from each country that live in a municipality. Most immigrants in Spain are registered with their municipality, regardless of whether they are otherwise documented or not, because there are strong incentives to do so. Registration with the municipality provides access to basic medical care, education for children, and many other social services.<sup>15</sup> Furthermore, even undocumented migrants can be certain that registering will not entail any negative legal consequences.<sup>16</sup> From the Town Hall Census we also obtain data on total population in each municipality, province, and autonomous region, as well as information about the overall presence of individuals from each country in Spain.

We use data from additional sources to construct our instrumental variables. Regarding the accessibility of each province by plane we consider data from the operator of Spanish airports (AENA) on the annual number of passengers arriving at each airport. We use data from the Ministry of Infrastructure for the number of passengers arriving by boat at each port. We used Google Maps to measure the distance between each province's capital city and the French border along major highways. For adjusting our instruments for tourism, we rely on survey data for 2007 published by the Ministry of Industry, Energy and Tourism regarding the number of tourist entries by means of transportation as well as the number of foreign travelers who stay overnight in each one of the Spanish autonomous regions ("Encuesta de Ocupacion Hotelera").

Finally for a subset of ten countries that receive large amounts of remittances from Spain

(so called corridor countries), we have data for 2008 from the World Bank on providers and prices charged for sending remittances. These data allow us to explore the relationship between network effects and costs of sending remittances.

### 3.2 Sample selection

We restrict our sample to individuals from countries of origin with at least 5,000 individuals living in Spain. We also exclude from our analysis two mid-size Spanish cities, Ceuta and Melilla, which are located on the African continent. We do so for two reasons: (i) Given that these cities have an independent administrative status (“autonomous cities”), including them leads to artificially more heterogeneity in all our province-based measures, and (ii) the vast majority of migrants in these cities arrives from Africa by land which makes it impossible for our instrument to predict migration to these cities. These restrictions leave us with data for 12,656 individuals from 59 different countries of origin distributed among all 50 provinces and 17 autonomous regions.<sup>17</sup>

### 3.3 Descriptive statistics

Table 1 displays summary statistics (mean, standard deviation, minimum, and maximum values) for all variables in our main sample. In order to maximize the number of individuals in our sample, despite some missing observations, we construct indicators for missing data regarding education, income, and family living abroad (see Table A2 of the Appendix for details). Individuals in our sample remitted on average around 670€ during the course of a year, ranging from no remittances at all to 60,000€. <sup>18</sup> Regarding individual charac-

teristics, half of all migrants in our sample are men, and they are on average around 40 years old. Slightly more than half are married, and they live in households with between two and three additional members. Most have secondary education (53%) followed by tertiary (21%) and primary education. Around 12% has not completed primary education. Approximately 18% of migrants in our sample completed their education in Spain. The majority is employed (65%), and average monthly income is around 700€. Around 24% of migrants indicate intentions to bring family members to Spain, while only 7% say that they intent to return to their country of origin within the next five years.<sup>19</sup> In the case of 5% and 13% of migrants, children and spouses respectively reside in the country of origin. Numbers are much higher for other family members: 35%, 29%, and 47% have mother, father, and siblings respectively living in their country of origin. The minimum value of the representativeness variable is zero and corresponds to those country groups with no representation in a given location. The maximum value is 300 and reflects that the population of Norwegians in Alfàs del Pi (Alicante) is 300 times higher compared to the national average of Norwegians in Spain. The logarithmic transformation mitigates this difference in variability somewhat. Average population size by province is 2.7 million, ranging from 93,000 in the province of Soria to more than six million in Madrid. Individuals from most countries of origin typically entered Spain by plane, followed by arrivals via roads (or railroads).

[Table 1 here]

In Table A1 of the Appendix we report for each of the 59 countries of origin in our sample averages for the following key variables: presence in Spain and in our sample, remittances

sent, age, close family (spouse or children) living abroad, and monthly labor income. There is large variation in average remittances sent, ranging from no remittances at all sent by migrants from Switzerland or Australia to 2,117€ sent by individuals from Mauritania. For country averages we observe no clear relationship between remittances sent and monthly labor income. However, for countries of origin with a large fraction of individuals reporting that their close family lives abroad, average remittances are higher.<sup>20</sup> The correlation between the two terms in our interaction defining network effects (average remittances and log representativeness) is positive but relatively low (0.0246). Summary statistics for additional variables used in our estimations for heterogeneity and mechanisms of network effects (years in Spain, continent of origin, remittance channels, etc.) as well as information on missing variables are displayed in Table A2 of the Appendix. Note that on average, migrants in our sample have lived in Spain for 11 years, initially arriving in Spain in the late 1990's. In Tables A3 and A4 of the Appendix we report the use of remittance channels by country of origin and World Bank data on the prices for sending remittances charged by the least and most expensive providers in Spain.

## 4 Results

### 4.1 Presence of network effects

We explore whether migrants' remittance choices are influenced by network effects. Table 2 displays coefficients for the different measures of network effects discussed before (for the full set of coefficients see Table A5 in the Appendix). The first column reports the



results from estimating Equation 2.1 that considers the most “naive” way of measuring networks, using the average amount remitted by co-nationals who live in the same municipality. The coefficient is positive and highly significant, indicating that individuals who live in municipalities where their co-nationals remit much, remit relatively more.

[Table 2 here]

However, this result could be driven by the effect that individual remittances have on the country average in the municipality. Column two reports the coefficient for the improved model that uses national averages by country of origin instead (see Equation 2.2). This coefficient is somewhat smaller but still positive and significant at the 5% level. Individuals from countries that remit a lot also tend to remit more. In column three the coefficient on average remittances at the municipality level is only half the size of the coefficient in column one, which shows that the correlation between individuals’ remittances and group averages is lower when considering all migrants within a municipality independently of their country of origin. Column four reports OLS estimates for Equation 2.4 using Bertrand, Luttmer and Mullainathan [2000]’s definition of network effects which allows us to control for unobserved municipality and country specific factors. Coefficients for network effects and representativeness in this estimation are positive but not significant. When comparing the coefficient on network effects to the one from the IV estimation displayed in the last column, we observe that the OLS estimation suffers from a negative bias. As discussed before, this is driven by differential self-selection of individuals into their place of residence. In particular, individuals with a relatively high (low) propensity to remit and who belong to below-average (above-average) remitting countries tend to

move to municipalities where their co-nationals concentrate. Alternatively, individuals with a relatively high (low) propensity to remit and who belong to above-average (below-average) remitting countries tend to move to municipalities with few co-nationals.

Results from our IV estimation that is able to set aside differential self-selection indicate a positive and very significant coefficient for network effects. This shows that individuals from above-average remitting countries increase the amount of remittances they send as a consequence of living surrounded by relatively many co-nationals and/or that those from below-average remitting countries decrease the amount of remittances they send as a result of living in larger networks. We test which group is driving the aggregate result by including interaction terms of network effects with indicator variables for individuals who are from above-average remitting countries and for those who live in municipalities where their country is overrepresented. Results from these two regressions show that network effects are exclusively driven by individuals from above-average remitting countries (see Table A6 in the Appendix).

While we find positive and significant network effects, these are not easily quantifiable. Following one possible approach suggested in Bertrand, Luttmer and Mullainathan [2000], we estimate that networks amplify individuals' remittance choices by 56.3%. This implies that if in the absence of networks, a sudden shock leads to a one percentage point increase in individual remittances – for instance due to a natural disaster in the home country – then networks give rise to an increase of 1.6 percentage points.<sup>21</sup> However, as Bertrand, Luttmer and Mullainathan [2000] point out, this number has to be taken with a grain of salt because its calculation assumes that any change in a country's average remittances

implies a one-to-one change in its remittance “culture.” A somewhat looser interpretation suggests that the amount of remittances is only indicative for how co-nationals can affect individuals’ remittance behavior. In this case, a shock that increases a country’s average remittances may not change network effects as much as suggested by our simple calculation, and hence the amplification would be smaller. First stage estimations for our instrument of network effects and representativeness are displayed in Table 3. Our instruments are highly significant, and the adjustment for tourism shows the expected sign. Given that we have two endogenous variables, we need to use Angrist and Pischke [2009]’s formula to compute the F-statistics. These numbers are 18.61 for network effects and 121.5 for representativeness. As both lie above the criteria for weak instruments in Stock and Yogo [2005], we reject that our instruments are weak.

[Table 3 here]

Regarding other determinants of individuals’ remittance sending behavior and similar to findings in literature, we also estimate a positive correlation of income and employment and bonds with the home country and a negative correlation of ties with the host country. With respect to the latter, for all but the first specification, we find that in particular being educated in Spain is related to significantly lower remittances. On the other hand, having children, spouse, mother, or father living abroad as well as return intentions – all indicators of bonds with one’s country of origin – are related to more remittances. We also find that individuals who intend to bring their family to Spain – something that may indicate both, ties with the home and links to the host country – send more remittances, see Table A5 in the Appendix.

However, some of these additional aspects of remittance sending behavior like employment and income have been shown to be affected by networks themselves. This could potentially bias our estimates. Following Bertrand, Luttmer and Mullainathan [2000] we thus check whether adding controls sequentially to our regression, affects results. In addition, if individual unobserved factors were mainly driving our results, one would expect that increasing the number of unobservables by removing observables would alter our coefficients. In the first column of Table 4 we report our IV coefficients for the most sparse regression that only includes country dummies. We then add municipality fixed effects in column two and additional groups of control variables one by one until arriving at our main specification in the last column. The coefficient on network effects is very stable across all specifications, and once municipality fixed effects are accounted for, the same is true for the coefficient on representativeness. This indicates that these controls are not affected much by network effects, and that individuals' unobservable characteristics are not driving our results. In Tables A7 and A8 of the Appendix we show that also our first stage estimations are robust to sequentially adding controls.

[Table 4 here]

#### 4.1.1 Robustness: Sample

In addition to sequentially adding controls, we also check the robustness of our results along other dimensions. We first make sure that our results are driven by economic migrants, i.e. migrants from poorer countries. While there are also immigrants from France,

Italy or the United Kingdom who report to send money to their countries of origin, these are likely to be idiosyncratic transfers, and they may be different from remittances. We hence re-run our main regression excluding from our sample individuals from countries where GDP per capita in 2007 was higher than in Spain's. While this reduces our sample by around one fourth, results in Table A9 are almost indistinguishable from those in our main estimation, confirming that our results are not driven by other types of monetary transfers.

We then check that results are not exclusively driven by individuals from certain countries of origin, in particular by those from the two countries with the largest representation in Spain, Morocco and Romania. The first three columns of Table A10 display results excluding individuals from these countries. Without Moroccans, network effects are smaller, while they are somewhat larger and more significant when excluding Romanians. Results are also robust to the exclusion of individuals from both countries of origin. On the other hand, individuals from the majority of African countries in our sample report to send rather large amounts of remittances. In the fourth column we show results for a sample that excludes individuals from Africa. Compared to our main estimation, network effects are only slightly smaller and remain significant at the 5% level. Finally, the Spanish Balearic and Canary islands are the only provinces for which accessibility by land is undefined. This could potentially affect our results. Coefficients for a sample that excludes these provinces are displayed in column five. Without considering migrants living on islands, network effects are somewhat larger.

Our main sample is limited to individuals from countries of origin with a representation

of at least 5,000 individuals in Spain. However, coefficients in Table A11 in the Appendix show that our results are robust to using a sample that includes individuals from countries of origin with a representation of at least 2,000 individuals. We also test the robustness of our results regarding modes of transportation. There could exist some concern that contrary to our assumption, tourists and migrants use different means of transportation. To account for this, we repeat our main estimation including only countries of origin where more than 60% of individuals use one particular mode of transportation, making it unlikely that tourists and migrants could choose very different modes. For instance, both migrants and tourists from Latin America arrive in Spain by plane, while individuals arriving from France may choose to come by plane or by car depending on their migrating or travel intentions. Results in Table A12 show that our results remain unchanged. Our results are also robust to an alternative definition of network effects that uses the simple ratio for relative representativeness without the logarithmic transformation. The coefficient on network effects in our IV estimation remains positive and significant at the 5% level (see Table A13 of the Appendix). Finally as mentioned before, the fact that some individuals choose to send remittances via others could threaten the validity of our instrument if this were systematically linked to higher or lower remittances and also to certain modes of transportation. While on average only 4% of individuals report the use of this remittance channel, we check the robustness of our results excluding individuals who choose to remit via others (see Table A14), and excluding countries where more than 10% of individuals remit via others (see Table A15 ). Our results remain robust.

## 4.2 Heterogeneity of network effects

Our results show that immigrants from above-average remitting countries remit more if they live in larger networks. However, network effects are likely to operate differently depending on a variety of individual characteristics such as cultural background, family situation, length of stay, or legal situation in Spain. To investigate this matter we repeat our IV estimation interacting network effects with indicators for the following variables: “having Spanish nationality”, “years lived in Spain”, “children or spouse lives abroad” and five indicators for continent of origin. Table 5 displays the results. Network effects are negative for immigrants with Spanish nationality, and they decrease with years lived in Spain; see columns one and two. Results in column three show that network effects for remittances are particularly strong for individuals whose spouse or children live abroad. When considering continents of origin, we only find significant effects for individuals from America. However, effects are also large - although probably due to reduced samples not significant – for individuals from Africa, Asia, and Oceania. For Europeans the estimated coefficient is much smaller.

[Table 5 here]

## 4.3 Mechanisms of network effects

How do network effects operate? In the introduction we suggested four direct mechanisms through which living surrounded by others from the same country of origin could affect individuals’ remittance choices: (i) Migrant communities can help to maintain ties

with the home country thus increasing the desire to remit, (ii) migrant communities can help to establish ties with the host country thus decreasing the desire to remit, (iii) peer pressure from network members and fear of ostracism could induce network members to remit more, and (iv) living surrounded by many co-nationals, in particular if they remit much, might lower effective remittance prices via sharing of information about cheaper ways of sending money home and/or via increased competition among remittances service providers in these locations. Given that we estimate positive network effects that are driven by individuals from above-average remitting countries who live in larger networks only mechanisms (i), (iii), and (iv) could be at work. While our data does not allow us to test for mechanism (iii) directly, we can test for the presence of mechanisms (i) and (iv). Outcomes that could suggest that mechanism (i) operates are: return intentions or the desire for family reunification. Furthermore, owning a house in the country of origin could also be seen as an indicator for return intentions as could not participating in Spanish elections.<sup>22</sup> We test for the relationship between network effects and all these outcomes, but do not find any significant relationships. We also test if network effects on remittances operate indirectly through better employment opportunities or higher income related to living surrounded by many co-nationals from above-average remitting countries but find no support for this; see Table A16. However, note that our results do not exclude the possibility that migrant networks defined differently: i.e. not in terms of remittance sending behavior, could affect such outcomes for immigrants in Spain. Put otherwise, we do not dismiss the possibility that mechanism (i) is operative, but we are not able to pin down such effects in our data.

Regarding mechanism (iv), the Spanish Migrant Survey asked individuals how they send



remittances, offering the following answers: (a)Bank transfer, (b)money order in post office, (c)agency, (d)via other people, (e)different way (see Tables [A2](#) and [A3](#) of the Appendix). More than half of all individuals send remittances via agencies, followed by bank transfers (29%), and money orders in post offices (14%). Around 4% send remittances via other people. For approximately a third of individuals in our sample who answered this question we construct two dummy variables. The first one takes on value one for those who use bank transfers and zero otherwise, and the second dummy variable takes on value one for individuals who indicate the use of other formal channels (money order in post office or agency). For the subsample of individuals who provided information on remittance channels, we repeat our IV estimation replacing the previous outcome variable with these indicator variables. Table [6](#) displays the results. We find that due to network effects, migrants are more likely to send remittances via bank transfers. They are less likely to use other formal means such as money orders in post offices or agencies. In particular, an increase by one standard deviation in the average quantity remitted by individuals from a certain country (523€), implies an increase in the probability of remitting through bank transfers for the average network of 0.031.<sup>23</sup> Given that the average probability of sending remittances through bank transfers in our sample is 0.3, we conclude that a shock that increases remittances by one standard deviation increases the probability of using bank transfers by 10.37%. Given that the average use of other formal channels is 0.645, this same shock implies a decrease in the probability of remitting using those methods by 4.83%.

[Table [6](#) here]

In order to further investigate how a change in remittance channels provoked by network effects might lead to higher remittances, we consider data from the World Bank on remittance service providers in Spain. Data is available for the following ten countries which receive particularly large amounts of remittances from Spain: Brazil, Bulgaria, China, Colombia, Dominican Republic, Ecuador, Morocco, Peru, Philippines, and Romania. Note that individuals from these ten countries represent 47% of all individuals in our sample and more than 2.2 out of the five million immigrants residing in Spain in 2007. Table A4 in the Appendix displays the names of the most and least expensive providers, their type (agency, bank, post), and prices charged (in %) for sending 200\$ and 500\$ respectively, for the earliest available data in 2008.

For individuals from these ten countries who answered the survey question on remittance channels, we construct dummy variables indicating if they have used their country's most expensive channel. With this indicator as the outcome variable, we reestimate our regression for mechanisms of network effects. Results are displayed in Table 7. Network effects are related to fewer individuals using the most expensive channel for sending money to their country of origin. While effects are rather small, they suggest two possible channels by which network effects could lead to higher remittances. If large networks of migrants from countries that remit a lot: i) are better at sharing information about the cheapest ways of sending money home, and/or ii) provoke market entry and increased competition among remittance service providers, then cost savings in fees could allow migrants to send more money over the course of a year.

[Table 7 here]

#### 4.4 Macroeconomic implications of network effects

The spread – i.e. the percentage point difference in costs between most and least expensive providers– varies quite a bit across the sample of ten countries. A lower spread could be interpreted as an indicator of increased competition among providers. Looking at the average measure of network effects by country and cost spreads for sending 200\$ and 500\$, we find cross-country correlations of -0.0601 and -0.4892 respectively (both correlations are significant at the 1% level.) Cost differences between providers are hence lower for countries characterized by stronger network effects in Spain. Or put otherwise, individuals from countries that send a lot of remittances and who tend to geographically concentrate more, face lower spreads. In the spirit of findings on the effect of migrant networks on trade flows, this could be interpreted as evidence for the existence of additional macroeconomic effects of migrant networks.

Areas with many individuals from high-remitting countries represent attractive markets. New remittance service providers may react by entering these markets, while incumbent providers may find it profitable to lower remittance prices to capture and/or to keep their clients. The latter mechanism may be reinforced if networks share information about remittance prices posted by the different providers in an area. Migrants of high-remitting countries who on average tend to live closer together may face lower price spreads because they represent the most attractive market. Therefore, our estimated network effects on remittances could be explained because networks may induce market entry in the remit-

tance service provider industry and thus exert pressure to lower remittance prices.

In line with the hypothesis of market entry, we observe a simultaneous increase in foreign population and number of bank branches and registered remittance service providers in Spain between 2001 and 2008. Data from the Bank of Spain [2018] shows that the number of registered remittance service providers increased from 32 to 50 during that time period. Regarding bank branches, for the same period of time, the correlation between the number of bank branches and foreign residents in Spain is 0.98 (Bank of Spain [2018] and Spanish National Statistics Institute for foreign population). However we cannot distinguish if new bank branches are mainly due to remittances or banks' regular business for which demand also increases due to migration. Unfortunately, we neither have information on the locations of branches for each bank, nor do we know the geographic locations of money sending agencies other than their headquarters in Spain. This makes it impossible to test directly for the entry of new providers into different locations. We thus cannot rule out that both mechanisms, information-sharing among migrants and pressure on existing providers and entrance of new providers, are behind lower costs spreads of countries characterized by stronger migrant networks.

## 5 Conclusion

Immigrant networks have causal effects on individuals' remittance sending behavior. In particular, migrants from above-average remitting countries send more remittances when they live surrounded by relatively more co-nationals. For a subset of ten countries that

all receive large remittance flows from Spain, we show that migrants in larger networks are less likely to use most expensive remittance channels. Network effects hence have the power to boost policy efforts to reduce remittance costs, such as the World Bank’s “Project Greenback.”

Remittances to developing countries have been shown to have powerful effects on individual outcomes such as education and entrepreneurship (Yang [2008]) as well as countries’ development; e.g. capital accumulation (Chiodi, Jaimovich, and Montes-Rojas [2012] ) or poverty reduction (Yang and Martinez [2005]). Our results highlight that migrant networks could play an important role for increasing remittances, and that positive network effects for remittances are particularly strong for individuals whose children and spouse remain in the country of origin. Furthermore, large networks of individuals who send a lot of remittances seem to face smaller price differences for sending remittances, which could be due to market entry by new providers as well as networks sharing information about cost effective ways of sending money to countries of origin. Relatively small network effects could thus translate into higher remittances which have important effects for individuals in receiving countries.

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# Notes

<sup>1</sup>According to the World Bank in 2015 remittance inflows to developing countries reached \$435 billion, equivalent to approximately 7% of output produced by low and middle income countries.

<sup>2</sup>There are also indirect ways in which migrant networks could affect remittances sent, as a byproduct of network effects on employment or wages.

<sup>3</sup>In 2007 Spain recorded remittance outflows of \$14 billion and was ranked 5th after the US, Russia, Saudi Arabia, and Germany. Spain's remittance outflows in 2007 were equal to 5% of all remittance outflows worldwide, while Spanish GDP amounted to 2.5% of World GDP (World Bank).

<sup>4</sup>In 2011 the World Bank launched "Project Greenback" with the objective of reducing the average cost of sending remittances in order to increase remittances. The project envisioned a five percentage point decrease in costs over five years (estimated cost savings of \$16 million per year). As key challenges the project identified access to information and healthy competition amongst providers. Financial education workshops and organized awareness raising initiatives in selected cities (up to this date in Turin, Italy and Montreuil, France ) as well as monitoring of remittance prices (<https://remittanceprices.worldbank.org>) were launched to achieve this objective.

<sup>5</sup>Also for the US, Andersson, Burgess, and Lane [2014] apply the same method and find positive migrant network effects for employment.

<sup>6</sup>Rapoport and Doquier [2006] state the need for further research "on the social determinants of remittances, possibly in connection with the social networks literature"(pg. 1171).

<sup>7</sup>As Bertrand, Luttmer and Mullainathan [2000] point out, this regression is affected by the so-called reflection problem as first defined by Manski [1993] which prevents us from interpreting a positive estimate of the coefficient  $\alpha$  as evidence for network effects. The authors interpret this problem as essentially equivalent to the presence of two types of biases due to omitted variables regarding: (i) personal characteristics and (ii) neighborhood characteristics. Our baseline estimation addresses the latter by including municipality fixed effects and the former by instrumenting for networks.

<sup>8</sup>Spain's Mediterranean coastline together with the coasts of the Canary Islands sum 3,561 km, and

according to the Spanish Ministry of Internal Affairs [2007] in 2006 and 2007 39,180 and 18,057 illegal immigrants respectively arrived on makeshift rafts. While according to the same source the vast majority was repatriated, controlling for this route of access is potentially important.

<sup>9</sup>As an example consider the predicted number of Moroccans in the province of Malaga; i.e. the product of the degree of accessibility of the province of Malaga for Moroccans ( $\lambda_{malaga,moroccans}$ ) and the number of Moroccans in Spain ( $FB_{Morocco}$ ). To compute the degree of accessibility we use the share of Moroccans entering Spain by boat, road (via France), plane, and makeshift rafts, 0.634, 0.225, 0.099, and 0.042, respectively (terms  $e_{plane,Morocco}$ ,  $e_{road,Morocco}$ , etc.). We combine these numbers with the accessibility of the province of Malaga by each mode of transportation. In particular, the terms  $a_{malaga,land}$ ,  $a_{malaga,air}$ ,  $a_{malaga,boat}$ ,  $a_{malaga,raft}$  indicate the relative accessibility of the province of Malaga relative to other provinces by each mode of transportation, and they take on values: 0.002, 0.042, 0.013 and 0.067, respectively. Combining these numbers we thus forecast that 1.566% of all Moroccans in Spain are located in Malaga; i.e.  $\lambda_{Malaga,Morocco}$  takes on value  $0.01566 = 0.225 \cdot 0.002 + 0.099 \cdot 0.042 + 0.634 \cdot 0.013 + 0.042 \cdot 0.067$ . Given 605,961 Moroccans in Spain ( $FB_{Morocco}$ ) we thus predict that 9,489 Moroccans reside in the province of Malaga.

<sup>10</sup>We sum the share of migrants entering Spain by makeshift rafts to the share of those entering by boat. Data for mode of entry of tourists by country of origin is only available from 2013 onwards and hence not perfectly comparable. Nevertheless for 86% of countries preferred modes of transportation in this data and our data on migrants coincide.

<sup>11</sup>We predict this share ( $t_{r,m}$ ) by multiplying  $T_r$ , the number of tourists in each region by  $s_m$ , the share of tourist arrivals in Spain by each mode of transportation  $m$ , where  $m = air, land, sea$  and  $t_{r,m} = T_r s_m$ . Note that due to the different levels of aggregation we are not able to simply subtract the predicted number of tourists (at the autonomous region level) from the number of migrants (at the province level).

<sup>12</sup>In our estimation the regressor of interest is the interaction of an exogenous and an endogenous variable. We hence follow Angrist and Pischke [2009] (pg 176) and Wooldridge [2002] (section 5.2) who for such cases propose to carry out a Two Stage Least Squares estimation with multiple endogenous variables.

<sup>13</sup>For countries in Latin America the only valid arrival mode is by plane, while for countries in Europe

or Africa the choice between car or plane or boat or plane is most likely determined by closeness of airports in countries of origin or routes covered by airlines at a certain point in time (when migrants first arrived in Spain), aspects that are both independent of individual remittance sending behavior.

<sup>14</sup>For further information on the survey design and methodology see Reher and Requena [2009] or the methodological description provided by the Spanish National Statistics Institute (INE): [http://www.ine.es/en/daco/daco42/inmigrantes/inmigra\\_meto\\_en.pdf](http://www.ine.es/en/daco/daco42/inmigrantes/inmigra_meto_en.pdf)

<sup>15</sup>This is no longer the case. In 2012 a law was passed (“Real Decreto 1192/2012”) that excludes undocumented migrants from access to medical care.

<sup>16</sup>Town Hall Censuses are regularly updated. It is compulsory for non-EU immigrants to re-register in the Town Hall Census every two years and records of EU immigrants who do not re-register every two or five years will be automatically deleted from the Census.

<sup>17</sup>See Figure A-2 in the Appendix for two maps displaying Spain’s 50 provinces and its 17 autonomous regions.

<sup>18</sup>Note that while we do not adjust these quantities by the income level of origin countries, the country dummies in our regressions account for any differences in purchasing power across countries of origin.

<sup>19</sup>The legislation in force during 2006/2007 regarding family reunification with spouse, children, and elderly parents required that non-EU migrants had renewed their residence permit at least once, and that they had adequate housing and sufficient economic means to maintain their family.

<sup>20</sup>Retiree migration mainly from Nordic countries to the South of Spain explains the higher average age observed for migrants from these countries. The same phenomenon explains the relatively high share of close family living abroad (their adult children) as well as the fact that average labor income is low, as pension receipts are not included in this measure.

<sup>21</sup>On pages 1039-1040 Bertrand, Luttmer and Mullainathan [2000] show how this amplification effects of networks can be calculated. First for each country  $x_k = 1/(1 - \alpha \overline{Rep}_k) - 1$  is calculated where  $\alpha$  is the coefficient on network effects from our IV estimation, and  $\overline{Rep}_k$  is the average representativeness of country  $k$ . Then the weighted average over all countries’  $x_k$ s provides the estimate of 56.3%.

<sup>22</sup>While foreign citizens can neither vote in general elections nor in elections for the autonomous regions,

EU citizens can vote in elections for the European parliament as well as elections for the municipality. The later is also true for Norwegians. Since 2010 this right has been extended to citizens of additional countries.

<sup>23</sup>This number is obtained by multiplying 523 with the estimated coefficient of 0.0001 and the average representativeness of 0.595.

# Tables

Table 1: Summary statistics (population-weighted): Main Sample

Variable	Mean	Std. Dev.	Min.	Max.
<i>Remittances:</i>				
Remittance sent in 2006, €	670.286	1,758.526	0	60,000
<i>Individual Characteristics:</i>				
Male	0.511	0.5	0	1
Age	39.371	14.511	18	98
Married	0.536	0.499	0	1
Household members	3.634	1.738	1	18
<u>Education:</u>				
Primary	0.144	0.351	0	1
Secondary	0.531	0.499	0	1
Tertiary	0.212	0.409	0	1
<u>Host country ties:</u>				
Educated in Spain	0.176	0.381	0	1
Employed	0.648	0.478	0	1
Monthly income, €	698.374	843.353	0	15,000
Participation in elections	0.207	0.405	0	1
Intentions to bring family	0.241	0.428	0	1
<u>Home country links:</u>				
Return intentions next 5 years	0.068	0.251	0	1
Spouse abroad	0.048	0.214	0	1
Children abroad	0.129	0.335	0	1
Mother abroad	0.349	0.477	0	1
Father abroad	0.285	0.451	0	1
Sibling abroad	0.467	0.499	0	1
<i>Network variables:</i>				
Representativeness, municipality	4.923	11.373	0.01	338.013
Log Representativeness, municipality ( $Rep_{j,k}$ )	0.766	1.232	-4.619	5.823
Individuals from each country of origin in municipality	6,072	16,948	2	111,308
Individuals from each country of origin in province	27,180	35,722	4	150,263
Population in province	2,693,712	2,226,465	93,503	6,008,183
<i>Country means for arrival mode:</i>				
Land (Bus,car, train)	0.290	0.320	0	0.911
Plane	0.610	0.371	0.088	1
Boat	0.093	0.204	0	0.634
Makeshift raft	0.007	0.023	0	0.333
N=12,656				

Table 2: Main estimation: Network effects

	(1)	(2)	(3)	(4)	(5)
Mean remit, mun. and country	0.972 (0.017)***				
Mean remit, country		0.709 (0.322)**			
Mean remit, municipality			0.493 (0.203)**		
Network effects				0.051 (0.035)	0.609 (0.242)**
Representativeness				4.990 (21.755)	-56.967 (95.136)
Municipality fixed effects	x	x		x	x
Country fixed effects	x		x	x	x
Obs.	12,656	12,656	12,656	12,656	12,656
$R^2$	0.544	0.251	0.251	0.251	0.228

The dependent variable is the amount of euros that individuals report to have remitted over the course of the previous year. The coefficients are marked with \* if the level of significance is between 5% and 10%, \*\* if the level of significance is between 1% and 5% and \*\*\* if the level of significance is less than 1%. Columns 1 to 4 are estimated by population-weighted OLS, column 5 is estimated by population-weighted 2SLS. All regressions contain the following individual characteristics: gender, age, marital status, number of household members, education, education received in Spain, family living abroad, income, employment, return intentions, participation in elections, intentions to bring family (see Table A5 in the Appendix for the full set of results). Standard errors are clustered at the municipality-country level.



Table 3: First stage

	Network effects	Representativeness
	(1)	(2)
Instrument network effects ( $\overline{R_k} \times Rep_{p,k}$ )	0.113 (0.014)***	-.00007 (0.00002)***
Instrument representativeness ( $Rep_{p,k}$ )	8.421 (6.116)	0.24 (0.014)***
Adjustment tourism	-.009 (0.001)***	4.90e-06 (2.35e-06)**
Interaction adjust. tourism	6.66e-09 (1.04e-08)	-1.29e-10 (1.81e-11)***
Obs.	12,656	12,656
$R^2$	0.629	0.537

The dependent variables are “network effects” ( $\overline{R_k} \times Rep_{j,k}$ ) in column (1) and “Representativeness” ( $Rep_{j,k}$ ) in column (2). The coefficients are marked with \* if the level of significance is between 5% and 10%, \*\* if the level of significance is between 1% and 5% and \*\*\* if the level of significance is less than 1%. The regressions are estimated by population-weighted OLS and contain all individual characteristics included in our main estimation (see Table A5) as well as municipality and country dummies. Standard errors are clustered at the municipality-country level.

Table 4: Main IV estimation: Network effects - adding controls sequentially

	(1)	(2)	(3)	(4)	(5)	(6)
Network effects	0.693 (0.223)***	0.651 (0.259)**	0.656 (0.26)**	0.637 (0.259)**	0.588 (0.242)**	0.609 (0.242)**
Representativeness	125.674 (80.652)	-34.254 (100.101)	-37.564 (99.226)	-43.346 (100.658)	-40.073 (96.858)	-56.967 (95.136)
Country fixed effects	x	x	x	x	x	x
Municipality fixed effects		x	x	x	x	x
Gender, age, marital status			x	x	x	x
Education			x	x	x	x
Family abroad					x	x
Remaining controls						x
Obs.	12,656	12,656	12,656	12,656	12,656	12,656
$R^2$	0.05	0.143	0.15	0.156	0.214	0.228

The dependent variable is the amount of euros that individuals report to have remitted over the course of the previous year. The coefficients are marked with \* if the level of significance is between 5% and 10%, \*\* if the level of significance is between 1% and 5% and \*\*\* if the level of significance is less than 1%. All regressions are estimated by population-weighted 2SLS. Standard errors are clustered at the municipality-country level. Remaining controls refer to number of household members, income, employment, return intentions, participation in elections, and intentions to bring family.

Table 5: Heterogeneity of network effects

	(1)	(2)	(3)	(4)
Network effects	0.808 (0.237)***	1.008 (0.287)***	0.371 (0.233)	
Network effects× Nationality	-.716 (0.249)***			
Network effects× Years in Spain		-.030 (0.008)***		
Network effects× Children/Spouse abroad			1.291 (0.28)***	
Network effects× Europe				0.138 (0.462)
Network effects× Africa				1.328 (1.173)
Network effects× America				0.507 (0.221)**
Network effects× Asia				1.175 (1.022)
Network effects× Oceania				0.798 (0.517)
Obs.	12,633	12,487	12,656	12,656
$R^2$	0.218	0.21	0.208	0.236

The dependent variable is the amount of euros that individuals report to have remitted over the course of the previous year. The coefficients are marked with \* if the level of significance is between 5% and 10%, \*\* if the level of significance is between 1% and 5% and \*\*\* if the level of significance is less than 1%. All regressions are estimated by population-weighted 2SLS and contain all individual characteristics included in our main estimation (see Table A5) as well as municipality and country dummies. Additionally in columns (1) and (3) indicators for having Spanish nationality and children or spouse living abroad are included. Column(2) includes a variable indicating years lived in Spain and column (4) indicators for continent of origin. Standard errors are clustered at the municipality-country level.

Table 6: Mechanism of network effects: Use of different remittance channels

	Bank transfer (1)	Other formal channels (2)
Network effects	0.0001 (0.00005)*	-.0001 (0.00005)*
Presence	-.011 (0.03)	0.011 (0.03)
Obs.	4,170	4,170
$R^2$	0.353	0.353

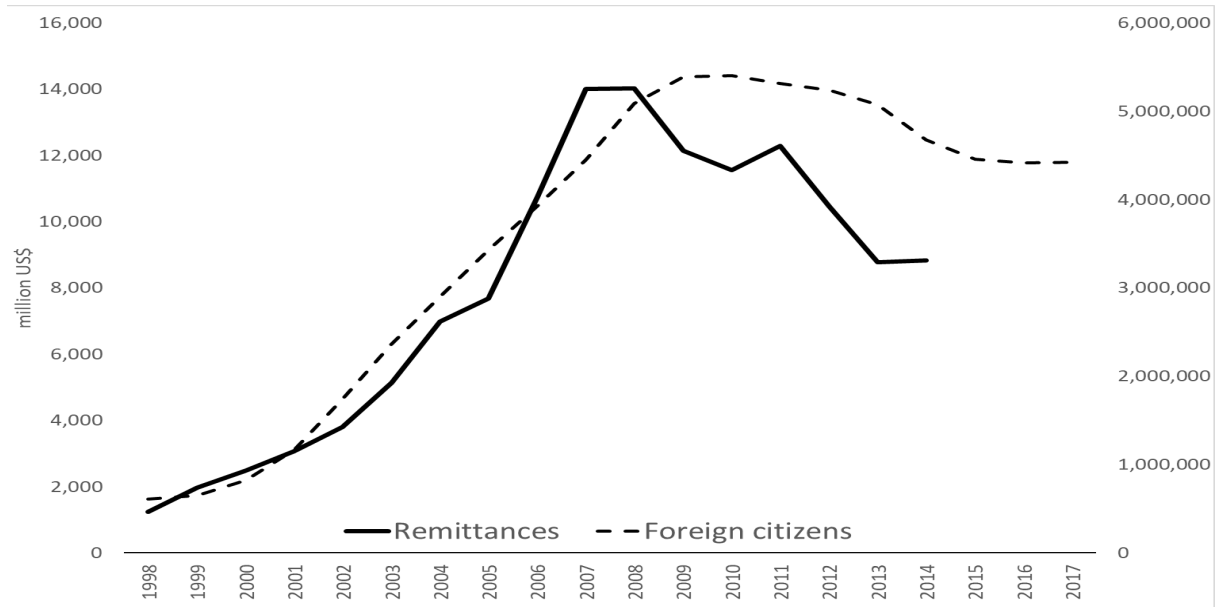
Dependent variables in column (1) and (2) respectively are dummy variable indicating if individuals send remittances by bank transfer or other formal channels (money order in post office or agencies). The coefficients are marked with \* if the level of significance is between 5% and 10%, \*\* if the level of significance is between 1% and 5% and \*\*\* if the level of significance is less than 1%. All regressions are estimated by population-weighted 2SLS and contain all individual characteristics included in our main estimation (see Table A5) as well as municipality and country dummies. Standard errors are clustered at the municipality-country level.

Table 7: Mechanism of network effects: Use of most expensive remittance channels  
(sample of individuals from 10 countries of origin)

	for sending 500\$	for sending 200\$
	(1)	(2)
Network effects	-.0009 (0.0004)**	-.0009 (0.0004)**
Presence	0.381 (0.193)**	0.462 (0.208)**
Obs.	2,955	2,955
$R^2$	0.255	0.221

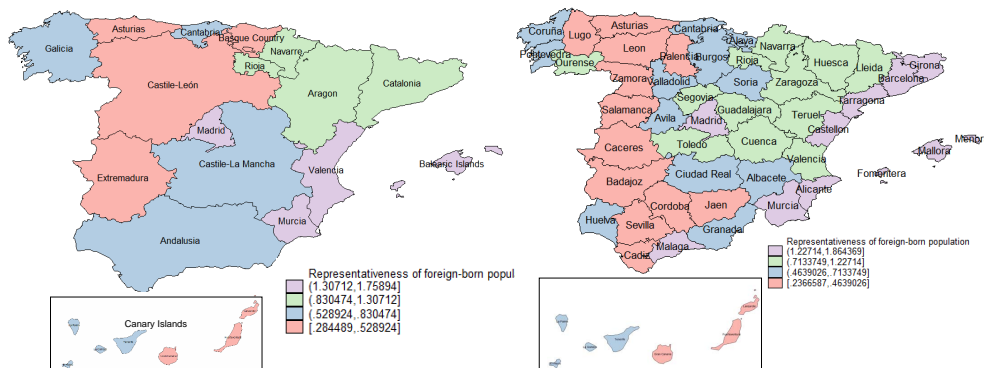
Dependent variables in column (1) and (2) respectively are dummy variable indicating if individuals send remittances by using the most expensive remittance mode for their country (based on information from World Bank Data). The sample for these regressions is limited to individuals from Brazil, Bulgaria, China, Colombia, Dominican Republic, Ecuador, Morocco, Peru, Philippines, and Romania. The coefficients are marked with \* if the level of significance is between 5% and 10%, \*\* if the level of significance is between 1% and 5% and \*\*\* if the level of significance is less than 1%. All regressions are estimated by population-weighted 2SLS and contain all individual characteristics included in our main estimation (see Table A5) as well as municipality and country dummies. Standard errors are clustered at the municipality-country level.

## A Appendix



Data: World Bank for remittances; Spanish National Statistics Institute for foreign population

Figure A-1: Foreign population in Spain and remittance outflows



Data: Spanish National Statistics Institute (INE)

Figure A-2: Representativeness of foreign-born individuals in Spain by autonomous region (left) and province (right), 2007

Table A1: Population-weighted averages for key variables by country of origin

Country	Individuals (survey)	Individuals Spain	Age	Quantity remitted	Close family abroad	Monthly labor income
Morocco	1,375	605,961	38.1	506.05	0.112	569.24
Romania	1,075	397,270	32.2	895.74	0.099	727.10
Ecuador	1,052	456,641	33.3	1554.24	0.197	741.47
France	914	199,364	44.0	111.40	0.043	888.08
Colombia	837	286,969	36.9	1444.37	0.187	739.46
United Kingdom	728	283,667	53.8	96.20	0.408	441.61
Argentina	721	271,444	41.1	288.01	0.072	866.71
Germany	596	208,933	45.3	25.68	0.151	774.62
Portugal	469	93,767	44.8	534.81	0.107	540.60
Bolivia	371	140,740	31.3	1453.86	0.242	670.23
Venezuela	359	124,851	36.8	162.91	0.042	797.08
Peru	345	123,464	39.2	1215.15	0.166	916.46
Brazil	281	93,396	34.1	574.69	0.088	643.77
Cuba	277	79,228	51.2	407.71	0.120	576.82
Bulgaria	277	100,763	35.8	766.53	0.135	690.24
Uruguay	238	76,635	39.4	212.86	0.066	779.98
Switzerland	206	62,632	40.8	0	0.101	623.17
Dominican Republic	204	87,111	36.3	927.62	0.229	618.54
Italy	183	60,175	46.7	157.38	0.145	741.58
Ukraine	174	69,359	37.5	1203.03	0.222	774.00
Algeria	171	52,159	40.2	324.97	0.126	511.68
Chile	148	57,864	39.2	469.27	0.115	817.31
Mexico	136	40,574	37.5	302.83	0.008	1028.76
Belgium	133	42,469	49.9	16.20	0.240	525.17
Poland	132	44,339	35.8	727.81	0.150	822.40
Russia	118	47,515	38.1	342.83	0.100	540.54
USA	101	32,626	42.6	20.60	0.069	1074.87
Netherlands	94	42,146	48.1	13.46	0.196	530.04
China	88	104,789	34.0	1248.45	0.034	691.58
Paraguay	83	30,155	32.2	1621.56	0.198	724.53
Philippines	78	26,368	43.4	1262.55	0.218	808.80
Pakistan	62	43,025	34.7	688.11	0.319	733.43
Equatorial Guinea	60	19,456	39.4	153.33	0.149	612.62
Moldova	43	11,034	30.7	1007.87	0.113	862.98
Nigeria	43	29,802	30.6	1336.81	0.169	550.50
Senegal	39	34,070	37.1	1067.78	0.539	462.88
Sweden	38	17,738	54.5	31.02	0.279	379.68
Denmark	33	9,975	53.9	7.56	0.153	445.10
Lithuania	31	15,200	29.7	371.15	0.095	693.27
Ghana	27	13,33	32.8	1285.57	0.509	810.49
Australia	25	5,131	36.7	0	0	669.72
India	24	23,296	39.7	172.16	0.007	874.50
Austria	24	7,704	48.4	0	0	990.70
Norway	23	14,037	47.8	85.35	0.392	531.32
Gambia	23	13,627	32.7	562.99	0.307	544.81
Mali	23	14,497	30.0	945.43	0.333	575.66
Ireland	22	11,495	52.7	990.05	0.583	657.26
Armenia	20	9,186	34.5	611.13	0.038	546.66
Czech Republic	19	5,654	38.8	94.71	0.210	424.12
Georgia	16	6,321	37.6	712.03	0.351	580.73
Canada	15	5,420	44.4	0	0	934.44
Guinea	15	9,901	34.5	547.03	0.191	625.59
El Salvador	14	5,102	47.7	68.56	0.271	580.67
Finland	13	9,865	60.5	0	0.456	113.47
Honduras	12	10,652	31.1	326.66	0.058	775.79
Japan	11	5,684	32.7	0	0	532.04
Bangladesh	7	6,130	29.9	623.70	0.299	528.89
Mauritania	6	9,308	38.2	2904.42	0.517	835.66
Guinea-Bissau	4	5,274	37.3	2350.50	0.130	1009.79
N=12,656						

Table A2: Additional summary statistics (population-weighted)

Variable	Mean	Std. Dev.	Min.	Max.	N
<i>Heterogeneity of network effects</i>					
Spanish nationality	0.233	0.423	0	1	12,633
Years in Spain	11.495	12.924	0	90	12,487
Close family (spouse or children) abroad	0.157	0.364	0	1	12,656
<u>Continent of origin</u>					
Europe	0.405	0.491	0	1	12,656
Africa	0.152	0.359	0	1	12,656
America	0.406	0.491	0	1	12,656
Asia	0.035	0.185	0	1	12,656
Oceania	0.002	0.043	0	1	12,656
<i>Mechanisms of network effects</i>					
Homeowner abroad	0.325	0.468	0	1	12,656
<u>Remittance Channel</u>					
Post office	0.139	0.346	0	1	4,170
Bank transfer	0.287	0.452	0	1	4,170
Agencies	0.521	0.5	0	1	4,170
Other people	0.042	0.202	0	1	4,170
Other method	0.011	0.105	0	1	4,170
<u>Missing observations on:</u>					
Education	0.084	0.277	0	1	12,656
Educated in Spain	0.084	0.277	0	1	12,656
Siblings abroad	0.237	0.425	0	1	12,656
Children abroad	0.457	0.498	0	1	12,656
Father abroad	0.073	0.261	0	1	12,656
Mother abroad	0.103	0.305	0	1	12,656
Income	0.002	0.042	0	1	12,656

Table A3: Use of remittance channels by country of origin, population-weighted

	Post office	Bank transfer	Agency	Other people	Other method
Morocco	0.187	0.126	0.600	0.065	0.021
Romania	0.156	0.191	0.581	0.062	0.011
Ecuador	0.124	0.318	0.548	0.007	0.004
France	0.060	0.672	0.095	0	0.172
Colombia	0.150	0.270	0.564	0.007	0.009
United Kingdom	0.054	0.636	0	0.106	0.204
Argentina	0.254	0.388	0.311	0.024	0.022
Germany	0.010	0.718	0.165	0	0.107
Portugal	0.078	0.526	0.183	0	0.213
Bolivia	0.098	0.286	0.610	0.006	0
Venezuela	0.156	0.323	0.451	0.046	0.018
Peru	0.086	0.378	0.531	0.004	0.001
Brazil	0.156	0.430	0.414	0	0
Cuba	0.038	0.603	0.104	0.231	0.024
Bulgaria	0.062	0.321	0.581	0.023	0.013
Uruguay	0.385	0.203	0.383	0.015	0.014
Switzerland					
Dominican Republic	0.156	0.199	0.630	0.015	0
Italy	0.157	0.729	0.114	0	0
Ukraine	0.040	0.332	0.587	0.010	0.031
Algeria	0.181	0.076	0.173	0.502	0.068
Chile	0.219	0.226	0.519	0.015	0.022
Mexico	0.092	0.701	0.169	0	0.037
Belgium	0.891	0.109	0	0	0
Poland	0.105	0.511	0.186	0.131	0.067
Russia	0.179	0.255	0.404	0.161	0
USA	0	0	1	0	0
Netherlands	0	0.532	0.468	0	0
China	0.077	0.772	0.045	0.065	0.041
Paraguay	0.170	0.043	0.775	0.011	0
Philippines	0.084	0.607	0.289	0.020	0
Pakistan	0.056	0.338	0.508	0.098	0
Equatorial Guinea	0.068	0.084	0.527	0.321	0
Moldova	0.332	0.303	0.338	0.023	0.003
Nigeria	0.124	0.057	0.778	0.018	0.023
Senegal	0.202	0.132	0.666	0	0
Sweden	0	1	0	0	0
Denmark	0	1	0	0	0
Lithuania	0.150	0.528	0.288	0.034	0
Ghana	0.049	0.087	0.864	0	0
Australia					
India	0.030	0.712	0.258	0	0
Austria					
Norway	0	1	0	0	0
Gambia	0.086	0.394	0.265	0.255	0
Mali	0.090	0.113	0.797	0	0
Ireland	0	1	0	0	0
Armenia	0.065	0.181	0.481	0.120	0.153
Czech Republic	0	0.708	0	0.292	0
Georgia	0.184	0.040	0.776	0	0
Canada					
Guinea	0.151	0.041	0.774	0	0.034
El Salvador	0.046	0.759	0.195	0	0
Finland	0	1	0	0	0
Honduras	0.470	0.284	0.246	0	0
Japan					
Bangladesh	0	0.033	0.967	0	0
Mauritania	0.091	0.100	0.630	0.179	0
Guinea Bissau	0.298	0	0.702	0	0

Countries are ordered by importance of migrant group in Spain and in our sample

Table A4: Remittance prices charged by cheapest and most expensive providers for sending 200\$ and 500\$ from Spain (in%), 2008 (2nd Q)

	Cheapest provider			Most expensive provider		
	Provider	Type	Cost	Provider	Type	Cost
<i>Sending 200\$</i>						
Brazil	Trans-Fast	Agency	0.53	Ria	Agency	6.25
Bulgaria	Maccorp Exact Exchange	Agency	4.44	Western Union	Agency/Post	10.74
China	Money Exchange	Agency	11.64	Western Union	Agency/Post	18.33
Colombia	Latinoenvios	Bank	3.48	Western Union	Agency/Post	9.58
Dominican Republic	Santander	Bank	4.59	Western Union	Agency/Post	7.80
Ecuador	Latinoenvios	Bank	3.95	Caja Madrid	Bank	12.05
Morocco	Ria	Agency	3.71	La Caixa	Bank	14.19
Peru	Latinoenvios	Bank	3.62	Caja Madrid	Bank	12.05
Philippines	Ria	Agency	4.66	MoneyGram	Agency	15.99
Romania	Master Envios	Agency	4.44	Safe Money Transfer	Agency	9.63
<i>Sending 500\$</i>						
Brazil	Trans-Fast	Agency	-1.22	Ria	Agency	3.62
Bulgaria	Maccorp Exact Exchange	Agency	1.82	Western Union	Agency/Post	8.94
China	Money Exchange	Agency	5.08	Western Union	Agency/Post	9.3
Colombia	Latinoenvios	Bank	2.16	MoneyGram	Agency	8.74
Dominican Republic	Universal de Envios	Agency	3.03	Western Union	Agency/Post	5.4
Ecuador	BBVA Dinero Express	Bank	2.29	Caja Madrid	Bank	8.11
Morocco	Ria	Agency	1.08	La Caixa	Bank	13.31
Peru	BBVA Dinero Express	Bank	2.29	Caja Madrid	Bank	8.11
Philippines	Ria	Agency	2.04	MoneyGram	Agency	14.27
Romania	Master Envios Unidos	Agency	1.82	Western Union	Agency/Post	9.7

Source: World Bank Remittance Prices. Note that since 1999 Western Union signed an agreement with the Spanish postal service such that money orders can be send from all post offices. Latinoenvios is part of Santander Bank.



Table A5: Main estimation: Full results

	(1)	(2)	(3)	(4)	(5)
Mean remit, mun. and country	0.972 (0.017)***				
Mean remit, country		0.709 (0.322)**			
Mean remit, municipality			0.493 (0.203)**		
Network effects				0.051 (0.035)	0.609 (0.242)**
Representativeness				4.990 (21.755)	-56.967 (95.136)
Male	84.165 (32.888)**	117.555 (38.390)***	117.555 (38.390)***	116.376 (38.448)***	104.952 (39.326)***
Age	13.256 (6.016)**	12.992 (6.940)*	12.992 (6.940)*	12.975 (6.937)*	12.854 (6.998)*
Age squared	-.122 (0.053)**	-.127 (0.063)**	-.127 (0.063)**	-.126 (0.063)**	-.111 (0.064)*
Primary education	51.546 (61.550)	93.411 (111.707)	93.411 (111.707)	93.074 (111.599)	83.508 (113.480)
Secondary education	118.743 (56.991)**	128.184 (104.450)	128.184 (104.450)	127.180 (104.583)	101.889 (108.191)
Tertiary education	36.353 (61.567)	33.610 (108.136)	33.610 (108.136)	32.552 (108.085)	-7.585 (114.170)
Educated in Spain	-30.060 (34.046)	-92.876 (44.411)**	-92.876 (44.411)**	-94.149 (44.591)**	-124.539 (51.505)**
Married	-14.634 (34.308)	-26.559 (41.171)	-26.559 (41.171)	-26.222 (41.200)	-26.844 (42.068)
Number household members	-12.260 (13.285)	-10.337 (15.390)	-10.337 (15.390)	-10.802 (15.489)	-12.904 (15.803)
Spouse abroad	710.175 (188.882)***	949.136 (208.066)***	949.136 (208.066)***	945.673 (207.993)***	912.819 (211.235)***
Sibling abroad	14.595 (40.885)	7.376 (48.801)	7.376 (48.801)	6.529 (48.735)	-7.669 (48.676)
Children abroad	479.081 (79.858)***	713.467 (88.148)***	713.467 (88.148)***	717.700 (88.218)***	781.109 (93.608)***
Father abroad	142.994 (49.399)***	193.257 (60.844)***	193.257 (60.844)***	192.755 (60.717)***	183.041 (60.685)***
Mother abroad	140.871 (48.591)***	237.187 (57.006)***	237.187 (57.006)***	237.057 (56.936)***	236.874 (57.334)***
Return intentions	270.696 (102.602)***	270.002 (111.700)**	270.002 (111.700)**	266.768 (111.537)**	240.629 (113.848)**
Participation in elections	31.469 (37.686)	62.233 (57.870)	62.233 (57.870)	56.418 (58.055)	-21.277 (60.283)
Intentions to bring family	315.776 (65.346)***	503.796 (68.083)***	503.796 (68.083)***	502.813 (68.123)***	494.921 (69.348)***
Employed	102.386 (48.561)**	204.812 (53.034)***	204.812 (53.034)***	202.307 (53.440)***	178.642 (54.117)***
Income	0.069 (0.025)***	0.085 (0.034)**	0.085 (0.034)**	0.086 (0.034)**	0.086 (0.035)**
Municipality fixed effects	x	x		x	x
Country fixed effects	x		x	x	x
Obs.	12,656	12,656	12,656	12,656	12,656
R <sup>2</sup>	0.544	0.251	0.251	0.251	0.228

The dependent variable is the amount of euros that individuals report to have remitted over the course of the previous year. The coefficients are marked with \* if the level of significance is between 5% and 10%, \*\* if the level of significance is between 1% and 5% and \*\*\* if the level of significance is less than 1%. Columns 1 to 4 are estimated by population-weighted OLS, column 5 is estimated using population-weighted 2SLS. Standard errors are clustered at the municipality-country level.

Table A6: Network effects for individuals from above-average remitting countries in overrepresented municipalities

Network effects	-0.704 (0.62)	-0.312 (0.369)
Representativeness	-399.938 (233.706)*	-172.494 (340.129)
Network effects $\times$ above-average	1.630 (0.841)*	
Representativeness $\times$ above-average	203.474 (345.158)	
Network effects $\times$ overrepresented		0.457 (0.432)
Representativeness $\times$ overrepresented		380.135 (529.894)
Obs.	12,656	12,656
$R^2$	0.230	0.247

The dependent variable is the amount of euros that individuals report to have remitted over the course of the previous year. The coefficients are marked with \* if the level of significance is between 5% and 10%, \*\* if the level of significance is between 1% and 5% and \*\*\* if the level of significance is less than 1%. All regressions are estimated by population-weighted 2SLS and contain the full set of individual characteristics (see Table A5) as well as country and municipality dummies. Standard errors are clustered at the municipality-country level.

Table A7: Adding controls sequentially: First stage network effects

	(1)	(2)	(3)	(4)	(5)	(6)
Instrument network effects	0.135 (0.014)***	0.109 (0.014)***	0.111 (0.014)***	0.112 (0.014)***	0.113 (0.014)**	0.113 (0.014)***
Instrument representativeness	-11.635 (5.485)*	11.672 (6.177)*	9.898 (6.168)	9.784 (6.174)	9.793 (6.164)	8.421 (6.116)
Adjustment tourism	-0.004 (0.0007)***	-0.009 (0.001)***	-0.009 (0.001)***	-0.009 (0.001)***	-0.009 (0.001)***	-0.009 (0.001)***
Interaction adjust. tourism	-2.80e-08 (1.07e-08)***	1.00e-08 (1.07e-08)	8.57e-09 (1.07e-08)	6.48e-09 (1.06e-08)	7.47e-09 (1.05e-08)	6.66e-09 (1.04e-08)
Country fixed effects	x	x	x	x	x	x
Municipality fixed effects		x	x	x	x	x
Gender, age, marital status			x	x	x	x
Education			x	x	x	x
Family abroad					x	x
Remaining controls						x
Obs.	12,656	12,656	12,656	12,656	12,656	12,656
$R^2$	0.396	0.619	0.621	0.623	0.625	0.629

The dependent variable is “network effects” ( $\overline{R}_k \times Rep_{j,k}$ ). The coefficients are marked with \* if the level of significance is between 5% and 10%, \*\* if the level of significance is between 1% and 5% and \*\*\* if the level of significance is less than 1%. All regressions are estimated by population-weighted OLS. Standard errors are clustered at the municipality-country level. Remaining controls refer to number of household members, income, employment, return intentions, participation in elections, and intentions to bring family.

Table A8: Adding controls sequentially: First stage representativeness

	(1)	(2)	(3)	(4)	(5)	(6)
Instrument network effects	-0.00006 (0.00002)***	-0.00006 (0.00002)***	-0.00006 (0.00002)***	-0.00007 (0.00002)***	-0.00007 (0.00002)***	-0.00007 (0.00002)***
Instrument representativeness	0.186 (0.013)***	0.241 (0.014)***	0.243 (0.014)***	0.241 (0.014)***	0.239 (0.014)***	0.24 (0.014)***
Adjustment tourism	6.80e-06 (1.51e-06)***	5.62e-06 (2.38e-06)**	5.43e-06 (2.38e-06)**	5.13e-06 (2.36e-06)**	5.04e-06 (2.36e-06)**	4.90e-06 (2.35e-06)**
Interaction adjust. tourism	-1.35e-10 (1.73e-11)***	-1.38e-10 (1.84e-11)***	-1.36e-10 (1.83e-11)***	-1.30e-10 (1.82e-11)***	-1.31e-10 (1.82e-11)***	-1.29e-10 (1.81e-11)***
Country fixed effects	x	x	x	x	x	x
Municipality fixed effects		x	x	x	x	x
Gender, age, marital status			x	x	x	x
Education			x	x	x	x
Family abroad					x	x
Remaining controls						x
Obs.	12,656	12,656	12,656	12,656	12,656	12,656
$R^2$	0.144	0.526	0.527	0.532	0.535	0.537

The dependent variable is “representativeness” ( $Rep_{j,k}$ ). The coefficients are marked with \* if the level of significance is between 5% and 10%, \*\* if the level of significance is between 1% and 5% and \*\*\* if the level of significance is less than 1%. All regressions are estimated by population-weighted OLS. Standard errors are clustered at the municipality-country level. Remaining controls refer to number of household members, income, employment, return intentions, participation in elections, and intentions to bring family.

Table A9: Robustness Check: Excluding countries whose GDP per capita in 2007 was larger than Spain's

	(1)	(2)	(3)	(4)	(5)
Mean remit, mun. and country	0.952 (0.019)***				
Mean remit, country		0.865 (0.328)***			
Mean remit, municipality			1.112 (0.061)***		
Network effects				0.074 (0.047)	0.602 (0.244)**
Representativeness				9.165 (27.979)	53.196 (103.810)
Municipality fixed effects	x	x		x	x
Country fixed effects	x		x	x	x
Obs.	9,497	9,497	9,497	9,497	9,497
$R^2$	0.537	0.257	0.257	0.257	0.246

The dependent variable is the amount of euros that individuals report to have remitted over the course of the previous year. The coefficients are marked with \* if the level of significance is between 5% and 10%, \*\* if the level of significance is between 1% and 5% and \*\*\* if the level of significance is less than 1%. Compared to our main sample here we exclude the following 17 countries who according to World Bank data had a GDP per capita in US\$ that was larger than Spain's: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Norway, Sweden, Switzerland, US, and UK. Columns 1 to 4 are estimated by population-weighted OLS, column 5 is estimated by population-weighted 2SLS. All regressions contain the full set of individual characteristics (see Table A5). Standard errors are clustered at the municipality-country level.

Table A10: Robustness Check: Different Samples

	Excluding:				
	Morocco	Romania	Morocco & Romania	Africa	Spanish islands
	(1)	(2)	(3)	(4)	(5)
Network effects	0.553 (0.229)**	0.665 (0.251)***	0.625 (0.245)**	0.576 (0.247)**	0.879 (0.343)**
Representativeness	-66.601 (95.124)	0.209 (111.843)	39.592 (121.747)	-69.687 (96.094)	-133.483 (133.851)
Obs.	11,281	11,581	10,206	10,870	11,078
$R^2$	0.239	0.235	0.245	0.238	0.203

The dependent variable is the amount of euros that individuals report to have remitted over the course of the previous year. The coefficients are marked with \* if the level of significance is between 5% and 10%, \*\* if the level of significance is between 1% and 5% and \*\*\* if the level of significance is less than 1%. All regressions are estimated by population-weighted 2SLS and contain the full set of individual characteristics (see Table A5) as well as country and municipality dummies. Columns (1), (2), (3), and (4) display results for samples that exclude individuals from Morocco, Romania, from both countries, and from Africa respectively. Column(5) shows results excluding immigrants living on the Balearic or Canary islands. Standard errors are clustered at the municipality-country level.

Table A11: Robustness Check: Sample with minimum representation of 2,000 in Spain

	(1)	(2)	(3)	(4)	(5)
Mean remit, mun. and country	0.973 (0.017)***				
Mean remit, country		0.724 (0.316)**			
Mean remit, municipality			0.49 (0.204)**		
Network effects				0.061 (0.035)*	0.669 (0.276)**
Representativeness				4.360 (21.337)	-65.557 (95.329)
Municipality fixed effects	x	x		x	x
Country fixed effects	x		x	x	x
Obs.	12,835	12,835	12,835	12,835	12,835
$R^2$	0.547	0.252	0.252	0.252	0.224

The dependent variable is the amount of euros that individuals report to have remitted over the course of the previous year. The coefficients are marked with \* if the level of significance is between 5% and 10%, \*\* if the level of significance is between 1% and 5% and \*\*\* if the level of significance is less than 1%. Compared to our main sample here we also include individuals from countries with a minimum representation of 2,000-4,999 individuals. Columns 1 to 4 are estimated by population-weighted OLS, column 5 is estimated by population-weighted 2SLS. All regressions contain the full set of individual characteristics (see Table A5). Standard errors are clustered at the municipality-country level.

Table A12: Robustness Check: Only including countries of origin where more than 60% of individuals use one mode of transportation

	(1)	(2)	(3)	(4)	(5)
Mean remit, mun. and country	0.969 (0.017)***				
Mean remit, country		0.658 (0.342)*			
Mean remit, municipality			0.477 (0.206)**		
Network effects				0.039 (0.039)	0.679 (0.296)**
Representativeness				12.226 (23.116)	-49.501 (96.850)
Municipality fe	X	X		X	X
Country fe	X		X	X	X
Obs.	11,320	11,320	11,320	11,320	11,320
$R^2$	0.538	0.251	0.251	0.251	0.227

The dependent variable is the amount of euros that individuals report to have remitted over the course of the previous year. The coefficients are marked with \* if the level of significance is between 5% and 10%, \*\* if the level of significance is between 1% and 5% and \*\*\* if the level of significance is less than 1%. Compared to our main sample here we include only individuals from countries where at least 60% of individuals used the same mode of transportation to enter Spain. Columns 1 to 4 are estimated by population-weighted OLS, column 5 is estimated by population-weighted 2SLS. All regressions contain the full set of individual characteristics (see Table A5). Standard errors are clustered at the municipality-country level.

Table A13: Robustness Check: Alternative definition of network effects without logarithmic transformation of representativeness

	(1)	(2)
Alternative network effects	0.006 (0.005)	0.254 (0.114)**
Alternative representativeness	2.276 (2.303)	-46.871 (62.005)
Obs.	12,656	12,656
$R^2$	0.251	.

The dependent variable is the amount of euros that individuals report to have remitted over the course of the previous year. The coefficients are marked with \* if the level of significance is between 5% and 10%, \*\* if the level of significance is between 1% and 5% and \*\*\* if the level of significance is less than 1%. “Alternative network effects” and “Alternative representativeness” are defined as  $(\bar{R}_k \times e^{Rep_{j,k}})$  and  $e^{Rep_{j,k}}$  respectively. Columns 1 is estimated by population-weighted OLS and column 2 by population-weighted 2SLS. All regressions contain the full set of individual characteristics (see Table A5). Standard errors are clustered at the municipality-country level.

Table A14: Robustness Check: Excluding individuals who send remittances via other people

	(1)	(2)	(3)	(4)	(5)
Mean remit, mun. and country	0.971 (0.017)***				
Mean remit, country		0.777 (0.349)**			
Mean remit, municipality			0.402 (0.232)*		
Network effects				0.048 (0.036)	0.614 (0.243)**
Representativeness				2.581 (22.173)	-68.854 (95.492)
Municipality fe	X	X		X	X
Country fe	X		X	X	X
Obs.	12477	12477	12477	12477	12477
$R^2$	0.543	0.252	0.252	0.252	0.229

The dependent variable is the amount of euros that individuals report to have remitted over the course of the previous year. The coefficients are marked with \* if the level of significance is between 5% and 10%, \*\* if the level of significance is between 1% and 5% and \*\*\* if the level of significance is less than 1%. Compared to our main sample here we exclude individuals who report to have sent remittance via others. Columns 1 is estimated by population-weighted OLS and column 2 by population-weighted 2SLS. All regressions contain the full set of individual characteristics (see Table A5). Standard errors are clustered at the municipality-country level.

Table A15: Robustness Check: Excluding countries of origin where more than 10% send remittances via other people

	(1)	(2)	(3)	(4)	(5)
Mean remit, mun. and country	0.959 (0.019)***				
Mean remit, country		0.839 (0.718)			
Mean remit, municipality			0.417 (0.227)*		
Network effects				0.06 (0.036)*	0.602 (0.268)**
Representativeness				3.807 (23.924)	-97.325 (94.572)
Municipality fe	X	X		X	X
Country fe	X		X	X	X
Obs.	11524	11524	11524	11524	11524
$R^2$	0.542	0.267	0.267	0.267	0.244

The dependent variable is the amount of euros that individuals report to have remitted over the course of the previous year. The coefficients are marked with \* if the level of significance is between 5% and 10%, \*\* if the level of significance is between 1% and 5% and \*\*\* if the level of significance is less than 1%. Compared to our main sample here we exclude countries where more than 10% of individuals report to have sent remittance via others (UK, Cuba, Algeria, Poland, Russia, Equatorial Guinea, Gambia, Armenia, Czech Republic, Mauritania). Columns 1 is estimated by population-weighted OLS and column 2 by population-weighted 2SLS. All regressions contain the full set of individual characteristics (see Table A5). Standard errors are clustered at the municipality-country level.

Table A16: Testing for alternative mechanisms of network effects

	employed	income	elections	return	house	bring family
	(1)	(2)	(3)	(4)	(5)	(6)
Network effects	-.00006 (0.00006)	-.117 (0.086)	0.00002 (0.00004)	0.00002 (0.00003)	1.00e-05 (0.00006)	2.90e-06 (0.00005)
Representativeness	0.035 (0.024)	73.513 (40.291)*	0.006 (0.017)	0.029 (0.012)**	0.03 (0.022)	-.001 (0.02)
Obs.	12,656	12,656	12,656	12,656	12,656	12,656
$R^2$	0.306	0.25	0.458	0.128	0.302	0.323

The dependent variable is a dummy variable for employment (1), monthly income in euros (2), an indicator for participating in Spanish elections (3), a dummy variable for return intentions (4), an indicator for owning a house in the country of origin (5) and an indicator variable for intentions to bring family to Spain (6). The coefficients are marked with \* if the level of significance is between 5% and 10%, \*\* if the level of significance is between 1% and 5% and \*\*\* if the level of significance is less than 1%. All regressions contain the following controls: country and municipality dummies, gender, age marital status, education, time in Spain, number of household members, and family living abroad and they are estimated by population-weighted 2SLS. Standard errors are clustered at the municipality-country level.