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Trade liberalization in a globalizing world

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Abstract

Globalization is not only about the rise of trade, FDI, and migration. It is also about the changing linkages among these flows. The main findings of the paper can be summarized as follows. First, at least in the nineties, import trade liberalization fostered not only trade but also inward investment, confirming that trade and FDI toward developing countries have become largely complements. Second, the presence of a skilled labour force is a relevant factor to attract FDI. Moreover, trade policies and the stock of FDI have a positive impact on the incentives to invest in education. This set of findings highlights the possibility of a low equilibrium trap where the lack of human capital discourages FDI and inadequate investment from abroad limits the domestic incentives to acquire education. Rich countries, by encouraging skilled immigration from relatively poor countries, are definitely aggravating such a risk. Third, we find little evidence supporting the contrary argument of a brain gain, where the possibility for skilled workers to migrate abroad raises the return to education and the investment in human capital. Overall, our results highlight the need to study globalization in a fully integrated way, not just as the sum of its different components. They also show that backtracking in one area (e.g. trade) feeds negatively on other areas (e.g. FDI).

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Non technical Abstract

International economic integration has been on the rise since at least the mid eighties. However, the present episode of globalization has a number of distinctive features that makes it more vulnerable to a turnaround in even one of its components. First and foremost, the nature of foreign direct investment, particularly toward developing and emerging markets, has changed. In the past, FDI was mainly directed to establish a production facility in foreign markets with a view to catering to foreign consumers and circumventing restrictions to trade. More recently, however, the investment decisions by international firms seems to be increasingly driven by the desire to cut production costs by slicing the value added chain among affiliates in different locations as a function of relative factor prices. Hence, trade costs happen to play a very different role in this context. They no longer encourage multinational firms to invest abroad with a view to getting better access to foreign consumers. Quite to the contrary, their impact is to increase the costs attendant on the fragmentation of the value added chain and discourage therefore firms from investing abroad. In other words, trade and FDI have increasingly become complements. As a result, any step back in either dimension would reflect negatively on the other.

Similar considerations apply to the link between trade and migration. The two have typically been seen as substitutes. The creation of NAFTA was indeed hailed by then President Salinas as reflecting the desire of his country “to export goods not people”. This relationship may still hold true, but increasingly less so. In particular, the growth in service trade, one of the most dynamic component in the expansion of international trade, is very much dependent on the ability to supply such services *in loco* through the firm’s own personnel and is therefore positively linked to migration. Once again, therefore, restriction on one component of globalization – say immigration - carry negative implication for other facets – trade in services - of the process.

The main findings of the paper can be summarized as follows. First, while trade and FDI policies have become steadily more liberal throughout the world, immigration policies in receiving countries have grown quite restrictive. Only for skilled workers has immigration policy in the main receiving countries become more generous, raising fears among sending countries of a brain drain. Second, at least in the nineties, import trade liberalization fostered not only trade but also inward investment, confirming that trade and FDI toward developing countries have been, most recently, largely complements. Third, the presence of a skilled labour force is a relevant factor to attract FDI. Moreover, trade policies and the stock of FDI have a positive impact on the incentives to acquire education. This set of findings highlights the possibility of a low equilibrium trap where the lack of human capital discourages FDI and inadequate investment from abroad limits the domestic incentives to acquire education. Rich countries, by encouraging skilled immigration from relatively poor countries, would be definitely aggravating such a risk. Fourth, we find little evidence supporting the contrary argument of a brain gain, where the possibility for skilled workers to migrate abroad raises the return to education and the investment in human capital.

1. Introduction

International economic integration has been on the rise since at least the mid eighties. Trade in goods and services has been one key component in the process. While world GDP rose on average by 3.8% between 1985 and 2000, world exports expanded at a substantially faster rate during the same period, 6.1% on an average annual basis. The growth in trade did not come at the expense of reduced factor mobility, as traditional trade theory would typically imply. Between 1985 and 2000, real foreign direct investment increased at an average annual rate of 17.7%. The stock of inward FDI rose from 8.4 % of world GDP in 1985 to 22.3 % in 2002. Even migration, in many respects the grand absentee of the present globalization episode, played a non negligible role in fostering international integration. In the US, for instance, the stock of foreign born population increased from 6.2% of total population in 1980 to 10.4% in 2000.

Yet, more recently, there have been signs that globalization is retreating. FDI fell markedly by 41% in 2001 and again by 20% in 2002. International trade virtually stagnated in 2001 and failed to rebound in 2002. The volume of merchandise trade actually fell in industrial countries. A key question is whether this is simply a cyclical phenomenon, reflecting the global economic slowdown, or whether it carries more worrisome implications.

Clearly, it is too early to tell. What we can say however is that the present episode of globalization has a number of distinctive features that makes it more vulnerable to a turnaround in even one of its components. First and foremost, the nature of foreign direct investment, particularly toward developing and emerging markets, has changed. In the past, FDI was mainly directed to establish a production facility in foreign markets with a view to catering to foreign consumers and circumventing restrictions to trade. Accordingly, an increase in trade barriers would have been associated with a rise in FDI. By and large, therefore, trade and FDI were substitutes. More recently, however, the investment decisions by international firms seems to be increasingly driven by a different set of considerations. Improvements in communication and transportation technology allow firms to achieve substantial cost reductions by slicing the value added chain among affiliates in different locations as a function of factor prices. Hence, trade costs play a very different role in this context. They no longer encourage multinational firms to invest abroad with a view to getting better access to foreign consumers. Quite to the contrary, their impact is to increase the costs

attendant on the fragmentation of the value added chain and discourage therefore firms from investing abroad. In other words, trade and FDI have become increasingly complements. As a result, any step back in either dimension would reflect negatively on the other. In particular, increasing trade restrictions would not only depress trade, but also negative reflect on the incentives to undertake FDI.

Similar considerations apply to the link between trade and migration. The two have typically been seen as substitutes. The creation of NAFTA was indeed hailed by then President Salinas as reflecting the desire of his country “to export goods not people”. This relationship may still hold true, but increasingly less so. In particular, the growth in service trade, one of the most dynamic component in the expansion of international trade, is very much dependent on the ability to supply such services *in loco* through the firm’s own personnel and is therefore positively linked to migration. Once again, therefore, restrictions on one component of globalization – say immigration - carry negative implication for other facets – trade in services - of the process.

These considerations have substantive implications for both policy and research. At the academic level, they highlight the need to study globalization in a fully integrated way, not just as the sum of its different components. Separate analyses of trade, FDI, and migration would not do the job. Even bivariate studies of the link say between trade and migration or between trade and FDI may miss the full picture. We know little either empirically or theoretically about the links between FDI and migration. We know even less about the intricate relationships that tie together trade, foreign direct investment, and migration.

From a policy point of view, the need for policy coherence becomes paramount. Restricting trade may be detrimental to the ability to attract FDI. Similarly, limiting migration may discourage FDI and depress trade. Unfortunately, policy coordination is weak, particularly in developing countries, with key decisions affecting trade, inward FDI, and migration policies often being taken by different public bodies. Policy coherence is also particularly inadequate at the international level. Coordination among international institutions is the exception rather than the rule. Also, there is no international institution in charge of migration issues. Similarly, attempts to define a set of multilateral rules for FDI have completely floundered and have all but been abandoned. Finally, the drive to coordinate aid, trade, and capital flows policies have so far yielded no tangible results.

The remainder of this paper is organized as follows. The next section briefly reviews the major trends in international economic integration since the early nineties. We focus on trade, FDI, and migration. We also look at policies. We find that while trade and FDI policies have become steadily more liberal throughout the world, immigration policies in receiving countries have grown quite restrictive, particularly in Europe. Only for skilled workers has immigration policy in the main receiving countries become more generous, a trend however that has raised considerable concerns among developing countries afraid of losing their best and most educated talents.

These trends carry substantive implication for the ability of developing and emerging markets to fully benefit from globalization. Trade liberalization across the world should foster trade, boost openness and encourage FDI. We test these conjectures in section 3. As expected, we find that, at least in the nineties, import trade liberalization fostered both trade and inward investment. At the same time, we also find that the presence of a skilled labour force is a relevant factor to attract FDI. In section 4, therefore, we take a close look at the determinants of the investment in human capital in developing countries. We seek to assess whether, in addition to more traditional determinants, also trade policies and the stock of FDI have a positive impact on the incentives to acquire education. We find that this is indeed the case, suggesting the possibility of a low equilibrium trap where the lack of human capital discourages FDI and inadequate investment from abroad limits the domestic incentives to acquire education. Rich countries, by encouraging skilled immigration from relatively poor countries, would be definitely aggravating such a risk. Developing countries are therefore right to be concerned about the negative growth implications of the brain drain.

However, the case could be made that the brain drain is not necessarily a curse for sending countries¹. It may well be that the opening up of industrial countries borders to skilled migration from the developing world raises the return to education there, thereby boosting investment in human capital. Under these conditions, trade liberalization, FDI, and the brain drain would no longer work at cross purpose, but would be mutually reinforcing. Trade liberalization and the brain drain would both be associated with a larger flow of FDI. This is because the sheer ability to migrate abroad would boost the incentive in education, potentially raising the domestic supply of skilled workers and in the end triggering an even larger flow of foreign direct investment. We assess the empirical plausibility of this argument in section 5. The available evidence suggests that this rosy scenario is somewhat unlikely. Overall, while the results can only be seen as preliminary,

¹ See for instance Stark et al. (1997, 1998), Mountford (1997) and Beine et al. (2001, 2003),

nonetheless they clearly indicate the need to examine the effects of trade, FDI, and migration policies in a fully integrated manner.

2. Trade and factor mobility: trends and policies

The key facts of globalization have all been well documented elsewhere and need only to be briefly recalled here. Between 1985 and 2000 world real GDP increased at an average annual rate of 3.8%. During the same period, real exports increased at an average rate of 6.1% and real FDI flows by 17.7%. As a result, the share of both exports and FDI in world GDP increased substantially (figure 1). Migration also expanded, but at a substantially slower pace. Cross country comparisons of migration data are marred by definitional problems. Yet, available evidence shows that migrants stocks, as a percentage of population, have been rising relatively slowly for the main receiving countries and, in a number of cases, have even declined (table 1).

For the purpose of this paper, the key fact is the expanding role of developing countries. Their share in world exports has increased quite rapidly, particularly in the nineties, largely driven by the exceptional performance of Asia (figure 2). Developing countries are also playing an increasingly relevant role as host of FDI. While foreign direct investment goes predominantly to developed countries, the share of developing countries has been rising since the late eighties. It fell in the aftermath of the Asian crisis but has been recovering since, albeit at a slow pace (fig. 3). Perhaps more crucially, developing countries have witnessed a substantial rise in their exposure to the international economy. Figures 4 and 5 give the regional details for trade and FDI respectively. From figure 4 we see how trade openness – defined as the sum of imports and exports over GDP - has risen steadily in Asia, developing Europe, and Latin America. The picture for Africa is a bit less univocal and so is that of the Middle East, despite the fact that openness is measured at constant prices and hence is not affected by gyrations in commodity prices. Foreign direct investment also shows a rising trend as a percentage of host country GDP (fig. 5). With the exception of the Middle East, inward foreign direct investment has surged in all regions and now accounts for about 4% of GDP in Africa, Asia, developing Europe and Latin America. Contrary to widespread beliefs, Africa has also benefited from the rapid expansion in FDI. Its low share in world FDI simply reflects its

low share in world GDP. Finally, the substantial increase in FDI to Latin America is partly the mirror image of the large scale privatization program during the nineties.

A more liberal policy stance has been instrumental in opening up the economies of developing countries. In fig. 6, we see how over the last twenty years tariff barriers have been declining quite significantly in most developing regions, from 33% to 20% in Africa, from 35% to 15% in Asia and from 30% to 13% in Latin America. Developing Europe, a relatively latecomer to the globalization process, also managed to halve its average tariff rate from 20% to 10%. The noticeable exception to this fairly general trend is the Middle East where tariff barriers increased from 13% in the early eighties to 16% in the late nineties. Turning to non tariff barriers, they have also declined for most developing countries. Kee, Nicita, and Olarreaga (2004) have computed the tariff equivalent value of both core and non core NTBs for three selected years during the nineties (figure 7). Perhaps, the most striking finding is that, on average, non tariff barriers do not restrict trade as much as commonly thought. In all cases, their ad valorem equivalents are below 10%. Only for Latin America and the Middle East they are actually close to such value. For Africa, Asia and developing Europe they stand at much lower levels, around 2-4%.

Summing up so far, two facts stand out. First, tariff barriers are still relatively high in many developing countries, but have been on a downward trend since the early eighties, with the only noticeable exception of the Middle East. Second, non tariff barriers do not restrict trade significantly, as measured at least by their tariff equivalent values.

Turning to barriers with respect to FDI, the general picture of a more liberal regime still holds. Restrictive measures are more difficult to quantify in this area. Nonetheless, UNCTAD has maintained a headcount of FDI measures and classifies them according to whether they represent a move toward a more or less liberal regime. The trend is definitely toward a more open policy regime with liberalizing measures outranking restrictive ones by a factor of 10.

Last but not least, the stance on migration policy stands in sharp contrast with the increasingly liberal attitude with respect to trade and FDI. Indeed, since 1974, most industrial countries have tried to restrict new immigration and, at the same time, favour the return of previous immigrants. While many of these policies have only been partly successful, they have nonetheless succeeded in slowing down the flow of immigrants that had characterized the post war period. More recently, in response to the growing shortage of skilled workers, most receiving countries have tried to shift the

focus of their immigration policy, with the view to favouring the recruitment of highly skilled workers. This new twist in the policy stance toward immigration has become a source of considerable concern in traditionally sending countries, that are afraid of losing their most skilled and entrepreneurial workers. Unfortunately, empirical evidence on the determinants and the size of the brain drain is quite limited. The gap has been partly filled by the work of Carrington and Detragiache (1998). Using the US census on the educational and the geographical origin of immigrants into the US and combining this information with the Barro-Lee data set on the level of educational achievements in sending countries, they are able to estimate migration rates for different educational groups. Their main finding is that skilled migration can represent a significant drain at least for some developing countries. Table 2 reports migration rates for secondary and tertiary educated migrants for a selected group of sending countries.

3. Trade and factor mobility: the most recent trends

The rapid growth in trade and FDI came to a sudden stop in 2001. The fall in FDI was massive, minus 41% in nominal terms. Fortunately enough, there was no collapse in world trade, but the volume of trade was virtually unchanged with respect to the previous year. Matters did not improve much in 2002. FDI fell again, this time by 20%. The recovery in trade was modest, 3.2%, basically in line with the growth in world output. The prospects for 2003 are not particularly bright, with growth in trade projected to stay once again below that of world output.

Largely, the slowdown in the pace of globalization can be attributed to the slowdown of the global economy and, to a lesser extent, to the correction of the financial excesses in the late nineties. Yet, comparisons with earlier periods suggest that the fluctuations of the world economy cannot fully explain what happened to trade and FDI in 2001-2003. For the purpose of comparison, we look at the 1991-1993 slowdown, when world output growth stood at 3% as it did in 2001-2003. We find that world trade increased by only 3.9% in 1991 but then recovered quite rapidly to 9.5% and 11.4% in the two following years. As we have just seen, there has been no such recovery of trade in the current slowdown. Similarly, FDI fell in 1991, by 20%, but then recovered very rapidly in 1992 and particularly so in 1993 when its rate growth stood at around 30%. As argued by UNCTAD (2003), what is of concern today therefore is not only the downturn's severity but also its duration.

These concerns should not be overblown. The fall in world FDI reflects the collapse in mergers and acquisitions, itself linked to the decline in the stock markets. Moreover, data for 2003 seem to indicate a bottoming out of the FDI cycle. Yet, the fact remains that trade, a component not too prone to financial excesses, fell relatively more, and was relatively slower to recover, compared to previous slowdowns.

The policy stance is an additional source of concern. The failure of the Cancun ministerial meeting and the collapse of the negotiations for a multilateral agreement on investment provide an hefty reminder that the trend toward more open policies should not be taken for granted. We also know from history that globalization is not an irreversible process, driven by the forces of technology. Policy matters, even more so in a context where, as noticed earlier, complementarities among the different facets of globalization play an increasingly relevant role. Failure to liberalize trade, or worse a retreat from current trade policies, would not only depress the expansion of trade flows, but could well undermine also the incentives for capital and labour mobility.

4. Trade liberalization, trade flows and factor mobility

There is considerable disagreement in the literature as to the growth effects of a more liberal trade regime. A key difficulty is whether the stance of the trade regime should be measured by an output indicator, such as the relative size of trade flows, or more directly by an index of trade policy. The former are easier to compute, but do not necessarily provide a good measure of the trade policy stance as they reflect the influence of many confounding factors. The latter are harder to get and typically perform less well in empirical analyses. Still, until very recently, the conventional wisdom was that trade openness, whether measured by an output or a policy indicator, was positively associated with per capita income growth. However, an influential paper by Rodriguez and Rodrik (2000) showed that standard wisdom was, as it often happens, less conclusive than commonly thought. Not only were traditional measures of trade openness very imperfect indicators of the actual stance of trade policy, but, more crucially, trade restrictions, compared to other unsound policies, were found to play a relatively minor role in determining the growth performance across countries. More recently, though, Wacziarg and Welch (2003), while confirming most of the early findings of Rodriguez and Rodrik, showed that, in a time series context, properly identified trade liberalization episodes have a positive and robust effect on growth and investment.

a) trade policy and trade flows

For the purpose of this paper, the key finding of Wacziarg and Welch (2003) is that trade policy measures are indeed associated with greater trade openness, measured by the sum of exports and imports over GDP. This result supports the view that typically the effects of trade liberalization are not negated by offsetting measures or by poor implementation. We assess the robustness of the findings by Wacziarg and Welch (2003) by adding to their regression a number of structural factors, namely per capita GDP and total population, with a view to capturing the impact of economic development and size on openness. Trade policy is simply measured by an indicator of tariff barriers compiled by the World Bank. We ran the following simple five year regression over the eighties and the nineties (1981-85, 1986-90, 1991-95, 1996-2000) for a large sample (92) of developing countries:

$$\frac{X + M}{Y} = \alpha + \beta \ln Y_{pc} + \gamma \ln Pop + \delta \tau \quad (1)$$

where X, M and Y denote exports, imports and GDP while Y_{pc} , Pop and τ represent per capita income, total population, and tariff barriers. Details about estimation methods and data sources are relegated to the appendix. Suffice to say here that, in an effort to cope with endogeneity problems, explanatory variables are equal to their value at the beginning of each five year period, while the dependent variable is averaged over the whole period. Also, as an indicator of τ we use both the level of import duties and its log. As expected, we find that openness is positively associated with income per capita and negatively related to population (table 3), confirming the view that rich and small economies tend to trade relatively more. Furthermore, trade policy also affects quite significantly, both in statistical and quantitative terms, the level of openness. A 10 per cent decline in the level of tariff is associated with a 2 per cent increase in the level of openness.

Summing up, a more liberal trade stance will positively affect openness, even after controlling for the more structural determinants of trade flows².

² Had we not controlled for the structural determinants of openness (income per capita, and population) the impact of tariffs would have been substantially larger. See Frankel and Rose (2000) for a similar result.

b) trade policy and foreign direct investment

We can now turn to the relationship between trade policy and inward foreign direct investment. Unfortunately, theory does not provide a clear-cut answer as to the direction of such a link. Consider first the standard model of trade. An increase in tariff barriers will typically depress both exports and imports. In a capital poor country, it will also raise the returns to capital and hence attract investment from abroad. This is the standard substitutability results between trade and factor mobility. Conversely, the lifting of trade restrictions should boost trade and discourage factor mobility. Interestingly enough, even less orthodox models come to similar conclusions. Consider for instance the product cycle paradigm. Initially, the new product will be exported by the innovating firm. However, once production becomes routine, it will be moved to a foreign location, where production costs are cheaper. Therefore, here too FDI is viewed as replacing trade.

The models above basically fit the description of horizontal FDI, where the shift of production to a foreign location is motivated by the desire to circumvent trade barriers, save on trade costs and gain access to foreign consumers. Even in this set-up, however, the medium term link between trade and FDI is not unambiguous. As noticed by UNCTAD (1996), for instance, foreign affiliates typically generate a steady demand for imports of capital and intermediate goods from their parent firm. In the medium run therefore, following the investment abroad, trade flows may grow rather than contract. However, it is still true that trade will grow less compared to the case where the firm had not established a production platform abroad. Accordingly, the prediction that trade barriers will depress trade and encourage market seeking FDI still holds.

Market seeking inward FDI is certainly not the rule for most developing countries, given the small size of their markets. A perhaps more relevant motivation of inward FDI has been the desire to exploit the availability of natural resources in host countries. Resource seeking FDI is typically trade creating. Multinational firms will mostly cater to consumers in their home country or in third markets. Indeed, the main motivation of resource seeking FDI is to produce for exports rather than for host country consumption. The key observation here is that trade barriers are unlikely to matter much. Compared to manufacturing firms, primary sector affiliates are less dependent on the imports of intermediate goods. They are also unlikely to face major barriers in export markets. At any rate, trade barriers in the host country are unlikely to be a determining factor in the location decision of resource seeking FDI. Even imports of capital goods are typically taxed at very favourable rates if

not totally exempted. Accordingly, the prediction is that trade barriers should not have a substantive effect on resource seeking FDI.

It is also worth noting that this form of FDI has been steadily losing relevance. For instance, exports by US primary sector affiliates as a percentage of host countries exports of primary goods has declined from 35 per cent in 1977 to 11.2% in the early nineties (UNCTAD, 1996). This trend mostly reflect the policies of indigenization of primary sectors by host countries. Moreover, the primary sector itself has lost much ground as a source of foreign exchange for the developing world. Indeed, in the early nineties, the primary sector accounted for more than 22% of the stock of inward FDI in developing countries, but during that decade only less than 9% of the total flow of inward FDI went to that sector.

Efficiency seeking, or vertical, FDI represents a further motivation for the firm decision to locate in foreign country. The aim is simple, namely to cut production costs by slicing the value added chain and relocating abroad the production of those intermediate goods which are too costly to produce domestically. The implications for trade are immediate: efficiency seeking FDI is trade creating. Transactions within the firm or among firms in the home country are replaced by trade between the parent firm and its affiliates. Quite often, moreover, affiliates will start selling to firms other than their parent. Similarly, the role of trade barriers changes radically. Pervasive restrictions to trade in the host country would raise the costs of vertical disintegration between the parent firms and its affiliates abroad. Hence, trade barriers discourage vertical FDI.

To sum up, we have distinguished three types of motivations for FDI, with altogether different implications for both trade and for the impact of trade barriers. First, horizontal FDI substitutes for trade and is generally fostered by high trade barriers in host countries. Second, resource seeking FDI augments trade but is relatively insensitive to trade barriers in host countries. Finally, vertical FDI is also trade creating, but is highly responsive to trade barriers³.

These are all testable implications. They require however that we are able to distinguish between these three forms of FDI. Unfortunately, this is a tall task, one reason being that most often aggregate data include all three types of investment. Moreover, even for firm level data the different

³ A further source of complementarity between trade and FDI may stem from the growing role of services. Particularly for LDCs, inward FDI in marketing and services is complementary to their ability to exports. This further strengthens the argument that during the nineties FDI and trade in developing countries have become strong complements to each other.

kinds of motivations can all be present at the very same time. Nonetheless, there are indications of a negative relationship between trade costs and vertical FDI once data series are extended to cover the nineties (Barba Navaretti and Venables, 2004). For instance, Hanson, Mataloni and Slaughter (2001) find a negative relationship between the host country's trade costs and both the ratio of affiliate exports to affiliate sales to the local market and the ratio of affiliate imports from parents to total affiliate sales⁴.

In what follows, we take a very simple route. We start from the observation that resource seeking FDI has been somewhat on a downward trend, at least in relative terms. We also note that vertical FDI has been gaining importance, even with respect to market seeking FDI. Indirect evidence in this respect comes from the fact the average export propensity of US majority owned manufacturing affiliates in developing countries has been steadily rising from 8.4% in the mid sixties to 22% in the early eighties and to 39% in the mid nineties. The biggest rises have been in Latin America and developing Asia. In Asia's newly industrializing economies, the exports propensity of US affiliates has actually declined, albeit from very high levels, most likely reflecting the expanding size of the host countries domestic markets. Again, we see that a sharp distinction between horizontal and vertical FDI is hard to draw. Yet, these data, taken together, point to the growing role of vertical FDI. If so, then, we would expect trade barriers to increasingly discourage FDI to developing countries, particularly in the nineties.

We test this proposition in a simple manner. First, we take the UNCTAD measure of FDI attractiveness. This is basically a simple average of the scores achieved by different countries on a number of indicators that are deemed to attract FDI⁵. The key observation here is that the UNCTAD FDI potential index does not include trade barriers. We therefore ran the following simple regression:

$$\frac{FDI}{Y} = \alpha + \beta PI + \gamma \tau \quad (2)$$

⁴ However, Markusen and Maskus (2001) using aggregate US data, found a positive relationship between the host country's trade costs and the affiliate exports back to the home country. They interpret this finding as evidence of export platform FDI, where the firm's locational choice is dictated by the desire to cater to third markets.

⁵ The indicators are real GDP growth, GDP per capita, total exports as a percentage of GDP, telephone lines and mobile phones per 1000 inhabitants, per capita commercial energy use, R&D spending as a percentage of GDP, tertiary enrolment, country risk, exports of natural resources as a percentage of world total, exports in services as a percentage of world total, inward FDI stock.

where Y is GDP, PI is the UNCTAD potential index of inward FDI and τ is a measure of trade barriers. Note that a high level of PI indicates that the country is not relatively attractive as a destination of FDI. We expect therefore $\beta < 0$ (countries with high PI are unattractive to foreign investors) and $\gamma < 0$ (if vertical FDI is predominant). Here too, details about estimation methods and data sources are relegated to the appendix. Suffice to say that the sample includes only developing countries. Industrial countries are excluded on the ground that inward FDI there is still motivated by market seeking considerations and, accordingly, is encouraged by high trade barriers (Navaretti, Haaland, and Venables, 2003)⁶. Furthermore, we focus only on the nineties, where efficiency seeking FDI has been playing an increasingly relevant role⁷. Overall, therefore, given that we exclude industrial countries (where horizontal FDI is still very relevant) and focus only on the nineties (when vertical FDI became more relevant) our expectations is to find that trade barriers discourage FDI, i.e. that $\gamma < 0$. As a measure of τ we take the sum of tariff barriers and the *ad valorem* equivalent of non tariff barriers.

The results are strikingly simple (table 4). First, as expected, the index of potential FDI is negatively associated with the GDP share of inward FDI (recall that a high level of PI means that the country is not very attractive as a host to FDI). Second, trade barriers discourage, and significantly so, inward FDI. The results are robust to the inclusion of regional fixed effects. They suggest that vertical FDI has indeed been the predominant mode of investment internationalization toward developing countries during the nineties.

We have also tried to extend our analysis to earlier periods. Unfortunately, the UNCTAD index is not available before the nineties. We had to run therefore a more complex regression controlling for (some of) the main factors that are thought to affect the attractiveness of FDI. Moreover, we are less optimistic in our quest to find a significant impact of trade barriers on FDI given that for earlier periods the three motivations – resource, market and efficiency seeking - were even more all present confounding therefore the impact of trade restrictions. The new regression is:

$$\frac{FDI}{Y} = \alpha_0 + \alpha_1 K_{FDI} + \alpha_2 HK + \alpha_3 PK + \alpha_4 \ln(Y_{pc}) + \alpha_5 \tau \quad (3)$$

⁶ Inappropriate pooling of industrial and developing countries can strongly bias the results. See Blongen and Wang (2004).

⁷ The index PI is available only for the nineties.

where K_{FDI} denotes the ratio of inward FDI stock to GDP, HK and PK are two measures of the stock of human and physical capital respectively, Y_{pc} is income per capita and τ denotes as usually the size of trade barriers. As a measure of the stock of human capital, we use the average number of school years per inhabitant, as recently updated by Barro and Lee (2000). As a proxy for physical capital, we take the number of telephone lines per 1000 inhabitants. Finally, for trade barriers we only have indicators of tariff restrictions. The ad valorem equivalent of NTB's that were used in table 4 are available only for the nineties and not for earlier periods.

Three facts stand out (table 5). First, and perhaps not unexpectedly, trade barriers have no clear impact on FDI decisions, when a longer period is considered, presumably reflecting the wider variety of motivations of multinational firms. Second, the availability of both physical and human capital encourages inward FDI, confirming that multinational firms are attracted by the presence of a skilled labour force and of adequate infrastructures. The role of human capital is particular notable, as it confirms the conjecture in much of the literature (Blomstrom and Kokko, 2003, Borensztein et al., 1998) that it is not simply the availability of low wage unskilled labour that attracts foreign investors.

By and large, therefore, our results so far show that FDI toward developing countries has become increasingly motivated by efficiency considerations. Both progress in communication technology and lower trade barriers have contributed to the international fragmentation of the value added chain along efficiency lines. Furthermore, we find that the availability of a pool of educated workers is also a key consideration in the location decision of multinational firms in developing countries. This latter finding raises an intriguing possibility. Consider the case where investment in human capital is encouraged by the presence of foreign investors. We may then well have two equilibria, one with a limited presence of foreign firms and poor educational achievements, the other with a large stock of foreign capital and strong educational levels. We explore this possibility in the next section. Before that, however, we turn to the relationship between trade and migration.

c) trade policy and migration

Trade policy can also affect the mobility of people and workers. For instance, restrictive trade measures in industrial countries will discourage exports from developing countries and strengthen the push factors of migration. They will also encourage the expansion of low skill intensive import

substituting sectors in receiving countries, thereby reinforcing the pull factors of immigration. On both counts, therefore, migration pressure will increase. These effects are evident for instance for the Common Agricultural Policy of the EU. By discouraging the expansion of agricultural exports from Northern African countries, they foster out-migration. Conversely, the disproportionate size of the agricultural sector in the EU acts as magnet for would be migrants.

Some further evidence in this respect comes from the sectoral allocation of migrants in receiving countries. Faini and Venturini (1993) show that by and large immigrants are more likely to be employed in import competing sectors.

Trade restrictions in sending countries are also likely to encourage out-migration. There is only very limited evidence in this respect, however. Faini, Grether and de Melo (1999) show, with the help of a simple simulation model, that in a Ricardo Viner framework trade liberalization will have fairly complex effects on out-migration. In particular, if exports respond slowly to the new trade regime, then trade liberalization will be accompanied by a relatively strong real exchange rate depreciation that will foster out-migration. Historical evidence by Collins, O'Rourke, and Williamson (1999) is also compatible with the notion that trade and migration may have been complements, at least in the nineteenth century.

The plausibility of a complementarity relationship between migration and trade is also strengthened by the growing role of service trade. For, many services must be delivered personally. Moreover, even tradeable services often require skilled or at least trained personnel to be relocated, most likely temporarily, in the importing country.

Overall, also the relationship between trade and migration is not unambiguous. While substitutability may have been for most of the post war period the rule rather than the exception, the new forms of international exchange of goods and services increasingly imply a complementarity relationship.

5. Foreign investment, investment in human capital and the brain drain

a) does FDI boost the incentive to invest in human capital?

We have seen in the previous section how foreign investment is typically attracted by an adequate supply of skilled workers. This raises an intriguing question. How are the incentives for human capital accumulation affected by the presence of foreign firms? Existing evidence shows that by and large foreign firms employ relatively more skilled labour than their domestic counterparts (Barba Navaretti and Venables, 2004). Similarly, Feenstra and Hanson (1996a, 1996b) showed, in a fairly influential set of papers, that foreign direct investment may raise the relative demand for skills both in the home and in the host country⁸. We would then expect the incentive to acquire further education to be strengthened by a sufficiently large presence of foreign firms.

For the purpose of illustration, consider a simple model where (foreign) capital accumulation (I_{PK}) is negatively related to its own stock (PK) but positively related to the stock of human capital (HK). The previous section offered some supporting evidence for both of these conjectures⁹. Similarly, we assume that investment in human capital (I_{HK}) is negatively affected by its own stock but is encouraged by the presence of foreign investment. Formally:

$$I_{PK} = f(PK, HK) \text{ with } f_{PK} < 0 \text{ and } f_{HK} > 0 \quad (4)$$

and

$$I_{HK} = g(PK, HK) \text{ with } g_{PK} > 0 \text{ and } g_{HK} < 0 \quad (5)$$

This admittedly simple model is amenable to a graphical representation (fig. 8). In a steady state equilibrium - we assume that the standard conditions for such an equilibrium to exist are fulfilled – we have that $I_{HK} = I_{PK} = 0$. Given our assumptions ($f_{HK} > 0$ and $g_{PK} > 0$), both schedules are positively sloped. For instance, an increase in PK will discourage investing in physical capital and will need to be offset by a rise in HK.

The fact that both schedules $I_{HK} = 0$ and $I_{PK} = 0$ are positively sloped raises the possibility of multiple equilibria. In fig. 8 we depict three of those. The middle one is unstable, the other two are stable. We see therefore the emergence of a low level trap (point A in the figure) where foreign

⁸ This is simply because the goods whose production is relocated to the South are skill intensive for the South but unskilled intensive for the North.

⁹ The derivative of FDI with respect to the stock of foreign capital is likely to be negative for reasonable values of the depreciation parameter.

firms are discouraged from investing in the host country because of the inadequate supply of human capital there, while the limited presence of foreign firms reduces the demand for skills and discourages investment in education.

Is this an empirically plausible scenario? For an affirmative answer, we still need to show that investment in education is encouraged by the presence of foreign firms. To ascertain this possibility, we ran a simple econometric equation with the view to explaining the level of educational enrolment at the secondary and the tertiary levels. We take this variable as a reasonable proxy of investment in human capital, I_{HK} .

We then postulate that investment in human capital is a function of: a) per capita income, with a positive relationship provided that education is, as it should, a normal good; b) trade policy, with a priori ambiguous impact on I_{HK} . In the standard model of trade with two factors (skilled and unskilled labour), trade liberalization in a unskilled abundant country should penalize skilled labour and hence discourage investing in human capital. However, the analyses of Feenstra and Hanson (1996a, 1996b) suggest that this may not always be the case, with trade liberalization boosting instead the returns to skills and the incentives to education in both skilled abundant and skilled scarce countries¹⁰; c) the endowment of natural resources, to allow for the possibility that the abundance of natural resources may discourage investing in human capital; and d) the presence of foreign firms, as measured by the stock of foreign capital. Formally:

$$I_{HK}^i = \alpha_0 + \alpha_1 K_{FDI} + \alpha_2 \ln(Y_{pc}) + \alpha_3 \tau + \alpha_4 D_{NR} \quad i=S,T \quad (6)$$

where I_{HK}^i denotes investment in human capital at the secondary or tertiary level (i =secondary, tertiary), K_{FDI} is the stock of foreign direct investment over the host country GDP, Y_{pc} is income per capita, τ is the level of tariffs, and D_{NR} is a dummy variable that takes a value of one if natural resources exports account for more than 40% of total exports.

The results for secondary school enrolment are presented in table 6. As expected, we find that income per capita is positively associated with secondary school enrolment, while a large endowment of natural resources has a negative impact on I_{HK}^S . Interestingly enough, both trade liberalization and the presence of foreign firms raise investment in human capital at the secondary

¹⁰ See also Schiff and Wang (2004) for a similar result for Latin America

school level, thereby supporting the notion that the accumulation of human capital responds favourably to a more liberal trade and foreign investment regime. This is a key result for the purpose of our analysis. It shows that foreign capital has a significant and positive impact on investment in education, as we indeed conjectured in eq. (5) and in fig. (8) . Taken together with our earlier finding that a well educated workforce is a crucial factor to attract foreign investors, it highlights the existence of a complementarity relationship between FDI and human capital. By and large, therefore, the existence of a low level trap, where the lack of foreign capital and of an educated workforce feed on each other, is something more than a mere theoretical possibility. In addition, our results are consistent with the findings of Feenstra and Hanson (1996a, 1996b) that FDI raises the returns to education.

We have also ran the same equation separately for the five main geographical regions, Africa, Asia, developing Europe, Latin America and the Middle East. Interestingly enough, the regional estimates suggest that the previous results hold also for all the main regions, with just one exception, namely the Middle East. The predominance of resource seeking FDI in such a region may explain why neither the stock of foreign direct investment nor trade liberalization have a positive effect on the incentives to accumulate human capital.

We now turn to tertiary school enrolment. Econometric results are presented in table 7. They are quite similar to those for secondary school enrolment except for the fact that now trade policy is no longer a significant influence on educational investment for the pooled specification. Running the equation separately for the five main developing regions confirms the finding that the Middle East is an outlier, with the stock of foreign direct investment having a *negative* impact on tertiary enrolment. Trade liberalization raises investment in education at the tertiary level for Latin America and Africa, but not for the other areas.

Overall, the results in this section suggest that trade liberalization has a twofold effect on investment in human capital. First, the lifting of trade restrictions attracts foreign firms and, accordingly, raises the demand and the returns to skills. Second, trade liberalization itself has a positive impact on the incentive to invest in human capital, at least for secondary school. In terms of figure 8, trade liberalization would shift the $I_{HK} = 0$ schedule to the right, with two main implications. First, it would raise the steady state levels of both human and foreign capital. Second, the rightward shift, if sufficiently large, of the $I_{HK} = 0$ schedule may eliminate the low level equilibrium altogether. In both cases, the economic and welfare effects are likely to be positive.

Perhaps more crucially, our results show that also education and FDI policies are complements. Opening up the economy to foreign capital increases the incentive to invest in education, which in turn further strengthens the attractiveness of the host economy to FDI. Conversely, any strengthening in the quality of educational facilities would have a positive impact on the steady state levels of both human and foreign capital.

b) the brain drain: a curse or a blessing?

We have so far focussed on trade and foreign direct investment, neglecting labour mobility. However, the previous set-up lends itself quite easily to an analysis of the effects of skilled migration. Suppose to begin with that, prompted by the unexpected opening of industrial countries borders to highly educated immigration, the sending country suffers from a sudden loss in its skilled labour force. Let the initial equilibrium be at C, where both the human and the foreign capital stock are relatively large. Neither the $I_{HK} = 0$ nor the $I_{PK} = 0$ schedules would shift. The new (temporary) equilibrium would then be at a point like D, but the equilibrium would slowly move back to its original position. There is one case, though, where this may not happen. In particular, if the initial loss of skilled workers is large enough, then the economy may shift from the ‘good’ equilibrium to the low level trap in A.

Even abstracting from such a dramatic outcome, the effects of the brain drain are unlikely to be positive. Consider for instance the case where we model the brain drain in a somewhat different way, as leading to a steady loss of skilled workers that migrate abroad. In a sense, the investment in human capital has become less productive because of higher depreciation (i.e. emigration) of the existing stock of human capital. Formally, this amounts to make the $I_{HK} = 0$ steeper with a twofold effect. First, the steady state levels of both human and physical capital will decline. Second, the probability that the economy remains trapped in the low level equilibrium at A will increase. Independently of how we model the impact of brain drain, its impact on the sending country’s economic welfare is likely to be negative.

Our assessment of the impact of the brain may however be a bit too gloomy. A recent stream of literature has argued that in the end the brain drain may not be as bad as previously thought for the

sending country. The reason is simple. So far, we have treated the brain drain as a purely exogenous phenomenon with no impact on the behaviour of domestic agents. This approach however may be a bit too restrictive. Suppose that the returns to skills are higher abroad, say because of better technology. Consider the case where the foreign country opens up its border to skilled immigration, so that home country educated residents have now a positive probability, say $p > 0$, to move abroad. Clearly, the expected return to education will rise, as it will now be equal to a weighted average of the higher return abroad and the initial return at home and, as a result, investment in education will also increase. If the latter effect is large enough it may offset the loss of skills due the brain drain and allow the country to retain a larger pool of educated workers compared to the no migration case. In such a circumstance, the brain drain becomes a brain gain (Stark et al., 1997, 1998; Mountford, 1998).

Is this outcome empirically plausible? The evidence on the education boosting effect of the brain drain is quite limited, also because of the paucity of data on the size of skilled migration. While the gap has been partly filled by the Carrington and Detragiache (1998), their work focus almost exclusively on the US and make generalizations to other receiving countries quite tenuous. Recent work by Adams (2003) provides only a few additional observations.

Notwithstanding these limitations, there have been in the literature of number of attempts to assess whether the possibility of migrating abroad effectively boosts the investment in education. The evidence is mixed, with both Beine et al. (2003) and Faini (2004) finding some positive but relatively weak effects of the brain on secondary enrolment. Faini (2004) actually finds that the probability of tertiary migration actually depresses tertiary enrolment, a finding that he attributes to the choice by would be migrants to pursue their graduate studies abroad.

In what follows we have tried to take a further shot at the issue. We combine the data set of Carrington and Detragiache (1998) and of Adams (2003). We then augment the equation for I_{HK}^i with a variable p^i that denotes the probability of migration for workers whose skill level is equal to i .

$$I_{HK}^i = \alpha_0 + \alpha_1 K_{FDI} + \alpha_2 \ln(Y_{pc}) + \alpha_3 \tau + \alpha_4 D_{NR} + \alpha_5 p^i \quad (7)$$

As a measure of p^i we take the migration rate for workers with educational level equal to i . The results are presented in Table 8. They are far less than encouraging. Due to the limited number of

observations for p^i , the size of the sample shrinks dramatically. We drop the natural resource dummy, as it is never significant. Per capita income is the only significant determinant of secondary school enrolment. The stock of foreign capital has the expected positive sign but is not statistically different from zero at standard significance levels. For tertiary school enrolment, the tariff rate enters again the equation, as it did in table 8, with a negative coefficient, suggesting that trade protection discourages investment in human capital. The noticeable fact though is that the probability of migrating abroad, i.e. the variable p^i , plays no role whatsoever in determining the educational choices at either the secondary or the tertiary levels. Moreover, the coefficient on p^i is negative in both equations, contrary to the prediction of the brain gain model. These results should be taken with a grain of salt, given the very limited number of degrees of freedom. However, they provide no evidence in support of the brain gain argument.

6. Conclusions

The interaction between trade, capital, and labour mobility is a key factor in determining the impact of globalization on developing countries. Separate analyses of the effects of trade, migration and FDI are increasingly at risk of missing some key feedbacks between the different facets of globalization.

One of the main findings of this paper is that trade liberalization, in addition to its standard and somewhat controversial effects on growth, also increase the host country's attractiveness for foreign direct investment. This adds a new channel through which a more liberal trade regime can favour growth¹¹. Moreover, trade liberalization can also boost the investment in education and, hence, allow an economy to escape from a low equilibrium trap.

We have also shown how skilled migration can interact with FDI and the investment in human capital to generate a welfare inferior equilibrium, where foreign firms refrain from investing in the host country because of its inadequate supply of skills, while the incentives to get educated remain weak because of the lack of foreign capital. The brain drain in this set up means that a substantial share of skilled workers will migrate abroad, thereby aggravating the disincentive for foreign investors. The possibility that the brain drain may be turned into a brain gain, by raising the returns to skills, seems in this context quite remote and, at any rate, is not supported by available evidence.

¹¹ Even though the growth impact of FDI is also controversial in the literature. The findings by Borensztein et al. (1998) have been recently challenged by Carkovic and Levine (2002).

The policy message is that policy coherence both at the domestic and at the international levels is key. International institutions should lead the way in this respect, by better integrating their policy advice in the fields of trade, FDI, and migration. National policy makers should make sure that different provisions do not work at cross purpose with each other.

Finally, and perhaps more generally, we have seen how complementarities between the different aspects of globalization have become increasingly pervasive. This is both good and bad news for the world economy. It is good news to the extent that the effects of a more liberal regime tend to be mutually reinforcing. It is bad news when backtracking in one area feeds negatively on other areas. The concerns about the recent trends in globalization and in the policy stance may be exaggerated. However, a far greater risk is to underestimate the risks to the liberalization of trade, investment - and perhaps one day also migration - regimes.

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Table 1

**Stock of foreign population in OECD countries
(as a percentage of total population)**

	1990	2000
United States	7.9	10.4
Japan	0.9	1.3
France	6.3	5.6
Germany	8.4	8.9
Italy	1.4	2.4
UK	3.2	4.0
Belgium	9.1	8.4

Source: SOPEMI (2003)

Table 2

The Brain Drain

Migration rates by educational attainments

(percentage of host country's educational group)

Origin country	To the US		To the OECD	
	Secondary educ.	Tertiary educ.	Secondary educ.	Tertiary educ.
Korea	1.2	5.7	3.3	14.9
Philippines	4.4	6.6	6.0	9.0
Ghana	0.3	15.1	0.7	25.7
Uganda	0.6	15.4	0.6	15.5
Domin. Rep.	29.7	14.2	30.5	14.7
Guatemala	29.1	13.5	29.1	13.5
Colombia	3.6	5.6	3.8	5.6
Mexico	20.9	10.3	20.9	10.3

Source: Carrington and Detragiache (1998)

Table 3
Openness and trade policy

Dep. Variable: $[(X+M)/Y]_{t,t+4}$

	(1)	(2)
$\ln(Y_{pc})_t$	13.1 (4.3)	9.30 (2.2)
$\ln(\text{pop})_t$	-12.4 (6.5)	-12.4 (6.8)
τ_t	-0.20 (2.01)	--
$\ln \tau_t$	--	-12.7 (4.5)
$\chi^2(7)$	654.5	780.9
R^2	0.47	0.56
N. of observations	206	194

Legends:

X: exports, M: imports, Y: GDP, Y_{pc} : per capita income, pop : population, τ : tariff rate

Table 4
FDI and trade policy

Dep. Var: $[FDI/Y]_{t,t+4}$

	(1)	(2)
PI_{FDI}	-1.04 (1.80)	-1.58 (2.28)
$\ln \tau$	-1.23 (2.5)	-1.03 (1.95)
Wald test $\chi^2(2)$	20.4	27.5
Hausman test [$\chi^2(4)$]		4.34
Estimation method	FE	RE
$\chi^2(4)$ for regional dummies	--	6.16
R^2	0.35	0.40
N. of observations	61	61
Regional dummies	no	yes

Legends:

FDI: foreign direct investment, Y: GDP, PI_{FDI} : potential for FDI, τ : trade barriers.

FE: fixed effects estimator, RE: random effect estimator

Table 5
FDI, human capital, and trade policy

Dep. Var: $[\text{FDI}/\text{Y}]_{t,t+4}$

	(1)	(2)
K_{FDI}/Y	0.05 (1.94)	0.07 (3.06)
HK	0.94 (2.26)	0.87 (2.2)
PK	0.01 (2.1)	0.01 (1.33)
$\ln(Y_{\text{pc}})$	-1.01 (0.71)	-0.5 (0.4)
τ	0.01 (0.5)	--
$\ln \tau$	--	0.05 (0.1)
F(5,70)	6.13	7.4
Hausman test	9.3 [$\chi^2(4)$]	9.6 [$\chi^2(5)$]
Estimation method	FE	FE
R^2	0.17	0.40
N. of observations	140	130
Regional dummies	No	No

Legends:

K_{FDI} : stock of foreign direct investment, Y: GDP, τ : tariff rate, HK: average years of schooling (human capital), PK: telephone lines per 1000 inhabitants (physical capital), Y_{pc} : per capita income
FE: fixed effects, RE: random effects

Table 6
The determinants of secondary school enrolment

Dep. Var: [SSE]_t

	Full sample	Africa	Asia	Europe	Latin Am.	Middle East
K_{FDI}/Y	0.34 (5.5)	0.22 (1.3)	0.75 (5.3)	0.32 (2.4)	0.3 (2.8)	-0.3 (0.7)
$\ln(Y_{pc})$	17.7 (3.2)	7.9 (1.2)	5.8 (1.0)	42.5 (4.0)	11 (1.7)	11.5 (0.7)
$\ln \tau$	-6.24 (5.4)	-4.9 (1.90)	-4.9 (1.57)	-3.4 (1.0)	-9.5 (5.0)	-1.5 (0.3)
D_{NR}	-3.0 (2.2)	-7.3 (3.1)	-5.3 (2.1)	-7.2 (1.2)	1.7 (0.7)	0.5 (0.1)
F(m,n)	41 (4,286)	5.3 (4,60)	23 (4,62)	10 (4,33)	14 (4,101)	0.7 (4,14)
Hausman test	19 [$\chi^2(4)$]	--	--	--	--	--
Estim. method	FE	FE	FE	FE	FE	FE
R^2	0.51	0.72	0.14	0.29	0.31	0.22
N. of observations	378	91	80	53	127	27
Regional dummies	No	No	No	No	No	No

Legends

SSE: secondary school enrolment, K_{FDI} : stock of foreign direct investment, Y: GDP, τ : tariff rate,

D_{NR} : dummy for natural resource abundant country, Y_{pc} : per capita income

FE: fixed effects, RE: random effects

Table 7
The determinants of tertiary school enrolment

Dep. Var: [TSE]_t

	Full sample	Africa	Asia	Europe	Latin Am.	Middle East
K _{FDI} /Y	0.12 (3.4)	0.12 (3.8)	-0.15 (1.1)	0.44 (5.3)	0.11 (3.1)	-0.7 (1.84)
ln (Y _{pc})	14.6 (8.3)	5.4 (4.5)	23 (4.2)	41 (6.5)	7.1 (2.9)	6.3 (0.5)
ln τ	0.2 (0.3)	-1.4 (3.1)	2.2 (1.1)	1.5 (0.8)	-2.1 (2.8)	-1.4 (0.4)
D _{NR}	-1.6 (2.1)	-1.3 (2.9)	-0.9 (0.5)	2.3 (0.6)	1.1 (1.2)	-12 (3.5)
F(m,n)	29 (4,313)	17 (4,75)	9.1 (4,65)	30 (4,34)	12 (4,109)	4.5 (4,15)
Hausman test	81 [$\chi^2(5)$]	--	--	--	--	--
Estim. Method	FE	FE	FE	FE	FE	FE
R ²	0.38	0.69	0.57	0.15	0.17	0.33
N. of observations	408	106	83	55	136	28
Regional dummies	No	No	No	No	No	No

Legends

TSE: tertiary school enrolment, K_{FDI}: stock of foreign direct investment, Y: GDP, τ: tariff rate, D_{NR}: dummy for natural resource abundant country, Y_{pc}: per capita income

FE: fixed effects, RE: random effects

Table 8
Educational achievements and the brain drain

	Secondary school enrolment	Tertiary school enrolment
K_{FDI}/Y	0.18 (1.26)	-0.06 (0.98)
$\ln(Y_{\text{pc}})$	22.8 (7.1)	8.4 (5.97)
$\ln \tau$	-1.41 (0.4)	-3.73 (2.4)
p^i	-0.06 (0.3)	-0.07 (1.4)
Estimation method	RE	RE
Hausman test [$\chi^2(4)$]	3.56	3.46
R^2	0.52	0.54
Number of observations	47	50

Legends

K_{FDI} : stock of foreign direct investment, Y : GDP, τ : tariff rate, abundant country, Y_{pc} : per capita income, p^i : migration rate for educational group i

FE: fixed effects, RE: random effects

Figure 1
World trade and world FDI (as a percentage of world GDP)



Figure 2
Shares of world non oil exports

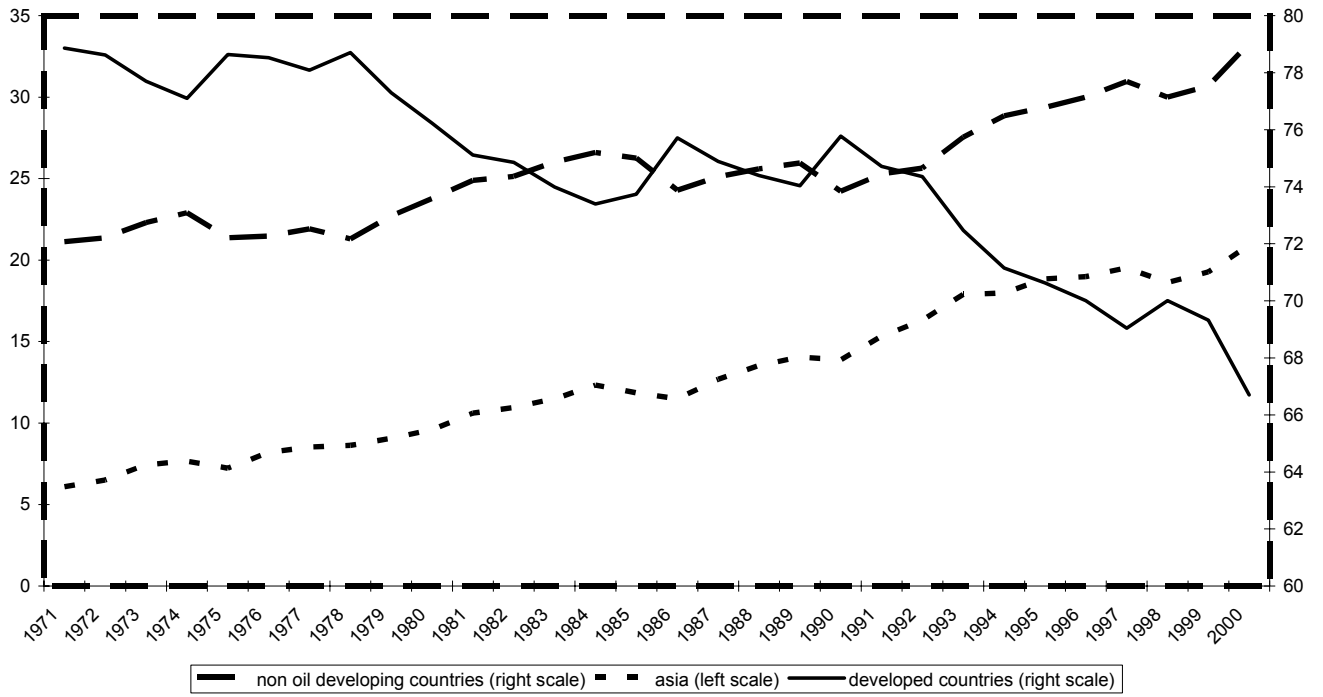


Figure 3
Shares of world FDI



Figure 4
Openness in developing countries

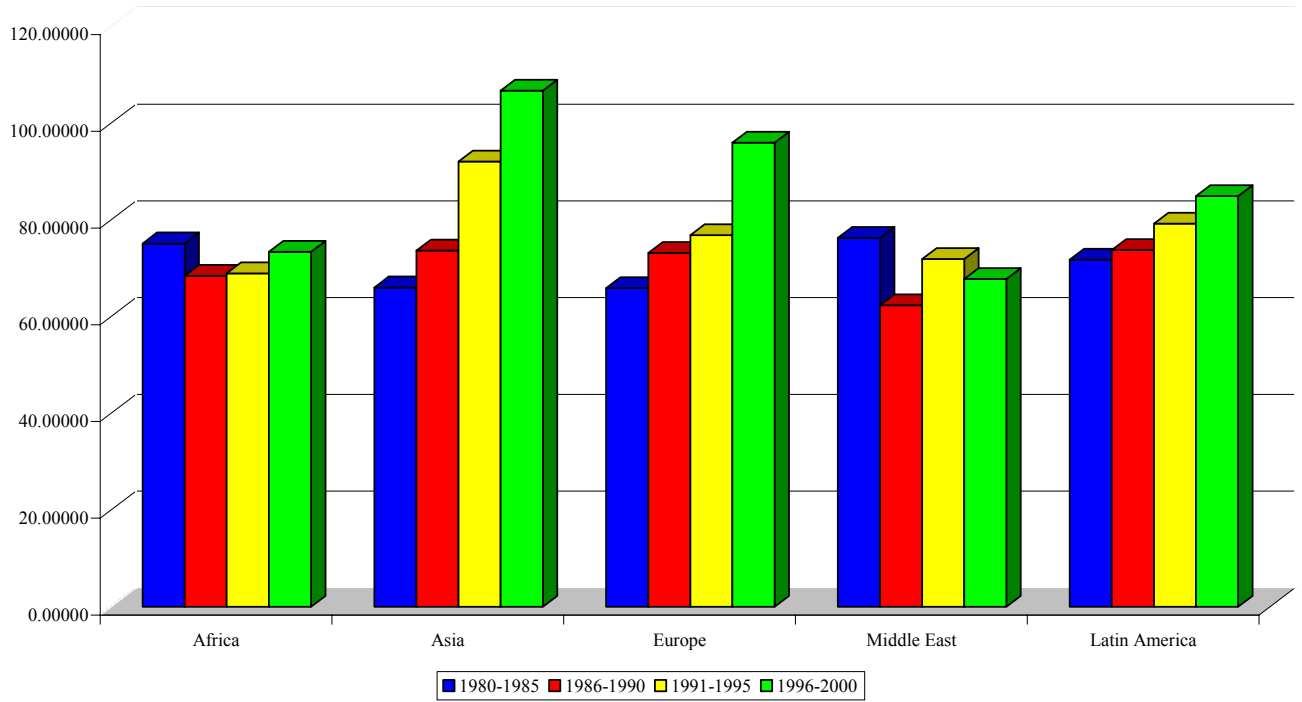


Figure 5
Inward FDI as a percentage of GDP

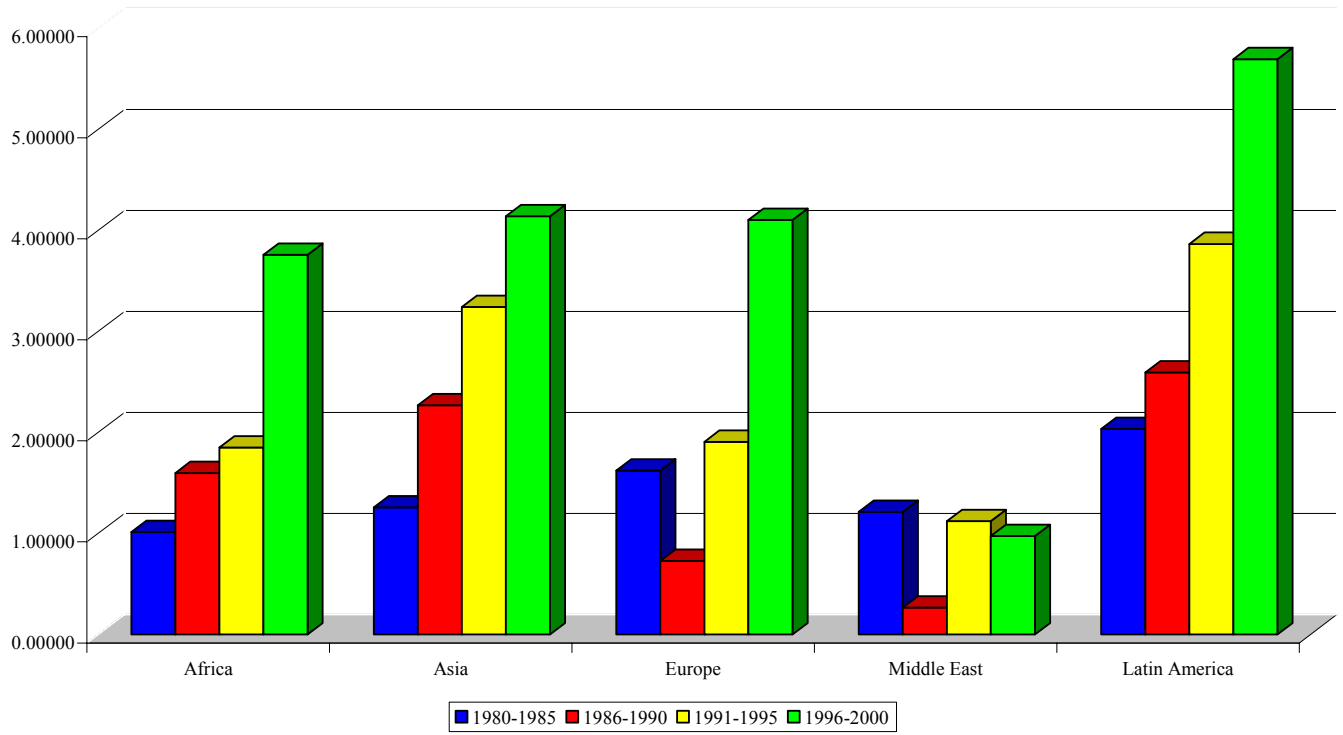


Figure 6
Average tariff rates

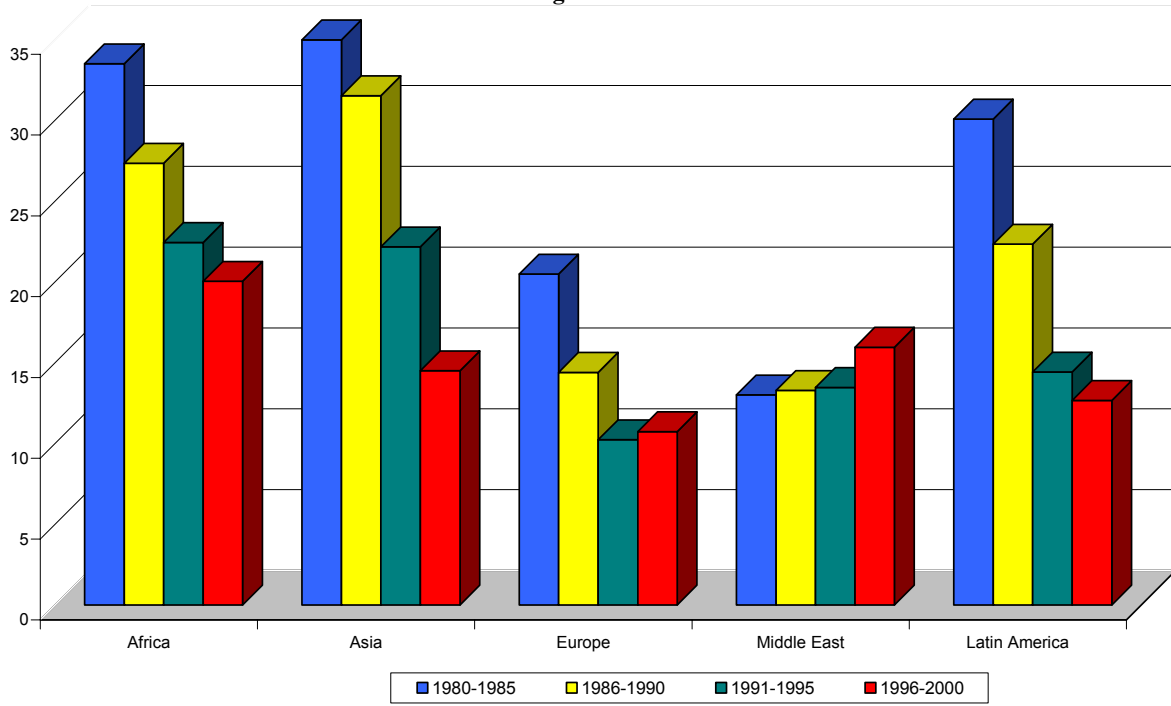


Figure 7
Ad valorem equivalents of non-tariff barriers

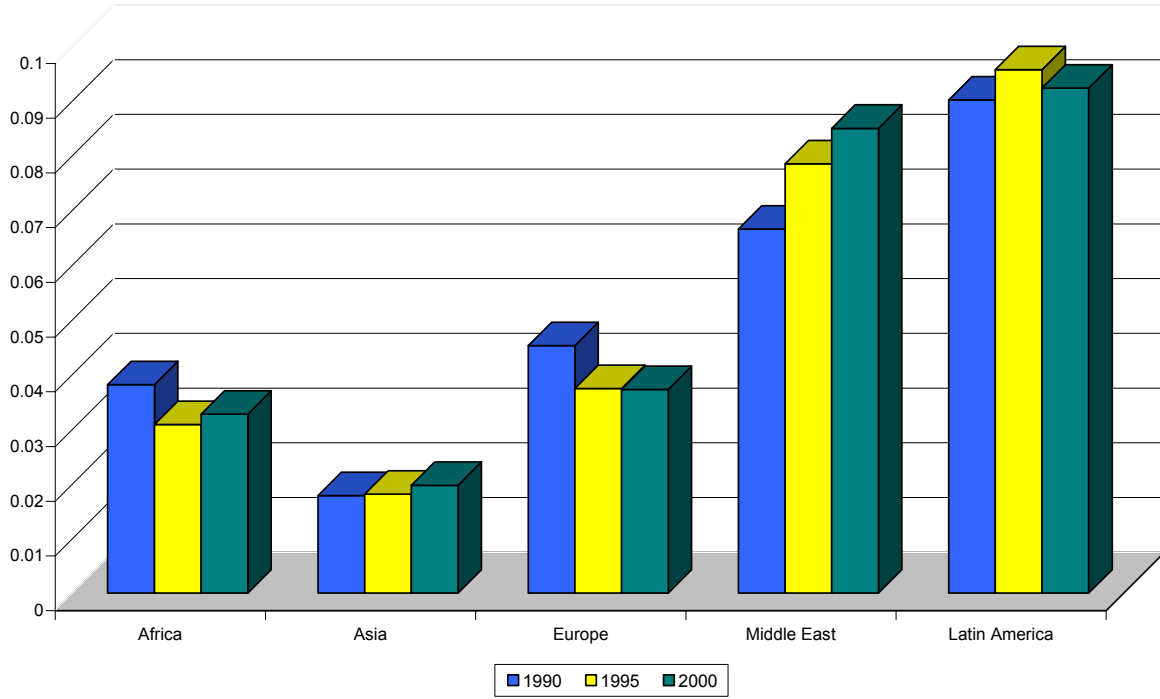
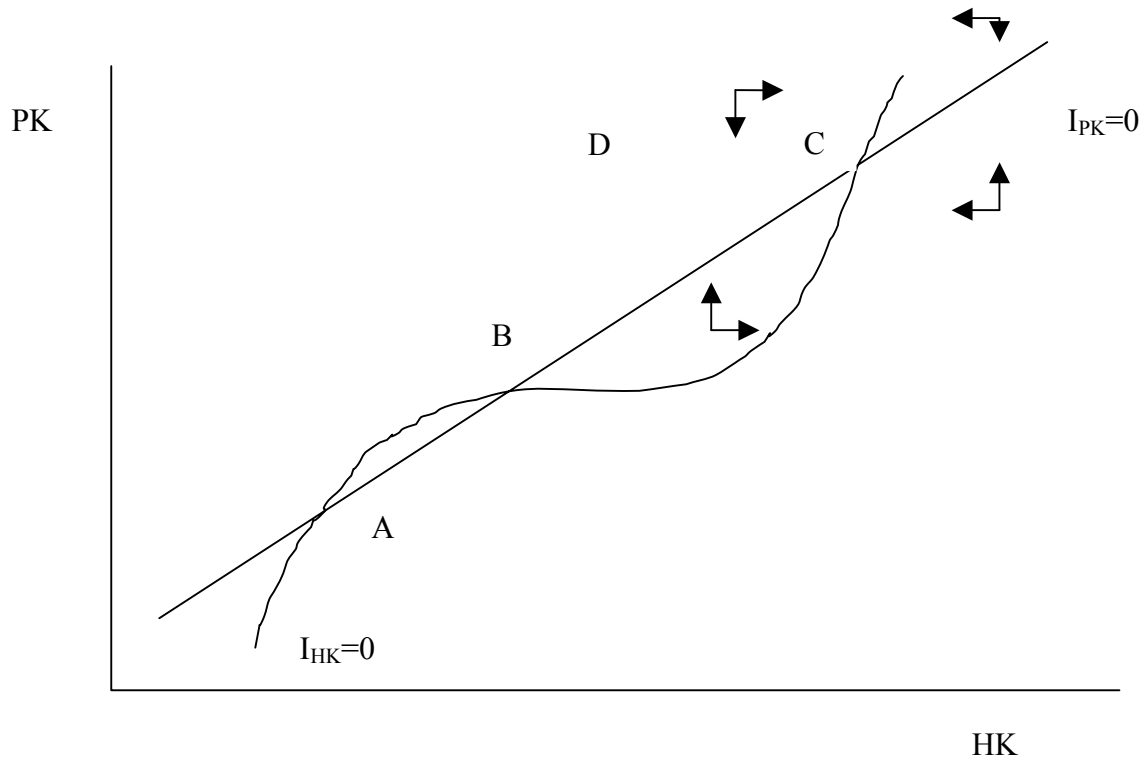


Figure 8

Multiple equilibria with foreign and human capital investment



Appendix

All equations have been first estimated with a random effect estimator. The Hausman test was used to assess whether the unobservable random effects were correlated with the regressors. If so, the equation was re-estimated with a fixed effect estimator

Regional dummies have been added to each equation. Their joint significance was tested. They are not included in the fixed effect estimation.

In all but one equation, the dependent variable is measured by its average value over a five year period (1981-1985, 1986-1990, 1991-1995, 1996-2000). For right hand side variables, we take their value at the beginning of the relevant five year period.

The school enrolment equation relies on annual data from 1983 to 2000.

Data appendix

FDI (flows and stocks): UNCTAD data base

Tariff rates: World Bank

Openness (in constant prices): Heston, Summers, and Aten (2002)

GDP per capita in PPP: Heston, Summers, and Aten (2002)

Population: Heston, Summers, and Aten (2002)

Tertiary and secondary school enrolment: World Bank

Telephone lines: World Bank

Years of schooling: Barro and Lee (2000)