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Richard Perkins and Eric Neumayer

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Address, both: Department of Geography and Environment, London School of Economics and Political Science, Houghton Street, London WC2A 2AE, U.K.

Fax: +44 (0)20 7955 7412

Tel: +44 (020) 7955 7605

*Richard Perkins = r.m.perkins@lse.ac.uk

Eric Neumayer = e.neumayer@lse.ac.uk

*Corresponding author

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

Abstract

Recent work has 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. Yet the existing literature has not done a good job of evaluating the substantive importance of migrants in explaining large disparities in levels of bilateral voice traffic observed between different countries. Nor has it gone very far in examining how the influence of migrant stocks on international calling is moderated (i.e. amplified or attenuated) by domestic and relational factors. Our contribution in the present article 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.

Introduction

Recent work has ascribed a major role for telecommunications in the lives of cross-border migrants (Esman 2009; Horst 2006; Ros 2010). Amongst others, 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 two-fold. 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 which mediate the degree to which migrant stocks give rise to calls between home and host countries is also of practical significance. Amongst others, this is because boundary-spanning communications between migrants and their

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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, telephone calls are known to play a role in arranging remittances (Collins 2009; Horst 2006), such that factors which constrain international telephony may have far-reaching implications for family members remaining in the homeland.

Unfortunately, the literature has not done a good job of evaluating the substantive importance of migrants in international telephony, or investigating the factors which 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 which have done so have typically used comparatively small samples, or crude measures/proxies which fail to identify migrants' countries of origin (Cui 2005; Lago 1970; Rietveld and Janssen 1990; Muñoz and Amaral 1996; Kellerman 1990; Sandbach 1996). Importantly, 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 & Oiarzabal 2010). Missing from previous work have been efforts to systematically analyse how geographic factors impact call volumes between migrants and their homelands using a large sample, multivariate research design.

The present article addresses these gaps. To do so, it makes use of 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. Additionally, advancing on previous work, we use an interactive model specification to explore how geographic attributes moderate (i.e. 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 the actual amount of telephone calling between migrants and their homeland communities is increased by two factors, namely, higher aggregate country pair income and greater distance between the origin and destination countries. 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 organisational 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 (US) as a source/recipient of international telephone calls. The United Kingdom (UK) also emerges as a key calling partner amongst the sample of countries. One factor likely contributing to the importance of these countries is that they are host to large numbers of migrants (34.3 and 4.8 million, respectively) 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 of the top ten calling partners with India, for example, are countries which are known to host significant numbers of Indian immigrants. Likewise, Germany's large Turkish migrant community may go some way in explaining why Turkey appears amongst the country's major calling partners.

Yet, while few would deny a significant role for migrants, they are likely to be one amongst many factors shaping global patterns of telephony. Thus, another plausible reason as to why the US 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 industrialised 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 most important calling partners are located in the European macro-region, Canada and Mexico are the leading calling partners of the US, 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.

From this brief snap-shot 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 percent of the world's population (Ratha and Xu 2008). Another is that falling costs and innovations such as pre-paid 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 on-going contact with the homeland may help migrants to 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 amongst 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). Amongst others, 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 diaspora 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 proactively make use of 'ethnic' networks in foreign countries, e.g. by recruiting prominent diaspora members to make business introductions (Datta 2009; Esman 2009; Harvey 2009). Additionally, diaspora ties may provide the foundation for transnational business relationships, with managers, entrepreneurs, etc., 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 which 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; Muňoz and Amaral 1996; Rietveld and Janssen 1990; Sandbach 1996).[3]

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 which 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 be correlated with migrant stocks, it is highly questionable as to whether inferences can be made about the overall influence of migrants on bilateral calling. Additionally, based on observations from a comparatively small sample of non-randomly selected countries which have experienced large growth in bilateral call volumes, it remains unclear as to whether the influence of

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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 which 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 which fail to distinguish between migrants' country of origin (Muňoz 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 e.g. Spain or the US (Cui 2005; Lago 1970; Muňoz and Amaral 1996). Needless to say, such a narrow geographic focus restricts the generalizability of these studies' findings, and prompts questions as to whether similar patterns hold for larger country samples. Where specified, samples of the telecommunications partner countries are larger, e.g. 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 which limits the usefulness of past multivariate studies is that the only two studies which 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 foreign born population are more influential determinants of calling between the US and major

foreign communication routes than trade. It is worth noting that both of 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 which 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 amongst 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 (Collins 2009; Horst 2006; Alonso and Oiarzabal 2010). 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 which might influence patterns of bilateral telephony, including those which are correlated with migrant stocks. Two datasets are used in the study, namely: one which records the cumulative number of migrants from country i residing in country j (Parsons et al. 2007); and one which 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 the impact of migrant stocks on international telephone calls is amplified or retarded by various geographic factors. More specifically, we model the influence of bilateral migrant stocks as conditional on two key variables, namely: (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. There are, of course, other attributes which could plausibly have a conditioning influence. Yet these are either closely related to the above (e.g. 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 (i.e. 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 Telegeogaphy's telephone voice data is that they do not include Voice over Internet Protocol (VoIP) traffic. However, non-dyadic data from Telegeogaphy (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 is 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 (e.g. 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 (e.g. 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 a total of 226 states. Migrants are taken by the authors as individuals born outside their current country of residence.[4] Consistent with analyzing the sum total of bilateral telephone calls, our migrant stock variable measures the sum total of bilateral resident migrants, i.e. 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 (Williams and Hall 2000; Margheritis 2007). Parsons et al.'s data are not entirely immune from these accounting problems, e.g. 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 which are 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 relative 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/receive calls from family and friends in their home country (Palm 2002). Similarly, business travellers are known to make/receive calls to/from their home country whilst on their trips abroad (Millar and Salt 2008). This is confirmed by a number of quantitative studies which show that various measures of visitor flows (total inward/outward flows of tourists, foreign travel expenditure, etc.) have a positive impact on international telephone traffic (Cui 2005; Garín-Muñoza and Pérez-Amaral 1998; Kellerman 1990; Lago 1970; 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, subsidiaries co-ordinate with foreign parents, and so on (Cracknall 1999; Millar and Salt 2008; Warf 2008). The idea that trade (imports or imports and exports) between countries is positively correlated with international telephone traffic is supported by

numerous studies (Cui 2005; Garín-Muñoza and Pérez-Amaral 1998; Hackl and Westlund 1995; Karikari and Gyimah-Brempong 1999; Kellerman 1990; Lago 1970; Rea and Lage 1978; Rietveld and Janssen 1990; Palm 2002). To the best of our knowledge, evidence that direct investment raises international calling is restricted to a single study[1] (Lago 1970), 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*. Trade and investment data were obtained from World Bank (2009) and UNCTAD (2009) respectively.

A third set of variables attempt to capture spatial proximity. Previous work has found that international calling falls as the distance between the countries of the caller/recipient grows (Choi 2004; Rietveld and Janssen 1990; Sandbach 2006). Most likely, this is explained by the fact that (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 form part of a 'community of interest' (Ouwersloot and Rietveld 2001).[2] 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 less 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, i.e. 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 1994; 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 their former colonial masters, and vice versa. Previous research largely endorses these claims, although mostly on the basis of findings derived from fairly rudimentary research designs (Kellerman 1990; Palm 2002; Rietveld and Janssen 1990). Data for these fourth and fifth relational variables are from CIA (2009).

We also control for a number of non-relational factors which 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, both in terms of 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 US. Directly, a number of studies have found that GDP p.c. (per capita) is a statistically significant predictor of outward calling volumes (e.g. Rea and Lage 1978; Sandbach 1996). We take the sum of GDP p.c. of the two countries as the relevant variable, rather than the product, because we find it plausible that a high GDP

p.c. in one country can substitute for a low GDP p.c. in the other country since for bilateral telephony it is sufficient if one party can afford long-distance international calls.

Finally, we also include the sum of population sizes of the two countries to control for the fact that more populous countries 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. Data for GDP p.c. and population were obtained from World Bank (2009).

Interaction effects

We explore how the influence of bilateral migrant stocks on inter-country voice calling traffic is conditioned by two attributes. 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, both for 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: larger stocks of bilateral migrants will give rise to more voice traffic in country pairs where the sum of GDP p.c. is greater.

Although no previous studies have explicitly investigated the links between country income and international calling associated with migrants, empirical research nevertheless

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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 GDP p.c. is positively correlated with international calling, with telephone call demand found to be more price inelastic in richer countries (Cui 2005; Garín-Muñoza 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 (Larsen et al. 2006; Kellerman 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 to more costly physical travel, such that migrants and homeland actors in spatially remote country pairs call each other more, but travel less (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 re-connect with their territorial birthplace as a means to reaffirm or construct their in-group identity. Indeed, consistent with these interpretations, interviews with

migrants suggest that communication technologies can help to 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 (e.g. Sandbach 1996). Yet this does not necessarily mean that distance has the same conditioning influence on the propensity of migrants or their family, partners and friends to call one another.

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. The 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 which could be correlated with our explanatory variables, the omission of which would cause omitted variable bias, we include year-specific fixed effects for both of the countries in a dyad. In other words, each country 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:

$$\ln telephony_{ijt} = \ln migrantstock_{ij} + \ln visitors_{ijt} + \ln trade_{ijt} + \ln FDIstock_{ijt}$$

$$+ \ln(GDPpc_{it} + GDPpc_{jt}) + \ln(pop_{it} + pop_{jt}) + \ln(pop_{it} + pop_{jt})^2 + \ln dist_{ij}$$

$$+ contiguity_{ij} + samelanguage_{ij} + coloniallink_{ij} + u_i \cdot \gamma_t + v_j \cdot \gamma_t + \varepsilon_{ijt}$$

The variables are defined as described above, $u_i \cdot \gamma_t$ and $v_j \cdot \gamma_t$ 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 GDP p.c. and the

other of the migrant stock with distance.

Our data cover 160 countries over the years 2001-2006. For these 160 countries,

TeleGeography does not report positive telephone traffic with all potential partner countries,

such that 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.

<<INSERT TABLE 2 HERE>>

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 travelers 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 as to 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 ten percent increase in the size of bilateral migrant stocks is associated with a 3 percent increase in bilateral telephone traffic. The estimated increase in telephony is 2.8 percent, 2.4 percent and 0.7 percent for a ten percent 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 also the strongest one of the four relational mobilities.[5]

As expected, we find that higher aggregate GDP p.c. 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 year-specific country fixed effects.

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. The fact that we account for other well-known distance-dependent variables in our research design, i.e. trade, investment, migration and tourist flows (e.g. see 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. It could be that higher calling costs deter longer-distance telephony, or that distance captures the general tendency of individuals to be less personally or professionally acquainted with people living in countries further away (Ouwersloot 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 which might be correlated with contiguity, actors in neighboring countries do not call each other more than actors in non-contiguous countries.

Finally, we find that country pairs where one of their main languages is shared 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 travelers. 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 which are correlated with colonial ties such as trade and migration.

Columns 2 and 3 show our estimation results with the interaction effects included. All of 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 which 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 have an influence over international calling. All that counts are the coefficients of the interaction effect variables which, 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 plot 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 GDP p.c. and distance. Yet the effect increases as distance between the country pair grows and rises, even more strongly, with higher aggregate sum of both countries' GDP p.c. Thus, where country pairs are close, a ten percent increase in the stock of migrants raises bilateral telephony by just above two percent, but by almost 3.5 percent where the two countries are far apart. At very low combined levels of per capita income, a ten percent increase in the stock of migrants only raises bilateral telephony by just above one percent, but the same effect is much larger at almost four percent 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 two-fold: (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 migrants' influence over bilateral calling is shaped by various geographic attributes.

For a sample of 160 developed and developing countries and 2041 country pairs, we provide statistically rigorous evidence that county pairs which 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 ten percent increase in the number of either is associated with a 3 or close to three percent increase in bilateral telephone traffic, more than the equivalent figure for bilateral trade (2.4 percent), and substantially greater than bilateral FDI (less than 1 percent).

Another significant contribution of our article is to show that, although having a large influence over patterns of inter-country voice traffic, the degree to which stocks generate increased bilateral telephone calls is governed by two factors. 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 greater access to the means to make 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).

A second factor found to influence the degree to which migrant stocks raise bilateral telephone calling is spatial proximity. Specifically, if migrants are further away from their country of origin, bilateral call volumes would appear to be relatively higher. This could be because telephony and physical travel are substitutes, i.e. rather than travelling to meet with family, partners and friends in person, migrants further away might satisfy their demand for communication remotely through telephone calls (Falk and Abler 1980; Ouwersloot and Rietveld 2001). Alternatively, it could be that physical distance increases 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 underscore 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 2008; Harvey 2009). Mobilities of ideas, knowledge and values conveyed by voice traffic are mapped on to 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 inter-personal 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; Smith and White 2004; Kellerman 2006). Thus, despite growing corporeal mobilities, peoples' affinities continue to be moored in particular places.

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

Inevitably, the way in which 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 in that other forms of communication are just as, or indeed more likely, to be complements 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 more diverse ways 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, another important factor which is likely to shape the future of migrant-related telephony is border controls. A growing number of countries, including those which have historically operated more liberal regimes (e.g. 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 following 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' well-being, 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 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 which 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.

Endnotes

[1] 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).

[2] Spatial proximity is a potentially ambiguous underlying influence on telephony. It is not entirely clear as to whether physical distance itself deters remote communications, or whether distance is a proxy variable, capturing the effect that distant dyads enjoy less bilateral investment, travel, etc. 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.

[3] 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 US for the period 1962-1964.

[4] Note, 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.

[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 Informaton 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] Note, because 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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Table 1. Top ten calling partners (million minutes) for selected countries, average over 2001 to 2006.

	Brazil		Germany		India		Nigeria		United States	
1	United States	1360.4	United States	2396.8	United States	2573.9	United States	322.0	Canada	12059.2
2	United Kingdom	254.5	United Kingdom	1747.6	United Arab Emirates	889.4	United Kingdom	198.1	Mexico	11399.3
3	Japan	237.1	Switzerland	1520.0	Saudi Arabia	633.8	South Africa	19.2	United Kingdom	4653.7
4	Portugal	183.8	France	1470.0	United Kingdom	520.4	Italy	13.1	India	2573.9
5	Argentina	111.4	Italy	1428.3	Canada	208.2	Netherlands	5.1	Germany	2396.8
6	Spain	91.5	Austria	1393.3	Singapore	159.3	Canada	3.4	Philippines	2315.5
7	Switzerland	41.5	Netherlands	1174.2	Australia	120.3	Lebanon	3.0	Dominican Republic	2195.4
8	France	39.2	Spain	1083.3	Qatar	69.5	France	2.7	Guatemala	2040.3
9	Germany	36.2	Turkey	837.7	Oman	67.1	India	1.9	Japan	1473.8
10	Chile	35.0	Poland	720.0	Malaysia	65.7	Germany	1.9	Colombia	1382.0

Table 2. Estimation results

	(1)	(2)	(3)
$\ln migrantstock_{ijt}$	0.300***	-0.0830	0.227***
	(0.0175)	(0.0874)	(0.0294)
$\ln migrantstock_{ijt} \cdot \ln(GDPpc_{it} + GDPpc_{jt})$		0.0406***	
		(0.00922)	
$\ln migrantstock_{ijt} \cdot \ln dist_{ij}$			0.0111***
			(0.00376)
$\ln visitors_{ijt}$	0.285***	0.287***	0.274***
	(0.0207)	(0.0206)	(0.0206)
$\ln trade_{ijt}$	0.237***	0.239***	0.231***
	(0.0258)	(0.0259)	(0.0258)
$\ln FDIstock_{ijt}$	0.0692***	0.0559***	0.0689***
	(0.0106)	(0.0107)	(0.0106)
$\ln(GDPpc_{it} + GDPpc_{jt})$	0.538***	0.195**	0.534***
	(0.0596)	(0.0950)	(0.0594)
$\ln(pop_{it} + pop_{jt})$	-1.677**	-1.672**	-1.702**
	(0.748)	(0.739)	(0.751)
$\ln(pop_{it} + pop_{jt})^2$	0.0472**	0.0475**	0.0484**
	(0.0226)	(0.0223)	(0.0227)
$\ln dist_{ij}$	-0.0492***	-0.0514***	-0.174***
	(0.0170)	(0.0173)	(0.0483)
$contiguity_{ij}$	-0.120	-0.105	-0.115
	(0.0881)	(0.0883)	(0.0886)
$samelanguage_{ij}$	0.361***	0.336***	0.363***
	(0.0706)	(0.0712)	(0.0699)
$coloniallink_{ij}$	0.121	0.182	0.172
	(0.184)	(0.192)	(0.174)
Observations	5546	5546	5546
Dyads	2041	2041	2041
Akaike/Bayesian Information Criterion	13770.6/21086.6	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.

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

In(sum of GDP pc in both countries)

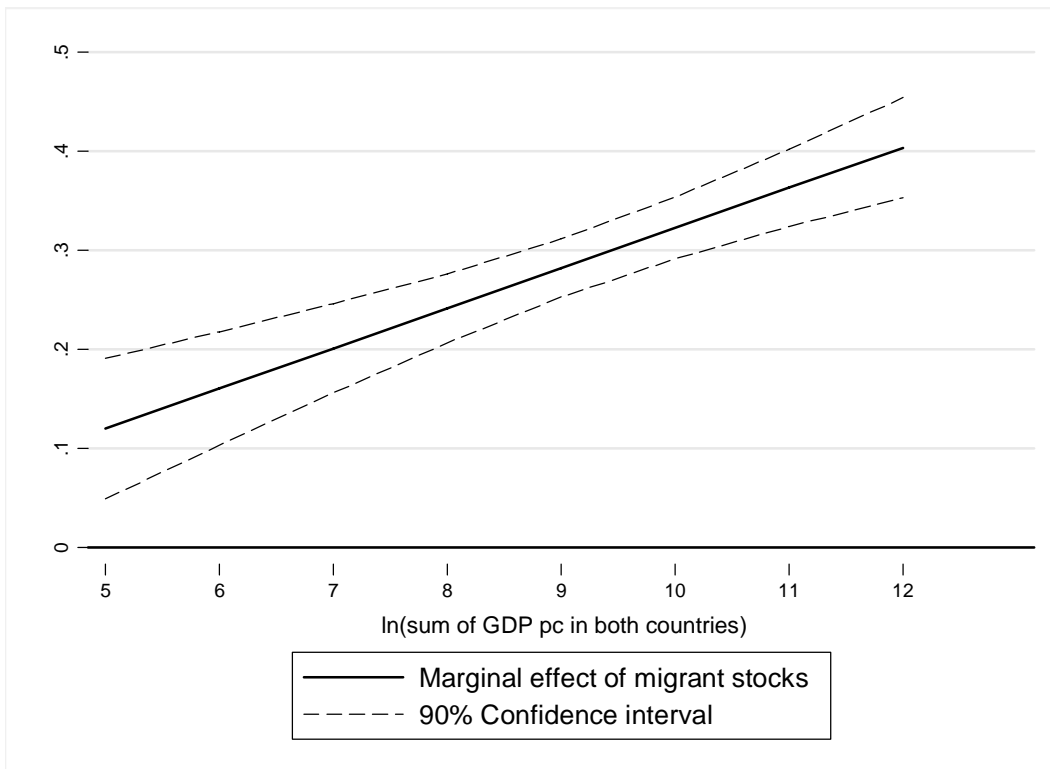Marginal effect of migrant stocks
90% Confidence interval

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