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FDI, the Brain Drain and Trade: Channels and Evidence

by

Artjoms Ivlevs and Jaime de Melo

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The Authors
Artjoms Ivlevs is an Internal Research Fellow in GEP, University of Nottingham; Jaime de Melo is a Professor of International Economics at the University of Geneva.

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Abstract

This paper explores the links between the patterns of migration (high vs. low-skill), trade policy, and foreign direct investment (FDI) from the standpoint of sending countries. A skeleton general equilibrium model with a non-traded good and sector-specific labour is used to explore the effects of the skill-composition of exports on FDI. The model suggests that if exports are low-skill intensive, emigration of high- skill labour leads to positive FDI, suggesting that migration and FDI are complements. Cross-sectional analysis using FDI and emigration data for 103 migration-sending countries over the period 1990-2000 finds some support for this conjecture.

JEL Classification: F13, F16, F22

Keywords: brain drain, FDI, migration, trade

Outline

1. *Introduction*
2. *Migration, FDI, and Trade: A Skeleton Model*
3. *Data and Empirical Specification*
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Non-Technical Summary

Globalization has become a major feature of the modern economic world. For many, the integration of goods and factor markets is believed to bring substantial gains to the countries opening their borders to trade, foreign capital, and migration, although labor markets are from being integrated. In spite of the joint determination of migration, investment (FDI) and trade, the large and growing theoretical and empirical literatures on the migration-investment-trade nexus have not been analyzed in an integrated framework.

We explore the links between FDI, trade and the composition of migration, considering all three jointly. Assuming that FDI responds to changes in the reward to capital, we investigate the effects of changes in the skill composition of the labour force through migration (emigration is assumed exogenous and determined by immigration policies in host countries) on FDI. If exports in migration sending countries are relatively less skill intensive than non-traded goods, a skewed pattern of emigration towards skilled labour which raises the price of the non-traded good will also raise the net capital reward, thereby leading to positive FDI. While non-traded sectors are usually assumed to be low-skill intensive, recent migration patterns suggest that this may not always be the case (e.g. the emigration of medical workers). Similarly, if the elasticity of substitution between imported and non-traded good is less than 1, the reduction in trade costs will result in higher price of capital and positive FDI. The effect of a reduction in trade costs on FDI works independently of the effects of the composition of emigration.

Correlations on a sample of 103 developing countries using emigration rates by skill for 1990 and 2000 from Docquier and Rapoport (2006) support the predictions of our theoretical framework. Over 1990-2000, the conditional correlation between FDI flows and the pattern of emigration suggests that an increase in the emigration rate of high-skilled workers (net of low-skilled emigration) by 10 percentage points is associated with an increase in annual FDI (as a share of GDP) of about 0.2 percentage points. The complementarity between skilled emigration and FDI is generally robust, notably to different measures of FDI and to different samples (i.e. excluding transition economies or small islands). It is also fairly robust to an alternative estimation on a smaller sample in which diaspora-related FDI has been purged. We also find that average tariffs are negatively correlated with net FDI inflows. The inclusion or exclusion of the tariff variable does not affect the sign and significance of the coefficient of the migration variable. Taken together, the results are supportive of studying the migration-trade-FDI nexus in a general equilibrium setting taking into account the skill composition of emigrants.

1. Introduction

Globalization has become a major feature of the modern economic world. For many, the integration of goods and factor markets is believed to bring substantial gains to the countries opening their borders to trade, foreign capital and migration, although labor markets are from being integrated. For example, the annual earnings premium for a Mexican worker in the US is around 17,500$ and multilateral negotiations on reducing barriers to labor mobility are not on the agenda. According to received wisdom, one would expect that the combination of sharp reduction in trade costs and in policy-erected barriers to trade in goods would reduce migratory pressures as trade in goods would tend to close the wage gap across countries, in other words, one would expect that trade and migration are substitutes. Applying the same reasoning, one would expect that reductions in the barriers to investment, reflected in growing FDI, would also reduce migratory pressures, i.e. one would expect that FDI and migration are substitutes. Likewise, until recently trade and FDI were largely viewed as substitutes: high trade costs and policy-erected barriers to trade would be associated with an increase in what is now called horizontal or tariff-jumping FDI.

In spite of the joint determination of migration, investment (FDI) and trade, the large and growing theoretical and empirical literatures on the migration-investment-trade nexus have not been analyzed in an integrated framework. Diaspora and human capital effects have been emphasized in the migration-FDI literature[1]; the nature of FDI (vertical or horizontal) has been emphasized in the FDI-trade literature[2]; and substitutability-complementarity relations have been emphasized in the trade-migration literature[3]. It

[1] Cecchi, De Simone and Faini (2007) question the virtuous circle between Human Capital (HC) and FDI proposed in the literature on the 'brain gain' initiated by Mountford (1997). Using data on skilled migration rates for 1990 and 2000, they find that tertiary enrolment is conditionally correlated positively with FDI (countries experiencing continuous FDI would then upgrade their skill content). However, at the same time the effect of this positive association on enrolments is eliminated by the negative correlation between tertiary school enrolment and emigration. Moreover, they obtain a negative conditional correlation between secondary enrolments and FDI.

[2] Recent models of trade and FDI distinguish between vertical FDI (VFDI) that takes advantage of differences in factor costs and tariff-jumping or horizontal FDI (HFDI) that seeks to avoid trade costs. With high trade costs, horizontal FDI (HFDI) takes places, while with sufficiently different factor proportions between countries (and sufficiently low trade costs), vertical FDI (VFDI) will take place. In this framework developed by Markusen (2002) and Navaretti and Venables (2005), HFDI substitutes for trade and VFDI creates trade. Using macro data, Amiti and Wakelin (2003) find support for the predictions of these models. They find that investment liberalization among countries with similar factor endowments stimulates exports when trade costs are low whereas investment liberalization reduces trade for countries with similar size and endowments when trade costs are high.

[3] The literature on trade and migration has recently emphasized complementarities either because of credit constraints preventing the emigration of unskilled workers, or because of diaspora effects operating in the

should not be surprising then that in a recent survey of the literature, Schiff (2007) concludes that what he calls the MIT (for migration, investment and trade) linkages are complex, making it difficult to draw suggestive policy recommendations for source or sending countries.

Recent data on the skill-composition of emigration for 1990 and 2000 compiled by Docquier and Marfouk (2006) shows that it is especially South-North migration of skilled labor that has increased and that for all but the large developing countries, skilled emigration is a sizeable fraction of the labor force (Docquier (2007), Docquier, Lohest and Marfouk (2007)). Indeed, the availability of this data makes it possible to incorporate the skill-composition of emigration in the debate about the links between trade, migration and FDI and explore the channels through which emigration affects welfare in sending countries earlier identified in the 'brain drain' literature.[4]

This paper continues the exploration of the links between FDI, trade and the composition of migration, considering all three jointly. Section 2 sketches a Ricardo-Viner model of a price-taking economy with skilled and unskilled labor in which FDI flows respond to differences in rates of return and in which migration is considered exogenous reflecting barriers to immigration in receiving countries. This model provides a link between FDI, changes in trade costs, changes in the skilled-unskilled migration pattern of the sending country. The structural model serves to link patterns of FDI to a few structural characteristics (the labor market and trade structure) of the economy. Owing to a lack of data to confront the model's predictions to the data directly, section 3 estimates the relation between FDI and the skill-composition of emigration for a sample of 103 sending countries over the period 1990-2000. Results are encouraging, suggesting that the skill-composition of emigration highlighted by the model matters for the pattern of FDI inflows.

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literature on ethnic networks in international trade. However, most of the evidence is for the US. Evidence supportive of complementarities in bilateral trade between host and sending countries has been found for the US (Gould (1994), Head and Ries (1998), Rauch and Trinidade (2002) and Rauch and Casella (2003)). The role of diasporas has also been emphasized in several case studies on Information Technology between the US and India and between the US and Israel (Arora and Gambardella (2005)). Again, relying on US data, Kugler and Rapoport (2005, 2007) find that FDI in services are positively correlated with diaspora stocks indicating complementarities, whereas for manufactures unskilled diasporas and FDI are substitutes. Docquier and Lodigiani (2006) find evidence of positive externalities between skilled migration and FDI suggesting 'brain gain' effects associated with skilled migration.

[4] The 'brain drain' literature has been challenged on several fronts. Three channels have been identified to transform a 'brain drain' into a 'brain gain':(i) skilled migrants remit relatively large amounts; (ii) selective immigration policies in host countries may raise the attractiveness of migration for high-skilled individuals, which in turn raises the private returns to education via a reduced supply inducing an additional investment in education in the host country; (iii) network effects may lead to technology transfer via FDI between host and sending countries

2. Migration, Trade and FDI: A Skeleton Model

In view of the importance of migration in many sending countries, we develop a model that captures some of the economy-wide effects associated with emigration and the skill-composition of emigrants. Emigration is considered exogenous (subject to emigration policies in receiving countries), and capital is internationally mobile, responding to differences in the return to capital. Take then an economy producing two goods, non-traded (N) and exported (E) and to simplify, assume that all the production of the (E) sector is exported. Three fully-employed factors are available in fixed amounts in the economy: two types of industry-specific labor, L_N (employed in the non-traded sector) and L_E (employed in export sector), and capital K. Labor is internationally mobile (exogenously), but sector-specific while capital is intersectorally mobile within the economy with FDI responding to endogenously determined changes in the domestic return to capital. [5]

Constant returns to scale neoclassical production functions with a constant elasticity of substitution between factors describe the technology. Let a_{NN} (a_{EE}) be the amount of specific factor $L_N\,(L_E)$ necessary to produce one unit of good of the non-traded (exported) good. The amount of capital (mobile factor) necessary to produce one unit of the non-traded (export) good is equal to a_{KN} (a_{KE}). Assume that all factors are fully employed.

Following Jones (1971), total differentiation of the system describing the zero profit and full employment conditions, yields two expressions (see definition of variables below). The first links the rewards to capital, the mobile factor, to prices and endowments:

$$\hat{R} = \beta_N \hat{p}_N + \beta_E \hat{p}_E + \frac{1}{\Delta}\left(\lambda_{KN}\hat{L}_N + \lambda_{KE}\hat{L}_E - \hat{K}\right);\ \Delta > 0 \qquad (1.1)$$

Equation (1.1) yields two familiar predictions from the Ricardo-Viner model. Emigration (i.e. a reduction in either type of labour) decreases the price of capital. Second, any increase in a goods price (i.e. a change in the relative price of goods) raises the rewards of the mobile factor in the sector whose relative price increases, though by less than the price increase.

[5] There is support for this hypothesis. For example, Friedberg (2001) finds a significant positive relationship between source and destination country sector employment for Russian immigrants to Israel in the nineties.

The second expression links product mix changes to changes in goods prices and endowments:

$$(\hat{N}-\hat{E})=\Omega\ (\hat{p}_N-\hat{p}_E)+\left(\hat{L}_N-\hat{L}_E\right)+\frac{1}{\Delta}\left(\frac{\theta_{KN}\sigma_N}{\theta_{NN}}-\frac{\theta_{KE}\sigma_E}{\theta_{EE}}\right)\left(\hat{K}-\lambda_{KN}\hat{L}_N-\lambda_{KE}\hat{L}_E\right) \tag{1.2}$$

where a '^' over a variable denotes the percentage change in that variable:

R is the reward to the mobile factor;

(p_N, p_E) are goods' prices;

$\left(\theta_{ij},\ i=L_N,L_E,K,\ j=N,E\right)$ is factor's i share in total income generated in sector j;

$\left(\lambda_{Kj}, j=N,E\right)$ is the fraction of capital factor absorbed by the sector j;

$\left(\sigma_j=\frac{(\hat{a}_{Kj}-\hat{a}_{jj})}{(\hat{R}_j-\hat{R}_K)}\ j=N,E\right)$ is the elasticity of substitution between factors in sector j;

$$\beta_{j,j=N,E}=\frac{\lambda_{Kj}\frac{\sigma_j}{\theta_{jj}}}{\Delta}>0;\ \Delta=\sum_{j=N,E}\lambda_{Kj}\frac{\sigma_j}{\theta_{jj}}>0\,;\Omega=\theta_{KN}\frac{\sigma_N}{\theta_{NN}}\beta_E+\theta_{KE}\frac{\sigma_E}{\theta_{EE}}\beta_N\,.$$

Expression (1.2) links changes in outputs to changes in factor endowments, and to changes in prices, with the limiting case of no output responsiveness to price changes (a rectangular PPF) when the elasticities of factor substitution tend to zero $(\Omega\to 0\ if\ \sigma_E\to 0\ and\ \sigma_N\to 0)$.

Suppose momentarily that both goods are traded and the economy is small with fixed goods prices $(\hat{p}_E=\hat{p}_D=0)$. Then emigration of either type of labor will cause a decrease in the capital reward and a capital outflow or 'negative' FDI. Thus, if both goods produced were perfectly tradable as in most trade models, capital "follows" labor: migration and FDI are substitutes.

To keep the model tractable we minimize the number of parameters by taking a representative consumer with a homothetic utility function consuming an imported good, *M*, along with the non-traded good. Utility maximization yields:

$$\frac{M}{N}=k\left(\frac{p_N}{p_M}\right)^{\sigma} \tag{1.3}$$

where $k = \left(\frac{\chi}{1-\chi} \right)^{\sigma}$ is a constant capturing expenditure shares and p_N and p_M are unit prices, and σ is the elastiticity of substitution (i.e. the income-compensated price-elasticity of demand).

In this simple model, the revenue-equal-expenditure constraint implies balanced trade, i.e.:

$$\bar{\pi}_M M = \bar{\pi}_E E \tag{1.4}$$

with the bar on the foreign-currency prices of traded goods reflecting the small-country assumption for traded goods. Letting world prices equal to one by choice of units, in the absence of trade taxes, consumers and producers face world prices, i.e. $p_M = e\bar{\pi}_M$ and $p_E = e\bar{\pi}_E$ where e converts foreign currency units to domestic currency units. In the more general case, when there are barriers to trade (transport costs and/or trade taxes), the relative price guiding domestic decisions will be given by

$$\frac{p_M}{p_E} = \phi \frac{\bar{\pi}_M}{\bar{\pi}_E}; \phi > 1$$

and where $d\phi < 0$ captures the effects of a reduction in trade costs. Or, considering separately import and export costs (domestic consumers pay for imports more than $\bar{\pi}_M$ and domestic producers receive for their exports less than $\bar{\pi}_E$), eq. (1.4) can be rewritten as:

$$\frac{E}{M} = \frac{\mu * \bar{\pi}_M}{\varepsilon * \bar{\pi}_E}; \frac{\mu}{\varepsilon} = \phi, \mu > 1, \varepsilon < 1 \tag{1.5}$$

and where $d\mu < 0$ captures the effects of a reduction in importing costs and $d\varepsilon > 0$ captures the effects of a reduction in exporting costs. The model is closed by choosing a numéraire, say the exchange rate. Then, the relative price of the non-traded good, or the real exchange rate, $e^R = 1/p_D$, is the equilibrating variable.

Consider now the links between migration (assumed to be exogenous) and induced capital flows. To find the effect of migration on the reward to capital and consequently on FDI flows, consider first the change in the price of non-traded good induced by labor flows

and in a second step the effect on the reward to capital. Solve then the system consisting of (1.2) and the log differentials of (1.3) and (1.4) assuming that only labor endowments change and exports and imports prices are exogenous. This gives the system:

$$\begin{aligned}
&(\hat{N}-\hat{E}) = \Omega\,\hat{p}_N + \left(\hat{L}_N - \hat{L}_E\right) + \frac{1}{\Delta}\left(\frac{\theta_{KN}\sigma_N}{\theta_{NN}} - \frac{\theta_{KE}\sigma_E}{\theta_{EE}}\right)\left(-\lambda_{KN}\hat{L}_N - \lambda_{KE}\hat{L}_E\right)\\
&\hat{M}-\hat{N} = \sigma\,\hat{p}_N \qquad (1.6)\\
&\hat{M}-\hat{E} = 0
\end{aligned}$$

Solving (1.6) provides the expression linking the equilibrium domestic price to factor endowments.

$$\hat{p}_N = -\frac{1}{(\sigma+\Omega)}\left(\alpha_N\hat{L}_N + \alpha_E\hat{L}_E\right) \qquad (1.7)$$

where

$$\alpha_N = 1 - \lambda_{KN}\frac{1}{\Delta}\left(\frac{\theta_{KN}\sigma_N}{\theta_{NN}} - \frac{\theta_{KE}\sigma_E}{\theta_{EE}}\right) > 0 \text{ and}$$

$$\alpha_E = -1 - \lambda_{KE}\frac{1}{\Delta}\left(\frac{\theta_{KN}\sigma_N}{\theta_{NN}} - \frac{\theta_{KE}\sigma_E}{\theta_{EE}}\right) < 0$$

The impact of factor endowment changes on the domestic price is straightforward. From (1.7), emigration of labor specific to the non-traded sector raises the relative price of the non-traded good while emigration of export-specific labor lowers the relative price of the non-traded good. The adjustment mechanism is as follows: a decrease [increase] in the relative supply of non-traded labor L_N increases [decreases] its relative marginal product putting upward [downward] pressure on the relative price of the non-traded good. In the limit, if the two consumption goods are easily substitutable, the effect of labor emigration on the non-traded sector vanishes.

Substituting (1.7) into (1.1) shows that labor emigration affects the reward to capital through a familiar direct effect and indirectly via the induced change in the relative price of the non-traded good according to the following expression:

$$\hat{R} = +\frac{1}{\Delta}\left(\lambda_{KN}\hat{L}_N + \lambda_{KE}\hat{L}_E\right) - \frac{1}{(\sigma+\Omega)}\beta_N\left(\alpha_N\hat{L}_N + \alpha_E\hat{L}_E\right)$$

with the indirect effect vanishing when goods are perfect substitutes in consumption $(\sigma \to \infty)$ or the marginal rate of transformation in production is infinite $(\Omega \to \infty)$. Rearranging the above expression yields:

$$\hat{R} = \frac{\lambda_{KN}}{\Delta}\frac{(\sigma - \sigma_N)}{(\sigma + \Omega)}\hat{L}_N + \frac{\left(\frac{\sigma_N}{\theta_{NN}}\left(\frac{\lambda_{KN}}{\lambda_{KE}} + \theta_{KN}\right) + \sigma\right)}{(\sigma + \Omega)}\hat{L}_E = \gamma_N \hat{L}_N + \gamma_E \hat{L}_E \quad (1.8)$$

Emigration of export-specific labor leads to a reduction in the reward to capital, i.e. to FDI outflow $(\gamma_E > 0)$ while emigration of non-traded sector labor is ambiguous $(\gamma_N > 0 \Leftrightarrow \sigma > \sigma_N \; ; \gamma_N < 0 \Leftrightarrow \sigma < \sigma_N)$. Factor substitutability in production combined with low substitutability in consumption leads to an increase in the reward to capital, and hence to FDI inflow.

Add now the effects of a change in trade costs. Differentiating (1.5) $\hat{M} - \hat{E} = \hat{\varepsilon} - \hat{\mu}$ and substituting $\hat{p}_M = \hat{\mu}$ and $\hat{p}_E = \hat{\varepsilon}$, the expression for the change in the home good price is:

$$\hat{p}_N = \frac{\hat{\mu}(\sigma - 1)}{(\sigma + \Omega)} + \frac{\hat{\varepsilon}(\Omega + 1)}{(\sigma + \Omega)} - \frac{1}{(\sigma + \Omega)}\left(\alpha_N \hat{L}_N + \alpha_E \hat{L}_E\right) \quad (1.9)$$

If imports and non-traded goods are sufficiently good substitutes in consumption $(\sigma > 1)$, then a reduction in import-related costs $(d\mu < 0)$ which lowers the relative price of imports will lead to a decrease in the price of the home good, p_N. A reduction in export-related transaction costs $(d\varepsilon > 0)$ will make export goods more profitable and will always increase p_N, with the effect vanishing when it becomes costless to shift resources across sectors, i.e. when $\Omega \to \infty$.

The effect of changes in trade costs on the reward to capital is given by:

$$\begin{aligned} \hat{R} &= \beta_N\left(\frac{\hat{\mu}(\sigma - 1)}{(\sigma + \Omega)} + \frac{\hat{\varepsilon}(\Omega + 1)}{(\sigma + \Omega)}\right) + \beta_E \hat{\varepsilon} + \gamma_N \hat{L}_N + \gamma_E \hat{L}_E \\ &= \left(\frac{\beta_N(\sigma - 1)}{(\sigma + \Omega)}\right)\hat{\mu} + \left(\frac{\beta_N(\Omega + 1)}{(\sigma + \Omega)} + \beta_E\right)\hat{\varepsilon} + \gamma_N \hat{L}_N + \gamma_E \hat{L}_E \end{aligned} \quad (1.10)$$

If the elasticity of substitution between imported and domestic good is less than 1, the reduction in trade costs (lower μ or higher ε) will result in higher price of capital and positive FDI. The effect of a reduction in trade costs on FDI works independently of the effects of the composition of emigration.

To sum up, the skeleton model is useful to investigate Migration-FDI and Trade-FDI links. Starting with Migration-FDI links, it indicates that the skill composition of migration will have an impact on FDI with the possibility that emigration of non-traded labour will have an ambiguous effect on the profitability of FDI with the possibility of a complementarity relation. As to the Trade-FDI links, the model results can be linked to the literature on market-seeking (HFDI) and efficiency-seeking (VDFI). Take the case of HFDI. Then, if imports and domestic substitutes are good substitutes in consumption $(\sigma > 1)$, an increase in the barriers to imports will attract FDI, as predicted by the HFDI literature. Take now the case of VFDI. Then a decrease in trade-related costs will make outsourcing more profitable and hence export activities in the home-country with a resulting increase in FDI.

3. Data and Empirical Specification

Predictions about the pattern of emigration on FDI suggested by the model are going to be confronted to data on FDI between 1990 and 2000 for 103 migration sending countries. To explore the links between trade, the skill-composition of migration and FDI for migration-sending countries, we dispose of migration rates by level of education from Docquier and Marfouk (2006) and two-way (inward and outward) FDI for a reasonably large sample of countries since 1990. For our sample of migration sending countries, all are net receivers of FDI for both years so we explore the correlates of changes in the net inward inflow of FDI over the two years (1990 and 2000) for which data is available on the composition of migration.

The model predicts that changes in FDI should be linked to changes in trade policy, the composition of migration and control variables. The usefulness of the model rests on the plausibility of two key assumptions: (i) the disaggregation between skilled and unskilled emigration; (ii) the importance of general equilibrium effects when studying the impact of emigration on FDI. As a prelude to the econometric estimates that follow, we take a look at emigration patterns over the period considered.

Figure 1 here

Figure 1 displays the data and shows the evolution of migration rates, the composition of emigration and the schooling gap (defined here as the ratio of the schooling level of emigrants to the average schooling of the population) Four patterns are discernible in the data First, emigration has been mostly of the skilled (the skilled emigration rate is higher than the average emigration rate for all group of countries for both years). Second, the SG is consistently greater than unity and higher for the low income countries. Third, the SG has fallen slightly by 2000. Fourth, there are substantial variations across broad country groupings with very large emigration rates of skilled labour from small developing countries.

3.1. Specification

Dropping the time subscript, let ΔX_i refer to the change in the value of variable X for country i between 1990 and 2000 and $\left(\Delta K_i^* / Y_{it}\right)$ represent the flow of net FDI as a percent of GDP, Y_{it}, where t is a subscript usually indicating the beginning of period, 1990. As suggested by the model, the change in the labour supply is estimated by the change in the stock of emigrants over the 1990-2000 period expressed as a percent of labour supply (including emigrants) in 1990, i.e. : $\left(\Delta MIG_i^s / L_i^s; s = H, M, L\right)$. To capture the change in the relative skill level, we take the change in the skill gap, ΔSG_i where the skill gap is now defined as $SG_{it} = \left(\frac{MIG_{it}^H}{L_{it}^H} - \frac{MIG_{it}^L}{L_{it}^L}\right)$. The model also suggests that changes in trade restrictiveness, ΔTR_i, belongs to the basic specification. The specification is completed by including a vector of control variables, C_i^m. This leads to the following equation for estimation:

$$\left(\Delta K_i^* / Y_{i,90}\right) = \beta_1 \Delta SG_{it} + \beta_2 \Delta TR_i + \sum_m \gamma_m C_{i,90}^m + \varepsilon_i \quad ; \Delta X \equiv X_{00} - X_{90} \quad (1.11)$$

Including an adequate set of controls is a first challenge since the links between FDI, migration and trade barriers depend on a host of other factors. To name the most important ones, we include a measure of remoteness, a proxy for the skill composition of exports, income per capita and its growth rate, and proxies for the quality of institutions and political stability that would influence the return to investment.

A second major challenge is reverse causality since the relationship between FDI and migration is likely to go both ways.[6] One the one hand, migration influences FDI through the change in the return to capital (as our model suggests) or via other channels such as migrant networks (not included in the model but controlled for in table 3). On the other hand, FDI is also likely to influence migration, and in particular that of skilled labour. Higher levels of FDI may increase the demand for skilled labour or increase overall income, thereby reducing migration. Or, if financial constraint to migration is binding, higher income generated by FDI may lead to higher outflows of workers.

We use the stock of migrants in 1980 in the USA and Canada as percentage of sending-country population (these are the only two countries with sufficient data for our sample). The justification for this choice is that the prior of stock of emigrants is likely to meet the exclusion restriction (i.e. to be potentially correlated with migration but not directly with FDI). Arguably, more migrants from developing countries in 1980 in the USA and Canada would make the subsequent migration (especially high-skilled labour) easier via migrant networks. At the same time, migrants who arrived in the USA and Canada before 1980 would be less likely to influence FDI in 1990-2000 period, since they are less informed about recent investment opportunities in their home countries. Indeed, it is likely that the longer the migrant has lived abroad, the less likely he would have information about current investment opportunities in the source country to convey to potential investors. In other words, recent migrants are the most knowledgeable about where and how to invest in their home countries. This is especially true for developing countries where political regimes and administrative procedures/laws etc. often change.

[6] Education levels influence both FDI and migration decisions, and past migration has been found to influence current FDI through network effects, Checchi et al. (2007)). FDI is also sensitive to the political and economic environment of the host country. In turn migration is influenced by the networks between migrants in FDI outflow countries and migrant sending countries, Rauch and Trinidade (2002), Rauch and Casella (2003).

4.2. Sample and Data

The sample of migration sending countries is chosen by excluding 26 "traditional" immigration-receiving countries[7] as well as developed Asian countries - Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand[8] from the whole sample of countries covered by Docquier and Marfouk (2006). Given the availability of data for the other variables, this gives us a sample of 103 countries.

The annex describes data sources in detail. The dependant variable is the net FDI inflow constructed from the UNCTAD inward and outward foreign direct investment data. Our preferred measure is the average annual net FDI as a percentage of GDP between 1990 and 2000[9]. As a check on the sensitivity of our results, we also use as a second measure, the difference in net FDI stocks (as % of GDP) between 1990 and 2000. As mentioned above, migration data comes from Docquier and Marfouk (2006) and Beine et al. (2007). The database contains information on emigration stocks by educational attainment (low, medium, high[10]) in 1990 and 2000).[11]

Among the key variables included in the model, we had difficulty obtaining an indicator of the change in a country's trade policy for our large sample with many small countries, including islands. We refrained from constructing an index residually from a regression estimating trade volumes and opted for the average tariffs in 1996-2000 from the World Bank Trade Data Base.[12]

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[7] Australia, Austria, Belgium, Canada, Cyprus, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Malta, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

[8] These countries are excluded because of high skill intensity of exports making them less comparable to other MSC and being potentially immigration receiving countries.

[9] By taking averages, we are also able to cope with the problem of missing data for countries which became independent in the early 1990s (e.g. countries in Central and Eastern Europe).

[10] Using data from Beine et al (2007) we control for the age of entry of high-skilled immigrants (at least 22 years of age). This allows excluding emigrants who obtained their education in the country of destination and never participated in the labour force of their country of origin.

[11] Restricting the change in labour force to changes in the composition of emigration neglects factors other than emigration that affect education levels, such as education policies, and linkages between human capital and emigration. Short of modelling the supply of skills directly as in e.g. Cecchi et al.(2007), we include among the controls some of the factors affecting the supply of skills (income per capita and its growth rate). Controls also include factors affecting the investment climate like measures of political stability. This said, the results in Cecchi et al. suggest the potential for reverse causality since educational decisions are linked to past FDI and past migration.

[12] This period is chosen because of close to complete data availability for the sample because for the period 1990-1995, tariff data is missing for many countries. We also experimented with interpolation to fill missing data to measure trade liberalization as (tariff (2000)-tariff (1990)/1+ tariff (1990)). We also computed 10 years tariff average. Neither was significant. Since a change in tariffs will have a different incentive on FDI according to whether the country is receiving HFDI or VFDI, this is not surprising.

To sum up, the set of controls include the following. The skill-intensity of exports is approximated by the share of machinery and transport equipment (Section 7 of Standard International Trade Classification (SITC)) in total exports, a category listed among the most skill intensive industries by Romalis (2004) (see his table 1) . The logarithm of GDP at constant prices in 1990 and the logarithm of population in 1990 serve as a proxy for the effects of wage costs on the nature of FDI. The share of high-skill workers in 1990, which is negatively correlated with the skill gap in emigration patterns during 1990-2000 serves as a proxy for human capital. We also include the change in the share of the highly skilled in the labour force between 1990 and 2000, a measure of human capital formation related to educational policies. Since we also include the change in GDP and population, we have essentially a first-difference specification in the main variables of interest, GDP, population and the skill-composition in emigration.

Two variables are included to proxy for the risk premium and socio-political environment: the index of political stability (increasing values corresponding to more stability), and an index of linguistic fractionalization (higher values corresponding to higher diversity)[13].

Remoteness is measured by the inverse of the distance-weighted GDP and comes from Andrew Rose's database. For each country i and year t, remoteness is defined as $R_{it} = 1/\left(\sum_j \frac{GDP_{jt}}{D_{ij}}\right)$, where j represent all other countries (except i) and D_{ij} is the distance in km between the capitals of countries i and j.

Finally in view of the stylized differences in regional patterns of emigration, we also include as controls three regional dummy variables for Persian Gulf countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates), small developing islands (defined as in Docquier and Marfouk (2006)) and transition economies (Central and Eastern European countries, including former Yugoslavian and Soviet Union Republics (altogether 26 countries)).

As to the data source for our instrument – the sum of stocks of migrants in the USA and Canada from developing countries in 1980 relative to the home country populations – it comes from the official USA and Canada 2000 Population Census statistics. In particular, the 2000 Population Censuses of these countries contain (the publically and electronically

[13] If population shares of n linguistic groups in a country are $p_1, p_2, \ldots, p_n$, the index of linguistic fractionalization is given by $F = 1 - \sum_{i=1}^{n} p_i^2$.

available) information on whether the foreign-born (from practically all countries of the world) arrived before 1980, between 1980 and 1990, or between 1990 and 2000.[14]

4. Results

Table 1 reports the results with robustness and sensitivity checks reported in tables 2 and 3. Consider first OLS results . Regardless of the definition of skills, table 1 shows that, after taking into account the controls, FDI and a change in the pattern of emigration towards skilled labour are positively correlated. Thus, a reduction in the relative supply of skilled labour (more emigrants) attracts FDI, i.e. the pattern of observed emigration and FDI are complements. Using alternative definitions for the measurement of the skill composition of emigration in columns [1] - [3], after taking into account the separate influence exerted by the controls, a 1 percentage point decrease in the relative supply of skilled labour between 1990 and 2000 has been associated with an increase in annual FDI (as a percentage of GDP) of about 0.017-0.019 percentage points. Thus, an increase in skilled- labour emigration (net of low-skilled emigration) of e.g. 10 percentage points between 1990 and 2000 was associated with an increase in FDI inflows by 0.17-0.19 percentage points annually(as a share of GDP). The OLS result is significant at 1%.

Turning to the IV results (columns [4] – [6] of table 1), the instrument is significant at the 1% level in the first stage regression and (depending on the definition of the skill composition), explains 23-36% of the variation of the migration variable. The Cragg-Donald F-statistic is sufficiently high (ranging from 26.6 to 37.9), confirming that the coefficient of the instrument in the first stage regression is different from 0. As to the IV results, for all the specifications, migration coefficient values increase to 0.022-0.032 and remain highly significant.

Table 1 here: Correlates of FDI in Migration-sending Countries

[14] Migrants who arrived to the USA or Canada before 1980, but died between 1980 and 2000 cannot be accounted for, since we can use only 2000 Census data. Census data for 1980 and 1990 are either unavailable or extremely limited and in all cases not sufficiently disaggregated by country of origin. In our sample, stocks of migrants in the USA and Canada are highly correlated ($\rho = 0.69$) so that results are unaffected if as instrument the stock in either country rather than the sum of stocks.

Comfortingly, most of the controls have the expected signs and several are significant. The negative partial correlation between GDP (controlling for population) and FDI inflows conforms with predictions. Note, however, that this correlation would also be consistent with another interpretation if income per capita is a proxy for differences in factor endowments. Then, low income-per-capita countries would, as suggested by the neoclassical growth model, attract VFDI. As in Cecchi et al., the education level is positively correlated with FDI, significantly so when we use the difference measure of FDI in col. [1] and [2] of table 2. At the same time, the impact of the relative change in the share of the high-skilled workers affects FDI flows negatively and significantly so.

Average 1996-2000 tariffs are negatively correlated with net FDI inflows as would be expected if FDI is of the VFDI type since higher trade costs reduce the incentives for efficiency-seeking (as opposed to market-seeking) FDI. Note also that the inclusion or exclusion of the tariff variable does not affect the sign and significance of the coefficient of the migration variable (both in OLS and IV). However, given that the average tariffs do not measure the changes in trade policy over the period, it is difficult to put much significance on this result.

Country size is negatively correlated with FDI flows but the coefficient is not significant. Neither is remoteness a significant correlate of FDI inflows over the period. Among the dummies, the dummy for island economies is significant at 10%, probably reflecting tourism-related FDI.

The sign of the coefficient associated with the linguistic variable is interesting. Linguistic fractionalisation is negatively associated with FDI inflows. This result is in line with previous evidence indicating an adverse impact of linguistic and ethnic heterogeneity on various social and economic variables, e.g. the provision of public goods, the literacy rate, the extent of corruption and political freedom, the incidence of civil wars, and growth (see e.g. Easterly and Levine (1997), La Porta et al. (1999), Alesina et al. (2003), Montalvo and Reynal-Querol (2005a, 2005b)).

The OLS result is robust to a different measure of FDI when we use the difference in stocks of net FDI (as % of GDP) between 2000 and 1990 as dependent variable (col. [1] and [2] in table 2) . Again, we find that a more than proportional outflow of high-skill labour between 1990 and 2000 is associated with a positive change in FDI stock. Specifically, a 10 percentage point increase in relatively high skilled emigration in 1990-2000 is associated with 1.2 (OLS) – 2.2 (IV) percentage point increase of FDI stock (as % of GDP).

Table 2 here: Correlates of FDI: Robustness and Sensitivity Checks

Results are also robust to a change in sample when transition economies (col. [3] and [4] of table 2) and small developing island economies (col. [5] and [6]) are excluded. Using OLS, we still obtain a significant and positive coefficient of relatively high-skilled emigration. However, excluding small island economies reduces by half the value of the coefficient. Using 1980 migrant stock in the USA and Canada as an instrument, there is no change in results when transition economies are excluded, but we notice that these instruments are no longer valid if small islands are excluded from our sample.[15]

In spite of the included controls and the above robustness checks, this apparently robust correlation might be spurious as it might reflect some omitted variable affecting both FDI and emigration. Among the more important possibilities, changes in immigration policies in host countries might have fostered diasporas which in turn could have contributed to changes in the perception about the attractiveness of FDI, or to changes in FDI policies in migration-sending countries. To see if this diaspora channel might be important, we purge from the data an estimate of FDI-related networks.

To control for the importance of networks (see Docquier and Lodigiani (2007)), we use data by Docquier, Lowell and Marfouk (2007) to build migration data by country of destination. In a first step we find the three main migrant destinations for all sending countries, which for most countries in our sample account for close to 90% of migrants. In a second step, we calculate for each sending country the percentage of the stock of FDI that comes from the three main destinations of migrants (we find the major origins of FDI in the UNCTAD country profiles, although sometimes only flow data for certain years (e.g. 2000) are available). We then subtract the share of FDI coming from the migrant destination countries from the aggregate FDI value to isolate "networks-related FDI" from total FDI inflows. As a result of this construction of bilateral migration and FDI, we lose 40 % of observations.

Table 3 here: Estimates Excluding Diaspora-related FDI

[15] Given the significance of the dummy variable for small islands, this confirms the fact that small islands are important and different as evident from the patterns in figure 1. Clearly other instruments would be desirable for a restricted sample of developing countries that would exclude small islands, though there is no a priori reason to exclude small islands, especially in an otherwise small cross-section sample.

The results from this new set of estimates are reported in table 3 are still broadly supportive of the complementarity results reported in tables 1 and 2. Not surprisingly, with this smaller sample, estimates are less precise, although the signs of the control variables remain the same. If the dependent variable is the average annual FDI (col. [1]), the migration (high-skilled less low-skilled) variable is positive, but insignificant. However, if the dependent variable is the difference in the stock of FDI (col. [3]), the migration variable is positive and significant at the 1% level**.** With IV estimates (see cols. (2) and (4)), the value of the migration coefficient increases with greater statistical significance when the difference in the FDI stocks is used as dependent variable rather than average annual FDI growth.

5. Summary

This paper investigated the channels linking FDI, migration and trade for migration-sending countries in a unified framework suitable for empirical investigation with macro data. Assuming that (horizontal) FDI responds to changes in the reward to capital, we investigate the effects of changes in the skill composition of the labour force through migration (emigration is assumed exogenous and determined by immigration policies in host countries) on FDI. If exports in migration sending countries are relatively less skill intensive than non-traded goods, a skewed pattern of emigration towards skilled labour which raises the price of the non-traded good will also raise the net capital reward, thereby leading to positive FDI. In this set-up, emigration of skilled labour is complementary with FDI whereas in the standard specific-factor trade-theoretic models trade and factor movements are substitutes as the outflow of one factor of production (here aggregate or skilled labour) raises the return to the remaining factor (capital) inducing its inflow. In the skeleton model developed here, with a non-traded sector and different skill-intensities between the non-traded good and exports, the substitutability proposition can be reversed if the non-traded sector is relatively skill-abundant. While non-traded sectors are usually assumed to be low-skill intensive, recent migration patterns suggest that this may not always be the case (see e.g. Bhargava and Docquier (2008)).

Correlations on a sample of 103 developing countries using emigration rates by skill for 1990 and 2000 support this conjecture. Over 1990-2000, the conditional correlation between FDI flows and the pattern of emigration suggests that, after controlling for

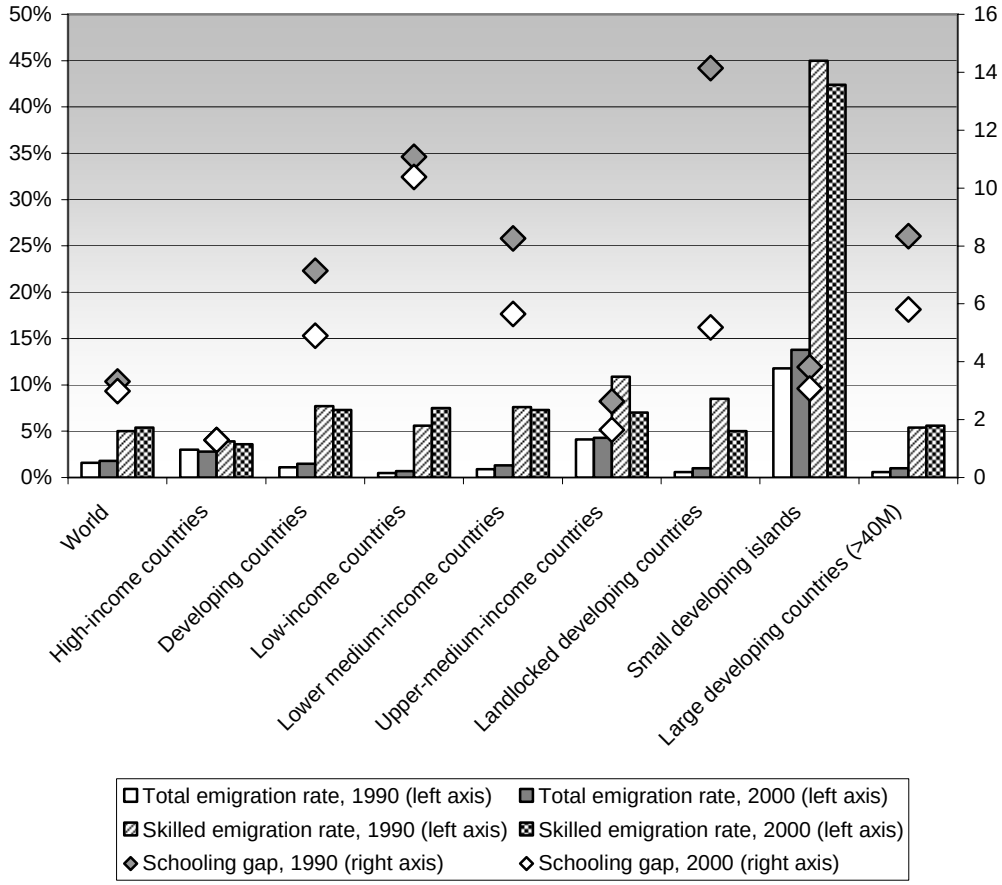
countries' GDP per capita, education level and other factors, an increase in the emigration rate of high-skilled workers (net of low-skilled emigration) by 10 percentage points is associated with an increase in annual FDI (as a share of GDP) of about 0.2 percentage points.

The complementarity between skilled emigration and FDI is generally robust notably to different measures of FDI and to different samples (i.e. excluding transition economies or small islands). The correlation suggesting complementarity is also fairly robust to an alternative estimation on a smaller sample in which diaspora-related FDI has been purged. Taken together, the results are supportive of studying the migration-trade-FDI nexus in a general equilibrium setting taking into account the skill composition of emigrants.

The results also extend the channels through which linguistic fractionalization diversity affect developing-country performance. Whereas previous channels emphasized growth and corruption, we find here that linguistic fractionalization is negatively correlated with FDI inflows.

Tables and Figures

Figure 1: Emigration Rate and Schooling Gap: 1990 and 2000



Source: Adapted from Docquier, Lohest and Marfouk (2007, table 1)

Table 1. Correlates of FDI in migration sending countries.

	Dependent variable: Average annual FDI (as % of GDP) between 1990 and 2000					
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	IV	IV	IV
$\Delta L_H/L_{H(1990)}$ - $\Delta L_L/L_{L(1990)}$, in %(.)	0.018***			0.026***		
	(0.004)			*(0.006)*		
$\Delta L_H/L_{H(1990)}$ + $\Delta L_M/L_{M(1990)}$ - $\Delta L_L/L_{L(1990)}$, in %(.)		0.017***			0.022***	
		(0.003)			*(0.005)*	
$\Delta L_H/L_{H(1990)}$ − $\Delta L_M/L_{M(1990)}$ - $\Delta L_L/L_{L(1990)}$, in %(.)			0.019***			0.032***
			(0.004)			*(0.008)*
Remoteness	0.614	1.525	-0.543	2.078	2.858	0.937
	(5.329)	*(5.346)*	*(5.341)*	*(5.121)*	*(5.092)*	*(5.264)*
Average tariffs, 1996-2000, in %	-0.069**	-0.065*	-0.075**	-0.059*	-0.056*	-0.062*
	(0.034)	*(0.034)*	*(0.034)*	*(0.032)*	*(0.032)*	*(0.034)*
Skill intensive exports, in %	0.034	0.035	0.033	0.036	0.036	0.035
	(0.024)	*(0.024)*	*(0.024)*	*(0.023)*	*(0.023)*	*(0.024)*
Ln (GDP), 1990	-0.730**	-0.738**	-0.722**	-0.697**	-0.718***	-0.666**
	(0.291)	*(0.290)*	*(0.293)*	*(0.275)*	*(0.271)*	*(0.287)*
GDP growth, 1990-2000, in %	0.005	0.005	0.005	0.004	0.004	0.004
	(0.008)	*(0.008)*	*(0.008)*	*(0.007)*	*(0.007)*	*(0.008)*
Share of high-skilled, 1990, in %	0.010	0.011	0.009	0.014	0.014	0.013
	(0.065)	*(0.065)*	*(0.066)*	*(0.062)*	*(0.061)*	*(0.064)*
Change in the share of high-skilled, 1990, in %	-0.016***	-0.015***	-0.017***	-0.021***	-0.018***	-0.025***
	(0.005)	*(0.005)*	*(0.005)*	*(0.006)*	*(0.005)*	*(0.007)*
Ln (Population), 1990	0.352	0.389	0.309	0.357	0.404	0.288
	(0.313)	*(0.313)*	*(0.316)*	*(0.296)*	*(0.292)*	*(0.308)*
Population growth, 1990-2000, in %	-0.053**	-0.051*	-0.057**	-0.054**	-0.050**	-0.059**
	(0.026)	*(0.026)*	*(0.026)*	*(0.024)*	*(0.024)*	*(0.025)*
Political stability, 1996	-0.711*	-0.660*	-0.767**	-0.749**	-0.671*	-0.863**
	(0.378)	*(0.377)*	*(0.381)*	*(0.357)*	*(0.351)*	*(0.375)*
Linguistic fractionalisation, 2001	-2.327**	-2.294**	-2.355**	-2.455***	-2.375***	-2.572***
	(0.904)	*(0.902)*	*(0.910)*	*(0.858)*	*(0.843)*	*(0.895)*
Transition economies	0.165	0.391	-0.094	0.151	0.452	-0.289
	(1.226)	*(1.225)*	*(1.236)*	*(1.158)*	*(1.143)*	*(1.208)*
Persian Gulf	1.065	1.280	0.812	1.159	1.414	0.787
	(1.290)	*(1.290)*	*(1.298)*	*(1.219)*	*(1.207)*	*(1.264)*
Islands	1.885*	1.829	2.015*	1.021	1.192	0.770
	(1.105)	*(1.106)*	*(1.106)*	*(1.185)*	*(1.146)*	*(1.268)*
Constant	15.672***	14.841***	16.715***	14.515***	13.752***	15.631***
	(4.178)	*(4.195)*	*(4.185)*	*(4.017)*	*(4.003)*	*(4.119)*
Instrument[a] : *coeff. 1st stage*				18.841***	22.388***	15.295***
standard error				*(3.061)*	*(3.205)*	*(2.963)*
Partial R^2 of excl. instrument				0.30	0.36	0.23
Cragg-Donald F-stat				37.89	48.80	26.64
(p-value)				(0.000)	(0.000)	(0.000)
Number of observations	103	103	103	103	103	103
R^2	0.548	0.550	0.542	0.523	0.537	0.485

Standard errors in parenthesis

[a] Stock of migrants in the USA and Canada in 1980 as % of sending country population.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

$\Delta L_i/L_i$, *i = high, medium, low*, is the change in emigration stock of labor with skill level *i* between 1990 and 2000 (positive, if *e*migration stock increased) with respect to total labor force with skill level *i* in 1990, expressed in %.

Skill-intensive exports is a share of machinery and transport equipment (SITC7) in total exports.

Political stability index ranges from -2.5 to 2.5. Higher values correspond to better governance outcomes.

Linguistic fractionalization index ranges from 0 to 1. Higher values correspond to higher linguistic and religious diversity.

Persian Gulf dummy equals 1 for Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates, otherwise 0.
Transition dummy equals 1 for countries of the former socialist block, including ex-Yugoslavia, otherwise 0.

Islands dummy equals 1 for the Bahamas, Comoros, Fiji, Guyana, Jamaica, Mauritius, Papua New Guinea, Saint Lucia, Saint Vincent and the Grenadines, Sao Tome and Principe, Trinidad and Tobago

Table 2. Correlates of FDI: Robustness and sensitivity checks.

Dependent variable ➔	Stock of FDI (% of GDP) in 2000 - stock of FDI (% of GDP) in 1990		Average annual FDI (as % of GDP) between 1990 and 2000			
			Without transition economies		Without small island economies	
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	IV	OLS	IV	OLS	IV
$\Delta L_H/L_{H(1990)}$ - $\Delta L_L/L_{L(1990)}$, in %(.)	0.120***	0.216***	0.018***	0.025***	0.009**	0.027
	(0.031)	*(0.054)*	*(0.004)*	*(0.006)*	*(0.005)*	*(0.034)*
Remoteness	-22.907	-5.276	-1.240	0.140	3.857	2.864
	(45.596)	*(44.929)*	*(5.533)*	*(5.233)*	*(5.060)*	*(5.404)*
Average tariffs, 1996-2000, in %	-0.490*	-0.363	-0.057	-0.048	-0.034	-0.038
	(0.288)	*(0.285)*	*(0.035)*	*(0.033)*	*(0.033)*	*(0.033)*
Skill intensive exports, in %	0.248	0.272	0.046	0.046*	0.034	0.032
	(0.207)	*(0.200)*	*(0.030)*	*(0.027)*	*(0.022)*	*(0.022)*
Ln (GDP), 1990	-7.325***	-6.931***	-0.625*	-0.601**	-0.794***	-0.757***
	(2.488)	*(2.416)*	*(0.325)*	*(0.302)*	*(0.284)*	*(0.292)*
GDP growth, 1990-2000, in %	-0.006	-0.017	0.007	0.006	0.002	0.001
	(0.067)	*(0.065)*	*(0.008)*	*(0.008)*	*(0.007)*	*(0.007)*
Share of high-skilled, 1990, in %	0.953*	0.992*	-0.008	-0.001	0.042	0.029
	(0.558)	*(0.540)*	*(0.084)*	*(0.078)*	*(0.058)*	*(0.063)*
Change in the share of high-skilled, 1990, in %	-0.129***	-0.183***	-0.016***	-0.020***	-0.007	-0.019
	(0.045)	*(0.050)*	*(0.005)*	*(0.006)*	*(0.005)*	*(0.023)*
Ln (Population), 1990	4.203	4.267	0.264	0.279	0.507*	0.524*
	(2.681)	*(2.596)*	*(0.345)*	*(0.320)*	*(0.291)*	*(0.292)*
Population growth, 1990-2000, in %	-0.622***	-0.627***	-0.062**	-0.062**	-0.022	-0.046
	(0.222)	*(0.215)*	*(0.030)*	*(0.027)*	*(0.025)*	*(0.052)*
Political stability, 1996	-6.164*	-6.626**	-0.696*	-0.736**	-0.294	-0.480
	(3.230)	*(3.135)*	*(0.398)*	*(0.370)*	*(0.352)*	*(0.499)*
Linguistic fractionalisation, 2001	-6.222	-7.770	-2.087**	-2.197**	-2.275***	-2.663**
	(7.734)	*(7.524)*	*(1.015)*	*(0.943)*	*(0.826)*	*(1.110)*
Transition economies	-16.657	-16.820*			1.296	0.381
	(10.491)	*(10.156)*			*(1.154)*	*(2.094)*
Persian Gulf	5.970	7.100	1.060	1.146	1.649	1.560
	(11.036)	*(10.697)*	*(1.310)*	*(1.214)*	*(1.167)*	*(1.179)*
Islands	8.139	-2.269	1.738	1.057		
	(9.450)	*(10.399)*	*(1.171)*	*(1.207)*		
Constant	137.219***	123.287***	14.889***	13.784***	12.434***	12.651***
	(35.750)	*(35.237)*	*(4.718)*	*(4.450)*	*(3.925)*	*(3.947)*
Instrument[a] : *coeff. 1st stage*		*18.841****		*19.086****		*4.807*
standard error		*(3.061)*		*(3.528)*		*(4.049)*
Partial R^2 of excl. instrument		0.30		0.30		0.02
Cragg-Donald F-stat		37.89		29.26		1.41
(p-value)		(0.000)		(0.000)		(0.2388)
Number of observations	103	103	82	82	92	92
R^2	0.424	0.361	0.581	0.561	0.365	0.242

Standard errors in parenthesis

[a] Stock of migrants in the USA and Canada in 1980 as % of sending country population.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

See notes of table 1.

Table 3. IV Estimates Excluding Diaspora-related FDI

Dependent variable ➔	Average annual FDI (% of GDP) between 1990 and 2000, excluding FDI from three major migrant destinations		Stock of FDI (% of GDP) in 2000- stock of FDI (% of GDP) in 1990, excluding FDI from three major migrant destinations	
	OLS	*IV*	*OLS*	*IV*
	(1)	(2)	(3)	(4)
$\Delta L_H/L_{H(1990)}$ - $\Delta L_L/L_{L(1990)}$, in %(.)	0.008	0.013*	0.094***	0.102**
	(0.005)	*(0.007)*	*(0.034)*	*(0.049)*
Remoteness	3.937	3.603	21.568	20.990
	(5.829)	*(5.124)*	*(38.753)*	*(33.783)*
Average tariffs, 1996-2000, in %	-0.050	-0.044	-0.404	-0.392
	(0.044)	*(0.040)*	*(0.295)*	*(0.262)*
Skill intensive exports, in %	0.009	0.010	0.132	0.133
	(0.023)	*(0.020)*	*(0.153)*	*(0.133)*
Ln (GDP), 1990	-0.550*	-0.507*	-5.753***	-5.679***
	(0.306)	*(0.273)*	*(2.034)*	*(1.801)*
GDP growth, 1990-2000, in %	-0.002	-0.004	-0.094	-0.098*
	(0.009)	*(0.008)*	*(0.058)*	*(0.053)*
Share of high-skilled, 1990, in %	-0.025	-0.013	0.461	0.483
	(0.072)	*(0.065)*	*(0.479)*	*(0.428)*
Change in the share of high-skilled, 1990, in %	-0.002	-0.003	-0.017	-0.019
	(0.007)	*(0.006)*	*(0.046)*	*(0.041)*
Ln (Population), 1990	0.223	0.196	4.053*	4.006**
	(0.340)	*(0.300)*	*(2.260)*	*(1.976)*
Population growth, 1990-2000, in %	-0.046	-0.035	-0.309	-0.290
	(0.045)	*(0.042)*	*(0.301)*	*(0.276)*
Political stability, 1996	-0.368	-0.292	-2.079	-1.947
	(0.484)	*(0.434)*	*(3.216)*	*(2.863)*
Linguistic fractionalisation, 2001	-2.112**	-2.132**	-5.045	-5.079
	(1.025)	*(0.898)*	*(6.814)*	*(5.923)*
Transition economies	1.038	1.047	-2.217	-2.202
	(1.392)	*(1.219)*	*(9.252)*	*(8.039)*
Island	2.078	1.318	4.494	3.179
	(1.546)	*(1.649)*	*(10.280)*	*(10.870)*
Constant	12.048**	11.222**	84.650**	83.220***
	(5.306)	*(4.760)*	(35.275)	*(31.382)*
Instrument[a] : *coeff. 1st stage*		14.548***		14.548***
standard error		(2.768)		(2.768)
Partial R^2 of excl. instrument		0.38		0.38
Cragg-Donald F-stat		27.61		27.61
(p-value)		(0.000)		(0.000)
Number of observations	61	61	61	61
R^2	0.551	0.543	0.552	0.551

Standard errors in parenthesis

[a] Stock of migrants in the USA and Canada in 1980 as % of sending country population.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

See notes of table 1.

Appendix

Table A1: Data Sources and Definitions

Name of Variable	Definition	Source
FDI: $\left(\Delta K_{it}^{*} / Y_{it}\right)$	Net FDI as % of GDP	UNCTAD data base
GDP	GDP in 1990	WDI indicators
Population	Population in 1990	WDI indicators
Share of high-skilled, 1990	Share of high skill in the labor force	Docquier and Marfouk (2006)
Remoteness	Inverse of distance-weighted GDP	A. Rose database
Average tariffs	Average tariffs in 1996-2000	Ng database
Skill intensive exports	Machinery and transport /total exports	SITC, section 7
Political stability, 1996	Political stability -2.5 (less stable)<PS_i+2.5 (more stable)	World Bank Aggregate Governance Indicators
Linguistic fractionalisation, 2001	Linguistic fractionalization [0 (low diversity) … 1 (high diversity)]	Alesina et al. (2003)

Table A2. Summary statistics.

Variable	Observ.	Mean	Std. Dev.	Min	Max
average annual FDI (as % of GDP), 1990-2000	103	2.49	2.88	-5.25	14.72
stock of FDI (% of GDP) in 2000 - stock of FDI (% of GDP) in 1990	103	16.30	21.83	-48.34	124.85
$\Delta L_H/L_{H(1990)}$ - $\Delta L_L/L_{L(1990)}$	103	28.00	75.02	-5.23	489.06
$\Delta L_H/L_{H(1990)}$ +$\Delta L_M/L_{M(1990)}$ - $\Delta L_L/L_{L(1990)}$	103	34.30	82.33	-6.75	504.77
$\Delta L_H/L_{H(1990)}$ - $\Delta L_M/L_{M(1990)}$ - $\Delta L_L/L_{L(1990)}$	103	21.69	68.75	-27.86	473.35
Remoteness	103	0.18	0.06	0.07	0.33
Average tariffs, 1996-2000, in %	103	15.50	8.14	0.24	38.13
Skill intensive exports, in %	103	8.92	12.63	0.04	59.64
Ln (GDP), 1990	103	22.83	1.83	17.47	26.86
GDP growth, 1990-2000, in %	103	31.37	40.18	-64.39	180.15
Share of high-skilled, 1990, in %	103	6.93	6.07	0.10	20.10
Change in the share of high-skilled, 1990, in %	103	44.50	52.00	-10.00	300.00
Ln (Population), 1990	103	15.81	1.74	11.60	20.85
Population growth, 1990-2000, in %	103	18.57	14.63	-13.55	53.22
Political stability, 1996	103	-0.28	0.81	-2.92	0.98
Linguistic fractionalisation, 2001	103	0.40	0.29	0.01	0.92
Transition economies	103	0.20	0.40	0	1
Persian Gulf	103	0.04	0.19	0	1
Islands	103	0.11	0.31	0	1

Stock of migrants in the USA and Canada in 1980 as % of sending country pop.	103	0.91	2.39	0	12.34
Average annual FDI (% of GDP) between 1990 and 2000, excluding FDI from three major migrant destinations	61	1.97	2.22	-2.65	10.15
Stock of FDI (% of GDP) in 2000- stock of FDI (% of GDP) in 1990, excluding FDI from three major migrant destinations	61	12.76	14.75	-15.20	66.28

Table A3. Correlation Matrix between independent variables.

	Migration	Remote-ness	Average tariffs	Skilled exports	Ln(GDP)	GDP growth
Migration $\Delta L_H/L_{H(1990)} - \Delta L_L/L_{L(1990)}$	1.00					
Remoteness	0.10	1.00				
Average tariffs	0.08	0.22	1.00			
Skill intensive exports	-0.11	-0.42	-0.27	1.00		
Ln (GDP), 1990	-0.38	-0.21	-0.16	0.39	1.00	
GDP growth	0.09	0.29	0.22	-0.04	-0.03	1.00
Share of high-skilled	-0.27	-0.47	-0.50	0.30	0.34	-0.47
Change in the share of high-skilled	0.41	0.22	0.17	-0.20	-0.19	0.18
Ln (Population)	-0.34	-0.02	0.06	0.13	0.78	0.11
Population growth	0.03	0.48	0.29	-0.39	-0.26	0.55
Political stability	0.15	-0.07	-0.18	0.29	-0.30	0.00
Linguistic fractionalisation	0.01	0.26	0.11	-0.31	-0.17	-0.01
Transition economies	-0.17	-0.63	-0.44	0.43	0.21	-0.63
Persian Gulf	-0.07	-0.05	-0.19	-0.10	0.11	0.07
Islands	0.47	0.23	0.30	-0.09	-0.41	0.03

Table A3, cont.

	High-skilled: share	High-skilled: change	Ln (pop)	Population growth	Political stability	Ling. fract.	Transit. econ.	Gulf
Share of high-skilled	1.00							
Change in the share of high-skilled	-0.46	1.00						
Ln (Population)	-0.03	0.02	1.00					
Population growth	-0.57	0.23	0.01	1.00				
Political stability	0.18	-0.26	-0.54	-0.27	1.00			
Linguistic fractionalisation	-0.34	0.16	0.13	0.31	-0.24	1.00		
Transition economies	0.69	-0.38	0.01	-0.73	0.21	-0.12	1.00	
Persian Gulf	0.14	-0.09	-0.13	0.08	0.02	-0.06	-0.10	1.00
Islands	-0.24	0.06	-0.52	-0.11	0.35	-0.21	-0.18	-0.07

Note: see table A1 for definition of variables

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