Skills Research Initiative
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The International Mobility of Highly Educated Workers among OECD Countries

Steven Globerman (Western Washington University)
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Abstract

In this study, we specify and estimate an augmented gravity model of the determinants of bilateral migration flows across OECD countries. We find that migration is greatest between countries with large populations and is reduced when geographic, linguistic and religious "distances" are large. Migration is also influenced by relative labour market conditions. Specifically, migrants tend to leave countries where economic conditions are relatively poor (high unemployment; low GDP per capita) and move to areas where conditions are better. Our results also confirm the importance of FDI and trade as determinants of migration flows: both are complements to migration. Finally, the results indicate that there are important differences in the determinants of migration outcomes by level of education. In particular, highly educated migrants are more influenced by the "pull" of economic conditions in host countries, while those with less education are more heavily influenced by the "push" of economic factors in their home countries.

Résumé

Dans cette étude, nous précisons et nous estimons un modèle gravitaire augmenté des déterminants des flux de migration bilatéraux entre les pays de l'OCDE. Nous avons constaté que la migration est plus importante entre les pays très peuplés et moins importante lorsque les « distances » géographiques, linguistiques et religieuses sont grandes. La migration est aussi fonction de la conjoncture relative des marchés du travail. Plus précisément, les migrants ont tendance à quitter des pays où la situation économique est relativement mauvaise (taux de chômage élevé, faible PIB par habitant) et à s'installer dans des régions où la conjoncture est meilleure. Nos résultats confirment aussi l'importance de l'IED et du commerce pour les flux de migration : les deux sont des compléments à la migration. Enfin, les résultats montrent qu'il y a de grandes différences entre les facteurs qui déterminent la migration selon le niveau de scolarité. En particulier, les migrants hautement scolarisés sont davantage motivés par l'effet d'attraction de la conjoncture économique de leur pays d'accueil, tandis que ceux qui ont une scolarité moins grande sont davantage motivés par l'effet d'impulsion de la conjoncture économique de leur pays d'origine.

INTRODUCTION

Developed countries experiencing slower growing, or even declining work forces owing to retirements of "Baby-Boomer" workers, have been increasingly turning to policies to promote the inward migration of highly educated workers (HEWs) from abroad (Tremblay, 2004). Yet politicians in many OECD countries remain under pressure from business groups to expand allowable quotas of skilled and educated migrants.

Obviously, the formulation of public policies designed to attract and retain HEWs requires an understanding of the determinants of international migration decisions, particularly those taken by highly educated workers. Indeed, it might well be the case that individual countries are at a comparative disadvantage with respect to attracting HEWs, because they do not possess "attraction attributes" in sufficient quantities compared to other countries. Moreover, the costs of enhancing the relevant attributes at the national level, to the extent that they can be enhanced, may well exceed the anticipated benefits of attracting greater numbers of HEWs. In short, policymakers need to understand the factors influencing migration patterns for HEWs before even deciding to compete with other countries for those individuals.

While the forces of globalization that have increased flows of goods and capital also appear to have facilitated the international mobility of highly educated and skilled workers (Lopes, 2004), the magnitudes of the international flows of HEWs are not yet clear (Harris, 2004), in part because no consistent international data on HEW migration patterns has been hitherto available. Therefore, there are relatively few empirical studies of HEW migration. As a result there is a substantial amount of theorizing about the determinants of HEW migration with relatively limited accompanying empirical evidence.

The primary purpose of this study is to specify and estimate a model of international migration using newly available OECD data that distinguishes migrants by education levels and country of origin. We employ a gravity model specification to estimate the determinants of these bilateral movements among OECD countries using data for both home and host countries, and including a range of explanatory variables that account for cross-county differences in economic, geographic and cultural "distance".

The model is estimated for both HEWs and total migrants in order to identify what might be possibly unique about HEW migration.[1] Because international movements of labour may be related to the international movements of capital and goods, we focus particular attention on the impacts of bilateral foreign direct investment (FDI) flows and bilateral trade on international migration. The model and the data are discussed in more detail below.

Perhaps the most critical finding of our study is that HEW migration is strongly complementary to FDI and trade flows suggesting that the migration of HEWs is increasingly an aspect of the global production systems created and operated primarily by multinational companies. While local economic conditions in the home and host countries are important determinants of migration for individuals at all levels of attained education, the "pull" factor of host country conditions is apparently more significant the higher the individual's formal education level. Both physical and "cultural" distance between host and home countries influences migration, although not identically across different levels of education.

The remainder of the paper proceeds as follows. Section 2 provides a broad review of the theoretical and empirical literature focusing on inter-country migration patterns for HEWs, and links the literature on migration with that of international trade and foreign direct investment (FDI). The section also contains a brief survey of the use of the gravity model as a tool to analyse bilateral flows of labour, capital and goods.

Section 3 describes the migration data source(s) that will be utilized in the original empirical work undertaken in this study, and presents summary statistics. The data report *stocks* of immigrants and emigrants for 29 OECD countries. Immigration and emigration data are reported for three categories of educational attainment. The stock data therefore reflect the cumulative flow of both permanent and temporary potential workers at different educational levels over past decades as reflected in 2000 Census data or equivalent sources.

[1] It should be noted explicitly that the OECD data identifies migrants, and not strictly employed migrants. That is, the data do not specifically identify workers, but more accurately potential workers. While it seems reasonable to conclude that most highly educated migrants obtain employment in host country labour markets, the foregoing distinction should be borne in mind. Nevertheless, for convenience, we may occasionally refer to highly educated "workers" rather than the more precise highly educated "individuals".

Section 4 sets out the specification of our statistical models and discusses the estimation techniques that will be utilized. The focus of the models is to identify the determinants of stocks of immigrants, both in total and by attained education level. The analysis will focus on intra-OECD bilateral flows of migrants. Following the literatures on bilateral immigration, FDI and trade flows, we will estimate cross-section equations of the determinants of bilateral immigration stocks. The estimates will employ a gravity model framework whereby the logarithm of the number of foreign born people in any one country that originate in a second OECD country will be regressed on a number of variables that measure characteristics of both countries.

Section 5 presents and discusses the empirical results from estimating the models described in Section 4. The results suggest that the international migration of individuals is well-explained by a model that includes both economic and non-economic variables. In particular we find that bilateral movements of goods and capital are positively related to bilateral movements of people. Thus, the globalization of economic relationships, largely achieved through MNEs, is important to our understanding of international migration. Although we expected these relationships to be more important for HEWs, we in fact find that they affect all international migration. Indeed, it appears that at the country level, there are minimal differences between the determinants of HEW migration and total migration. A summary of our findings is presented in Section 6.

REVIEW OF THE LITERATURE

Although there is a substantial literature on migration, both within and between nations (recent examples include Pedersen et. al, 2004; Gonzalez and Maloney, 2005; Mayda, 2005), there are relatively few studies that focus specifically on HEWs. Nevertheless, the conceptual foundation of all models of migration is the assumption that an individual will seek to migrate from one location to another only if the expected present value of the anticipated benefits exceeds the expected present value of the anticipated costs. The substantive theoretical and empirical issues therefore involve the identification of the important determinants of the anticipated benefits and costs.

Economic Incentives

A specific assumption in most models of migration, especially models of HEW migration, is that prospects of higher real income levels associated with labour market employment are the main anticipated benefit associated with migration (Head and Ries, 2004). A worker possessing any given level of human capital might anticipate earning a higher real income in a host country than in his or her home country if there is a relative scarcity of human capital in the host country such that real, exchange rate-adjusted salaries are higher in the host country for workers with that given level of human capital. Equivalently, if there is a greater relative demand in the host country for workers possessing a given level of human capital, the probability of obtaining employment in the host country might be higher than in the home country. The OECD (2002) highlights the presumed importance of labour market conditions in noting that differences in skills premia, job opportunities and career opportunities are key drivers of the mobility of highly qualified individuals in the new global economy.

Surveys of HEWs focusing on the motivations for international migration highlight the importance of job market opportunities in the form of better career development opportunities and higher salaries (HRDC, 1999; Globerman, 1999; Wagner, 2000 and DeVoretz and Iturralde, 2000). More generally, most econometric analyses of bilateral migration flows indicate that labour market conditions, as measured by relative unemployment and wage rates, are important determinants of migration decisions (Pedersen et. al, 2004; Gonzalez and Maloney, 2005; Mayda, 2005).

Survey and econometric evidence is more equivocal on the importance of tax rate differences as an incentive for HEW migration, although there tends to be agreement that tax differences are less important than gross income differences (HRDC, 1999; Globerman, 1999; Wagner, 2000). Non-pecuniary benefits (or amenities) may also influence the migration decisions of HEWs. These include lifestyle considerations such as a relatively clean and safe physical environment, “good” weather, the availability of cultural amenities and other leisure time opportunities, as well as the presence of excellent educational institutions for one’s children and accessible and high quality

medical care (Hart, 2004; Gonzalez and Maloney, 2005). However, there is little statistical evidence available that bears upon their quantitative importance.

There are obvious costs associated with HEW migration. These include expenses associated with identifying and securing employment in the host country, acquiring the appropriate visa approval, physically moving oneself and, perhaps, one's family to the host country, and learning how to function effectively in a new environment. Most studies proxy these costs by various measures of distance. Dostie and Leger (2004) suggest that the physical distance between origin and destination locations might be a good proxy for the costs associated with migrating from one location to another. Gonzalez and Maloney (2005) link physical distance to moving costs but see "networks" of migrants from the same home country as an important factor influencing the costs directly or indirectly borne by immigrants associated with "assimilating" into the host country. Pedersen et. al. (2004) and Mayda (2005) use dummy variables for countries that share common borders and common languages as proxies for migration costs. Presumably, employment should be easier to secure when the migrant already possesses host country language skills; however, since HEWs are more likely to have acquired other languages, a common language at the country level may be a less relevant determinant of HEW migration.[2]

Links to Foreign Direct Investment and Trade

The availability of a variety of visa alternatives should reduce waiting times and lower the associated costs associated with migration, including legal costs. In particular, migration through corporate "sponsorship", for example, as an "intra-corporate transferee", should reduce direct legal costs, since such costs are borne by the employee's company, as are relocation costs. In this regard, countries that are significant hosts to foreign-owned companies should be characterized by above-average inflows of HEWs, other things constant. In particular, the migration of managers and executives is likely to be particularly affected by the expanding activities of home country multinationals, as well as those of foreign affiliates located in the home country (Mahroum, 1999).

[2] A number of authors have noted that foreign students enrolled in host country educational institutions obtain country-specific knowledge that, in turn, reduces the costs normally associated with migration to that host country as an HEW in the future (Tremblay, 2004; Advisory Council on Science and Technology, 2004).

Mahroum (1999) notes that the migration of managers and executives often originates with temporary intra-corporate transfers that, later, turn into longer term, or even permanent moves. In this regard, Salt and Clarke (1998) found that the majority of foreign professionals (from non-EEA countries) that sought residency in the United Kingdom in 1995 were mainly executives and managers who were intra-corporate transferees from advanced economies such as Japan and the United States. Similar results were obtained for engineers and technicians. Lopes (2004) found in a survey of Canadian businesses and industry associations that Canadian companies move a very small percentage of their workforce across borders, but those that do move are likely to be managers, executives or employees with specialized skills.

These findings suggest that the migration of HEWs is linked to foreign direct investment (FDI) activities.[3] At a general level, both the migration of HEWs and FDI flows represent movement across borders of relatively mobile factors of production that are directly or indirectly human capital intensive. Factors that conceptually influence the migration decisions of HEWs are similar in many cases to those that conceptually influence FDI movements, particularly the degree of economic and social development of sending and receiving countries, and the sizes of the sending and receiving countries' economies.

In theory, FDI and international migration might be substitutes or complements, and the relationship could be different for HEWs and other migrants. FDI and migration might be substitutes, for example, if the FDI results in migrant workers in the home country being displaced by local workers in the host country. Alternatively, and as we have suggested above, FDI and the migration of HEWs might be net complements if MNEs use internal labour markets to reallocate managers and technical personnel who are resident in different countries across multinational production units around the world. Thus, the extent of bilateral FDI stocks can have a potentially important influence on bilateral migration flows, but the issue remains empirically unresolved.[4]

[3] Faini (2004) argues that the relevant relationship is complex and involves trade flows as well.
[4] Head and Ries (2004) note the potential for "two-way causality" between the migration of HEWs and FDI stocks. Specifically, the activities of multinational companies in a country should promote increases in HEWs. At the same time, multinational companies will be attracted to locations with a relative abundance of HEWs, as the FDI literature tends to suggest (Eaton and Tamara,1994; Mody and Srinivasan,1998).

At the same time, trade and FDI are linked. A substantial share of international trade takes the form of intra-firm trade carried out by MNEs. A key input to the efficient operation of MNE trade networks is information about trade opportunities and key success factors in importing and exporting countries. HEWs with knowledge of and experience with foreign markets can be an effective source of information that, in turn, can improve the efficiency of an MNE's international trade network.[5] The effective diffusion of information within the MNE network might therefore involve substantial intra-corporate transfers of HEWs among MNE affiliates, thereby strengthening an expected complementary relationship between the mobility of HEWs and stocks of FDI for any two countries. Equally, prospects for increased gains from trade should enhance the benefits of international migration as a means of diffusing market information.

The openness of the host economy has also been linked to inward FDI (Globerman and Shapiro, 2002). To the extent that trade and FDI are complements through intra-industry trade in intermediate inputs, greater openness to trade should make it more profitable for MNCs to operate in the host economy. On the other hand, to the extent that FDI moves into a host economy to surmount tariff and non-tariff barriers, the openness of the host economy might be negatively related to inward FDI. On balance, the evidence suggests that trade and FDI are complements. The implication for models of HEW migration is that trade-creating FDI can be expected to encourage HEW migration flows, for reasons noted above.

In summary, to the extent that significant bilateral FDI and trade flows between the home and host countries improve employment and income prospects for migrant HEWs, and also lower the effective costs of migration by reducing associated legal and other transaction costs, one expects trade and FDI to enhance international migration of HEWs. To the extent that relative wages in the host country are changed by trade and FDI, the incentive for migration of low skill individuals might also increase.[6]

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[5] Combes, Lafourcade and Mayer (2005) formalize this argument in a model of "border effects". Specifically, they argue that labour mobility is an instrument for diffusing information about geographically segmented markets, thereby promoting trade between those markets.

[6] At the same time it must be recognized that causality remains an issue. As noted above, FDI may well be attracted to regions where HEWs are prevalent. In addition, the presence of relatively large numbers of foreign-born HEWs in a host country might promote increased trade between that country and parent countries of the migrants, especially if the migrants possess proprietary knowledge about foreign markets

Gravity Models

Gravity models have become the standard technique for the empirical analysis of inter-regional and international bilateral flows of labour, capital and goods. The basis of most empirical models of bilateral migration, trade and FDI flows is the "barebones" gravity equation, whereby any interaction between a pair of countries is modeled as an increasing function of their sizes and a decreasing function of the distance between the two countries. Indeed, the gravity equation has become "the workhorse for empirical studies….to the virtual exclusion of other approaches", (Eichengren and Irwin, 1998, p.13).[7] While this statement was written with reference to trade flows, the same has been true of migration studies (recent examples include Gonzalez and Maloney, 2005; Mayda, 2005) and FDI studies (Hejazi and Safarian, 2001; Hejazi and Pauly, 2005).

Most available studies augment the basic gravity model in various ways. In particular, a number include measures of non-physical distance, and, in particular, measures of cultural distance such as common language and common religion (Frankel and Rose, 2002; Mayda, 2005). Arguably, advances in information communication technology are contributing to differences in cultural and even political institutions being increasingly important influences on "distance" costs relative to physical distance.[8] Similarly, physical distance, *per se*, should increasingly be a less important influence on migration decisions as costs of communicating with family and friends in the home country, as well as costs of traveling between home and host countries, decline in real terms.

Gravity models are also used to examine the relationships among migration, trade and FDI. For example, Hejazi and Safarian (2001) examine the degree of complementarity between FDI and trade using a gravity model. Similarly Gonazalez and Maloney (2005) include both trade and FDI variables in their examination of migration

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that lowers transaction and information costs associated with international trade. For a theoretical discussion of this possibility, see Globerman (1994). See Gould (1994), Rauch (2001), Rauch and Trinidade (2002) and Head and Ries (2001) for some empirical evidence on the linkage between migration and subsequent changes in international trade.

[7] Frankel and Rose (2002) also note that the gravity equation as applied to international trade is one of the more successful empirical models in economics.

[8] Empirical evidence on the importance of "institutional" differences across countries as determinants of economic integration is presented in de Groot, Linders, Rietveld and Subramanian (2004).

within Mexico (and find that they are substitutes). However, Pedersen et. al. (2004) find that trade and international migration are complements. The causality running from trade and FDI to migration implied by such results is called into question by Head and Ries (1998) who find that the presence of immigrants enhances trade with their country of origin.

In general, gravity models have been highly successful in explaining bilateral patterns of trade, migration and FDI. However, only a few studies have examined the inter-relationships among these various measures, and no study of which we are aware has developed a model involving all three measures.

THE OECD DATABASE

Our empirical analysis is based on recently published OECD data on migration patterns for individuals possessing different levels of education.[9] These data are collected in a uniform way, thereby addressing some previous problems surrounding earlier studies of international migration patterns. In particular, many countries previously reported data only on the number of foreign nationals, rather than the number of foreign-born. A focus only on foreign nationals will likely understate considerably the number of immigrants (Dumont and Lemaitre, 2004b). Moreover, it might distort comparisons across countries to the extent that the ratio of foreign nationals to total immigrants varies across countries. The OECD database is the first internationally comparable data set with detailed information on the foreign-born population of OECD countries, by country of origin and by level of education. Thus, this data set allows, for the first time, a reliable means to compare immigrant populations across countries and, importantly, to identify the migration patterns of HEWs.

The OECD data report stocks of immigrants and emigrants in 29 OECD countries based on country of birth. For most countries, the data were collected from population censuses or population registers that identified people by country of birth and level of education. In some cases, such as Korea and Japan, where country of birth was not available, nationality was used as a proxy measure for country of birth. For most countries, the data are recorded as of 2000, and for most countries the data were obtained

[9] The underlying data are described in J.C. Dumont and G. Lemaitre (2004 a,b).

from population censes for the year 2000. For the 29 countries participating in the data collection, fairly detailed data were obtained. The objective was to minimize the number of residual categories ("Other"). As a result, 227 OECD and non-OECD countries were identified as "countries of birth" for each of the 29 OECD countries. By focusing on country of birth, the OECD data provide a more comprehensive measure of international migration than earlier databases because they include all migrants, and not just those who are permanent residents. For the purposes of this study we focus on the bilateral flows among OECD countries.

The education and skill qualifications were based on the International Standard Classification of Education System (ISCED). Since data were unavailable for all countries on a sufficiently detailed basis, the ISCED system was used to create three broad categories of education: less than upper secondary (ISCED 0/1/2); upper secondary and post-secondary non-tertiary (ISCED 3/4) and tertiary (ISCED 5/6). A residual category was also created for "unknown status".

Evidently, creating the data involved a variety of judgments, including those regarding how to define countries.[10] Perhaps the most important point to note is that the immigration data are stocks, not flows. The stock data therefore reflect the cumulative flow of permanent and temporary workers over past decades as reflected in 2000 Census data or equivalent sources. It is likely that the stock of immigrants reported in 2000 censes migrated in the 1980s and, particularly, in the 1990s. For one thing, a substantial percentage of immigrants who migrated in earlier decades are likely to be deceased. For another, temporary immigration based upon work-related visas was substantially greater in the 1990s than in earlier decades. The implication is that the most relevant determinants of the immigrant stocks reported in the OECD database are likely to reflect economic and other conditions prevalent in the 1980s and 1990s, rather than much earlier periods.

Table 1 provides a summary of some elements of the data. Specifically, it reports the percentage of foreign born, the major OECD country of origin for foreign born, the percentage of foreign-born immigrants possessing a tertiary education and the percentage

[10] Many of these issues are discussed more fully in Dumont and Lemaitre (2004b).

of expatriates possessing a tertiary education. As can be seen in Column 1 of Table 1, there is considerable variation across countries in the percentage of foreign-born with the "settlement" countries of Australia, Canada and New Zealand having foreign-born populations as a share of total population well above the OECD mean. It is also seen that Luxembourg and Switzerland have foreign-born populations that exceed 20 percent of total population, while some European countries, including Austria, Germany and the Netherlands, have percentages that exceed that for the United States. As noted by Dumont and Lemaitre (2004a), the percentages reported in Column 1 are appreciably higher than those obtained when immigration is measured on the basis of foreign-born nationals, and this is particularly true for Europe.

The immigrants originated from over 200 countries, but in this study we focus only on OECD countries of origin. Column 2 identifies the most prominent OECD country of origin for each of the OECD countries in the sample. For the most part, these are also the largest source countries in general, e.g. the U.K. It can also be seen that the largest source country is often characterized by former colonial ties, (the U.K. is the largest source country for Australia, Canada and New Zealand), by contiguous borders (Germany with Austria and Poland), or by previous history (Czech and Slovak Republics; U.K. and Ireland). In addition, the importance of Turkish immigrants, often as guest workers, across Europe is clearly evident. Columns 3 and 4 illustrate the propensity of the highly educated to migrate. Specifically, the mean percentage of foreign-born with a tertiary education is well above the population means for the sample countries, as is the percentage of expatriates with a tertiary education.

The immigration data employed in this study therefore cover 29 OECD countries for which bilateral data are available.[11] Two types of migration data were available: foreign born (the number of foreign born in country *i* originating in country *j*) and foreign nationals (the number of foreign nationals in *i* originating in *j*). Within each category, the data identify migrants by their level of education (high, medium and low). In this study we employ foreign born as the measure of international migration because foreign nationals understates the degree of immigration (Dumont and Lemaitre, 2004a). However, as is seen in Table 2, these measures are highly correlated, particularly across

[11] The countries are listed in Table 1. Italy was not included as a home country, because data were not available, but was included as a source country.

comparable education categories. For example, the correlation coefficient for total migration (FORT and NATT) is r = 0.849, whilst that for high education (FORH and NATH) is r = 0.808.[12] The correlation coefficients among educational categories are also quite high. Thus, countries receiving high levels of one type of migrant from another country tend to receive more of all types of migrants.

MODEL SPECIFICATION

A basic framework of a model of migration is provided in Gonzalez and Maloney (2005). In their model, the potential migrant chooses among a set of possible destinations where *j* is the region of origin and *i* is the migration region chosen. The migration decision reflects the value of the function identified in Equation 1:

(1) $I^* = V_i - V_j - C$

Where I* is the potential migrant's overall level of welfare in any of *k* countries, V_i is an indirect utility function reflecting the pecuniary and non-pecuniary attributes of living and working in specific country *i*, V_j is an indirect utility function reflecting the attributes of living and working in specific country *j* and C is a measure of the direct and indirect costs of migrating between the two countries.

The utility of living and working in any country *j* is assumed to be a linear or log-linear combination of location characteristics denoted as a vector X in equation 2:

(2) $V_j = (X_j)B + \varepsilon_j$

Where B represents a vector of coefficient values reflecting the importance of the individual location attributes of country *j* to the utility of living and working in country *j* and ε represents random determinants of the indirect utility of living and working in country *j*.

[12] Given this high correlation, it is not surprising that the empirical results do not change in any material way when foreign nationals is used as the dependent variable for model estimation.

If any specific destination region is more desirable than a specific originating region, and if the migrant has sufficient resources to move, migration from *j* to *i* will take place. That is, migration will take place if the expected value of I* is greater than zero. From Equation 1, the expected value of I* will be greater than zero if the expected value of $(V_i - V_j - C)$ is greater than zero. Equivalently, by virtue of substituting Equation 2 into Equation 1, the likelihood of migrating from region *j* to region *i* is expressed by Equation 3:

(3) $\text{Prob}\ (I^* > 0) = \text{Prob}\ ((X_{i)}B + \varepsilon_i - (X_j)B - \varepsilon_j) - C)) > 0$

Assuming that the ε terms are randomly distributed around a mean value of zero, Equation 3 suggests that if we observe actual migration from region *j* to region *i*, it is because the weighted value of the attributes of living and working in region *i* impart greater utility than the weighted value of the attributes of living and working in region *j*. That is, observed migration from *j* to *i* (M_{ij}) will be a function of X_i, X_j and C.

(4) $M_{ij} = f(X_i, X_j, C)$

The specification of a migration model therefore requires specifying the vectors X_i and X_j for all sample countries, as well as the precise functional form of the equation. As discussed above, the gravity model specification suggests that bilateral flows from *j* to *i* are directly proportional to the "mass" of *i* and *j*, and inversely proportional to the "distance" between *i* and *j*, where distance can be interpreted to include geographic, cultural, and economic distance. Thus, we estimate variations of equation (5).

(5) $M_{ij} = f((POP_i \times POP_j), D_{ij}, L_{ij}, Z_{ij})$

In the equation, M_{ij} represents migration from country *j* to country *i*; POP is the population of each country;[13] D is vector of terms representing measures of geographic and socio-cultural distance between *i* and *j*; the L terms represent economic distance in terms of labour market differences; and the Z's reflect other attributes of countries *i* and *j*

[13] In migration models, it is typically population measures that serve as a measure of mass (Zipf, 1946; Gonzalez and Maloney, 2005). In trade and FDI models, GDP is more typically employed. Estimates replacing POP with GDP are similar to those reported below.

that might plausibly affect migration between the two countries. In our case, the Z vector includes measures of bilateral trade and FDI.

The full set of variables included in the model, with their predicted impact on migration, is summarized in Table 3, and the variables are more fully defined in Table 4. Before considering each variable, three broad comments are in order.

First, although we have not to this point explicitly distinguished HEW migration from total migration, we do so in Table 3. However, the hypothesized direction of the impact of each explanatory variable is the same for all types of migration. What might differ is the magnitude of the impact. We will argue below that the most likely difference between HEW and total migration is most likely to be found in the trade and FDI variables. However, where relevant, we will also note other cases where the impact of a specific variable may be different for HEWs.

Second, in Table 3 we present a specification in which the relevant variables are defined as either differences (as is the case with the labour market variables) or log products (as is the case with the trade/FDI variables). Alternative specifications are possible. For example, in migration gravity models, it is often the case that labour market variables are measured as ratios (Lowry, 1966). We also estimate the models using ratios in place of differences, and the results are similar. Perhaps more important is the issue of whether host and home effects should be entered separately. The variable specification reported in Table 3 essentially assumes that home and host effects are equal. This may not be appropriate in a migration equation, since it has sometimes been found that destination area variables have a greater influence on the migration decision than originating area variables (Gonzalez and Maloney, 2005). F-tests were not always conclusive with regard to this restriction, and we therefore first present and discuss the restricted model, and later present results using an unrestricted model (where home and host variables are entered separately, and not as differences or products).

Third, it is important to recall that the dependent variable, M_{ij}, is in fact the stock of people born in country *j* now residing in country *i* in 2000. As noted above, this stock reflects the cumulative migration of people, mainly over the previous 10-20 years. As a

consequence, we measure the explanatory variables over that period. Where possible, variables are measured over the period 1985-2000, but in some cases (noted in Table 4) shorter time periods were required because of data availability.

We include three distance-related variables (adjacent country, common language and common religion). As noted above, physical distance might not be as relevant in models of migration as in models of international trade, and this may be particularly true of HEW migration. In models of international trade, physical distance is meant to reflect transportation costs. Specifically, greater physical distances impose larger transportation costs on shippers, which will reduce trade flows, all other things constant. In some studies, physical distance is taken to reflect other transaction costs (besides transportation costs) associated with doing "business" abroad. While it seems reasonable that costs of acquiring information, communicating with potential employers and so forth will increase with physical distance, the impact of physical distance, *per se*, in this dimension would again seem to be relatively modest compared to differences in other attributes such as language and culture.

In our gravity equation, two specific socio-cultural differences are specified as measures of "distance". One is a dummy variable identifying whether countries *i* and *j* share a common language. A second dummy variable identifies whether the two countries share a common religion. We do not entirely ignore physical distance, and also include a dummy variable indicating whether the two countries share a common border. We expect that countries sharing common borders, religions and languages should experience greater bilateral migration flows. Of these variables, the one most likely to differ in impact between HEW and other migrants is the language variable. To the extent that HEWs are more likely to acquire capabilities in languages other than those of their home country, the effect of common official languages may be reduced for HEWs.

In addition, we include a dummy variable for countries that were "officially" socialist over parts of the relevant time period. Such countries had in place restrictions on the movement of people, both inward and outward, that would result in lower levels of

migration, all other thing equal. Thus, we include this term as a control variable and expect its sign to be negative.[14]

We employ four broad measures of labour market conditions, although two are somewhat indirect. The first is the difference in unemployment rates between *i* and *j*. Unemployment rate differences between countries are likely to provide a meaningful segmentation between countries in terms of the likelihood of finding employment within any period of time and with "normal" search behaviour. For this variable, it is plausible that a migrant from country *j* will react to information about unemployment rates in country *i* differently from information about unemployment in country *j*, perhaps because it is easier to verify information about labour market conditions in country *j*. In this case, it might be appropriate to allow for the estimation of separate coefficients for the two unemployment variables. On the other hand, if the migrant's criterion strictly involves a comparison of labour market conditions between countries, holding other determinants of migration constant, then the ratio specification of the unemployment rates is arguably more appropriate. Because HEW migrants are more likely to have access to information, the assumption of equal coefficients is more likely justified for HEWs.

Another labour market-related variable is real per capita income in countries *i* and *j*. Higher per capita incomes are indicators of higher average wages. Higher values of real per capita income therefore signal the potential for higher real incomes to potential migrants from lower income countries. The use of purchasing power equivalent exchange rates to convert per capita income values into U.S. dollars for purposes of defining the variable mitigates any measurement error that might result from not incorporating cost-of-living measures explicitly into the migration equation. To be sure, real per capita income also implicitly measures a variety of economic and social amenities that might influence migration decisions. For example, education and health care infrastructure is likely to be more advanced in high-income countries. We try to isolate the labour market-related influence of real per capita income from the indirect (amenity) influence by using the UN index of human development (HDI) as an additional variable. In fact, the two

[14] The dummy variable for "socialist"countries is meant to capture the immigration and emigration policies of those countries. This ignores potentially important country-specific immigration and emigration polices for other countries. It is, however, difficult to measure and compare such policies across countries.

variables are highly correlated, and we ultimately employ them as separate measures. [15] The general hypothesis is that larger differences in income per capita (HDI) in favour of the host country will encourage migration.

Different tax rates may be an important component of the migration decision, particularly for HEWs. An indirect effort to estimate the influences of taxes on migration decisions is made by including a variable measuring the share of government revenues in GDP in country *i* relative to that same ratio for country *j*. In the absence of explicit and relevant marginal tax rates for each of the sample countries, the share of government revenues in GDP is used as a proxy for the average tax rate facing workers in that country; however, to the extent that the progressivity of tax rates varies across countries, this average measure will fail to identify accurately differences in marginal tax rates, particularly for (higher income) HEWs. Other unique circumstances of HEWs in different national tax jurisdictions may also make this average tax rate proxy a biased measure of the tax burden facing HEWs in specific countries. The hypothesis is that migrants will move from high- to low-tax jurisdictions, other factors held constant.

A unique feature of this study is the inclusion in the migration equation of variables relating to trade and FDI. As suggested above, the internal labour markets of multinational enterprises (MNEs) can be used to relocate people across borders, and this is particularly true for HEWs with idiosyncratic knowledge of host and home country conditions, or with technical and managerial skills that are especially valuable to the home or the host country affiliate. Thus, we include a term for the degree of bilateral FDI between *i* and *j,* and expect it to have positive impact on bilateral migration, particularly for HEWs.

Similar considerations apply to bilateral trade. Much international trade takes the form of intra-firm trade carried out by MNEs, and such trade may require employees with specialized knowledge about local markets. The effective diffusion of information within the MNE network might involve substantial intra-corporate transfers of HEWs among MNE affiliates, contributing to international migration. Thus, we expect a positive effect

[15] As with the unemployment variable, there is a specification issue regarding the per capita income variables. Namely, should the variables be entered separately and thereby be allowed to take on separate coefficients, or should the relevant variable be specified as a ratio of per capita income values of the countries involved? As in the case of unemployment rates, we try both specifications.

of bilateral trade on migration, and, in particular, on HEWs. Because FDI and trade tend to be complements, it may be difficult to separate the effects of the trade and FDI variables in capturing the enhanced returns to mobility associated with a greater demand for HEWs as "agents" that facilitate international business.

As specified, the estimated equation assumes that causality runs from FDI/trade to migration. However, as discussed above, there is some evidence to suggest that causality might also run in the opposite direction. However, given the relatively small share of the total work force that consists of immigrants in most countries, and the even smaller HEW portion of the workforce, our inclination is that any statistical influence running from migration flows to FDI is likely to be quite weak, and that ordinary least squares estimation of the migration equation, including FDI as an independent variable, is unlikely to be troubled by significantly biased coefficients. In addition, although the migration of HEWs from country *j* to country *i* might make country *i* a more attractive location in which to locate from the perspective of foreign investors, there is no obvious reason to believe that the migration of HEWs from *j* to *i* would make country *j* a more desirable location for MNC affiliates. Hence, by specifying the relevant independent variable as the product term of the bilateral FDI flows, the potential endogeneity of the FDI variable should be mitigated. Nevertheless, we do test for exogeneity of the FDI and trade terms, and estimate the migration equation using instrumental variables as necessary.

The inclusion of the trade and FDI terms also limits the need to consider other potentially relevant variables frequently included in models of international trade or FDI. One such variable is whether countries *i* and *j* belong to a free trade area or a common market. A second is whether the countries share a common currency.[16] The inclusion of such variables is likely to be superfluous once trade and FDI are included in the model, since both trade and FDI should be strongly and positively related to conditions such as membership in a common market or use of a common currency. Formal trade agreements such as NAFTA might still be relevant independent variables to the extent that they incorporate provisions that ease restrictions on the migration of HEWs between countries.

[16] For examples of the use of these variables in trade models, see de Groot, Linders, Rietveld and Subramanian (2004), Chen (2004), and Slangen, Beugelsdijk and Hennart (2004).

However, almost all of these agreements are encompassed by the variables indicating common borders and/or common language.

The definition of each variable, together with the source of the data is reported in Table 4. The major issue with respect to the data pertains to the bilateral FDI data. These data were obtained from the *International Direct Investment Statistics Year Book 1989-2000,* published by the OECD. These data are, in turn, obtained from national statistical sources, often in local currencies. As a consequence for many countries there are two available estimates of FDI: outflows from *i* to *j*, as recorded by *i*, and inflows from *i* to *j*, as recorded by *j.* While in principle these numbers should be the same, that is often not the case, and in some cases the discrepancy is large. We adopted the convention of using the data as recorded by the host country, on the grounds that countries are more likely, and more able, to track inflows accurately. However, this also means that inflows and outflows are often recorded in different currencies and therefore sensitive to exchange rate values. We used both nominal and PPP U.S. dollar exchange rates to convert reported FDI values, although there were no significant differences in results using either method. However, of all the data employed in this study, the FDI data are possibly subject to the largest measurement errors.

ESTIMATION RESULTS

We first examine results using the most parsimonious specification, in which all relevant variables are expressed as either differences or log products. We later consider alternative specifications, and the problem of endogeneity.

Table 5 reports the means and standard deviations (in parentheses) for the independent variables, as well as the correlation coefficients among the independent variables. The simple correlation coefficients are quite low with a few exceptions. One is the .703 correlation coefficient between the product term for bilateral exports between countries *i* and *j* and bilateral FDI between the two countries. The relatively strong positive correlation between bilateral trade and bilateral FDI is unsurprising. As noted earlier, the bulk of international trade among developed countries is carried out by MNCs, and most previous studies indicate that FDI and trade are complements. Another strong correlation exists between the differences in per capita GDP between countries and

the difference in scores of the U.N.'s Human Development Index (HDI) in the two countries. This is also not surprising given that the HDI includes GDP per capita. As a consequence, however, we do not use HDI and GDP per capita in the same equation. We do include both FDI and trade in the same equation, but as reported below the outcome is problematic.

Table 6 reports regression results for two groups of migrants. One is the total number of foreign born in country *i* who originated in country *j* (FORT). These results are reported in Columns (6)-(10). The second is total highly educated migrants in a sample country born in another country (FORH), and these results are reported in Columns (1)-(5).

Equations (1), (2), (5) and (6) report regression results of an augmented gravity equation that excludes the bilateral export and bilateral FDI variables. The odd-numbered equations report estimates using HDI, while the even numbered ones replace that term with GDP per capita. In all four equations, all coefficients have the expected signs, and all are statistically significant, with the exception of the government revenues term. Although this particular result may reflect measurement error owing to the limitations on interpreting this variable as a measure of relative tax rates in the two countries, it is consistent with most previous research suggesting that differences in tax rates may not be significant influences on migration decisions.

All of the other independent variables in the four equations are statistically significant at the .05 level. Of particular interest, the higher unemployment rates in the host country relative to the home country discourage migration, while higher relative standards of living/GDP per capita in the host country encourage migration. Variables serving as proxies for lower costs of migration (physical adjacency, common language and common religion) all perform as expected, i.e., lower costs of migration significantly promote increased migration. As expected, countries which were once officially "socialist" both sent and received lower number of migrants, other things equal.

In Equations (3)-(5), and (8)-(10), the product terms for bilateral trade and FDI are added, first one at a time and then together. For these purposes we use the more

general HDI measure, but the results are similar when GDP per capita is used in these same equations. When entered alone, both the trade and FDI terms are positive, and statistically significant in all equations. For the most part, all other variables are unaffected by the addition of these terms. In addition, while both terms add to the explanatory power of the model, the addition of the trade term creates a substantial increase in the R^2 (compare Columns 1 and 4; 5 and 8). Thus, comparable estimation results for the two sets of coefficients reinforce our interpretation of the linkages between FDI, trade and migration. Specifically, the human capital of HEWs is complementary to other assets possessed by MNCs that facilitate profitable trade and FDI carried out primarily by those same MNCs. However, we also note that the same result obtains for total migration, which we discuss further below.

Equations (5) and (10) include both bilateral trade flows and bilateral FDI flows in the estimating equation. Given the strong correlation between the two variables, there is a concern about multicollinearity, and it is perhaps not surprising that only one is statistically significant: the trade variable. On the surface, the result suggests that trade flows are a more important determinant of HEW migration than FDI flows; however, it is impossible, as a practical matter, to separately identify the impact of trade versus FDI on HEW migration when the bulk of international trade is carried out by MNCs. In addition, the potential measurement issues regarding bilateral FDI noted above contribute to the uncertainty regarding the precise strength of its influence on migration.

A question that might be asked is whether trade carried out by MNCs has a stronger effect on HEW migration than inter-firm trade. To gain some insight into this issue, we replaced the bilateral FDI variable in Equations (5) and (10) with an interaction variable, the bilateral trade variable multiplied by the bilateral FDI variable. In this specification, if the coefficient for the interaction variable is positive and statistically significant, it would indicate that intra-firm trade undertaken by MNCs has a greater impact on HEW migration than trade in general. However, this variable proved not to be statistically significant in either equation. Taken at face value, this latter result suggests that the complementary relationship between migration and trade is not necessarily enhanced when trade takes the form of intra-firm exports and imports within MNCs.

In general, the results for the total migration equations are similar to those for the highly educated migrants, both in terms of the individual regression coefficients, as well as the overall goodness of fit statistics. Thus, it is difficult to find important factors that distinguish HEW migrants from others. Indeed, several of the possible expected differences discussed in the previous section are not evident. In particular, there is little evidence that trade or FDI effects are more pronounced for HEWs. In addition, the coefficient for common language is somewhat greater for the highly educated migrant cohort. Although this result is not what was expected, it perhaps reflects the fact that highly educated migrants are more likely to pursue jobs that require a high degree of literacy, thereby requiring fluency or near-fluency in the language of the host country.

In order to further investigate the problem of whether the determinants of migration differ by education level, we also estimated the set of five equations using low education migrants as the dependent variable. These results (not reported) did suggest somewhat more specific effects of high education. For example, in the equivalent of equations (4) and (9), the differences in the language variable became more pronounced (1.14 for low education vs. 1.59 for high education), as did the effects of being adjacent (1.03 for low education vs. .01 for high education) and HDI (12.30 for low education vs. 6.65 for high education). These results suggest that physical distance is less of a constraint on migration for HEWs, and that common language skills are more important for the latter group. The larger coefficient for the HDI term for low education migrants (also found for GDP per capita) implies that less well educated migrants are more responsive to pecuniary income differences across countries, whereas highly educated workers are more likely to move to countries with more comparable standards of living.

As discussed in the previous section, an important specification issue in gravity models is whether variables expressed as differences or log products should be entered separately. In order to examine this question, the following procedure was employed. For all the relevant variables (unemployment rates, HDI, GDP per capita, government revenues, bilateral trade, and bilateral FDI), we first estimated unrestricted models (expressing each *i* and *j* variable separately), and tested these against the restricted models (those in Table 6). The restrictions were generally accepted for the entire set of variables. We then used a pair wise procedure for *each* variable to test the restriction that

the difference (log product) was appropriate. For example, in the case of HDI, we used an F-test to compare the unrestricted model (which included both HDI_i and HDI_j) against the restricted model, which included (HDI_i - HDI_j). We did this for each relevant variable, one at a time, and selected those for which the restriction was rejected. We then estimated a final model which included both variables for which the restriction was accepted and those for which the restriction was rejected. This model was tested against the restricted models reported in Table 6. The final model results are report in Table 7.

The only variables for which we could find evidence for an unrestricted specification were unemployment rates, GDP per capita, and HDI. Since the latter two variables could not be included in the same equation, we report separate specifications using each variable. Similarly, since the FDI and trade terms could not be entered separately, we report results separately for each. Since the results were similar for all cases, we report the trade equations using GDP per capita, and the FDI equations using HDI. We report each equation for the most highly educated migrants (FORH), the least highly educated migrants (FORL), and the total of all migrants (FORT).

For comparable variables, the results reported in Table 7 are not different from those discussed above. The results confirm that, in general, the gravity model explains bilateral migration flows. Cultural and religious distances are important determinants of migration, as are trade and FDI networks. However, the new results also reveal greater differences among migrants with different levels of education. In particular, it is clear that "pull" factors (those associated with the host country, *i*) are relatively more influential for highly educated migrants. In contrast, "push" factors (those associated with the home country, *j*) are relatively more important for migrants in the lowest education category. For the most part, unemployment rates, GDP per capita and HDI in country *i* are more important relative to the comparable effects in country *j* for those with the highest levels of education. For migrants with the lowest levels of education, conditions in county *j* are relatively more important.

These results suggest that highly educated migrants likely do well in their home country, and therefore require more positive incentives to re-locate. In addition, they are likely to have more information about host country markets. Those with lower levels of

education leave when local conditions deteriorate, and may have less information about potential destinations.

The results in Table 7 continue to indicate that FDI and trade are important determinants of migration flows. In addition, rejection of the unrestricted version suggests that it is the total size of the FDI and trade networks that matter, an implication that should be pursued in subsequent research. However, as was the case above, these results also fail to show that trade and FDI variables are more strongly related to the migration of HEWs, as we expected.

As discussed above, there is reason to believe that the potential endogeneity of the FDI and trade variables may create biased estimates, and that our results might not be robust to specifications that account for the potential endogeneity of these variables. Thus, unobserved variables may simultaneously affect immigration, trade and FDI, and/or two-way causality may exist. For example, unobserved heterogeneity across countries may result in simultaneous movement of capital, goods and people, or strong trade and FDI links may result from immigration. As a consequence, we adopted an instrumental variables estimation procedure, using a method initially proposed by Evans and Kessides (1993), but more recently employed by Edwards and Waverman (2004) and Cubbin and Stern (2005).

We constructed a rank based instrument for all trade and FDI variables, including the interaction terms reported in Tables 6 and 7. For example, following Edwards and Waverman (2004), we sorted the log (FDIij*FDIji) variable into three ranks (1, 2, 3) and so created an FDI rank index. By construction, this rank index is correlated with the original FDI term, and will also be orthogonal to the error term if exogenous disturbances do not affect a country's rank, a condition that is unlikely to be violated except for observations near the rank thresholds. For this reason, the number of ranks should be relatively small. A regression of this rank index on the FDI variable produced an R^2 of .90. Following Cubbin and Stern (2005), the residual from that equation was used to test for endogeneity, and the predicted valued of FDI derived from this equation was used as an instrument for estimation by instrumental variables. A similar procedure was used for FDIij and FDIji separately, and for the trade terms. We adopted this technique because

of the difficulty in finding suitable and different instruments (different variables that are both correlated with the suspected endogenous variable and uncorrelated with the error term) for *both* the trade and FDI terms.[17]

The results suggest that although the trade and FDI terms are endogenous, the instrumental variables estimates are not different in any material way from the OLS estimates reported in Tables 6 and 7. Therefore, we do not present these equations. None of the non-trade and non-FDI variables are impacted in any significant way through estimation by instrumental variables, and we are still unable to find evidence that trade and FDI are more strongly related to HEW migration than to total migration

SUMMARY AND CONCLUSIONS

In this study, we specify and estimate an augmented gravity model of the determinants of bilateral migration flows across OECD countries. This study adds two dimensions to the literature. First, it employs newly available data that distinguishes migrants by level of education. Second, it includes measures of both bilateral trade and FDI as determinants of bilateral migration flows.

The primary migration data employed in this study is based on the stock of foreign born individuals from country *j* in country *i*, organized by level of education. There is a relatively high level of correlation among the various education categories: countries with high numbers of foreign born from a specific home country tend to have high numbers for all education groups. This is likely caused by the importance of immigration networks within a host country that provide cultural amenities and other forms of support.

Our results indicate that bilateral migration flows for migrants at all levels of education are well-explained by a basic gravity model. In particular, migration is greatest between countries with large populations, and is reduced when geographic, linguistic and religious "distance" is high. Migration is also influenced by relative labour market

[17] The chosen instruments must still be approached with some caution. In particular, the 2000 immigration stock measure reflects cumulative flows over the preceding 40 years, while the FDI and trade flows are measured over shorter time periods. In particular, FDI flows are measured for only seven years. However, the method does create rankings, which are unlikely to have changed in a significant way over the years.

conditions. Specifically, migrants tend to leave countries where economic conditions are relatively poor (high unemployment; low GDP per capita) and move to areas where conditions are better. Our results also confirm the importance of FDI and trade as determinants of migration flows. We find that both are complements to migration. In general, we find no evidence that higher levels of bilateral trade or FDI replace movements of labour.

Finally, our results indicate that there are important differences in the determinants of migration outcomes, by level of education. In particular, highly educated workers are less constrained by physical distance and are more likely to move to countries that share a common language. Importantly, highly educated migrants are more influenced by the "pull" of economic conditions in host countries. In contrast, workers with less education are more heavily influenced by the "push" of economic factors in their home countries. All results are robust to correction for the potential endogeneity of trade and FDI variables.

Perhaps the most important policy inference that one might draw from this study is that macroeconomic performance is an important determinant of migration. In particular, a robust labour market and a rising real income level are strong attractions for migrants, especially HEWs. As is true in so many areas of economic policy, conditions encouraging real economic growth stimulate investment decisions that contribute further to future real economic growth. In this regard, while an increasing number of developed countries have been focusing on "specialized" programs to encourage in-migration of HEWs, it may well be that "conventional" public policies focused on promoting long-run real economic growth are more powerful factors encouraging the in-migration of HEWs. These include policies to promote deeper trade and investment integration.

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TABLE 1
OECD Sample Characteristics

	(1) Percentage Foreign Born	(2) Major OECD Country of Origin	(3) Percentage of Foreign Born with Tertiary Education	(4) Percentage of Expatriates with Tertiary Education
Australia	23.0	UK	42.9	43.6
Austria	12.5	Germany	11.3	28.7
Belgium	10.7	France	21.6	33.8
Canada	19.3	UK	38.0	40.0
Czech Republic	4.5	Slovak Rep.	12.8	24.6
Denmark	6.8	Turkey	19.5	34.6
Finland	2.5	Sweden	18.9	25.4
France	10.0	Portugal	18.1	34.4
Germany	12.5	Turkey	15.5	29.5
Greece	10.3	Germany	15.3	16.1
Hungary	2.9	Slovak Rep.	19.8	28.7
Ireland	10.4	UK	41.0	23.5
Italy	n.a.	n.a	n.a.	12.4
Japan[1]	1.0	USA	n.a.	48.9
Korea[1]	0.3	Japan	32.2	43.2
Luxembourg	32.6	Portugal	21.7	26.2
Mexico	0.5	USA	37.8	5.6
Netherlands	10.1	Turkey	17.6	34.0
New Zealand	19.6	UK	31.0	40.6
Norway	7.3	Sweden	31.1	32.1
Poland	2.1	Germany	11.9	25.7
Portugal	6.3	France	19.3	6.5
Slovak Republic	2.5	Czech Rep.	14.6	13.8
Spain	5.3	France	21.8	18.0
Sweden	12.0	Finland	24.2	37.8
Switzerland	22.4	Italy	23.7	35.8
Turkey	1.9	Germany	16.6	6.3
UK	8.3	Ireland	34.8	39.2
USA	12.3	Mexico	25.9	48.2
Total	7.8		22.8	28.9

1. No data on place of birth is available. Therefore, "non-citizens" is used as the relevant measure under the assumption that all non-citizens are foreign-born.

Source: Compiled by the authors using data from Dumont and Lemaitre (2004a).

TABLE 2

Means and Correlation Matrix, Immigration Variables*

	Mean (sd)	FORT	FORH	FORM	FORL	NATT	NATH	NATM	NATT
FORT	23298 (258445)	1.000							
FORH	4253 (17717)	.687	1.000						
FORM	6219 (58312)	.993	.740	1.000					
FORL	12076 (189012)	.994	.611	.977	1.000				
NATT	20637 (106012)	.849	.827	.868	.814	1.000			
NATH	5084 (22860)	.425	.808	.470	.356	.802	1.000		
NATM	7291 (37196)	.765	.814	.804	.721	.962	.811	1.000	
NATL	7867 (54493)	.948	.696	.941	.696	.936	.560	.845	1.000

VARIABLE DEFINITIONS:

FOR: number of foreign born in country i originating in country j. FORT= total, FORH=high education, FORM=medium education, FORL= low education.

NAT: number of foreign nationals in country i originating in country j. NATT= total, NATH=high education, NATM=medium education, NATL= low education

* The number of observations for the calculation of correlation coefficients is 606. For means and standard deviations, n = 747 for FOR and 606 for NAT.

TABLE 3

Expected Signs of Explanatory Variables

Variable	Highly Educated Migrants (j to i)	Total Migrants (j to i)
Log (POPi*POPj)	+	+
Adjacent Countries	+	++
Common Language	+	++
Common Religion	+	+
Unemployment rates,(i – j)*	-	-
Log GDP per capita,(i – j)*	+	+
Human Development Index (HDI),(i – j)*	+	+
Government revenues as percentage of GDP,(i – j)*	-	-
Former Socialist Country	-	-
Log (EXPORTSij*EXPORTSji)**	++	+
Log (FDIij*FDIji)**	++	+

Country i is the host country, and country j is the home country. (i – j) indicates that the variables are calculated as differences. Detailed definitions are found in Table 4. The direction of the hypothesize effects are indicated by + (positive) and – (negative), but the magnitudes may differ between highly educated and total migrant samples. Where we hypothesize this to be the case, double signs are used. For example, in the text we suggest that trade and FDI variables should have a more significant impact on highly educated migration, whereas physical distance and common language will be more important for total migration.

* Denotes labour market variables (L)
** Denotes trade and FDI variables (Z)

TABLE 4

Variables, Definitions and Data Sources

VARIABLE	DEFINITION	SOURCE
Log (POPi*POPj)	POPi is the populations of the host country; POPj is the population of the home country, averaged 1985-2000 (five year intervals).	United Nations Statistics Division - Common Database
Adjacent Countries	A dummy variable =1 if country i and country j share a common border.	CIA World Fact Book
Common Language	A dummy variable =1 if country i and country j share a common official language.	John Haveman's International Trade Data. http://www.macalester.edu/research/economics/PAGE/HAVEMAN/trade.resources/tradedata.html#Gravity
Common Religion	A dummy variable =1 if country i and country j share a common religion.	Sala-i-Martin (1997) http://www.colombia.edu/~xs23/data.htm
Difference in unemployment rates, ij	Difference in unemployment rates, averaged over the period 1985-2000 (five year intervals).	International Labor Organization, Geneva - LABORSTA - Labour Statistics Database
Difference in log GDP per capita, ij	GDP per capita measured in terms of purchasing power, averaged over 1985-2000 (five year intervals).	United Nations Statistics Division - Common Database
Difference in Human Development Index (HDI), ij	HDI includes measures of GDP per capita, education and health. Averaged over the period 1996-2000.	Reports on Human Development, United Nations Development Programme
Difference in government revenues as percentage of GDP, ij	Government revenues as a percentage of GDP measured in constant US dollars, and averaged over 1985-2000 (five year intervals).	Penn World Data
Former Socialist Country	A dummy variable = 1 if either country i or country j were formerly officially a socialist country.	Authors' calculation
Log (EXPORTSij *EXPORTSji)	Exports from i to j and from j to i, measured in constant US dollars and averaged over 1985-2000 (five year intervals).	United Nations Statistics Division - Common Database
Log (FDIij*FDIji)	FDI inflows from i to j and from j to i, measured in constant US dollars and averaged over 1994-2000.	OECD - International Direct Investment Statistics Year Book 1989-00

TABLE 5
Means and Correlation Matrix, Independent Variables

	Mean (sd)	1	2	3	4	5	6	7	8	9	10	11
1. Log (POPi*POPj)	5.30 (2.14)	1.000										
2. Adjacent Countries	0.08 (0.27)	.054	1.000									
3. Common Language	0.07 (0.26)	.057	.298	1.000								
4. Common Religion	0.44 (0.49)	-.016	.233	.164	1.000							
5. Unemployment Rates (Difference)	-.153 (5.11)	.103	-.005	.026	.099	1.000						
6. Log Per Capita GDP (Difference)	.006 (0.64)	-.223	-.025	-.057	-.072	-.263	1.000					
7. HDI (Difference)	.002 (0.06)	-.152	.006	.003	.001	-.107	.687	1.000				
8. Government Revenues (Difference)	-.012 (5.64)	.054	-.006	-.014	-.157	-.021	-.040	-.230	1.000			
9. Former Socialist Country	.27 ((0.44)	.117	.081	-.121	.168	-.017	.051	.026	-.024	1.000		
10.Log (EXPij*EXPji)	10.13 (4.31)	.394	.393	.214	.195	.002	-.023	.003	.041	-.117	1.000	
11.Log (FDIij*FDIji)	11.72 (7.78)	.174	.235	.160	.245	.008	.030	.025	.031	-.200	.703	1.000

TABLE 6

The Determinants of International Migration: Regression Results

	High Education Migrants					Total Migrants				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Log (POPi*POPj)	.595* (.031)	.655* (.027)	.354* (.024)	.532* (.032)	.335* (.024)	.555* (.032)	.635* (.030)	.292* (.030)	.476* (.033)	.275* (.030)
Adjacent Countries	1.390* (.211)	1.390* (.199)	-.004 (.191)	.962* (.201)	-.012 (.206)	1.898* (.232)	1.852* (.209)	.379** (.218)	1.400* (.248)	.328** (.215)
Common Language	1.740* (.199)	1.692* (.198)	1.597* (.187)	1.708* (.207)	1.603* (.181)	1.495* (.213)	1.437* (.209)	1.331* (.201)	1.466* (.218)	1.351* (.197)
Common Religion	.615* (.125)	.669* (.119)	.256* (.102)	.409* (.128)	.338* (.108)	.605* (.134)	.685* (.120)	.214** (.116)	.342* (.136)	.311* (.115)
Difference in unemployment rates, i -j	-.106* (.021)	-.072* (.011)	-.073* (.009)	-.089* (.012)	-.065* (.010)	-.113* (.012)	-.066* (.012)	-.080* (.010)	-.089* (.013)	-.061* (.011)
Difference in Log GDP per capita, i -j		1.180* (.104)					1.540* (.126)			
Difference in Human Development Index (HDI), i - j	8.022* 1(.062)		6.657* (.804)	7.101* (.960)	6.032* (.805)	10.703* (1.174)		9.247* (.961)	9.603* (1.107)	8.582* (.971)
Difference in government revenues as % of GDP, i -j	-.004 (.009)	-.014 (.009)	-.001 (.008)	-.002 (.009)	-.003 (.020)	-.010 (.011)	-.022* (.010)	-.003 (.009)	-.006 (.010)	-.001 (.009)
Former Socialist Country	-1.591* (.132)	-1.596* (.126)	-.853* (.113)	-.976* (.141)	-.751* (.132)	-1.679* (.144)	-1.637* (.138)	-.840* (.123)	-.922* (.159)	-.718* (.135)
Log (EXPORTSij*EXPORTSji)			.260* (.015)		.272* (.020)			.278* (.015)		.292* (.022)
Log (FDIij*FDIji)				.011* (.002)	-.002 (.002)				.077* (.009)	-.003 (.002)
Intercept	2.982* (.184)	2.525* (.747)	-6.104* (.531)	2.514* (.170)	-6.354* (.680)	4.294* (.198)	3.691* (.180)	-5.098* (.576)	3.873* (.190)	-5.641* (.738)
Adjusted R Square	.540	.585	.688	.547	.662	.506	.572	.660	.581	.627
Observations	747	746	743	698	698	747	746	743	698	698

* indicates statistical significance at the 5% level; ** indicates statistical significance at the 10% level

Values in parentheses are heteroskedastic-consistent standard errors.

TABLE 7

The Determinants of International Migration: Additional Regression Results

	(1) FORH	(2) FORL	(3) FORT	(4) FORH	(5) FORL	(6) FORT
Log (POPi*POPj)	.491* (.033)	.396* (.045)	.411* (.036)	.528* (.029)	.446* (.037)	.472* (.033)
Adjacent Countries	.296 (.196)	1.202* (.253)	.600* (.213)	.982* (.213)	1.992* (.263)	1.411* (.243)
Common Language	1.472* (.189)	1.089* (.226)	1.254* (.197)	1.603* (.194)	1.185* (.248)	1.370* (.210)
Common Religion	.277* (.100)	.437* (.136)	.292* (.110)	.297* (.119)	.412* (.156)	.293* (.132)
Unemployment i	-.055* (.014)	-.040* (.018)	-.036* (.014)	-.092* (.016)	-.010 (.021)	-.070* (.017)
Unemployment j	.065* (.015)	.104* (.020)	.076* (.017)	.082* (.018)	.152* (.023)	.109* (.021)
GDP per capita i	1.471* (.156)	1.665* (.207)	1.554* (.164)			
GDP per capita j	-.479* (.127)	-1.411* (.205)	-1.010* (.163)			
HDI i				14.424* (1.388)	15.874* (1.919)	15.875* (1.594)
HDI j				.766 (1.484)	-8.537* (2.223)	-2.878* (1.528)
Ratio of government revenues as percentage of GDP, i -j	-.008 (.008)	-.008 (.011)	-.016** (.009)	-.002 (.010)	.010 (.014)	-.005 (.011)
Former Socialist Country	-.796* (.122)	-1.373* (.175)	-.920* (.132)	-.637* (.146)	-1.191* (.207)	-.732* (.167)
Log (EXPORTSij*EXPORTSji)	.195* (.018)	.212* (.024)	.227* (.020)			
Log (FDIij*FDIji)				.060* (.008)	.070* (.010)	.066* (.009)
Intercept	-13.89* (1.96)	-8.54* (2.89)	-9.50* (2.27)	-10.73* (1.92)	-5.33** (2.78)	-7.76* (2.34)
Adjusted R Square	.715	.608	.698	.590	.491	.540
Observations	742	742	742	698	698	698

* indicates statistical significance at the 5% level; ** indicates statistical significance at the 10% level
Values in parentheses are heteroskedastic-consistent standard errors.