

The ties that bind: the role of migrants in the uneven geography of international telephone traffic

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Abstract *Recent work suggests that migrants have been a major driving force in the dramatic growth of international telephony over recent decades, accounting for large rises in telephone calls between countries with strong immigrant/emigrant connections. Yet, the existing literature has done a poor job of evaluating the substantive importance of migrants in explaining large disparities in levels of bilateral voice traffic observed between different countries. It has also failed to go very far in examining how domestic and relational factors moderate (namely amplify or attenuate) the influence of migrant stocks on international calling. Our contribution addresses these gaps in the literature. For a sample, which includes a far larger number of countries than previous studies, we show that, together with shorter-term visitors, bilateral migrant stocks emerge as the relational variable with one of the substantively largest influences over cross-national patterns of telephone calls. We also find that the effect of bilateral migrant stocks on inter-country telephone traffic is greater where the country pairs are richer and more spatially distant from one another.*

Keywords INTERNATIONAL TELEPHONY, MIGRATION, TELECOMMUNICATION NETWORKS, TRANSNATIONALISM, CONNECTIVITY

Recent work has ascribed a major role for telecommunications in the lives of cross-border migrants (Esman 2009; Horst 2006; Ros 2010). Remote communications are said to be important in allowing family and friends to remain in contact; in forging, sustaining and re-imagining migrants' identity; and providing valuable information that forms the basis of subsequent migrations. Indeed, it has been suggested that migrants have been a major driving force in the dramatic growth of international telephony over recent decades, accounting for large rises in telephone calls between countries with strong immigrant/emigrant connections (Vertovec 2004).

The purpose of this article is twofold. First, it seeks to subject claims about the centrality of migrants in accounting for large disparities in bilateral telephone traffic to rigorous empirical scrutiny, and evaluate migrants' substantive importance *vis-à-vis* other relational forms of transnational connectivity. Second, it aims to provide new insights into how geographic attributes 'moderate' the degree to which migrant connections between home and destination countries give rise to international telephone traffic.

These issues are of both scholarly and applied interest. The importance of migrants in shaping patterns of international telephony, for example, is revealing in relation to academic debates about the role of migrants in contemporary transnationalism. Specifically, they indicate how longer-term corporeal mobilities underpin subsequent forms of boundary-spanning connectivity, and the relative importance of homelands as a site of ongoing social relations. Understanding the factors that mediate the degree to which migrant stocks give rise to calls between home and host countries is also of practical significance. Among others, this is because boundary-spanning communications between migrants and their homeland communities may be important in supporting economic development, transnational forms of political mobilization and the reproduction of diaspora identities (Esman 2009; Ros 2010). As an example, because telephone calls are known to play a role in arranging remittances (Collins 2009; Horst 2006), factors that constrain international telephony may have far-reaching implications for family members remaining in the homeland.

Unfortunately, the literature has fallen short of either convincingly evaluating the substantive importance of migrants in international telephony, or of investigating what factors influence the amount of calling between migrants and their homeland communities. Very few multivariate studies, which are best suited to examining the systematic influence of different relational attributes on patterns of bilateral telephone traffic, have included migrants as an explanatory variable. Those that have done so have typically used comparatively small samples, or crude measures/proxies that fail to identify migrants' countries of origin (Cui 2005; Kellerman 1990; Lago 1970; Muñoz and Amaral 1996; Rietveld and Janssen 1990; Sandbach 1996). Few of these past studies have compared the influence of migrants with other relational attributes, such as trade or investment ties. Regarding the moderating influence of geographic attributes, much of the literature has relied on anecdotes and descriptive statistics, for example invoking a role for income or tele-density based on single country case studies (Alonso and Oiarzabal 2010). Missing from previous work have been efforts to analyse systematically how geographic factors influence call volumes between migrants and their homelands using a large sample, multivariate research design.

We address these gaps in this article by using a recent database of bilateral migrant stocks (Parsons et al. 2007), which allow us to carry out a more globally representative and geographically refined analysis of the relative role of migrants as a source of border-spanning connectivity. In addition, advancing on previous work, we use an interactive model specification to explore how geographic attributes moderate (amplify or attenuate) the marginal impact of migrant stocks. The results of our large sample multivariate study show that, together with shorter term visitors, migrants

emerge as the relational variable with one of the substantively largest influences on cross-national patterns of telephony. However, we find that two factors, namely higher aggregate country pair income and greater distance between the origin and destination countries, increase the effect that migrants have on the amount of telephone calling between their resident country and their homeland. The article concludes by discussing the wider academic and applied implications of these results.

International telephone calls

Although commercial telephone services date back to the 1870s, it was not until the 1960s that international telephony began to take off (Fischer 1992). Aided by a series of technological and organizational innovations, which led to falling costs and improved service quality, the volume of international telephone calls increased dramatically from the 1970s onwards (Cracknall 1999; TeleGeography 2006). The growing popularity of cellular telephones over the past decade has further fuelled international voice traffic (Comer and Wikle 2008).

Yet, as with other forms of transnational connectivity and mobility, international telephony is spatially uneven (Perkins and Neumayer 2011). Data on international voice traffic not only reveal that certain countries have higher overall levels of telephone traffic, but also that domestic actors in particular countries tend to communicate more with actors in certain specific foreign countries than others, indicative of a spatiality of transnationalism (TeleGeography 2006). Table 1 highlights some of these spatial variations, showing the top ten inward/outward calling partners for a small sample of focal countries.

The table reveals the leading position of the United States as a source/recipient of international telephone calls. The United Kingdom also emerges as a key calling partner among the sample of countries. One factor likely contributing to the importance of these countries is that they are host to large numbers of migrants who might plausibly give rise to significant volumes of telephone traffic (Parsons et al. 2007). The spatial distribution of migrants could well account for other bilateral relationships shown in Table 1. All top ten calling partners with India, for example, are countries known to host significant numbers of Indian immigrants. Likewise, Germany's large Turkish migrant community may go some way towards explaining why Turkey appears among the country's major calling partners.

Yet, while few would deny a significant role for migrants, they are likely to be one among many factors shaping global patterns of telephony. Thus, another plausible reason for why the USA and UK are leading calling partners for the countries featured in the table is that they are major economies, both in gross and per capita terms. Indeed, members of the so-called G7 – a grouping comprising the world's major industrialized economies – recurrently appear as major calling partners in the list. Table 1 also strongly hints at a regional dimension to international telephony. Hence, most of Germany's main calling partners are located in the European macro region; Canada and Mexico are the leading calling partners of the USA, while Argentina and Chile appear in Brazil's list of major calling partners. As explained below, these

distance-related dynamics may arise because it is cheaper to call countries in the same macro region; individuals are more likely to holiday in the near abroad; countries in the same region trade and invest more with each other, or even regional neighbours are more likely to speak a common language.

Table 1: Top ten calling partners (million minutes) for selected countries, average over 2001 to 2006

| Global Market Performance Analysis - Q3 2023 | | | | | | | | | | |
|--|-----|--------|---------|--------|-------|--------|---------|-------|---------------|---------|
| Brazil | | | Germany | | India | | Nigeria | | United States | |
| 1 | USA | 1360.4 | USA | 2396.8 | USA | 2573.9 | USA | 322.0 | CAN | 12059.2 |
| 2 | UK | 254.5 | UK | 1747.6 | UAE | 889.4 | UK | 198.1 | MEX | 11399.3 |
| 3 | JPN | 237.1 | SUI | 1520.0 | KSA | 633.8 | RSA | 19.2 | UK | 4653.7 |
| 4 | POR | 183.8 | FRA | 1470.0 | UK | 520.4 | ITA | 13.1 | IND | 2573.9 |
| 5 | ARG | 111.4 | ITA | 1428.3 | CAN | 208.2 | NED | 5.1 | GER | 2396.8 |
| 6 | ESP | 91.5 | AUT | 1393.3 | SIN | 159.3 | CAN | 3.4 | PHI | 2315.5 |
| 7 | SUI | 41.5 | NED | 1174.2 | AUS | 120.3 | LIB | 3.0 | DOM | 2195.4 |
| 8 | FRA | 39.2 | ESP | 1083.3 | QAT | 69.5 | FRA | 2.7 | GUA | 2040.3 |
| 9 | GER | 36.2 | TUR | 837.7 | OMA | 67.1 | IND | 1.9 | JPN | 1473.8 |
| 10 | CHI | 35.0 | POL | 720.0 | MAS | 65.7 | GER | 1.9 | COL | 1382.0 |

Key: ARG = Argentina, AUS = Australia, AUT = Austria, CAN = Canada, CHI = Chile, COL = Colombia, DOM = Dominican Republic, ESP = Spain, FRA = France, GER = Germany, GUA = Guatemala, IND = India, ITA = Italy, JPN = Japan, KSA = Saudi Arabia, LIB = Lebanon, MAS = Malaysia, MEX = Mexico, NED = Netherlands, OMA = Oman, PHI = Philippines, POL = Poland, POR = Portugal, QAT = Qatar, RSA = South Africa, SIN = Singapore, SUI = Switzerland, TUR = Turkey, UAE = United Arab Emirates, UK = United Kingdom.

From this brief snapshot of calling partners, it is apparent that a number of geographic factors possibly contribute to shaping uneven patterns of bilateral telephony across the globe, and migrants are only one of these. Unfortunately, in the absence of a multivariate research design with controls, identifying the influence of individual determinants remains problematic.

Migrants in international telephony

There are a number of reasons why migrants might be expected to have been a significant factor underpinning the (uneven) growth of international telephone traffic. The first is the high number of migrants, with one recent estimate suggesting that there are currently 200 million people living outside their country of origin, equivalent to 3 per cent of the world's population (Ratha and Xu 2008). Another is that falling costs and innovations such as prepaid telephone cards have made it possible for migrants and communities in their homeland to call one another more regularly and for longer (Karikari and Gyimah-Brempong 1999; Vertovec 2004). The

third is that the corporeal movement of migrants can be seen as creating relational ties between homelands and new host countries, giving rise to telephone calls, as migrants seek to remain in voice contact with communities in their homeland (and vice versa).

One reason for calling is psychological (Alonso and Oiarzabal 2010; Kellerman 2006). Migrants' country of birth is likely to hold particular salience to the extent that it 'generates strong emotional ties and can continue to serve as a significant community of reference' (Hiller and Franz 2004: 733). Maintaining ongoing contact with the homeland may help migrants retain a sense of collective identity, belonging and ethnic solidarity. Within recent work, it is also said to play a role in reinvigorating existing or forging new bonds among diasporic communities with a real or imagined homeland (Collins 2009; Ghorashi and Boersma 2009; Smith and White 2004; Wong and Salaff 1998).

At a personal level, calling is likely to be closely associated with boundary spanning 'interpersonal ties' (Poros 2001), with migrants using telephones to talk with their families, partners and friends (Harvey 2009; Levitt and Jaworsky 2007). Indeed, anecdotal evidence indicates that migrants frequently make telephone calls to their relatives abroad, and regularly receive calls from family and partners located in their country of origin (Beaverstock 2005; Horst 2006; Thompson 2009). Among other things, telephone calls provide a means for re-establishing links with family and friends and for children to bond with their grandparents. Importantly, international telecommunications between kin are also known to play a role in the provision of remittances, with financial transfers potentially enabling families 'back home' to afford the costs of telephony (Collins 2009).

At a wider level, international call demand might arise as migrants or actors in their country of origin strategically exploit 'network capital', that is, the resources available from an extended network of contacts (Wong and Salaff 1998). Hence, domestic actors may draw upon foreign diasporas to advance economic and social development (Margheritis 2007; Mercer et al. 2009). As a form of state-led transnationalism (Elrick and Ciobanu 2009), governments have also been known to make use proactively of 'ethnic' networks in foreign countries, for example by recruiting prominent diaspora members to make business introductions (Datta 2009; Esman 2009; Harvey 2009). In addition, diaspora ties may provide the foundation for transnational business relationships with managers or entrepreneurs, preferentially dealing with companies managed by individuals from a similar self-identified ethnic group (Peng 2000). The important point is that these transnational networks between migrants and actors in the home territory are likely to be the source of bilateral telephone calls.

Previous work and its shortcomings

Two types of empirical study have identified a role for migrants. The first draws the inference that migrants have been a major driving force in the growth of international telephony based on the observation that a large share of particular countries' telephone traffic is with other countries that are the source/destination of migrants. A

prominent example is Vertovec (2004) who provides descriptive data showing that minutes of voice traffic between particular countries with strong immigrant connections have risen significantly over the period 1995–2001 (see also Collins 2009; and Kellerman 1990). A second type of research uses multivariate research designs with controls. These studies generally support the idea that bilateral migrants and telephone traffic are positively correlated (Cui 2005; Muñoz and Amaral 1996; Rietveld and Janssen 1990; Sandbach 1996).¹

Yet, although confirming what one might expect, both sets of studies suffer from a number of shortcomings. First, they fail to tell us how substantively important migrants are as a source of boundary-spanning connectivity, especially *vis-à-vis* other possible determinants of international telephony. This shortcoming is especially acute in the case of Vertovec's (2004) oft-cited work. By focusing solely on migrants, and failing to take account of other factors that might additionally drive international telephony, his assertions based on simple bivariate associations between migrant numbers and bilateral calling volumes are potentially misleading. Indeed, because several of these 'other' variables are likely to correlate with migrant stocks, it is highly questionable whether one can make inferences about the overall influence of migrants on bilateral calling. Furthermore, based on observations from a comparatively small sample of non-randomly selected countries that have experienced large growth in bilateral call volumes, it remains unclear whether the influence of migrants on telephone calls identified in Vertovec's (2004) work holds more generally across a larger sample of developed and developing countries.

Existing multivariate studies are superior in many of these respects, but also suffer from a number of weaknesses that limit their usefulness in evaluating claims about the substantive importance of migrants. Several of them use crude, geographically aggregated measures. Thus, Sandbach's (1996) finding that migrants have a positive influence on cross-border telephone traffic is based on a simple dummy variable, which attempts to capture the presence of large numbers of Turkish guest workers in Germany. Other studies have used measures that fail to distinguish between migrants' country of origin (Muñoz and Amaral 1996).

Another important weakness of existing multivariate studies is that they are based on comparatively small country samples. Most focus on incoming/outgoing telephone calls to/from a single focal country, for example Spain or the USA (Cui 2005; Lago 1970; Muñoz and Amaral 1996). Such a narrow geographic focus restricts the generalizability of these studies' findings, and prompts questions on whether similar patterns hold for larger country samples. Where specified, samples of the telecommunications partner countries are larger, for example, 23 countries for Lago (1970), 27 countries for Rietveld and Janssen (1990) and 57 country routes for Cui (2005), but these still represent a small proportion of the world's states.

A further factor to limit the usefulness of past multivariate studies is that the only two studies that have gone on to investigate the relative importance of migrants have produced contradictory results. For outward international calling traffic from the Netherlands, Rietveld and Janssen (1990) find that trade explained the vast majority of variations, while migration only had a minor influence. Conversely, Cui (2005)

finds that tourism and a foreign-born population are more influential than trade as determinants of calling between the USA and major foreign communication routes. It is worth noting that both these studies focus on a single developed focal country.

A second important generic shortcoming of previous work is that it has paid very little attention to the factors that moderate the influence of migrant stocks on bilateral calling. The existing literature has generally assumed that there exists a straightforward relationship between migrants and the volume of bilateral telephone traffic. Yet, from a conceptual perspective, the degree to which higher migrant stocks give rise to increased voice traffic might well depend on other geographic attributes influencing the effective demand for telephony among migrants and actors in their homeland.

To be fair, a number of authors have acknowledged that migrant-related telephony is likely to depend on characteristics of the host country, as well as migrant communities themselves. Relevant factors mentioned in this respect include income and existing tele-density (Alonso and Oiarzabal 2010; Collins 2009; Horst 2006). However, beyond the use of anecdotes and descriptive statistics, very little empirical work has been undertaken into the domestic and relational attributes influencing the amount of calling between migrants and homeland communities. Indeed, to the best of our knowledge, previous multivariate studies have ignored this issue outright.

Re-examining migrant-related telephony

Our study seeks to address these weaknesses and gaps in the existing literature. We answer two questions: (1) how substantively important are migrants in shaping patterns of bilateral telephony *vis-à-vis* other relational attributes; and (2) what factors moderate the impact of migrant stocks on levels of bilateral telephony?

Advancing on previous bivariate work, we use multivariate, quantitative techniques, which allow us to control for other variables that might influence patterns of bilateral telephony, including those correlated with migrant stocks. Two datasets are used in the study, namely one that records the cumulative number of migrants from country *i* residing in country *j* (Parsons et al. 2007); and one that measures the annual number of telephone call minutes between country *i* and country *j* (TeleGeography 2006). An important advantage of these data is that they allow us to use a dyadic research design, wherein we examine (the sum of incoming and outgoing) telephone traffic between country pairs for a far greater number of states than previous research, including many developing ones. The inclusion of the latter is significant because a large number of international migrants originate and reside in developing countries (Levitt and Jaworsky 2007; Ratha and Xu 2008). Further, international telephone calls not only occur between pairs of developed economies, or developed and developing countries, but between developing country pairs (TeleGeography 2006).

We also advance on previous work by using an interactive model specification, which enables us to analyse how various geographic factors amplify or retard the impact of migrant stocks on international telephone calls. More specifically, we model the influence of bilateral migrant stocks as conditional on two key variables: (a) the sum of country pair per capita incomes and (b) distance between country pairs.

We include these two variables because, as explained below, they might be expected to play an especially influential role in shaping the propensity of migrants and individuals in their homeland to call one another. Of course, other attributes could plausibly have a conditioning influence. Yet, these are either closely related to the above (for example tele-density) or the conceptual arguments regarding their influence are less compelling than income or physical distance.

Research design

We use econometric estimation techniques to address our research questions. Before detailing our sample and estimator, we describe the dependent, main explanatory and control variables used in the study.

Dependent variable

The dependent variable is the annual sum of minutes of bilateral voice traffic between country pairs (dyads) using data from TeleGeography (2006). These data cover traffic from both landlines and cellular phones routed through conventional international Time Division Multiplexed networks. One possible objection to the use of Telegeography's telephone voice data is that they do not include Voice over Internet Protocol (VoIP) traffic. However, non-dyadic data from Telegeography (2006) show that these flows accounted for a small share of overall international voice traffic volumes during the period of our study.

We focus on the sum of traffic between country pairs, rather than on the traffic balance between two countries of a country pair, which are often highly uneven. Formally, this makes our dependent variable an undirected dyadic variable (Neumayer and Plümper 2010). As documented in the literature, the existence of reverse calling, differential settlement rates and call externalities mean that actors from one country may make many more outward calls to a specific country than they receive (for example Acton and Vogelsang 1992; Karikari and Gyimah-Brempong 1999). Because our central concern is with the role of migrants and other relational attributes, rather than the economics of inward and outward calling balances, a focus on the sum total of bilateral calls makes sense as it allows us to concentrate on key variables of interest. Controlling for uneven traffic balances would require an estimation model with variables explaining differences in incoming/outgoing calls between countries and the limited availability of data for such variables would severely constrain the sample size.

Main explanatory variable

We obtain data on bilateral migrant stocks from Parsons et al. (2007), which is the most geographically extensive source currently available and which has previously been used in a number of recently published studies (for example Kapur and McHale 2009; Perkins and Neumayer 2008). Constructed mainly from national censuses, the dataset records the stock of migrants in a particular destination country j from a

particular territory of origin i for 226 states. The authors define migrants as individuals born outside their current country of residence.² Consistent with analysing the sum total of bilateral telephone calls, our migrant stock variable measures the sum total of bilateral resident migrants, that is to say the sum of migrants from country i in country j and migrants from country j in country i .

It is widely acknowledged that measuring migrant numbers is problematic (Margheritis 2007; Williams and Hall 2000). The data of Parsons et al. are not immune from these accounting problems; for example, they do not record irregular immigrants, and the quality of data is generally better for developed than developing countries. It is also worth noting that the data only record aggregate migrant stocks around the time of the 2000 national censuses. This means that our explanatory variable for migrants only offers a snapshot of migrant numbers at a single point in time. Still, even though migrant stocks will have continued to change over the course of the following years of the sample period, they are unlikely to have done so much as to invalidate our findings.

Other explanatory variables

We also include a number of variables designed to capture relational attributes previously identified in the literature as (possible) correlates of bilateral telephony. We do so because omitting important predictors of voice traffic may, as a result of omitted variable bias, lead to wrong inferences regarding the influence of migrant stocks. What is more, we are especially interested in the relative importance of migrant stocks *vis-à-vis* other relational attributes associated with particular mobilities.

Our first relational variable captures the shorter-term movement of people across borders. Like longer-term migrants, tourists give rise to bilateral telephone traffic, as they make calls to or receive calls from family and friends in their home country (Palm 2002). Similarly, business travellers make and receive calls to and from their home country while on their trips abroad (Millar and Salt 2008). This is confirmed by a number of quantitative studies that show that various measures of visitor flows (total inward/outward flows of tourists, foreign travel expenditure, and so forth) have a positive impact on international telephone traffic (Cui 2005; Garín-Muñoz and Pérez-Amaral 1998; Lago 1970; Kellerman 1990; Palm 2002). We use a flow measure of foreign visitors between country pairs ij using data from UNWTO (2007).

A second set of relational variables seek to capture 'derived demand' created by various forms of cross-border economic dependence and, specifically, trade and FDI (Lee et al. 2007; Palm 2002; Rietveld and Janssen 1990). International business activity is likely to generate telephone calls as, for example, buyers and sellers in different countries negotiate prices, or subsidiaries coordinate with foreign parents and so on (Cracknall 1999; Millar and Salt 2008; Warf 2008). Numerous studies support the idea that trade (imports or imports and exports) between countries positively correlates with international telephone traffic (Cui 2005; Garín-Muñoz and Pérez-Amaral 1998; Hackl and Westlund 1995; Karikari and Gyimah-Brempong

1999; Kellerman 1990; Lago 1970; Palm 2002; Rea and Lage 1978; Rietveld and Janssen 1990). To the best of our knowledge, evidence that direct investment raises international calling is restricted to a single study (Lago 1970),³ although we include a FDI measure in our model because it seems entirely plausible that it should be a significant determinant of bilateral call volumes. Our trade variable is a measure of bilateral trade volumes (for all goods and services) between country pairs ij while our direct investment variable comprises a measure of bilateral FDI stocks between country pairs ij . We obtained trade and investment data from the World Bank (2009) and UNCTAD (2009) respectively.

A third set of variables attempts to capture spatial proximity. Previous work has found that international calling falls as the distance between the countries of the caller and recipient grows (Choi 1995; Rietveld and Janssen 1990; Sandbach 1996). Most likely, this is because (a) long-distance calling may be more expensive and (b) individuals living further away are less likely to share associative ties with one another and to form part of a 'community of interest' (Ouwensloot and Rietveld 2001).⁴ In the present study, we use two measures of spatial proximity – (a) physical distance in miles between the country pair's capital cities and (b) contiguity, measured using a dummy variable for dyads sharing a land border or being separated by fewer than 150 miles of sea. Distance and contiguity data are obtained from Bennett and Stam (2005).

A fourth relational attribute does not directly capture ties created by cross-border mobilities, namely the movement of goods, services, capital, people, but rather common language. To the extent that telephone calls require individuals to be able to communicate with one another, traffic should logically be greater between countries where a higher proportion of their respective populations share a similar language (Palm 2002), a thesis supported by the empirical literature (Choi 1995; Sandbach 1996; Yatrakis 1972). In the present article, we use a dummy variable set to one if one of the main languages spoken in both countries is the same. As a final relational attribute, we use a dummy variable set to one if the two countries were previously linked in a colonial relationship. We include Russia in this definition since its imposition of political and military control over ex-Soviet territories has been analogous to that exercised by the classic Western and Japanese colonizers. The underlying logic is that actors from ex-colonies are likely to communicate more frequently with individuals in the countries of their former colonial masters and vice versa. Previous research largely endorses these claims, although it is based mostly on findings derived from rudimentary research designs (Kellerman 1990; Palm 2002; Rietveld and Janssen 1990). Data for these fourth and fifth relational variables are from the CIA (2009).

We also control for a number of non-relational factors that should influence levels of telephone traffic. One is per capita income, which is anticipated to have a positive impact on international calling. Individuals in richer countries should be better able to afford the costs of making, receiving or returning international calls. Residents might find it easier to make calls because they have greater personal access to fixed telephone lines in their homes or can afford their own cellular handset. Directly, the

quality of telephone infrastructure should be superior in richer countries, in terms of both its coverage and capacity. Lending weight to these arguments, Karikari and Gyimah-Brempong (1999) provide evidence that capacity constraints have reduced outgoing calls (and, to a lesser extent, incoming ones) between various African countries and the USA. Directly, a number of studies have found that per capita GDP is a statistically significant predictor of outward calling volumes (for example Rea and Lage 1978; Sandbach 1996). We take the sum of the per capita GDP of the two countries as the relevant variable, rather than the product, because we find it plausible that a high per capita GDP in one country can substitute for a low one in the other country because, for bilateral telephony, it is sufficient if one party can afford long-distance international calls.

Finally, we also include the sum of the two countries' population sizes to control for the fact that countries that are more populous should have more bilateral telephone traffic. We also include the squared term of this variable. Pre-tests showed that, entered without its squared term, a higher combined population size increases bilateral telephone traffic if no year-specific country fixed effects are included (on these, see the discussion further below). Yet, if these fixed effects are included, population size is associated with decreased bilateral telephone traffic. Because this is counter intuitive, we include the squared population term to allow for a non-monotonous effect of population size on telephone traffic, which is in fact what we find. We obtained the data for per capita GDP and population from the World Bank (2009).

Interaction effects

We explore how two attributes condition the influence of bilateral migrant stocks on inter-country voice calling traffic. The first attribute, sum of country pair income, is hypothesized to amplify the marginal impact of migrants. As described above, residents in poorer countries are less likely to call abroad, for both demand and supply-side reasons. Migrants and their families, partners and friends in the home country may still wish to call each other. Yet, they may be constrained in doing so by limited purchasing power, access to landlines/cellular phones, or inadequate transmission capacity (Panagakos and Horst 2006). The result is that larger stocks of bilateral migrants will give rise to more voice traffic in country pairs where the sum of per capita GDP is greater.

Although no previous studies have explicitly investigated the links between country income and international calling associated with migrants, empirical research nevertheless supports our underlying line of argument. Within this context, case study evidence documents how a combination of ability to pay and calling capacity constraints have historically limited telephone usage by migrants or their geographically remote family, partners and friends in lower-income home countries (Collins 2009; Horst 2006). As detailed above, quantitative studies show that per capita GDP is positively correlated with international calling, with telephone call demand found to be more price inelastic in richer countries (Cui 2005; Garín-Muñoz and Pérez-Amaral 1998). To the extent that migrants and associated homeland actors may

account for a significant share of this traffic, their influence on calling minutes might plausibly be sensitive to country income.

A second conditioning variable introduced in the present study is physical proximity in terms of distance between the country pairs. The influence of proximity on the marginal impact of migrant stocks is theoretically ambiguous. Physical proximity could increase international calling if the higher costs of longer distance calling deters remote telephony, or if the strength of ties between migrants and homeland communities are stronger because travel and telephony are complements, and distance reduces the amount of physical travel (Kellerman 2006; Larsen et al. 2006; Ouwersloot and Rietveld 2001). On the other hand, it could be that telephone traffic increases with growing distance between the source and destination countries of international migrants. One possibility is that telephone calls are a substitute for more costly physical travel, so that migrants and homeland actors in spatially remote country pairs call each other more, but travel less frequently (Salomon 1985). Another possibility is that migrants residing in more spatially distant countries, which might be expected to share less in common with their homeland, call more because they have a greater psychological need to reconnect with their territorial birthplace as a means of reaffirming or constructing their in-group identity. Indeed, consistent with these interpretations, interviews with migrants suggest that communication technologies can help foster a sense of ‘closeness’ and ‘belonging’ with distant communities (Ros 2010: 57).

Again, existing multivariate work fails to provide a direct answer to the question of whether distance increases or decreases the marginal influence of bilateral migrant stocks. The empirical literature suggests that, for traffic from all groups, distance has a negative influence on inter-country calling (for example Sandbach 1996). Yet, this does not necessarily mean that distance has the same conditioning influence on the effect that migrants have on bilateral telephony.

Estimation technique and sample

In line with standard gravity-type models, we employ a logarithmic estimation model in which all variables (except dummies) are in natural logs. One advantage of this model is that it allows for an easy interpretation of the estimated coefficients as elasticities. To account for fundamental differences across countries that could be correlated with our explanatory variables, the omission of which would cause omitted variable bias, we include year specific fixed effects for both countries in a dyad. In other words, each member of a country pair has its own intercept, which varies from year to year. Standard errors are adjusted for the clustering of observations on country dyads. This stringent and conservative estimation strategy reduces the possibility of spurious findings. In sum, we estimate the following base model:

$$\begin{aligned} \ln telephony_{ijt} = & \ln migrantstock_{ij} + \ln visitors_{ijt} + \ln trade_{ijt} + \ln FDIstock_{ijt} \\ & + \ln(GDPpc_{it} + GDPpc_{jt}) + \ln(pop_{it} + pop_{jt}) + \ln(pop_{it} + pop_{jt})^2 + \ln dist_{ij} \\ & + contiguity_{ij} + samelanguage_{ij} + coloniallink_{ij} + u_i \cdot \gamma_t + v_j \cdot \gamma_t + \varepsilon_{ijt} \end{aligned}$$

The variables are defined as described above, $u_i\gamma_t$ and $v_j\gamma_t$ are the year-specific effects for each country of a dyad and ε_{ijt} is the idiosyncratic error term. To this, we add two interaction effects in a separate estimation: one of the migrant stock with per capita GDP and the other of the migrant stock with distance.

Our data cover 160 countries over the years 2001–06. For these 160 countries, TeleGeography does not report positive telephone traffic with all potential partner countries, so we have telephony data for a subset of potential country dyads. In addition, data for the explanatory variables are not available for all dyads for which voice traffic data exist, leaving us with a final sample of 2041 country dyads.

Results

Table 2 shows our estimation results. We begin with the model where our migrant stock variable enters in its non-interacted form (column 1). We estimate a positive and statistically significant relationship between measures of bilateral telephone voice traffic minutes and bilateral migrant stocks. Turning to other variables, our estimated coefficient of visitor flows is significantly positive, suggesting that cross-border travellers between country pairs give rise to increased bilateral telephone traffic. This is hardly surprising given our result for migrant stocks. Migrants and visitors are related in a number of ways and the reasons why their cross-border movements should give rise to higher telephone traffic are likely to overlap (Williams and Hall 2000).

We also find evidence that economic dependencies increase bilateral telephone traffic. The estimated coefficient of our measure of bilateral trade is statistically significant with the anticipated positive sign. Likewise, we show that levels of bilateral FDI stocks are also a statistically significant predictor of telephone calling minutes between country pairs.

How substantively important are these relational attributes? Migrant stock is the variable with the highest estimated elasticity. We find that a 10 per cent increase in the size of bilateral migrant stocks is associated with a 3 per cent increase in bilateral telephone traffic. The estimated increase in telephony is 2.8 per cent, 2.4 per cent and 0.7 per cent for a 10 per cent increase in the bilateral flow of short-term visitors, bilateral trade and bilateral FDI stocks, respectively. Thus, migrant stocks not only have a substantively important effect on bilateral telephone traffic, but they are also the strongest of the four relational mobilities.⁵

As expected, we find that higher aggregate per capita GDP in the partner countries leads to more bilateral telephone traffic, indicating that demand for international telephone calls is what economists call a normal good. A higher combined sum of population size is associated with lower bilateral telephone traffic – albeit at a decreasing rate. The negative effect of population size converges to zero at a combined population size of *c.*100 million, eventually becoming positive, but only at very high levels. As mentioned in the research design section, the (partially) negative effect of population size disappears if the model is estimated without dyad member country specific year fixed effects.

Table 2: Estimation results

| | (1) | (2) | (3) |
|--|------------------------|------------------------|------------------------|
| $\ln \text{migrantstock}_{ijt}$ | 0.300*** (0.0175) | -0.0830 (0.0874) | 0.227*** (0.0294) |
| $\ln \text{migrantstock}_{ijt} \cdot \ln(\text{GDPpc}_{it} + \text{GDPpc}_{jt})$ | | 0.0406*** (0.00922) | |
| $\ln \text{migrantstock}_{ijt} \cdot \ln \text{dist}_{ij}$ | | | 0.0111*** (0.00376) |
| $\ln \text{visitors}_{ijt}$ | 0.285*** (0.0207) | 0.287*** (0.0206) | 0.274*** (0.0206) |
| $\ln \text{trade}_{ijt}$ | 0.237*** (0.0258) | 0.239*** (0.0259) | 0.231*** (0.0258) |
| $\ln \text{FDIstock}_{ijt}$ | 0.0692*** (0.0106) | 0.0559*** (0.0107) | 0.0689*** (0.0106) |
| $\ln(\text{GDPpc}_{it} + \text{GDPpc}_{jt})$ | 0.538*** (0.0596) | 0.195** (0.0950) | 0.534*** (0.0594) |
| $\ln(\text{pop}_{it} + \text{pop}_{jt})$ | -1.677** (0.748) | -1.672** (0.739) | -1.702** (0.751) |
| $\ln(\text{pop}_{it} + \text{pop}_{jt})^2$ | 0.0472** (0.0226) | 0.0475** (0.0223) | 0.0484** (0.0227) |
| $\ln \text{dist}_{ij}$ | -0.0492*** (0.0170) | -0.0514*** (0.0173) | -0.174*** (0.0483) |
| contiguity_{ij} | -0.120 (0.0881) | -0.105 (0.0883) | -0.115 (0.0886) |
| samelanguage_{ij} | 0.361*** (0.0706) | 0.336*** (0.0712) | 0.363*** (0.0699) |
| coloniallink_{ij} | 0.121 (0.184) | 0.182 (0.192) | 0.172 (0.174) |
| Observations | 5546 | 5546 | 5546 |
| Dyads | 2041 | 2041 | 2041 |
| Akaike/ Bayesian Information Criterion | 13770.6/ 21086.67 | 13697.7/ 21020.3 | 13739.0/ 21055.0 |
| Root mean square error | 0.797 | 0.792 | 0.795 |

Notes: Standard errors clustered on country dyads in parentheses. Year-specific fixed effects for countries i and j included.

* statistically significant at .05 level.

** at .01 level.

Turning to our measures of spatial proximity, we find that physical distance between the country pairs has a statistically significantly negative effect on bilateral telephony. That is, actors in countries further away from one another call each other less frequently. That we account for other well-known distance-dependent variables in our research design, namely trade, investment, migration and tourist flows (see for example Parsons et al. 2007; Portes et al. 2001), suggests that the influence of distance is not mainly operating through mechanisms associated with these relational attributes. Higher calling costs could deter longer distance telephony, or distance could capture the general tendency of individuals to be less acquainted, personally or professionally, with people living in countries farther away (Ouwensloot and Rietveld 2001). The coefficient for a further measure of spatial proximity, contiguity, fails to achieve statistical significance at conventional levels. This could be because, once we take account of other relational attributes that might be correlated with contiguity, actors in neighbouring countries do not call each other more than actors in non-contiguous countries.

Finally, we find that country pairs that share a main language call each other more. This result is interesting, particularly given our specification of other explanatory variables, indicating that language does not matter simply because of the co-presence of first-generation migrants or travellers. In fact, the presence of a common language has a substantively very strong effect, raising bilateral telephony by approximately 44 per cent.⁶ However, we find no evidence that a former colonial relationship leads to increased bilateral calling, which could be because we take account of other attributes correlated with colonial ties, such as trade and migration.

Columns 2 and 3 show our estimation results with the interaction effects included. All the other main explanatory/control variables remain statistically significant with the same signs as in the non-interacted model. We find that the coefficient of migrant stocks conditioned on the sum of country pair GDP is positive and statistically significant. That is, the influence of migrant stocks on bilateral telephony is greater for richer country pairs, possibly because telephone infrastructure is better developed and migrants (together with their associates in the home country) are better able to afford the costs of international telephony. The estimated coefficient of the variable that interacts migrant stocks with physical distance is also positive and statistically significant. What this suggests is that the marginal influence of migrant stocks on bilateral telephony is higher where migrants are further away from their country of origin. In other words, while distance generally impedes international telephony, it would appear to amplify voice traffic associated with migrant stocks.

Note, with interacted variables, the coefficient of any constituent variable on its own no longer has the same meaning as in non-interacted models. The insignificant coefficient of the migrant stock variable does not imply that foreign-born residents no longer influence international calling. All that counts are the coefficients of the interaction effect variables that, in our estimations, suggest that the effect of migrant stocks on bilateral telephony volumes increase as country pair income and distance grows. This is confirmed by figures 1 and 2, which show the effect of migrant stocks

as a function of the values of the two conditioning variables. They show that the estimated effect of the migrant stock variable is positive even at low levels of the pair sum of per capita GDP and distance. Yet, the effect increases as distance between the country pair grows and rises, even more strongly, with a higher aggregate sum of both countries' per capita GDP. Thus, where country pairs are close, a 10 per cent increase in the stock of migrants raises bilateral telephony by just above 2 per cent, but by almost 3.5 per cent where the two countries are far apart. At very low combined levels of per capita income, a 10 per cent increase in the stock of migrants only raises bilateral telephony by just above 1 per cent, but the same effect is much larger, at almost 4 per cent, when both countries are rich.

Conclusions and discussion

One of the most striking indications of the growth of transnationalism has been the dramatic expansion of boundary-spanning communications over recent decades. Evidence suggests that more and more people are remotely communicating with individuals residing in other national territories, making use of technologies to transcend physical distance, and forging new or sustaining existing relationships (Comer and Wikle 2008; Hiller and Franz 2004; Warf 2008). Our contribution in the present article is twofold: (1) to investigate the relative importance of migrants in generating these boundary-spanning connectivities in the case of telephone traffic; and (2) to investigate how various geographic attributes shape migrants' influence over bilateral calling.

For a sample of 160 developed and developing countries and 2041 country pairs, we provide statistically rigorous evidence that county pairs that are the origin/destination of a greater number of migrants from one another are likely to have higher levels of inter-country telephone voice traffic. In fact, our results show that migrant stocks are not only a statistically significant correlate of telephone calling, but also a substantively important one. Together with shorter-term visitors, therefore, longer-term migrants emerge as one of the most substantively important relational attributes examined in our study. A 10 per cent increase in the number of either is associated with a 3 or close to 3 per cent increase in bilateral telephone traffic, more than the equivalent figure for bilateral trade (2.4 per cent), and substantially greater than bilateral FDI (less than 1 per cent).

Another significant contribution of our article is to show that, although having a large influence over patterns of inter-country voice traffic, two factors govern the degree to which stocks generate increased bilateral telephone calls. First, consistent with the idea that higher income liberates people from place (Hannam et al. 2006), migrant stocks are found to raise bilateral telephony more in county pairs with a higher aggregate sum of per capita incomes. A possible explanation for this finding is that (a) individuals in richer countries have more access to the means of making telephone calls because of better developed public and private telephone infrastructures and (b) residents of richer countries are more able to afford the costs of making international telephone calls for longer durations (Gyimah-Brempong and Karikari 2001).

Figure 1: The conditioning effect of GDP per capita on the effect of migrant stocks

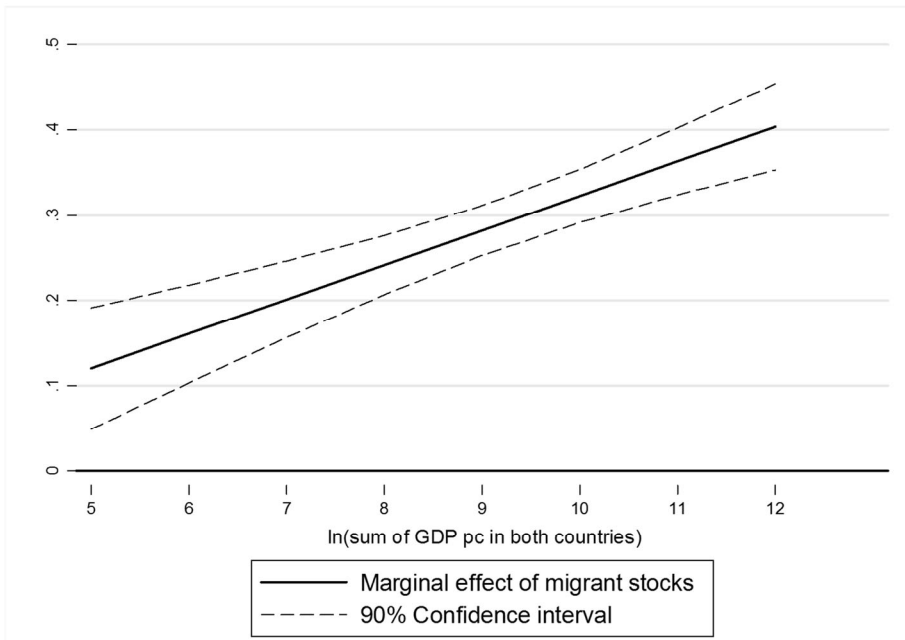
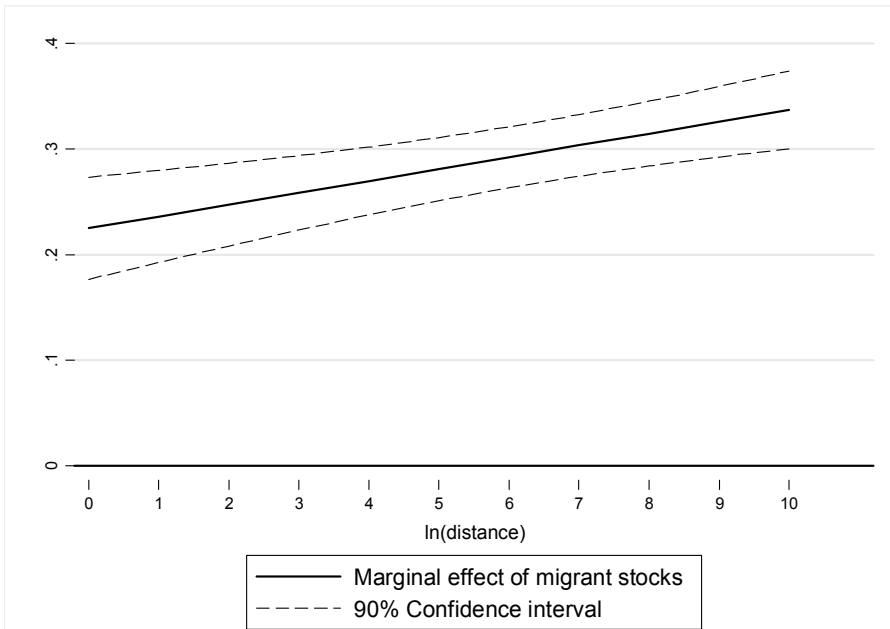


Figure 2: The conditioning effect of distance on the effect of migrant stocks



Spatial proximity is a second factor found to influence the degree to which migrant stocks raise bilateral telephone calling. Specifically, if migrants are further away from their country of origin, their impact on bilateral call volumes would appear to be higher than if they are closer to their homeland. This could be because telephony and physical travel are substitutes, that is to say rather than travelling to meet family, partners and friends in person, migrants farther away might satisfy their demand for communication remotely through telephone calls (Falk and Abler 1980; Ouwersloot and Rietveld 2001). Alternatively, physical distance could increase migrants' sense of isolation and detachment from place, fuelling their desire to connect with people from their territorial homeland via telecommunications (Hiller and Franz 2004: 733).

The above findings have wider implications for debates surrounding global networks, transnationalism and territory. First, they underline the importance of migrants as a source of boundary-spanning connectivity. Our statistical results indicate that the movement of people provides an important morphological foundation for transnational communication networks and flows (Datta 2009; Harvey 2009). Mobilities of ideas, knowledge and values conveyed by voice traffic are mapped onto border crossing mobilities of people, highlighting how global networks are fundamentally rooted in human agency.

Another implication that follows from our study, and reinforcing previous case-study research (Beaverstock 2005; Ghorashi and Boersma 2009; Horst 2006; Smith and White 2004), is that migrants remain closely wedded to their territory of origin. That existing stocks of migrants have a substantively strong effect on international telephone traffic suggests that peoples' birthplace provides a basis for ongoing transnational ties. The homeland would appear to retain an important position in the lives of geographically dispersed migrant communities, possibly because of the existence of interpersonal ties with family, partners and friends, but also because place and territory provide an anchor for personal identity, in-group belonging and community (Hiller and Franz 2004; Kellerman 2006; Smith and White 2004). Thus, despite growing corporeal mobilities, people continue to moor their affinities in particular places.

Technological innovations, by making international calling more convenient and less costly, are likely to strengthen these transnational communicative ties. Regulatory changes could have a similar effect. More specifically, under the right circumstances, reforms that open up telephone markets to new players, increase competition and stimulate new investment can lower prices and improve service quality (Estache et al. 2006; Wallsten 2001). In doing so, they could make long-distance telephony more accessible and affordable, allowing migrants and communities in the homeland to communicate more often and for longer (cf. Muñoz and Amaral 1996; Vertovec 2004).

Inevitably, the way people communicate across borders will evolve over time, with short message servicing (SMS), social networking and emailing becoming more important (Panagakos and Horst 2006). Moreover, how voice traffic itself is delivered is also likely to change, moving more towards internet-based forms of transmission. Yet, it seems unlikely that voice traffic itself will diminish because other forms of

communication are just as likely, or indeed more likely, to function as complements rather than substitutes (Andersson et al. 2009).

The ability of migrants and their family and friends in the country of origin to communicate more readily, cheaply, frequently and in ways that are more diverse is likely to have multiple consequences. These range from the ability of people to sustain friendships with individuals in other countries, self-identified ethnic groups' propensity to organize collectively, and even corporeal mobilities. For example, heightened communicative ties could further stimulate chain migration, as individuals in the homeland learn more about particular destinations through more regular conversations with prior emigrants. More research is needed in this area, however, to explore some of the positive and negative consequences of growing transnational communicative capacities and practices.

As well as regulatory and technological changes, border controls are another important factor likely to shape the future of migrant related telephony; a growing number of countries, including those that historically had liberal regimes (for example Canada and the UK), are imposing heightened restrictions on immigration. By limiting the longer-term movement of people, such controls could well slow the growth of associated cross-border telephony, notably between countries exercising controls. On the flip side, it could be that individuals, finding it more difficult to travel to particular countries, instead make more cross-border calls to their family and friends.

What potential public policy interventions follow from our empirical analysis? Most importantly, our article points to the importance of public policy measures to address the affordability of long-distance communications. Contrary to the idea that the falling costs of telecommunications mean that affordability is no longer a barrier to long-distance telephony, our results suggest that income continues to act as a constraint. These constraints are important in view of the potential significance of tele-connectivity for migrants' wellbeing, arising from a sense of identity, belonging to a wider community and contact with family and friends. It is also important from a developmental perspective in that – both for people in home and host states – long-distance communication may play a role in leveraging remittances, transnational network capital and other forms of assistance.

The need for public interventions to increase the affordability of calling is likely to be especially important in lower-income countries. Of course, there is only so much that governments can do to address per capita income, at least in the short term. Yet efforts to reduce the costs of international communications may be facilitated by various regulatory reforms that make calling and other forms of communications cheaper. In fact, these initiatives may take on particular significance for spatially-distant migrants, in that their demand for long-distance communications would appear to be stronger.

Notes

1. An exception is Lago (1970) who finds that a higher share of parents who came from a particular country did not increase calling from the USA for the period 1962–64.
2. Where data on the foreign-born population were unavailable, the creators of the dataset used data on foreign nationality to construct their measure of migration stocks.

3. This may in part be due to the relative lack of publicly available data on bilateral FDI – a shortcoming that we overcame by acquiring additional data from UNCTAD (2009).
4. Spatial proximity is a potentially ambiguous underlying influence on telephony. It is not entirely clear whether physical distance itself deters remote communications, or whether distance is a proxy variable, capturing the effect that distant dyads enjoy less bilateral investment and travel. Indeed, we argue that it only makes sense to include measures of spatial proximity if other theoretically plausible distance-dependent relational ties are included in the multivariate model, as is done in the present study.
5. Another way to evaluate the relative importance of each of these four relational variables is by dropping each one separately from the estimation model to assess the effect on the model fit, taking into account model complexity, as given by Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC). Doing so shows that the largest increase in AIC/BIC, representing a worse model fit, follows from dropping the migrant stock variable, followed by short-term visitors, trade and FDI. In other words, this analysis of relative importance to the model fit is consistent with our analysis of relative substantive importance in terms of estimated elasticities.
6. As common language is a dummy variable, its substantive importance can only be assessed in terms of the presence versus absence of linguistic ties. It is thus not directly comparable to the substantive importance of our four main relational variables.

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