WORK IN PROGRESS: COMMENTS
WELCOME

“Globalization is not only about the rise in trade, FDI and migration. It is also about the changing linkages among these flows”

R. Faini (2005)

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

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Abstract

This paper explores the recent links between the patterns of migration (high vs. low-skill), trade policy, and foreign direct investment (FDI) in developing countries. A skeleton general equilibrium model with a non-traded good and sector-specific labour is used to explore the effects of different patterns of skill emigration and returns to capital for horizontal FDI. If exports are low-skill intensive, emigration of high-skill labour leads to positive FDI, suggesting that migration and FDI are complements, a conjecture explored by Faini (2005). Cross-section analysis using FDI data over the period 1990-2000 combined with skill-composition emigration data provides some support to this conjecture.

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. Recent data shows that migration rates are on the rise, but that it is especially South-North migration of skilled labor (Bhargava and Docquier (2007), Docquier, Lohest and Marfouk (2007))1.

Somehow, 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. 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 market-seeking FDI.

Riccardo Faini had deeply felt interests in policies that he believed would make the world a better place for all. In his latest contributions, he wrote on the links between migration and FDI expressing fears about the shape and vulnerability of the current wave of globalization. He also expressed doubts about recent contributions suggesting ‘brain gain’ effects from the growing emigration of skilled workers from developing countries.

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1 The greater controls on international labour movements is related to the additional economic and human costs for receiving societies (change in social norms leading to nationalism and xenophobia, migrants’ reliance on social security systems, illegal immigration). These adverse non-economic and indirect economic effects have been found to contribute to less favourable attitudes towards immigration in host countries, in turn resulting in stricter immigration policies. Among others, Mayda (2006), O’Rourke and Sinnott (2006) and Dustman and Preston (2004) confirm the role on non-economic factors in shaping individual immigration preferences.
In his 2005 paper, observing that much of recent FDI was aimed at vertical integration of activities to slice the value-added chain among affiliates in different countries to reduce costs, Faini argued that trade and FDI could be becoming increasingly complementary so that any increase in barriers to trade would reduce FDI rather than increase it. He also argued that trade and migration could also be becoming complements as growth in Services trade depends increasingly on the ability to supply services in loco. Restrictions on immigration would then have negative implications for another component of the globalization process, here trade in Services. Thus, Faini argued that the current wave of globalization is vulnerable, should there be a setback in any one of its components. In support of these conjectures, in his 2005 paper he adduced evidence of a negative correlation between FDI and a measure of trade barriers (after controlling for barriers to FDI) for a sample of developing countries.

In his most recent works, he questioned the plausibility of the recently touted ‘brain gain’ effects from skilled emigration. In Faini (2007), he argued --and gave supportive evidence-- that skilled emigrants remit less than unskilled workers, thereby reducing the gains from migration for the source country in the case of skilled migration. And most recently, 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.

This paper continues this exploration. We investigate the links between FDI, migration and trade using macro data for a large sample of developing

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2 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. Faini’s work questions (i) and (iii). See Docquier (2007) for a recent assessment of the state of the debate.
countries for two years, 1990 and 2000, years for which recent data on the
skill composition of emigrants has recently become available. Following a
brief review of recent contributions and recent trends in sections 2 and 3, we
build in section 4 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 pattern of the sending country. The model serves to link patterns of
FDI to characteristics of the economy. In section 5, we confront some of the
predictions of the model with aggregate data on FDI, trade costs and skilled
and unskilled data for 1990 and 2000.

2. Complementarities in the Trade-Migration-Investment Nexus

In academic circles, the debate about migration started with the
insights provided by Mundell (1957) who showed that if a host country
(North) liberalized its trade policy, the resulting increase in exports from the
source country (South) would raise the price of the factor (presumably
unskilled labor) used intensively in exports, thereby reducing the wage
differential and hence the propensity to emigrate. With factor price
equalization (FPE) obtaining under Hecksher-Ohlin assumptions, trade and
migration would be substitutes with the gains from arbitrage being
indifferently obtained by either trade in goods or trade in factors of production
(labor or capital would suffice in the two-factor case). Thus the reductions in
barriers to trade (protection and trade costs more generally) and in
restrictions to the movement of capital should have reduced the incentives for
South-North migration, especially of unskilled labor.

The intuition behind this result is strong. First, the factor proportion
to describe trade continues to find support in more complex models allowing for
intra-industry trade and in which FPE does not hold. Using bilateral trade
data, Romalis (2004) finds that countries have larger shares of commodities
that use more intensively their abundant factors. Thus, since labor services
can either be exported directly via emigration or indirectly in the goods
embodying their services, reducing the export of services through one channel
(trade protection) will result in an increase in their exports through the other channel (migration).

Mundell concluded his paper with some implications of his substitution result, wondering if the growth of protection in the US land-abundant (and capital and labor-scarce) economy in the late 19th Century, might have led to labor immigration and inward FDI. He also wondered whether the high tariff barriers between the US and Canada might have induced US outward FDI to Canada. Much of the more recent public debate on migration has also been conducted within this framework with reduction in trade barriers being viewed as a means to reduce migratory pressures.3

2.1. Complementarities Between Trade and Migration

Several refinements to Mundell’s analysis are now accepted in the study of the links between trade and migration suggesting that the substitute relation may not hold after all (see Wong (1986) for alternative definitions of substutability and Schiff (2007) for an exhaustive survey). Among the most important, relaxing FPE, Markusen (1983) showed that trade and factor movements could be complements. Start from the standard 2x2x2 model with HO assumptions where N (North) and S (South) share the same technology and identical homothetic preferences with X the skilled-labor intensive good. From an initial situation with FPE, as relative costs are the same, initially there is no trade. Now suppose that N benefits from technical progress in X. To restore the zero profit equilibrium condition, under the small-country assumption, the skilled wage in N, $w^s_N$, has to increase. N will then export X and $w^s_N > w^s_S$ inducing emigration of skilled labor from S: trade and factor movements are complements.

Further realism to the channels linking trade and migration came from Lopez and Schiff (1998) who added financial constraints for unskilled labor to show that trade liberalization and migration could be complementary. Trade liberalization, by raising the wage of unskilled labor in the source country

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3 Shortly before the US Congress was to vote on NAFTA, President Salinas stated that NAFTA would help export goods, not people. During the debate on the Europe Agreements, several studies argued that a liberal trade regime between the EU and the CEECs would reduce migratory pressures towards the EU.
could increase migration if, as documented by historical and contemporary evidence, unskilled labor faces a financing constraint. Faini and Venturini (1993), using data from Southern Europe, showed the existence of a “migration hump” in the case of migration from Southern to Northern Europe with the data showing an inverted-U relationship between migration and income. More recent data for emigration rates in 1990 and 2000 confirm the potential role of moving costs and incentives as emigration rates are highest in middle-income countries with low emigration rates in high-income countries (low incentives) and low-income countries (liquidity constraints) (Docquier, 2007, table 1)). These data are also consistent with the findings of Faini and Venturini, although one would need to control for country size since there is a negative correlation between emigration and country size (Docquier et al. 2007, figure 3).

Complementarities have also been stressed in the 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 Trindade (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.

2.2 Complementarities Between Trade and FDI

The literature on FDI recognizes three motives for inward FDI: (i) resource-seeking in the case of countries with natural resources; (ii) market-seeking for MNEs wishing to produce manufactures in the domestic market rather than in headquarters to avoid trade costs; (iii) efficiency-seeking in the

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4 Exceptions are Docquier and Lodigiani (2007) who use global migration data and find that FDI is positively correlated with diasporas for countries with intermediate degree of corruption and democratization. Using bilateral FDI for 15 EU States, El Yaman, Kugler and Rapoport (2007) find that the stock of immigrants in 1990 are positively correlated with the level of bilateral FDI flows during the next decade.
case of vertically integrated MNEs wishing to carry out stages of production in
countries where costs are the lowest. The first two motives are the more
traditional motives and are associated with horizontal FDI while the third is
associated with vertical FDI.

Markusen (2002) and Navaretti and Venables (2004) develop two-
country models in which vertical and horizontal FDI arises endogenously. In
the Markusen model, imperfectly competitive firms produce in a two-stage
process with skilled-intensive headquarters producing blueprints while final
assembly is produced with an unskilled-labor intensive technology. With
international trade subject to trade costs, the model gives rise to national
firms and to vertical and horizontal MNEs. 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, HFDI substitutes for trade and VFDI creates
trade.

Exploring the trade-FDI link at the macro level for developing countries
has proven difficult. On the data side, rarely is there bilateral FDI data.
Second, the data gives little clue as to the main motives for FDI: resource-
seeking, market-seeking or efficiency-seeking. There are further difficulties
when investigation the link between trade and FDI as FDI is endogenous.
Endogeneity problems are compounded when investigating the FDI-trade-
migration nexus since migration is also susceptible to being endogenous. It is
then not surprising that many studies have been carried out at the sector,
firm, or even product, levels.

For studies using macro data, to overcome the endogeneity of FDI in a
trade-investment estimation, Amiti and Wakelin (2003), regress bilateral
trade on a proxy for trade costs and investment costs in a gravity model on a
sample of 36 (mostly developed) countries. 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 FDI, Trade and Migration: Trends and Stylized Facts

Figures 1, 2 and 3 tell the familiar story. FDI to developing countries has been rising continuously (with the exception of the blip corresponding to the aftermath of 9/11 and the 2001 stock market adjustment). Note that transition economies (in our sample used in section 5) did not receive significant FDI before the middle 90s. Figure 2 displays the lowering of barriers to trade. Figure 3 shows that trade openness (exports + imports as a share of GDP) has also been on the rise in all regions except for the Middle East and to a lesser extent SSA. Together, the emerging stylized fact is globalization across the world economy, albeit with differences across regions.

The remaining figures concentrate on migration and the patterns of migration. Figure 4 from Docquier (2007) shows that migration has kept pace with integration in goods and capital markets. More detailed calculations by the United Nations population division show that the rate of immigration as a percentage of world population increased from 2.5% to 2.9% over the period 1960 to 2005. As the share of trade in GDP rose from 20% to 30% during the period 1990-2000, the average growth of immigration in developed countries rose by 4% over 1985-2000 while the native population grew by 0.5%. For all but the largest source countries, migration is an important phenomenon justifying an exploration in a general equilibrium framework.

Figures 5, 6 and 7 give more details on the structure of emigration from source (origin) countries over the period 1990-2000 which covers the period used in the regressions of section 5. Figure 5 shows the clear negative correlation between emigration rates and the schooling gap. Since the brain drain (which defined as the share of high-skilled among emigrants) is equal to the product of the average emigration and the schooling gap, 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 schooling gap, but not to both.

Figure 6, also from Docquier et al. 2007 shows that the schooling gap decreases with natives’ human capital. The close pattern 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 7 compares the evolution of migration rates, the composition of emigration and the schooling gap across broad categories of countries between 1990 and 2000. Four patterns are evident in the data. First emigration has been mostly of skilled. Second, there is no clear change between the two years. Third, there are substantial variations across broad country groupings. Fourth, the schooling gap (defined as the ratio of the schooling level of emigrants to the average schooling of the population is consistently greater than unity and higher for the low income countries. Here too, regional variations are great, with very large emigration rates of skilled labour from small developing countries.

Finally, figure 8 gives information on the medical brain drain, showing the very high medical migration rates in a few countries. In spite of some outsourcing in the medical field, by policy imposition the health sector is largely non-traded.

Several of these stylized aspects of migration will now be incorporated in a model in stylized model of migration-sending economy.

4 Migration, Trade and Horizontal FDI: A Skeleton Model

The above stylized facts suggests a model that captures the skill-intensity of migration with capital mobility in an open economy is a useful
starting point to capture the links between migration and trade for a typical developing-country sending migrants to developed countries. Furthermore, in view of the importance of emigration in small countries, it is useful to capture general equilibrium effects of migration throughout the economy. 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.  

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:

\[
\hat{R} = \beta_N \hat{p}_N + \beta_E \hat{p}_E + \frac{1}{\Delta} \left( \lambda_{KN} \hat{L}_N + \lambda_{KE} \hat{L}_E - \hat{K} \right)
\]

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.

\[5\] 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:

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

(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;
- \((\theta_{ij}, i = L_N, L_E, K, j = N, E)\) is factor’s \(i\) share in total income generated in sector \(j\);
- \(\lambda_{Kj}, j = N, E\) is the fraction of capital factor absorbed by the sector \(j\);
- \(\sigma_j = \frac{(\hat{a}_{Kj} - \hat{a}_{jj})}{(\hat{K}_j - \hat{K})} \quad j = N, E\) is the elasticity of substitution between factors in sector \(j\);

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

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 \((\Omega \to 0 \text{ if } \sigma_E \to 0 \text{ and } \sigma_N \to 0)\).

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

\[
\frac{M}{N} = k \left( \frac{p_N}{p_M} \right)^{\sigma}
\] (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 \( \sigma \) is the elasticity 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.:

\[
\overline{\pi}_M M = \overline{\pi}_E E
\] (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. \( p_M = e\overline{\pi}_M \) and \( p_E = e\overline{\pi}_E \) 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. (1.4) can be rewritten as:

\[
\frac{E}{M} = \frac{\mu^* \overline{\pi}_M}{\epsilon^* \overline{\pi}_E}; \frac{\mu}{\epsilon} = \phi, \mu > 1, \epsilon < 1
\] (1.5)
and where \( d\mu < 0 \) captures the effects of a reduction in importing costs and \( de > 0 \) 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. \(^6\)

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:

\[
\begin{align*}
\dot{N} - \dot{E} &= \Omega \dot{p}_N + \left( \dot{L}_N - \dot{L}_E \right) + \frac{1}{\Delta} \left( \frac{\theta_{KN} \sigma_N}{\theta_{NN}} - \frac{\theta_{KE} \sigma_E}{\theta_{EE}} \right) \left( -\lambda_{KN} \hat{L}_N - \lambda_{KE} \hat{L}_E \right) \\
\dot{M} - \dot{N} &= \sigma \dot{p}_N \\
\dot{M} - \dot{E} &= 0
\end{align*}
\]

(1.6)

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

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

(1.7)

where

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

The impact of factor endowments change on the domestic price is straightforward. From (1.7), emigration of labor specific to the non-traded sector raises the relative price of the non-traded good while emigration of

\(^6\) For a graphical representation of the equilibrium in this model and further discussion, see de Melo and Robinson (1989).
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 (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:

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

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:

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

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)

$$
\hat{M} - \hat{E} = \hat{\epsilon} - \hat{\mu}
$$

and substituting $\hat{p}_M = \hat{\mu}$ and $\hat{p}_E = \hat{\epsilon}$, the expression for the change in the home good price is:

$$
\hat{p}_N = \frac{\hat{\mu} (\sigma - 1)}{(\sigma + \Omega)} + \frac{\hat{\epsilon} (\Omega + 1)}{(\sigma + \Omega)} - \frac{1}{(\sigma + \Omega)} \left( \alpha_N \hat{L}_N + \alpha_E \hat{L}_E \right) \quad (1.9)
$$
If imports and non-traded goods are substitutes in consumption, 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 become 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:

\[
\hat{R} = \beta_N \left( \frac{\hat{\mu}(\sigma - 1)}{(\sigma + \Omega)} + \frac{\hat{\varepsilon}(\Omega + 1)}{(\sigma + \Omega)} \right) + \beta_E \hat{\varepsilon} + \gamma_N \hat{L}_N + \gamma_E \hat{L}_E
\]

\[
= \left( \frac{\beta_N (\sigma - 1)}{\sigma + \Omega} \right) \hat{\mu} + \left( \frac{\beta_N (\Omega + 1)}{\sigma + \Omega} + \beta_E \right) \hat{\varepsilon} + \gamma_N \hat{L}_N + \gamma_E \hat{L}_E
\]

(1.10)

If the elasticity of substitution between imported and domestic good is less than 1, the reduction in trade costs (lower \( \mu \) or higher \( \varepsilon \)) will result in higher price of capital and positive FDI. The effect of reduction in trade costs on FDI works independently of the effect of migration on FDI.

5. Preliminary Evidence

In the single-country model above, migration is exogenous and trade responds to changes in trade costs and trade policies. While a satisfactory investigation of its predictions would recognize that migration decisions are at least potentially endogenous, as a first step one can explore the links between FDI, the skill composition of emigrants, and changes in barriers to trade. Of course, the links between FDI, migration and trade barriers, include more elements, go both ways, and other include other variables. 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.

Ideally, a panel data set with a sufficiently long time period for a sufficiently large number of countries receiving FDI and sending migrants would be needed to explore these links. While the UNCTAD data base on FDI provides two-way (inward and outward) FDI data for a reasonably large sample of countries since 1980, it is only recently that data on migration rates by skill level have become available for two years, 1990 and 2000 (Docquier and Marfouk (2007)). This limits considerably what can be investigated at the macro level with currently available data.

Under these circumstances, we specify the following:

$$\left( \Delta K^*_i / Y_i \right) = \mu_i + \beta_1 \left( \frac{MIG^{H}_{it}}{L^{H}_{it}} - \frac{MIG^{L}_{it}}{L^{L}_{it}} \right) + \beta_2 \Delta TR_{it} + \beta_3 XS_{it} + \sum_{m} C_{mit}$$

$$+ \varepsilon_{it}, i = 1, \ldots, n, t = 1990, 2000$$

(1.11)

where $\left( \Delta K^*_i / Y_i \right)$ is the flow of net FDI as a percent of GDP, $\mu_i$ is a country dummy that captures time-invariant omitted effects, $\left( \frac{MIG^{H}_{it}}{L^{H}_{it}} - \frac{MIG^{L}_{it}}{L^{L}_{it}} \right)$ is the measure of skill composition of emigrants, $\Delta TR$ is a measure of changes in barriers to trade, $XS$ is a measure of the skill composition of exports considered to be exogenous. We also include GDP in the base period, $Y_i$, which proxies for labour costs and the share of skilled labour in the labour force, $\left( L^{H} / L \right)$.

To these variables capturing the channels between migration, trade, and FDI, we add a vector of controls, $C_m$, that includes other determinants of FDI that will typically vary little over time and are taken as exogenous.
With only two years of data, we cannot use a random effects estimator that would allow the independent variables to be correlated with the unobserved component of the model. Taking first differences helps eliminate the influence of time-invariant omitted effects. Because we do not have a good measure of the change in trade policy over the period for a large number of countries, we take an estimate of trade policy for the earliest time available. This leads to the following equation for estimation:

\[
\left( \frac{\Delta K^*_i}{Y_i,90} \right) = \beta_1 \left( \frac{\Delta MIG^H_i}{L_i^H} - \frac{\Delta MIG^L_i}{L_i^L} \right) + \beta_2 TR_{i,90} + \beta_3 XS_{i,90} + \beta_4 Y_{i,90} + \beta_5 \left( \frac{L^H}{L} \right)_{i,90} + \sum_m \gamma_mC_{mi,90} + \epsilon_i \quad \Delta X = X_{00} - X_{90}
\]

(1.12)

For these preliminary results we concentrate on OLS estimation of (1.12) with White-corrected robust standard errors.

5.1 Sample and Data

The sample of migration sending countries (MSC) is chosen by excluding 24 “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 104 countries.

The appendix describes data sources in detail. The dependant variable is net FDI inflow constructed from the UNCTAD inward and outward foreign direct investment data. Our preferred measure used in cols. [1]-[3] of table 1 is the

\(^7\) Australia, Austria, Belgium, Canada, Cyprus, 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.
average annual net FDI as a percentage of GDP between 1990 and 2000\(^9\). To control for potential endogeneity, we also use as a second measure (cols. [4]-[6]), the difference in net FDI stocks (as % of GDP) between 1990 and 2000.

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. 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.:

\[
\frac{\Delta MIG^s_t}{L^s_t}; s = H, M, L. \]

To capture the change in the relative skill level, we take the difference between the change in high-skill and low-skill labour force, (medium-skill labour being alternatively excluded or included among the high and low skill). For the interpretation of results, note that an increase in emigration is entered negatively (it reflects a reduction in the labour supply). So an increase in emigration associated with an increase in FDI gives a negative sign for the corresponding migration variable in tables 1 and 2.

Restricting the change in labour force neglects other factors 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 the growth rate, are included among the controls as well as other factors such as our measure of political stability. This said, the results in Checchi et al. suggest the potential for reverse causality since educational decisions are linked to past FDI and past migration.

The set of controls included the following variables. 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

---

\(^9\) 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.
category listed among the most skill intensive industries by Romalis (see his table 1). The log of GDP per capita at constant prices in 1990 proxies for the effects of wages costs on 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 7 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)\textsuperscript{11}.

Finally in view of the stylized differences in regional patterns of emigration, we also include 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)).

5.2 Results

Table 1 reports the preliminary results with some robustness checks on the choice of variables reported in table 2. 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 negatively correlated. A reduction in the relative supply of skilled labour 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], we estimate that a 1 percentage point decrease in relative skilled labor supply between 1990 and 2000 has increased annual FDI (as a percentage of GDP) by about 0.015 percentage points in the same period,

\textsuperscript{11} 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 \( F = 1 - \sum_{i=1}^{n} p_i^2 \).
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 percentage points annually. The result is significant at 1%.

The result is robust to a different measure of FDI in columns [4] - [6] 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 emigration in 1990-2000 was associated with 0.9-0.95 percentage point increase of FDI stock (as % of GDP).

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

Comfortingly, most of the controls have the expect signs and several are significant. We find a significant negative impact of GDP per capita on FDI inflows, which is not surprising in a world where VFDI is on the rise, as surmised by Faini. Although positive, the coefficient on GDP growth controlling for the effects of human capital accumulation on FDI is not significant. As expected, country size, is negatively correlated with FDI flows, confirming that small countries usually attract a larger share of FDI. As in Cecchi et al., education level is positively correlated with FDI, significantly so when we use the difference measure of FDI in cols. [4]-[6]. Although not shown here, taken together, the partial correlations indicating that low-income but high-skill labour force countries are attractive for FDI are supportive of the case studies mentioned above stressing the role of diasporas as determinants of FDI flows.

12 We also entered separately the emigration rates by skill category. The results not reported here show that an increase in high-skilled emigration has a significant (at 1%) positive effect on annual net FDI, other things equal. An increase in high-skilled labour outflow by 10 percentage points between 1990 and 2000 raised FDI (as % of GDP) by 0.11 percentage points annually. The coefficient of low skilled migration is insignificant and the coefficient of medium skilled migration has the same sign as high-skilled but is significant at 10%.
Among the dummies, the dummy for transition economies is highly significant (as expected since there was no FDI to these countries at the beginning of the period). The islands dummy is also positive, probably reflecting tourism-related FDI.

The coefficient signs associated with linguistic and religious (and not ethnic, since ethnic is very highly correlated with linguistic) fractionalisation are informative. Linguistic fractionalisation is negatively associated with FDI inflows. This result is in line with the previous evidence indicating an adverse impact of linguistic and ethnic heterogeneity on various social and economic variables (provision of public goods, economic growth, literacy rate, extent of corruption and political freedom, incidence of civil wars), 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)).

Table 2 reports several robustness tests. To test the importance of past emigration, cols. [7] and [8] test whether emigration which took place prior to 1990 affected FDI in 1990-2000. Using the difference between high and low skilled emigration rates (as defined in Docquier and Marfouk (2006)) as a regressor, we obtain a positive correlation between past high-skilled emigration and positive subsequent FDI, reflecting persistence in migration patterns. Note also that the sample is smaller as transition economies are not included.

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.

We have not included a natural resource indicator to capture resource-seeking FDI. Neither have we included an indicator of investment costs as in e.g. Amiti and Wakelin. Devising a plausible IV strategy remains a challenge as we have not found convincing instruments for emigration (e.g. past emigration rates sufficiently far in time). Neither do we report the results of a specification with regional dummies (to be done).

Stock of emigrants if skill level $i$ in 1990 divided by working population of skill level $i$ in 1990.
Columns [9] and [10] returns to the definition of emigration used in col. [1] and checks for robustness to changes in the sample by excluding small developing island economies (col. [9]) and transition economies (col. [9]). In both cases, we still obtain a significant and negative coefficient of relatively high-skilled emigration. However, excluding small island economies reduces by half the value of the coefficient. This reflects the fact that these countries have relatively high emigration rates also receive relatively large FDI.

Finally, in column [11] we test for trade costs by including the trade restrictiveness index from Kee et al. (2006) which captures the effects of tariffs and non-tariff barriers. This reduces the sample by half. As would be expected if FDI is of the VFDI type, higher trade costs reduce the incentives for efficiency-seeking FDI. At the same time, this does not affect the sign and significance of the migration coefficient. However, due to the limited sample size, these last results should be interpreted with caution.

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.

6. Summary Conclusions

This paper continues investigating the channels linking FDI, migration and trade in developing countries explored by Faini in his late work where he argued that substitutability among these different channels of globalization might be giving rise to complementarities questioning the predictions based on standard trade models. 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.

The model rests on two apparently robust, recent stylized facts have guided our preliminary analysis. 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, 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.

We consider 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, 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). 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.

Preliminary results on a sample of 104 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 0.15 percentage points,
after controlling for countries’ GDP per capita, education level and other factors.

The results also extend the channels through which linguistic and religious fractionalization affect developing performance. Whereas previous channels emphasized growth and corruption, we find here that linguistic diversity have negative effects on FDI flows.
References


Arora, A. and A. Gambardella (eds) (2005), From Underdogs to Tigers: The Rise and Growth of the Software Industry in Brazil, China, India, Ireland and Israel, Oxford University Press.


Checchi, D. G. De Simone, and R. Faini (2007) “Skilled Migration, FDI and Human Capital”, Centro Luca d’Agliano WP #235


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

Artjoms Ivlevs, Jaime de Melo

Figure 1: Inward FDI as Percentage of GDP

Evolution of net FDI stock in developing and transition economies, in millions USD $

![Graph showing the evolution of net FDI stock in developing and transition economies, with data from 1990 to 2005. The graph compares developing economies and economies in transition.](image)

Source: UNCTAD FDI online database.

Figure 2: Average Tariffs

Average tariff rates for different regions and periods:

![Bar chart showing average tariff rates for Africa, Asia, Europe, Middle East, and Latin America from 1980-1985 to 1996-2000.](image)
Figure 2: Openness in Developing Countries

Source for figure, 2, 3: Faini (2005)
Figure 4: International Migration in the Long-Run

Figure 4. International migration in a globalized world

Fig 3.1. Globalization and world international migration
Fig 3.1. Globalization and immigration in the more developed countries


Source: Docquier (2007, figure 3)
Figure 5: Average Emigration Rate and Schooling Gap

Figure 2.1. Average emigration rates and schooling gaps

Figure 6: The Schooling Gap and Human Capital

Figure 2.3. The law of the decreasing schooling gap

Source for figures 5 and 6: Docquier, Lohest and Marfouk, (2007, figures 2, 3)
Figure 7: Emigration rates and schooling gap, 1990 and 2000

Source: Adapted from Docquier, Lohest and Marfouk (2007, table 1)
Figure 8: The Medical Brain Drain

Figure 2. Most affected countries by the medical brain drain

Source: Docquier and Bhargava (2006).

Source: Docquier (2007, figure 2)
Table 1. Correlates of FDI in migration-sending countries.

<table>
<thead>
<tr>
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<tr>
<td>(\Delta L_i/L_i(1990) - \Delta L_i/L_i(1990)) in %()</td>
<td>-0.015***</td>
<td>0.005</td>
<td>0.005</td>
<td>0.053*</td>
<td>0.053*</td>
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<tr>
<td>(\Delta L_i/L_i(1990) - \Delta M_i/L_i(1990)) in %()</td>
<td>-0.015***</td>
<td>0.005</td>
<td>0.005</td>
<td>0.053*</td>
<td>0.053*</td>
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<tr>
<td>(\Delta L_i/L_i(1990) + \Delta M_i/L_i(1990)) in %()</td>
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<td>0.004</td>
<td>0.053*</td>
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<td>Ln (GDP per capita), 1990</td>
<td>-0.647**</td>
<td>-0.640**</td>
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<td>0.010</td>
<td>0.010</td>
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</tr>
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<td>GDP per capita, 1990, in %()</td>
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<td>0.010</td>
<td>0.010</td>
<td>0.010</td>
<td>0.010</td>
<td>0.010</td>
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<td>(L_i/L_i, 1990, \text{ in } %())</td>
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<td>0.085</td>
<td>0.083</td>
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<td>1.480***</td>
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<td>(L_i(L_i(1990)-(L_i/L_i)(1990), \text{ in } %())</td>
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<td>0.053</td>
<td>0.989*</td>
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<td>Skill intensive exports, in %</td>
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<td>0.027</td>
<td>0.028</td>
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<td>0.193</td>
<td>0.199</td>
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<td>Political stability, 1996</td>
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<td>Religious fractionalisation, 2001</td>
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<td>2.414**</td>
<td>2.306**</td>
<td>25.614***</td>
<td>26.02***</td>
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<td>Persian Gulf</td>
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<td>1.509</td>
<td>8.674</td>
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<td>Transition economies</td>
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Note: OLS regressions, robust standard errors in italics.

***, **, * if estimated coefficients are significant at 1%, 5% and 10%, respectively.
\(\Delta L_i/L_i, i = \text{high, medium, low}\), is the change in emigration stock of labor with skill level \(i\) between 1990 and 2000 (negative, if emigration 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.

Table 2. Some Robustness checks.
<table>
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<td>Average annual&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Difference in stocks&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Average annual&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Average annual&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Average annual&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>(Rate&lt;sub&gt;H&lt;/sub&gt; - Rate&lt;sub&gt;L&lt;/sub&gt;)&lt;sup&gt;c&lt;/sup&gt;, 1990, in %(.)</td>
<td>-0.015***</td>
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</tbody>
</table>

Note: OLS regressions, robust standard errors in italics.
***, **, * if estimated coefficients are significant at 1%, 5% and 10%, respectively.
<sup>a</sup> Average annual FDI (as % of GDP) between 1990 and 2000.
<sup>b</sup> Stock of FDI (% of GDP) in 2000 - stock of FDI (% of GDP) in 1990
<sup>c</sup> Emigration rate per skill level defined as the ratio of the stock of emigrants in 1990 over 1990 labour force (including emigrants).
For all other variables, see table 1.
Appendix: Data Sources and Definitions
(to complete)

<table>
<thead>
<tr>
<th>Name of Variable</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Delta K_{it}^*/Y_{it} )</td>
<td>Net FDI as % of GDP</td>
<td>UNCTAD data base</td>
</tr>
<tr>
<td>( Y_i / N_i )</td>
<td>GDP pc. In 1990</td>
<td>WDI indicators</td>
</tr>
<tr>
<td>XS(_i)</td>
<td>Machinery and transport /total exports</td>
<td>SITC, section 7</td>
</tr>
<tr>
<td>PS(_i)</td>
<td>Political stability -2.5 (less stable)&lt;PS(_i)+2.5 (more stable)</td>
<td>World Bank Aggregate Governance Indicators</td>
</tr>
<tr>
<td>FR(_i)</td>
<td>Linguistic and religious fractionalization ( [0\text{ (low diversity)}&lt;FR_i&lt;1\text{ (high diversity)}] )</td>
<td>Alesina et al.</td>
</tr>
<tr>
<td>(L(H_i)/L(<em>i)) (</em>{1990})</td>
<td>Share of high skill in the labor force</td>
<td>Docquier and Marfouk</td>
</tr>
</tbody>
</table>

Table A1. Summary statistics (104 observations).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>average annual FDI (as % of GDP), 1990-2000</td>
<td>2.47</td>
<td>2.87</td>
<td>-5.25</td>
<td>14.72</td>
</tr>
<tr>
<td>( \Delta L_{H(1990)} - \Delta L_{L(1990)} )</td>
<td>-0.28</td>
<td>0.75</td>
<td>-4.89</td>
<td>0.05</td>
</tr>
<tr>
<td>( \Delta L_{H(1990)} - \Delta L_{M(1990)} - \Delta L_{L(1990)} )</td>
<td>-0.22</td>
<td>0.68</td>
<td>-4.73</td>
<td>0.28</td>
</tr>
<tr>
<td>( \Delta L_{H(1990)} + \Delta L_{M(1990)} - \Delta L_{L(1990)} )</td>
<td>-0.34</td>
<td>0.82</td>
<td>-5.05</td>
<td>0.07</td>
</tr>
<tr>
<td>Ln (GDP per capita), 1990</td>
<td>7.05</td>
<td>1.22</td>
<td>4.80</td>
<td>10.09</td>
</tr>
<tr>
<td>GDP per capita, relative change 1990-2000</td>
<td>0.10</td>
<td>0.30</td>
<td>-0.64</td>
<td>1.42</td>
</tr>
<tr>
<td>Share of high skilled</td>
<td>0.07</td>
<td>0.06</td>
<td>0.00</td>
<td>0.20</td>
</tr>
<tr>
<td>Share of high skilled, absolute change 1990-2000</td>
<td>0.02</td>
<td>0.02</td>
<td>0.00</td>
<td>0.14</td>
</tr>
<tr>
<td>Ln (population)</td>
<td>15.81</td>
<td>1.73</td>
<td>11.60</td>
<td>20.85</td>
</tr>
<tr>
<td>Export skill intensity</td>
<td>9.09</td>
<td>12.68</td>
<td>0.04</td>
<td>59.64</td>
</tr>
<tr>
<td>Political stability, 1996</td>
<td>-0.26</td>
<td>0.82</td>
<td>-2.92</td>
<td>1.01</td>
</tr>
<tr>
<td>Linguistic fractionalization</td>
<td>0.40</td>
<td>0.29</td>
<td>0.01</td>
<td>0.92</td>
</tr>
<tr>
<td>Religious fractionalization</td>
<td>0.44</td>
<td>0.24</td>
<td>0.00</td>
<td>0.86</td>
</tr>
<tr>
<td>Transition</td>
<td>0.20</td>
<td>0.40</td>
<td>0.0</td>
<td>1</td>
</tr>
<tr>
<td>Persian gulf</td>
<td>0.04</td>
<td>0.19</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Small islands</td>
<td>0.11</td>
<td>0.31</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: see table 1 for definition of variables
Table A2. Correlation between independent variables.

<table>
<thead>
<tr>
<th>Migration</th>
<th>Ln (GDP per cap)</th>
<th>GDP per cap, relative change</th>
<th>Share of high skilled</th>
<th>Share of high skilled, absolute change</th>
<th>Ln (popul)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Migration</td>
<td>ALn/Ln(1990) - ALn/Ln(1990)</td>
<td>1.00</td>
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<tr>
<td>Ln (GDP per cap), 1990</td>
<td>0.09</td>
<td>1.00</td>
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<tr>
<td>GDP per cap, relative change 1990-2000</td>
<td>-0.11</td>
<td>-0.03</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share of high skilled</td>
<td>0.27</td>
<td>0.59</td>
<td>-0.32</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Share of high skilled, absolute change 1990-2000</td>
<td>0.08</td>
<td>0.20</td>
<td>0.16</td>
<td>0.11</td>
<td>1.00</td>
</tr>
<tr>
<td>Ln (population)</td>
<td>0.34</td>
<td>-0.26</td>
<td>0.12</td>
<td>-0.03</td>
<td>0.06</td>
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<tr>
<td>Export skill intensity</td>
<td>0.12</td>
<td>0.44</td>
<td>0.14</td>
<td>0.32</td>
<td>-0.01</td>
</tr>
<tr>
<td>Political stability, 1996</td>
<td>-0.14</td>
<td>0.35</td>
<td>0.14</td>
<td>0.20</td>
<td>-0.02</td>
</tr>
<tr>
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<td>-0.16</td>
<td>-0.35</td>
<td>-0.27</td>
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<tr>
<td>Religious fractionalization</td>
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<td>-0.05</td>
<td>-0.08</td>
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<td>-0.33</td>
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<td>0.35</td>
<td>0.04</td>
<td>0.13</td>
<td>0.06</td>
</tr>
<tr>
<td>Small islands</td>
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<td>0.11</td>
<td>-0.24</td>
<td>-0.07</td>
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Table 3, cont.

<table>
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<th></th>
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</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>Political stability, 1996</td>
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<td>1.00</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Linguistic fractionalization</td>
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<td>1.00</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Religious fractionalization</td>
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<td>0.12</td>
<td>0.34</td>
<td>1.00</td>
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<td>-0.21</td>
<td>0.14</td>
<td>-0.17</td>
<td>-0.07</td>
</tr>
</tbody>
</table>

*Note: see table 1 for definition of variables*