WORK IN PROGRESS: COMMENTS WELCOME

FDI, the Brain Drain and Trade: Channels and Evidence.

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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 f 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.

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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 gap in wage rates 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

[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 (2004)

relations have been emphasized in the trade-migration literature[3]. It 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)). The recent 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 to 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. In section 2 we build a skeleton model of a price-taking economy with skilled and unskilled labor in which FDI flows respond to differences in rates of return. This allows us to link FDI flows to trade costs and to the skilled-unskilled migration

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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 literature on ethnic networks in international trade. However, most of the evidence is for the US.[3] 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

pattern of the sending country. The model serves to link patterns of FDI to a few structural characteristics (the labor market and trade structure) of the economy. Section 3 gives recent trends on the skill composition of emigration over between 1990 and 2000 justifying the adopted modeling assumptions. Section 4 then estimates the relation between FDI and the skill-composition of emigration for a sample of 104 over the period 1990-2000. Results are encouraging, suggesting that the skill-composition of emigration matters for the pattern of FDI inflows.

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.

[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.

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:

$$\hat{R} = \beta_N \hat{p}_N + \beta_E \hat{p}_E + \frac{1}{\Delta}\left(\lambda_{KN}\hat{L}_N + \lambda_{KE}\hat{L}_E - \hat{K}\right); \Delta > 0 \qquad (0.1)$$

Equation (0.1) 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.

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

$$(\hat{N} - \hat{E}) = \Omega\ (\hat{p}_N - \hat{p}_E) + \left(\hat{L}_N - \hat{L}_E\right) + \frac{1}{\Delta}\left(\frac{\theta_{KN}\sigma_N}{\theta_{NN}} - \frac{\theta_{KE}\sigma_E}{\theta_{EE}}\right)\left(\hat{K} - \lambda_{KN}\hat{L}_N - \lambda_{KE}\hat{L}_E\right) \qquad (0.2)$$

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 (0.2) 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 $\left(\Omega \to 0 \; if \; \sigma_E \to 0 \; and \; \sigma_N \to 0\right)$.

Suppose momentarily that both goods are traded and the economy is small with fixed goods prices $\left(\hat{p}_E = \hat{p}_D = 0\right)$. 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:

$$\frac{M}{N} = k\left(\frac{p_N}{p_M}\right)^{\sigma} \tag{0.3}$$

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.:

$$\bar{\pi}_M M = \bar{\pi}_E E \tag{0.4}$$

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

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

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 $\overline{\pi}_M$ and domestic producers receive for their exports less than $\overline{\pi}_E$), eq. (0.4) can be rewritten as:

$$\frac{E}{M} = \frac{\mu^* \overline{\pi}_M}{\varepsilon^* \overline{\pi}_E}; \frac{\mu}{\varepsilon} = \phi, \mu > 1, \varepsilon < 1 \qquad (0.5)$$

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 (0.2) and the log differentials of (0.3) and (0.4) assuming that only labor endowments change and exports and imports prices are exogenous. This gives the system:

$$\begin{aligned} &(\hat{N} - \hat{E}) = \Omega \, \hat{p}_N + \left(\hat{L}_N - \hat{L}_E\right) + \frac{1}{\Delta}\left(\frac{\theta_{KN}\sigma_N}{\theta_{NN}} - \frac{\theta_{KE}\sigma_E}{\theta_{EE}}\right)\left(-\lambda_{KN}\hat{L}_N - \lambda_{KE}\hat{L}_E\right) \\ &\hat{M} - \hat{N} = \sigma \, \hat{p}_N \\ &\hat{M} - \hat{E} = 0 \end{aligned} \qquad (0.6)$$

Solving (0.6) provides the expression linking the equilibrium domestic price to factor endowments.

$$\hat{p}_N = -\frac{1}{(\sigma + \Omega)}\left(\alpha_N \hat{L}_N + \alpha_E \hat{L}_E\right) \qquad (0.7)$$

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 endowments change on the domestic price is straightforward. From (0.7), 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 good are easily substitutable, the effect of labor emigration on the non-traded sector vanishes.

Substituting (0.7) into (0.1) 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:

$$\hat{R} = \frac{\lambda_{KN}}{\Delta}\frac{(\sigma - \sigma_N)}{(\sigma+\Omega)}\hat{L}_N + \frac{\left(\frac{\sigma_N}{\theta_{NN}}\left(\frac{\lambda_{KN}}{\lambda_{KE}} + \theta_{KN}\right) + \sigma\right)}{(\sigma+\Omega)}\hat{L}_E = \gamma_N\hat{L}_N + \gamma_E\hat{L}_E \quad (0.8)$$

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 (0.5) $\hat{M} - \hat{E} = \hat{\varepsilon} - \hat{\mu}$ and substituting $\hat{p}_M = \hat{\mu}$ and $\hat{p}_E = \hat{\varepsilon}$, the expression for the change in the home good price is:

$$\hat{p}_N = \frac{\hat{\mu}(\sigma - 1)}{(\sigma + \Omega)} + \frac{\hat{\varepsilon}(\Omega + 1)}{(\sigma + \Omega)} - \frac{1}{(\sigma + \Omega)}\left(\alpha_N \hat{L}_N + \alpha_E \hat{L}_E\right) \tag{0.9}$$

If imports and non-traded goods are 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:

$$\begin{aligned} \hat{R} &= \beta_N \left(\frac{\hat{\mu}(\sigma - 1)}{(\sigma + \Omega)} + \frac{\hat{\varepsilon}(\Omega + 1)}{(\sigma + \Omega)} \right) + \beta_E \hat{\varepsilon} + \gamma_N \hat{L}_N + \gamma_E \hat{L}_E \\ &= \left(\frac{\beta_N (\sigma - 1)}{(\sigma + \Omega)} \right) \hat{\mu} + \left(\frac{\beta_N (\Omega + 1)}{(\sigma + \Omega)} + \beta_E \right) \hat{\varepsilon} + \gamma_N \hat{L}_N + \gamma_E \hat{L}_E \end{aligned} \tag{0.10}$$

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. Stylized facts on emigration patterns

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 104 migration sending countries. 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 compares the evolution of migration rates, the composition of emigration and the schooling gap, SG, (defined here as the ratio of the schooling level of emigrants to the average schooling of the population) across broad categories of countries between 1990 and 2000. Four patterns are evident 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 reduced slightly by 2000. Fourth, there are substantial variations across broad country groupings with very large emigration rates of skilled labour from small developing countries.

Figure 1: Emigration Rates and the Schooling Gap: 1990 and 2000)

Figure 2, from Docquier et al. (2007), shows a negative correlation between SG and the average emigration rate, MIG. Since the brain drain---

defined as the share of high-skilled among emigrants---is equal to the average emigration times the schooling gap (BD=MIG*SG), as noted by Docquier et al. 2007, a big brain drain is either due to very open economies in the sense of high emigration rates (e.g. islands or SSA countries) or to a big SG value gap, but not to both. Figure 3, also from Docquier et al. (2007), shows that the SG decreases with natives' human capital. The close correlation suggests that it is useful when studying the pattern of emigration by skill to control for the level of human capital. This close correlation also invites to speculation, suggesting the possibility of clustering effects along the lines suggested by Kremer (1993).

Figure 2: Average emigration rate and Schooling Gap

Figure 3: The Schooling Gap and Human Capital

Finally, figure 4 gives information on the medical brain drain. These rates are very high for a number of small countries. In spite of some outsourcing in the medical field, by policy imposition, the health sector is largely non-traded. It could then well be that general equilibrium effects of skilled migration could be important for many developing countries.

Figure 4: The medical Brain Drain

The above stylized patterns broadly justify the modelling assumptions adopted above and suggest the inclusion of several control variables for the econometric estimates that follow. First, during 1990-2000, skilled emigration rates (7-8%) highly exceeded average emigration rates (1-2%) suggesting the usefulness of considering the skill-composition of emigration. Second, patterns of emigration differ greatly across groups of countries when classified by size and geographic characteristics. Third, the skill composition of emigration is sensitive to income levels. Fourth, the medical brain drain has been a major component of the recent emigration of skilled labour in developing countries. Insofar as the medical sector may be considered non-traded (because of policy restrictions), it may well be that non-traded sectors are skill-intensive.

4. Data and Empirical Specification

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 1980. 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.

4.1 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:

$$\left(\Delta K_i^* / Y_{i,90}\right) = \beta_1 \Delta SG_{it} + \beta_2 \Delta TR_i + \sum_m \gamma_m C_{i,90}^m + \varepsilon_i \quad ; \Delta X \equiv X_{00} - X_{90} \quad (0.11)$$

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 capital price (as our model suggests) or via other channels such as migrant networks (not included in the model). 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.

As potential instruments that would be potentially correlated with migration rates (but not directly with FDI), we rely on a wide range of nation-level health indicators (the prevalence of HIV and tuberculosis, healthy life expectancy, share of new-borns with low weight, infant mortality, government expenditures for health etc), as well as a variable capturing exposure to natural disasters - share of population affected by floods. We expect that emigration rates, and especially the outflows of the high-skilled, should be higher in countries where certain health indicators, such as HIV prevalence, are less favourable. We also expect that higher country's exposure to floods increases the emigration of high-skilled (they prefer to live in countries which are less exposed to natural disasters). Because most health-care indicators are strongly correlated, our final choice of instruments consists of three variables – floods, HIV prevalence and tuberculosis prevalence. These variables explain

[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).

around 16% of variation of both high-skilled emigration rate $\left(\Delta MIG_i^H / L_i^H\right)$ and the skill gap, $\left(SG_{it}\right)$ which are highly correlated.

4.2 Sample and Data

The sample of migration sending countries is chosen by excluding 25 "traditional" immigration countries[7] as well as developed Asian countries - Japan, 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 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.

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. Checchi et al., note that some of the factors affecting the supply of skills like income per capita, and its growth rate, are included among the controls as well as other factors such as our measure of political stability. This said, the results in

[7] Australia, Austria, Belgium, Canada, Cyprus, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, 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). 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.

Checchi et al. suggest the potential for reverse causality since educational decisions are linked to past FDI and past migration.

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 of countries (that includes many small countries, including islands) over the period 1990-2000. 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. This period is chosen because of close to complete data availability for our sample of countries. [11]

The set of controls include the following variables. A proxy for the skill-intensity of exports 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 log of GDP per capita at constant prices in 1990 proxies for the effects of wages costs on the nature of FDI. The share of high-skill workers in 1990 proxies for human capital which is negatively correlated with the skill gap in emigration patterns (see figure 3 above). We also include the change in the share of high-skilled in the labour force between 1990 and 2000, a measure of human capital formation related to educational policies. Two variables are included to proxy for risk premium and sociopolitical environment – the index of political stability (increasing values corresponding to more stability) and an index of linguistic and religious fractionalization (higher values corresponding to higher diversity)[12]. 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

[11] For the period 1990-1995, tariff data is missing for many countries so 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. Given that 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.

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

countries (except i) and D_{ij} is the distance in km between the capitals of countries i and j.[13]

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)).

Data for our instruments – prevalence of tuberculosis, HIV and floods - come from the World Health Organization, Joint UN Programme on HIV/AIDS[14] and the International Natural Disaster Database EM-DAT[15]. We use 1990 data for tuberculosis prevalence (per 100000 inhabitants), 2005 data for HIV prevalence rate among adults (15-49)[16], in %, and cumulative 1990-1999 number of people affected by floods (per 1000 inhabitants in 1995). We take logs of all three variables.

5. Results

Table 1 reports the results with some robustness and sensitivity checks in table 2. Consider first OLS regressions. 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. 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 specifications [1], [3] and [5], we estimate that a 1 percentage point decrease in relative skilled labor supply between 1990 and 2000 has been associated with an increase in annual FDI (as a percentage of GDP) by

[13] Not surprisingly, in our sample of 103 immigration-sending countries, European countries (Hungary, Czech Republic, Slovakia) are the least remote, while Pacific islands (e.g. Fiji) are the most.

[14] http://www.unaids.org/en/
[15] http://www.em-dat.net/
[16] Data for earlier years is not available.

about 0.015-0.018 percentage points in the same period, other things equal. This means the increase in skilled labor emigration (net of low-skilled emigration) by e.g. 10 percentage points between 1990 and 2000 raised FDI (as a share of GDP) inflows by 0.15-0.18 percentage points annually. The OLS result is significant at 1%.

Turning to the IV results, the prevalence of floods and HIV carry the expected signs and are significant in the first stage results in [2] with higher prevalence being associated with higher migration. However, higher prevalence of tuberculosis is associated with less migration. This is surprising, unless one can argue that high tuberculosis prevalence could serve as a proxy on financial constraints. These three instruments are significant at 5% in the first stage regression (see col. [2]) and jointly explain 15-16% of the variation of the migration variable. P-value of the F-statistic of the excluded instruments is between 0.01 and 0.02, confirming that the coefficients of these instruments in the first stage regression are different from 0. We also cannot reject the hypothesis that our excluded instruments are valid, i.e. uncorrelated with the error term and correctly excluded from the estimated equation (P-value of the Hansen *J*-statistic (which is equal to Sargan overidentification test but controls for heteroskedasticity) is about 0.30). As to the second stage results, for all the specifications, coefficient values change little, though significance levels drop (usually to the 10% level),

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

Comfortingly, most of the controls have the expect signs and several are significant. The negative partial correlation between GDP per capita and FDI inflows conforms with predictions from the neoclassical growth model. 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 would 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] 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 tariff variable does not affect the sign and significance of the coefficient of migration variable (both in OLS and 2SLS). 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 or of migration in the first stage regression Among the dummies, the dummy for island economies is highly significant, probably reflecting tourism-related FDI .

The signs of the coefficients associated with linguistic and religious fractionalisation are 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)). On the other hand, higher religious fractionalization is positively associated with higher FDI for the period 1990-2000 (a result significant at 10%). This result too is consistent with earlier findings that higher religious diversity in a particular country leads to more positive outcomes in terms of the quality of government (e.g. Alesina et al. (2003))[17].

The OLS result is robust to a different measure of FDI in column [1] of table 2 where we use the difference in stocks of net FDI (as % of GDP) between 2000 and 1990 as dependent variable rather than our preferred average measure. Again, we find that more than proportional outflows of high skilled labour between 1990 and 2000 induced a positive change in FDI stock. Specifically, a 10 percentage point increase in relatively high skilled

[17] Alesina et al. (2003) argue that higher religious diversity could be associated with higher tolerance and therefore lead to better outcomes in terms of government quality.

emigration in 1990-2000 was associated with 1 percentage point increase of FDI stock (as % of GDP). However, we find our set of instruments is not valid for this alternative measure of change in FDI (p-value of Hansen J-statistic is 0.025).

Robustness to a change in sample is done by excluding transition economies (col. [3] and [4] of table 2) and small developing island economies (col. [5] and [6]). 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 floods, HIV and TB prevalence as instruments, 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.[18]

In spite of the included controls and the above robustness checks, it could well be that this apparently robust correlation is spurious. It could be due to some omitted variable affecting both FDI and emigration. For example, it could be changes in immigration policies in host countries would 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. This is an area we plan to pursue further.

6. Summary

This paper pursues the investigation of the channels linking FDI, migration and trade for migration sending countries in a unified framework suitable for empirical investigation with macro data. We build a two-sector model representative of a developing economy where the export good is not consumed at home and where imports and domestically produced goods compete in consumption, capital is mobile between the two production sectors and two labour categories are sector-specific along Ricardo-Viner lines. Assuming that (horizontal) FDI responds to changes in the reward to capital,

[18] As with the results in table 1, instruments are not rejected when we do not control for heteroscedasticity. Given the significance of the dummy variable for small islands, this confirms the fact that small islands are important and different as was already mentioned in the discussion of 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.

we investigate the effects of changes in the skilled and unskilled labour force (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 trade-theoretic models, trade and factor movements are substitutes: the outflow of one factor of production (here aggregate or skilled labour) raises the return to the remaining factor (capital) more abundant and therefore would induce their outflow. 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.

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 an increase of 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 0.17 percentage points, after controlling for countries' GDP per capita, education level and other factors.

The results also extend the channels through which linguistic fractionalization and religious diversity affect developing-country performance. Whereas previous channels emphasized growth and corruption, we find here that linguistic fractionalization is negatively correlated with FDI inflows (capturing less public goods) while the opposite is the case for religious diversity (capturing higher quality of government).

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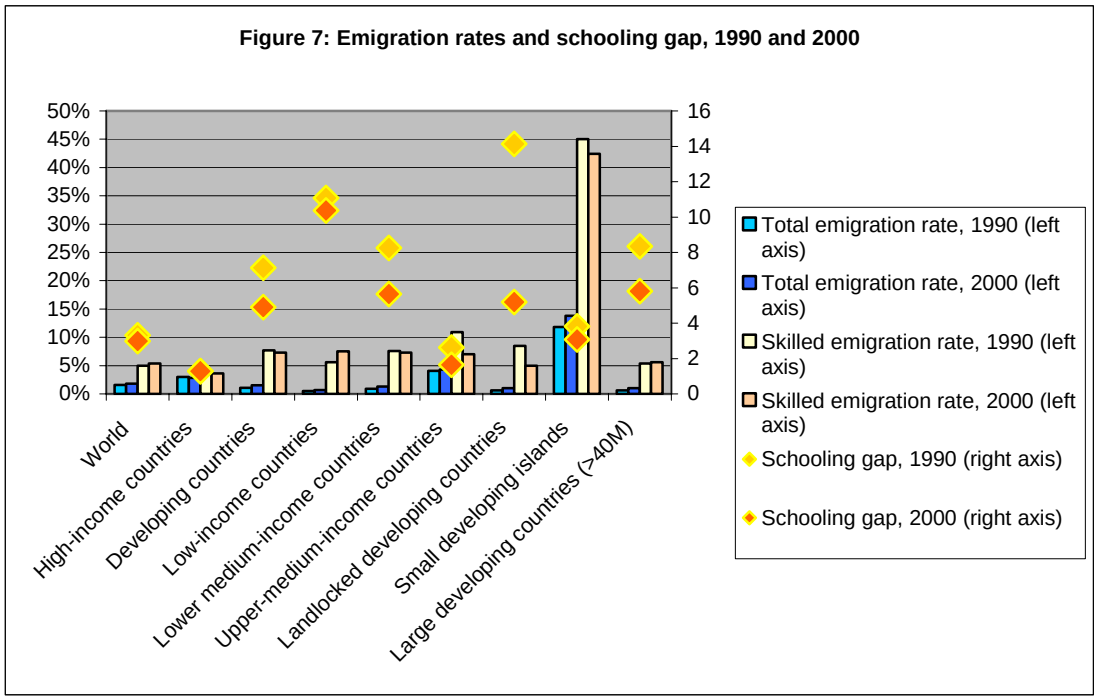
Figures and Tables to
FDI, the Brain Drain, and Trade: Channels and Evidence.

Artjoms Ivlevs, Jaime de Melo

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



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

Figure 2: Average Emigration Rate and Schooling Gap

Figure 2.1. Average emigration rates and schooling gaps

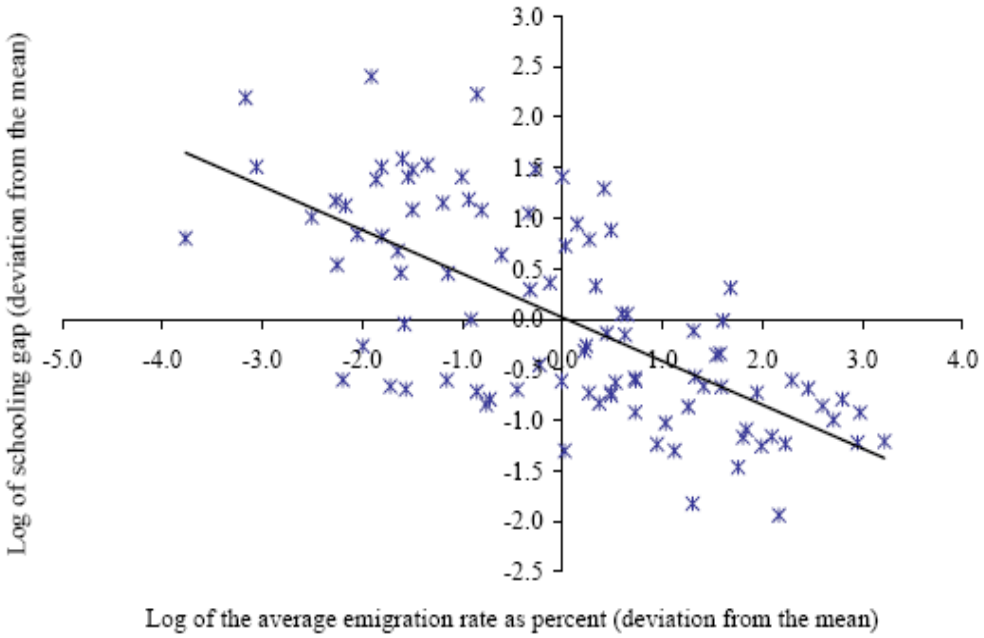
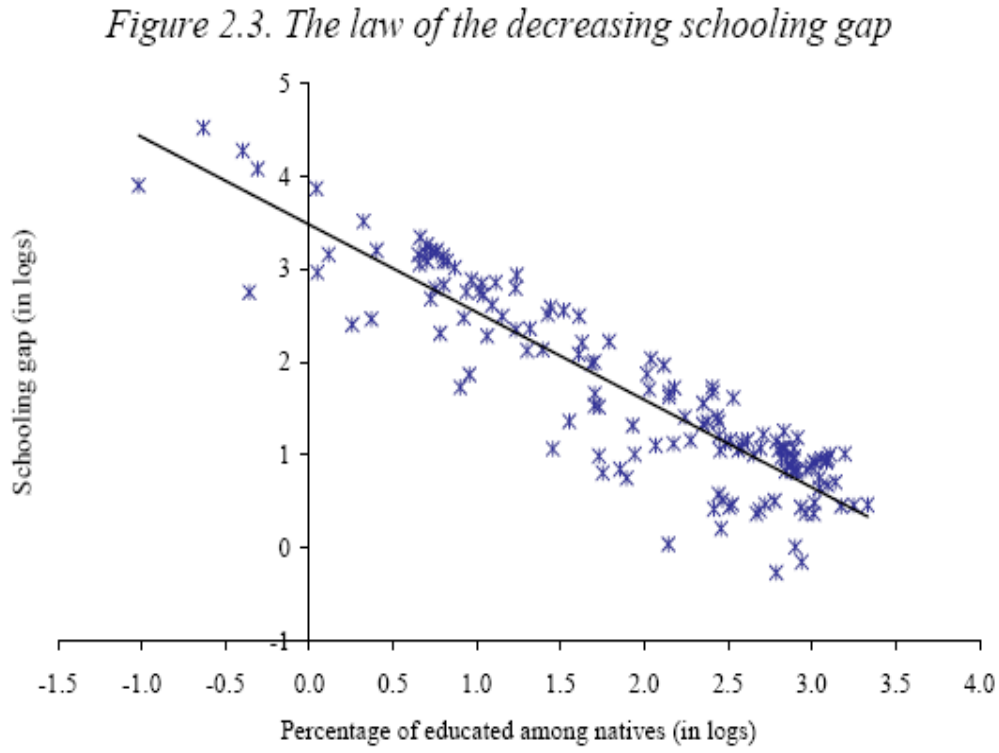


Figure 3: The Schooling Gap and Human Capital



Source for figures 5 and : Docquier, Lohest and Marfouk, (2007, figures 2, 3)

Figure 4: The Medical Brain Drain

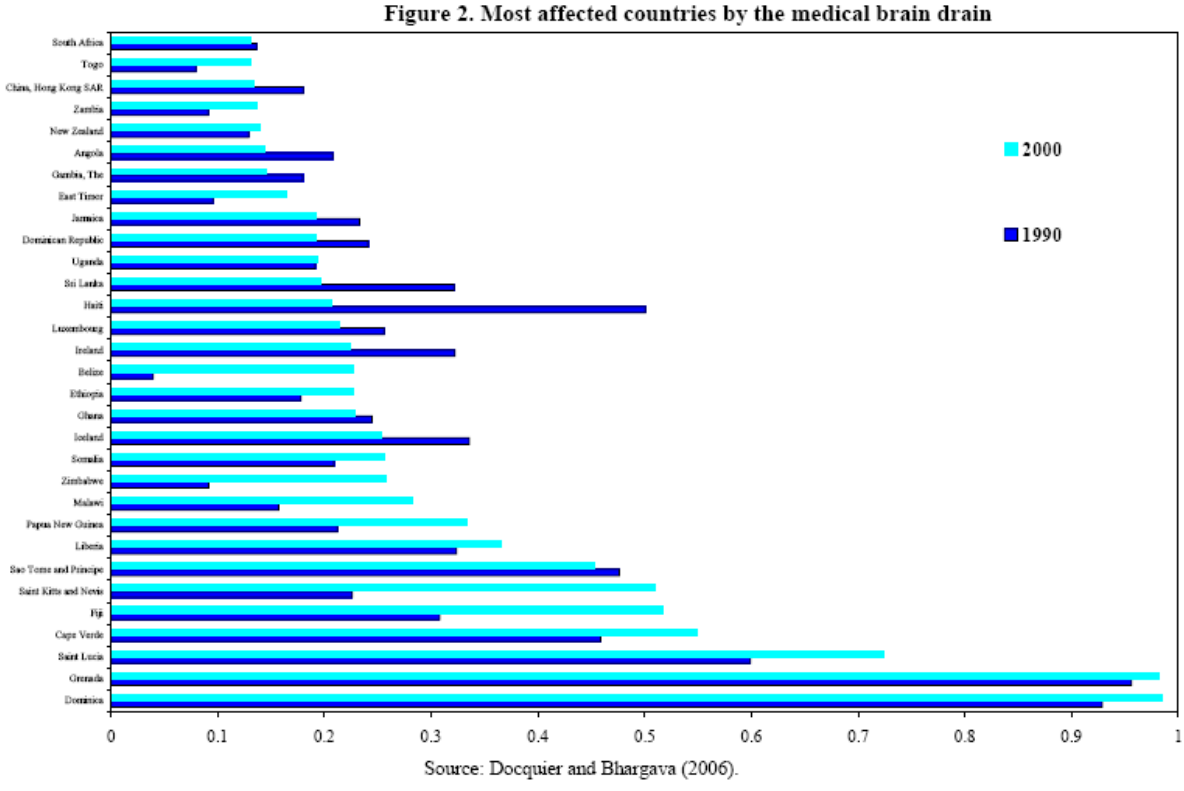


Table 1. Determinants of FDI in migration sending countries.

	Dependent variable: average annual FDI (as % of GDP) between 1990 and 2000						
Specification	[1]	[2]		[3]	[4]	[5]	[6]
	OLS	*2SLS (first stage)*	*2SLS (second stage)*	*OLS*	*2SLS*	*OLS*	*2SLS*
$\Delta L_H/L_{H(1990)}$ - $\Delta L_L/L_{L(1990)}$, in %(.)	0.0170*** *0.004*		0.0169* 0.0092				
$\Delta L_H/L_{H(1990)} - \Delta L_M/L_{M(1990)}$ - $\Delta L_L/L_{L(1990)}$, in %(.)				0.0178*** *0.004*	0.0185* *0.010*		
$\Delta L_H/L_{H(1990)} + \Delta L_M/L_{M(1990)}$ - $\Delta L_L/L_{L(1990)}$, in %(.)						0.0158*** *0.003*	0.0156* *0.008*
Remoteness (inverse of distance weighted by GDP)	-2.417 *5.761*	-184.46 *141.51*	-2.437 4.910	-3.656 *5.772*	-3.523 *4.954*	-1.450 *5.767*	-1.531 *4.929*
Average tariffs, 1996-2000, in %	-0.068** *0.030*	-0.404 *0.802*	-0.683** *0.028*	-0.073** *0.030*	-0.073*** *0.028*	-0.064** *0.030*	-0.065** *0.029*
Ln (GDP per capita), 1990	-0.645** *0.285*	-4.473 *7.913*	-0.645** *0.275*	-0.634** *0.290*	-0.630** *0.283*	-0.657** *0.282*	-0.658** *0.270*
$Ln(GDP\ per\ capita)_{2000}$ - $Ln(GDP\ per\ capita)_{1990}$	2.407 *5.966*	164.73 *179.19*	2.417 *5.637*	2.847 *6.042*	2.781 *5.650*	2.078 *5.930*	2.114 *5.644*
L_H/L, 1990, in %	0.041 *0.078*	-0.235 *1.212*	0.041 *0.071*	0.041 *0.079*	0.041 *0.073*	0.040 *0.077*	0.040 *0.071*
$((L_H/L)_{2000}-(L_H/L)_{1990})/(L_H/L)_{1990}$, in %	-0.012*** *0.004*	0.670* *0.381*	-0.011* *0.006*	-0.012*** *0.004*	-0.013* *0.007*	-0.011*** *0.004*	-0.011* *0.006*
Ln (Population), 1990	-0.232 *0.202*	-6.868 *4.720*	-0.232 *0.202*	-0.258 *0.203*	-0.256 *0.197*	-0.210 *0.203*	-0.212 *0.207*
Skill intensive exports, in %	0.028 *0.023*	-0.407 *0.472*	0.028 *0.020*	0.027 *0.023*	0.027 *0.020*	0.029 *0.023*	0.029 *0.020*
Political stability, 1996	-0.544* *0.230*	2.461 *12.32*	-0.544** *0.274*	-0.590* *0.299*	-0.595** *0.276*	-0.502* *0.302*	-0.501* *0.276*
Linguistic fractionalisation, 2001	-2.951*** *0.953*	-7.469 *28.24*	-2.95*** *0.877*	-3.007*** *0.970*	-3.009*** *0.890*	-2.901*** *0.941*	-2.902*** *0.868*
Religious fractionalisation, 2001	1.526* *0.904*	29.02 *36.79*	1.531* *0.898*	1.617* *0.916*	1.574* *0.913*	1.480* *0.897*	1.497* *0.889*
Persian Gulf	0.776 *1.479*	31.93 *29.13*	0.774 *1.346*	0.526 *1.475*	0.527 *1.356*	0.990 *1.490*	0.983 *1.354*
Transition economies	0.860 *1.126*	20.85 *26.79*	0.858 *1.025*	0.666 *1.141*	0.668 *1.047*	1.025 *1.119*	1.019 *1.019*
Islands	2.567** *1.181*	87.58** *39.85*	2.575** *1.141*	2.737** *1.181*	2.671** *1.138*	2.469** *1.178*	2.497** *1.153*
Ln (floods), 1990-1999		5.265*** *2.109*					
Ln (tuberculosis), 1990		-15.87** *7.889*					
Ln (HIV), 2005		14.783** *4.783*					
Constant	11.538*** *3.674*	240.34** *109.19*	11.55*** *3.906*	12.314*** *3.674*	12.248*** *3.731*	10.920*** *3.696*	10.965*** *4.070*
Number of observations	103	103	103	103	103	103	103
R-squared	0.54	0.53	-	0.53	-	0.54	-
Partial R-squared of excluded instruments		0.16			0.15		0.16
Excluded instruments F-stat (p-value)		3.75 *(0.014)*			3.54 *(0.018)*		3.90 *(0.012)*
Hansen J-stat (p-value)			2.33 *(0.311)*		2.538 *(0.281)*		2.16 *(0.340)*

Note: robust standard errors in italics.

***, **, * if estimated coefficients are significant at 1%, 5% and 10%, respectively.

$\Delta L_i/L_i$, 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 and religious fractionalization indexes range 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

Floods: number of people affected by floods in 1990-1999, per 1000 inhabitants in 1995

Tuberculosis: prevalence of tuberculosis, per 100000 inhabitants, in 1990
HIV: HIV prevalence rate among adults (15-49), in 2005

Table 2. 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			
	[1]	[2]	[3]	[4]	[5]	[6]
			Without transition economies		Without small island economies	
	OLS	*2SLS*	*OLS*	*2SLS*	*OLS*	*2SLS*
$\Delta L_H/L_{H(1990)}$ - $\Delta L_L/L_{L(1990)}$, in %(.)	0.102** *0.049*	0.121* *0.074*	0.0173*** *0.004*	0.0171** *0.009*	0.008*** *0.002*	0.017 *0.014*
Remoteness (inverse of distance weighted by GDP)	-59.758 *42.947*	-54.751 *40.001*	-3.927 *6.096*	-3.964 *4.908*	2.785 *4.892*	2.095 *4.849*
Average tariffs, 1996-2000, in %	-0.461** *0.218*	-0.438** *0.207*	-0.055* *0.031*	-0.055** *0.028*	-0.035 *0.025*	-0.036** *0.021*
Ln (GDP per capita), 1990	-6.124*** *2.148*	-6.021*** *1.992*	-0.508 *0.314*	-0.509* *0.297*	-0.746*** *0.276*	-0.697*** *0.260*
$Ln(GDP\ per\ capita)_{2000}$ - $Ln(GDP\ per\ capita)_{1990}$	9.857 *46.779*	7.585 *44.442*	4.916 *7.392*	4.935 *6.870*	-0.248 *5.830*	-0.516 *5.181*
L_H/L, 1990, in %	1.367** *0.550*	1.361*** *0.505*	0.019 *0.116*	0.019 *0.105*	0.048 *0.075*	0.046 *0.067*
$((L_H/L)_{2000}-(L_H/L)_{1990})/(L_H/L)_{1990}$, in %	-0.062 *0.044*	-0.075 *0.056*	-0.011*** *0.004*	-0.011* *0.006*	-0.006** *0.003*	-0.010 *0.008*
Ln (Population), 1990	-1.511 *1.591*	-1.426 *1.608*	-0.185 *0.228*	-0.186 *0.229*	-0.220 *0.185*	-0.165 *0.187*
Skill intensive exports, in %	0.145 *0.199*	0.152 *0.185*	0.037 *0.028*	0.037 *0.025*	0.033 *0.021*	0.031 *0.020*
Political stability, 1996	-4.568 *2.890*	-4.651* *2.679*	-0.514 *0.324*	-0.514* *0.288*	-0.200 *0.275*	-0.261 *0.299*
Linguistic fractionalisation, 2001	-14.44** *7.086*	-14.417 *6.545*	-2.807*** *1.050*	-2.806*** *0.948*	-2.437*** *0.927*	-2.684*** *0.913*
Religious fractionalisation, 2001	21.82*** *7.483*	20.56*** *7.531*	1.459 *0.969*	1.467 *0.931*	0.320 *0.768*	0.393 *0.747*
Persian Gulf	1.643 *13.085*	1.954 *12.186*	0.782 *1.560*	0.780 *1.394*	1.551 *1.596*	1.459 *1.475*
Transition economies	-5.548 *8.781*	-5.274 *8.085*			1.566 *1.079*	1.401 *1.025*
Islands	16.488 *10.841*	14.522 *10.261*	2.484** *1.256*	2.497** *1.068*		
Constant	84.564*** *31.035*	81.90*** *32.074*	9.903** *3.882*	9.924** *4.177*	10.67*** *3.372*	9.789*** *3.443*
Number of observations	103	103	82	82	92	92
R-squared	0.40	-	0.57	-	0.34	-
Partial R-squared of excluded instruments		0.16		0.17		0.07
Excluded instruments F-stat (p-value)		3.75 *(0.0139)*		3.84 *(0.0135)*		1.15 *(0.3351)*
Hansen J-stat (p-value)		7.402 *(0.0247)*		0.952 *(0.6212)*		4.315 *(0.1156)*

See notes of table 1.

Appendix Tables A1: Data Sources and Definitions

Name of Variable	Definition	Source
$\left(\Delta K_{it}^{*} / Y_{it}\right)$	Net FDI as % of GDP	UNCTAD data base
Y_i / N_i	GDP pc. In 1990	WDI indicators
XS_i	Machinery and transport /total exports	SITC, section 7
PS_i	Political stability -2.5 (less stable)<PS_i+2.5 (more stable)	World Bank Aggregate Governance Indicators
FR_i	Linguistic and religious fractionalization [0(low diversity) <FR_i<1(high diversity]	Alesina et al.
$(L_H/L)_{1990}$	Share of high skill in the labor force	Docquier and Marfouk (2006)
Average tariffs	Average tariffs in 1996-2000	Ng database
Remoteness	Inverse of distance-weighted GDP	A. Rose database
Floods	Number of people affected by floods in 1990-1999 (cumulative), per 1000 inhabitants in 1995	International Natural Disaster Database EM-DAT http://www.em-dat.net/
HIV	Prevalence of tuberculosis, per 100000 inhabitants, in 1990	UN programme on HIV/AIDS
Tuberculosis	HIV prevalence rate among adults (15-49), in 2005	World Health Organization

Table A2. Summary statistics (104 observations).

Variable	Mean	Std. Dev.	Min	Max
average annual FDI (as % of GDP), 1990-2000	2.47	2.87	-5.25	14.72
stock of FDI (% of GDP) in 2000 - stock of FDI (% of GDP) in 1990	16.13	21.79	-48.34	124.85
$\Delta L_H/L_{H(1990)}$ - $\Delta L_L/L_{L(1990)}$	-0.28	0.75	-4.89	0.05
$\Delta L_H/L_{H(1990)}$ -$\Delta L_M/L_{M(1990)}$ - $\Delta L_L/L_{L(1990)}$	-0.22	0.68	-4.73	0.28
$\Delta L_H/L_{H(1990)}$ + $\Delta L_M/L_{M(1990)}$ - $\Delta L_L/L_{L(1990)}$	-0.34	0.82	-5.05	0.07
Ln (GDP per capita), 1990	7.05	1.22	4.80	10.09
GDP per capita, relative change 1990-2000	0.10	0.30	-0.64	1.42
Share of high skilled	0.07	0.06	0.00	0.20
Share of high skilled, absolute change 1990-2000	0.02	0.02	0.00	0.14
Ln (population)	15.81	1.73	11.60	20.85
Export skill intensity	9.09	12.68	0.04	59.64
Political stability, 1996	-0.26	0.82	-2.92	1.01
Linguistic fractionalization	0.40	0.29	0.01	0.92
Religious fractionalization	0.44	0.24	0.00	0.86
Transition	0.20	0.40	0	1
Persian gulf	0.04	0.19	0	1
Small islands	0.11	0.31	0	1

Table A3. Correlation Matrix between independent variables.

	Migration	Ln (GDP per cap)	GDP per cap, relative change	Share of high skilled	Share of high skilled, absolute change	Ln (popul)
Migration $\Delta L_H/L_{H(1990)} - \Delta L_L/L_{L(1990)}$	1.00					
Ln (GDP per cap), 1990	0.09	1.00				
GDP per cap, relative change 1990-2000	-0.11	-0.03	1.00			
Share of high skilled	0.27	0.59	-0.32	1.00		
Share of high skilled, absolute change 1990-2000	0.08	0.20	0.16	0.11	1.00	
Ln (population)	0.34	-0.26	0.12	-0.03	0.06	1.00
Export skill intensity	0.12	0.44	0.14	0.32	-0.01	0.12
Political stability, 1996	-0.14	0.35	0.14	0.20	-0.02	-0.54
Linguistic fractionalization	-0.01	-0.46	-0.16	-0.35	-0.27	0.13
Religious fractionalization	-0.14	-0.05	-0.08	-0.10	-0.33	-0.14
Transition	0.17	0.29	-0.46	0.66	-0.25	0.01
Persian gulf	0.07	0.35	0.04	0.13	0.06	-0.13
Small islands	-0.47	0.11	0.11	-0.24	-0.07	-0.52

Table 3, cont.

	Export skill intensity	Political stability, 1996	Linguistic fractionaliz.	Religious fractionaliz.	Transition economies	Persian gulf	Small islands
Export skill intensity	1.00						
Political stability, 1996	0.30	1.00					
Linguistic fractionalization	-0.32	-0.25	1.00				
Religious fractionalization	-0.04	0.12	0.34	1.00			
Transition Economies	0.42	0.20	-0.12	0.10	1.00		
Persian gulf	-0.10	0.02	-0.06	0.01	-0.10	1.00	
Small islands	-0.09	0.34	-0.21	0.14	-0.17	-0.07	1.00

Note: see table A1 for definition of variables