Criss-Crossing Globalization: Uphill Flows of Skill-Intensive Goods and Foreign Direct Investment

Aaditya Mattoo and Arvind Subramanian

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This paper documents an unusual and possibly significant phenomenon: the export of skills, embodied in goods, services or capital from poorer to richer countries. We first present a set of stylized facts. Using a measure which combines the sophistication of a country's exports with the average income level of destination countries, we show that the performance of a number of developing countries,notably China, Mexico and South Africa, matches that of much more advanced countries, such as Japan, Spain and USA. Creating a new combined dataset on FDI (covering greenfield investment as well as mergers and acquisitions) we show that flows of FDI to OECD countries from developing countries like Brazil, India, Malaysia and South Africa as a share of their GDP, are as large as flows from countries like Japan, Korea and the US. Then, taking the work of Hausmann et al. (2007) as a point of departure, we suggest that it is not just the composition of exports but their destination that matters. In both cross-sectional and panel regressions, with a range of controls, we find that a measure of uphill flows of sophisticated goods is significantly associated with better growth performance. These results suggest the need for a deeper analysis of whether development benefits might derive not from deifying comparative advantage but from defying it.

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Introduction

The phenomenon of uphill flows of capital has been subject to great scrutiny in recent years (Bernanke, 2006; Caballero et. al. 2008, and Prasad et. al. 2007 among others). Much of this literature has focused on financial flows (alternatively foreign savings). Indeed in Caballero et. al., (2008), the authors attempt to explain why developing countries export savings while simultaneously importing foreign direct investment (FDI). The assumption has been that the only gravity-defying flow is finance.

But a number of recent high-profile developments raise the possibility of uphill flows in other dimensions. These flows run counter to predictions of standard trade models in which developing countries primarily export unskilled products and are recipients of foreign direct investment (FDI). The developments include the take-over of the U.K.'s Jaguar by a prominent Indian enterprise (TATA); China's Lenovo's acquisition of IBM; Brazil's success in exporting commercial aircraft market to industrial countries; and the growing exports of skilled services from Israel and India to OECD markets.

These developments have in common first the export of skills, embodied in goods, services, or capital (in the form of entrepreneurial and managerial skills associated with FDI); and second that these embodied skills are exported from poorer to richer countries. The first, on its own, while interesting, would not necessarily run counter to the predictions of standard trade models. For example, if China were exporting sophisticated goods to and investing in Africa that would not be inconsistent with their relative endowments. It is the fact that sophisticated goods and FDI are flowing from China to countries which have relatively more skills and capital that is noteworthy from a trade perspective. This paper is a first stab at documenting and understanding this unusual, and possibly significant, phenomenon.

How significant is this phenomenon? Chart 1 plots a measure, which is a combination of the sophistication of a country's exports and the average income level of the destination countries for sophisticated exports, against per capita income for the years 1991 and 2005.[1] Two features are noteworthy. First, there is an upward shift of the curve between the two time periods, suggesting that exogenous factors—perhaps technology—are increasing the propensity of countries, especially at lower levels of income, to export sophisticated goods to rich trading partners. Particular striking is that the performance of a number of developing countries such as South Africa, Mexico, China, Malaysia, and the Philippines in this respect surpasses that of a number of industrial countries in 1991 with much higher per capita incomes. Even more striking, a few developing countries (South Africa, Mexico, China) match even the contemporary performance of Japan, USA, Spain and Portugal.

Chart 2 presents a similar picture for outward flows of foreign direct investment, including both mergers and acquisitions (M&A) and greenfield investments.[2] On the vertical axis are FDI outflows from selected countries to OECD countries as a share of the sending country's GDP (averaged over the period 2003-07). This measure of "uphill"

[1] Uphill exports are defined precisely in Section IV.

[2] Data for M&A and greenfield investments are from different sources described in the Appendix.

FDI flows is plotted against the sending country's per capita income. Flows of FDI to OECD countries from developing countries like Brazil, India, Malaysia and South Africa as a share of their GDP, are as large as flows from countries like Japan, Korea and the US

Taken together, these charts provide evidence of the "precociousness" of some developing countries in exporting skills in a manner associated with countries at much higher levels of development.

This phenomenon, of course, has not gone unnoticed. A number of papers have recently emphasized the growing sophistication of the export and production base of developing countries. For example, Schott (2007) has shown that China's export profile is becoming increasingly similar to that of many OECD countries (see also Hummels and Klenow, 2005; and Schott, 2005). Ramamurti and Singh (2006) have documented FDI flows from developing to industrial countries.

A related literature has focused on the direction of these export flows but in a more normative context. For example, Samuelson (2004) and Krugman (2008) have examined the consequences of increasing US imports of manufactured goods produced in developing countries that compete with domestic US production. There has also been some discussion, in the popular press, of inward flows of FDI from developing countries (for example, the Dubai Port episode), but primarily related to security issues. These are perspectives, on uphill flows, even paranoid ones, from the top of the hill.

Furthermore, the vast literature on the *effects* of global integration, through goods and FDI, has focused primarily on flows to developing countries. For example, Coe et. al, (1997) highlighted the impact of technology diffusion through imports of capital goods on the growth of developing countries and Lumenga-Neso et al. (2004) the impact of direct and indirect imports from industrial countries. There is also a large literature documenting the effects of inward FDI (Borensztein et. al. 1998; Haskell et. al, 2002).

Recently, Hausmann, Hwang, and Rodrik (2007) have looked at the effects of the sophistication of a country's export profile on its own growth (see also Burgess and Venables, 2004). In a similar vein, Feenstra and Kee (2008) examine whether diversity of export production can have productivity-enhancing effects. However, the effects of outward flows of FDI and skilled exports and of the destination of these flows have received less attention.

Why should the destination of trade and FDI flows matter? Javorcik (2006) has shown that selling to foreign-owned firms located in a country has positive upstream productivity effects because of the possibility of induced technological and managerial improvements. In principle, these benefits can also arise from sales to foreign firms located abroad. Recently, de Loecker (2007), working with micro data of Slovenian firms, has demonstrated that productivity gains are higher for firms exporting towards high income regions. Moreover, exports of goods to high income destinations is frequently associated with being part of global production chains that confer important benefits (Hoekman and Javorcik, 2007).

This paper attempts two things. First, we will present some new data on developing country exports of services, goods, and FDI, assessing the extent to which these are going to richer countries. Second, we will undertake a preliminary exploration of the consequences of these uphill flows of embodied skills in term of the impact on growth of the source country. Here, we will follow closely the work of Hausmann et. al. (2007).

II. Data

Our focus in this paper is on the direction of flows of embodied skills. In three different areas—FDI, goods, and services—for which we present some broad data, we need to explain how we define or illustrate the flow of skills.

Our FDI data comes from two sources. The Thomson Financial SDC Platinum database provides data on FDI taking the form of mergers and acquisitions. The Financial Times' FDI Intelligence database provides similar data on Greenfield investments. These databases are described in detail in the appendix.

Our goods trade data comes from the WITS database of the United Nations. We collected data at the 5-digit level (largely because finer data say at the 6-digit level really become available only in the late 1980s and we were interested in checking whether the phenomenon of uphill flows was a feature of historical data). For computational reasons, we collected data for every 5-year interval and restricted the sample to countries that together accounted for about 90 percent of world trade.

We draw upon Hausmann et al. (2007) to characterize skill-intensive products. They calculate a measure called PRODY, which is a weighted sum of the per capita GDP of countries exporting a given product, and thus represents the income level associated with each of these goods. In this paper, we define—admittedly arbitrarily—skilled products that are either above the median level or in the top 25th percentile of PRODY for all products defined at the 5-digit level of aggregation for the year 1990.

Our services data comes from the IMF's Balance-of-Payments statistics and the U.S.' Bureau of Economic Analysis.

III. Stylized Facts on "Uphillness"

We first present some basic facts about the flows of embodied skills.

Foreign Direct Investment

In chart 3A, we plot the share of non-OECD countries in world FDI exports for the period 2003-2007 for which data are available. This share goes up from about 20 percent to 25 percent over the period under consideration.

While these charts show how developing countries are becoming increasing exporters of FDI, they do not give an indication of the direction of these flows. Chart 3B isolates the direction of flow of these skills. It calculates the share of non-OECD countries in FDI exports to OECD countries, and as such is a measure of uphill flows at the global level.

This share has been steadily rising from about 9 percent in 2003 to close to 15 percent in 2007, suggesting that uphill FDI flows have in fact been rising.

Exports of goods

We find a similar pattern for exports of sophisticated goods. The average income level of world exports of sophisticated products declined by a similar percent (about 10%) but over a slightly longer period (Chart 4A). Unlike in the case of FDI, China is a big contributor to this decline in the income of the source country for world exports of sophisticated products. Excluding China reduces the decline by nearly 5 percent (Chart 4B).

In Chart 4C, we calculate the uphill flows of sophisticated products from non-OECD countries. For each country, uphill flows are exports of sophisticated goods to countries richer than itself. These are added for all non-OECD countries and expressed as a share of total sophisticated exports to OECD countries. This share was about 1% in 1980 (0.2 percent for highly sophisticated products (HSPs))[3] and increased to 10 percent in 2006 (3 percent for HSPs).[4] The individual country charts show that uphill flows were very pronounced for China, Malaysia, and Mexico but much less so for India and Brazil (Chart 4D).

Services

In services, we focus on exports of services other than transport and travel, i.e. the category "other commercial" (in the US "other private") services, which cover most skill-intensive business services. Again we find a decline, albeit slow, in the average income level of services exporters (Chart 5A). This trend suggests that developing countries are becoming increasingly important exporters of skilled services.

Unfortunately, bilateral data on services trade is available only for the OECD countries, so it is not possible to construct measures of uphill flows analogous to those for goods and FDI.[5] However, bilateral data available for the United States shows that for some developing countries (e.g. India and Malaysia) services exports as a share of GDP are flowing uphill (Chart 5B)

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[3] There are two definitions of sophisticated products. The first covers exports that lie above the median value of PRODY (defined in the text) calculated for 1990. The second covers exports that lie in the top 25th percentile of PRODY values. For each definition, we compute the weighted average of per capita GDP of the exporting countries, with the weights being the share of each country in the total exports of sophisticated products.

[4] Of course, this development could simply reflect the fact that richer countries, which are more likely to demand sophisticated goods, have grown faster than poorer countries. But, during this period, the non-OECD countries in our sample grew substantially faster than the OECD countries.

[5] It is, in principle, possible to combine OECD data and IMF balance of payments statistics to obtain an estimate of the share of skilled services exports of developing countries directed to OECD countries. However, significant inconsistencies in the data between these two sources prevent meaningful comparisons.

Country heterogeneity

Although the phenomenon of uphill flows appears to characterize several developing countries, there is heterogeneity across them. It is not the case, for example, that countries that see uphill flows of sophisticated exports also see uphill flows of FDI. For example, in Chart 6A, for 21 important emerging market countries for which we have data, we plot the uphill FDI flows against uphill sophisticated exports. There seems to be little correlation between the two. Indeed, there appear to be four distinct categories: countries such as Israel and Malaysia do well on both counts; Brazil and India have significant uphill flows of FDI but relatively small uphill exports of sophisticated goods; China and some East Asian (Taiwan and Thailand) and east European (Hungary) countries, on the other hand, are exactly the opposite of Brazil and India, with large uphill export flows but limited FDI flows. Finally, there is a group of countries like Chile, Romania, and Poland that score low on both counts.

Notwithstanding the above, it might be possible that success in exporting sophisticated goods will be associated with the greater likelihood of investing in manufacturing. But this also does not turn out to be the case (The best examples are India and Brazil, which are not big uphill exporters of goods but score well on FDI in manufacturing, Chart 6B.).

"Preston Curves"

How recent is this phenomenon of uphill flows? We cannot carry out meaningful historical comparisons for FDI because data do not allow us to go sufficiently far back but we can attempt to answer this question for exports of sophisticated goods.

To do this, we plot "Preston curves" that relate uphill flows to the level of per capita GDP of a country for three points in time (1986, 1996 and 2005) that are sufficiently apart to allow changes to express themselves. These are shown in Charts 7A and 7B. The noteworthy point that emerges is that the relationship shifts markedly upward in the most recent period for which we have data.[6] The shift implies that over time, uphill flows are becoming more common across the income spectrum. We also find that the fit of the relationship between uphill flows and income tightens over time, suggesting that higher income countries are likely to see more uphill flows.

IV. Consequences of Uphillness

One obvious question is whether uphill flows matter for say economic growth? Hausmann et. al. (2007) have argued that the structure of exports matters for growth. In particular they show that countries that produce more sophisticated goods (defined as those produced by richer countries) are more likely to grow faster. But the focus of this paper is not so much the sophistication of exports but whether a country's export pattern defies comparative advantage. In this light, and as argued earlier, a poor country exporting relatively sophisticated goods to countries poorer than itself would not be

[6] This is true when we estimate the relationship: (i) without keeping the sample common across time periods; (ii) after controlling for area, population and remoteness of a country from the world's center of gravity; and (iii) using alternative measures of uphill-ness of flows. Also, when we estimated the Preston relationships in a formal panel context, we found that the coefficient on the 2005 dummy to be positive and statistically significant.

surprising or at odds with the predictions of the standard trade models. Therefore, we are interested not only in the sophistication of exports but also their destination.

To pursue this question of whether comparative advantage-defying (alternatively, "uphill") exports have growth consequences, we adopt the basic cross-national regression methodology deployed by Hausmann et. al. (2007). Our results for the pure cross-section are in Tables 1A and 1B while the panel regressions are contained in Tables 2A and 2B. .

Before we proceed, we need to explain our measure of such uphill exports. We calculate two measures of uphill exports. In the first, we combine the Hausmann et. al's indicator of sophistication (EXPY) with a measure of the average income level of the destination countries receiving such sophisticated exports; to be more specific, we add the log of the EXPY measure and the log of the average income level of destination countries, and call this UPHILL1. This is the measure used in Tables 1A and 2A.[7]

One particular issue with the HHR approach and our adaptation of it is that the measures of sophistication and uphillness are not scaled. For example, the EXPY measure of HHR captures the sophistication of an economy's export basket without taking account of how important (relative to the size of an economy) are the exports of these products. There is both a benefit and limitation in their measure being scale-free—the benefit is econometric in that there is less endogeneity bias; the downside is that the economic intuition is less clear. Our uphill measure too is scale free, capturing the importance of uphill flows in the export basket but not their economy-wide importance.

So we calculate a second measure, which is the share of exports of sophisticated products flowing uphill as a share of GDP. We calculate uphillness by simply adding the exports that a country sends to trading partners richer than itself. This is called UPHILL2 and is used in Tables 1B and 2B.

In column 1 of Table 1A, we present the basic result with controls for human capital, physical capital and institutions. Our measure of uphill flows is positively signed and statistically significant at the 1 percent confidence level. We find that China and Ireland

[7] As a referee pointed out, in principle, it may not be necessary to make such a drastic distinction between sophisticated and unsophisticated goods. We could arrange goods along a continuum from less to more sophisticated, on the basis of their PRODY values. A continuous measure of uphill exports of sophisticated goods could then be given by a weighted average of the product of the PRODY value of an export and the income level of the destination country, where the weight is the share of the export of the product to the particular destination as a share of total exports (i.e. sum of exports all products to all destinations). In notational form, such a measure would be $\sum_i \sum_j \frac{x_{ij}}{\sum_i \sum_j x_{ij}} P_i Y_j$ where *Pi* is the PRODY value of product i and Yj is the per capita income level of the destination country j. This measure is analogous to an interaction between EXPY and the average income level of all exports. This measure turns out to be highly correlated (0.93) with EXPY because there is relatively little variation in the average income level of all exports. We therefore use our uphill measure, which has a binary definition of sophistication, and is less correlated with EXPY.

are clear outliers, so in column 2 we drop them and find that our results remain unchanged. The coefficient suggests that a one percent increase in uphill flows could increase growth by about 1.1 percent a year (the partial scatterplot of this regression is shown in Chart. In column 3, we use the alternative measure of sophistication (based on a 25th percentile cut-off of products). In column 4, we use our uphill flow measure for 1995 instead of 1990. In column 5, we disaggregate our uphill measure into the sophistication component and the destination component and find that each is significant with the same magnitude (the equality of the two coefficients cannot be rejected).[8] In column 6, we subtract the destination income of countries receiving unsophisticated products from the destination income of countries receiving sophisticated products. This is a kind of validation check. In all cases, the coefficient on UPHILL1 remains significant, suggesting some strong association. In column 7, to address the potential endogeneity of our uphill measure, we instrument for it with the log of population and log of area (as in Hausman et al. 2007). The first stage suggests that the instruments are reasonably but not exceptionally strong. In the second stage the uphill measure has about the same magnitude and remains significant, albeit at the 10 percent confidence level.

Of course, there are a number of issues with our estimation method: some of our RHS variables are prone to endogeneity bias (despite our using the initial rather than contemporaneous values), we may be omitting other variables, and our variables could be mis-measured. Our results should therefore be interpreted at this stage as being conditional associations rather than as being fully identified.

In table 1B, we use the UPHILL2 measure (recognizing that this may well add another layer of endogeneity bias). We introduce these in the cross-country regressions instead of their scale-free counterparts that we used earlier (we can either add the total share of sophisticated exports to GDP and the uphill share of that as two variables or simply the uphill and downhill shares of sophisticated exports. We do the latter. We find that the coefficient on the share of uphill products to GDP is significant (column 1, Table 1B) and remains so after excluding Ireland and China (column 2). In column 3, we also control for the share of total unsophisticated exports in GDP and find that this variable is not significant and does not affect our uphill flow measure.[9]

Given the limitations of the above analysis, we turn to panel estimations in Tables 2A and 2B.[10] In Table 2A, we use the scale-free measures and in Table 2B, we use the measures scaled by GDP. Instead of going through all the columns, we highlight the key findings. When we use the scale-free measures (i.e. UPHILL1), we find that uphill flows are significant except when we add country fixed effects (column 5). But IV estimations (in this case with population and remoteness of a country from the world's center of gravity as instruments) yielded very strong first stage results, with correspondingly strong and statistically significant coefficients for uphill flows in the second-stage (columns 6 and

[8] The equality of these components provides additional econometric justification for combining them as we have done in UPHILL1.
[9] Population and area which were decent instruments for our UPHILL1 measure were poor instruments for the UPHILL2 measure, precluding the possibility of IV estimations.
[10] In the panel, we retained Ireland and China because they made no difference to the results.

7). When we use the UPHILL2 measure (which is scaled by GDP), we find that uphill flows are statistically significant (columns 2, 3, and 5) even after adding country and time effects.

One issue we attempted to explore in more detail was the PRODY measure. One could also try to get a measure of "sophistication" of products by, for example, using the level of education, or R and D, in the exporting country rather than the per capita income. For each product, we constructed a weighted average of the exporting countries' secondary school enrollment ratio or the exporting countries' spending on R&D as a share of GDP. When we did this, we found very similar results to using PRODY (results available from the authors upon request). For example, in Table 1, when we replaced the uphill measures based on PRODY with those based on education and R&D, the coefficient on the uphill measure was correctly signed and significant. The reason, of course, is that the income-based and the education and R&D-based measures are highly correlated, and the differences are not large enough to conclude that it is education, not per capita GDP, which is the more accurate measure of sophistication.

V. Discussion and Limitations of our Analysis

This paper is a first attempt at documenting a possibly new phenomenon, which we call uphill flows of skills. We presented a set of stylized facts relating to uphill flows of goods, services and FDI, and preliminary estimates of the consequences of these flows. We have not examined the determinants of these flows nor elaborated on the possible channels through which these flows could have growth consequences. Below we offer some suggestions in regard to these two issues.

Explaining uphill flows

Uphill flows raise some interesting theoretical questions. First, and most obviously, they seem to defy the prediction of the pure Hecksher-Ohlin model where trade is determined by relative factor endowments. Second, while such flows could be seen as a manifestation of intra-industry trade, driven by economies of scale and imperfect competition, this type of trade has typically been predicted between countries at similar levels of development (Helpman and Krugman, 1985).

Two possible explanations for uphill flows suggest themselves: one domestic and one international. Within developing countries, for example, there could be atypical patterns of development due to historical factors and policy actions. Two good examples are India and South Africa, which have both exhibited skill-intensive patterns of development (see Amin and Mattoo, 2006; and Kochhar et. al., 2006). In the Indian case, this has been due to the favoring of higher education at the expense of basic education, while in South Africa, apartheid and labor-market policies have played a role. Recent research shows that some of these larger developing countries are investing proportionately more in technical education than both poorer and richer countries (Sequeira, 2003). If such policies are then overlaid on regional disparities, then it is possible for pockets to emerge within developing countries that are sufficiently endowed with skill or are sufficiently developed to explain the observed patterns of "criss-crossing globalization." In other words, the inconsistency of uphill flows with theory may be more apparent than real if we

were to think of countries like China and India not as single units but as heterogeneous economic units (or regions) with widely differing relative factor endowments (Subramanian, 2007).

It is also possible for the relevant heterogeneity to emerge at the level of firms. For example, Melitz (2003)) allow for firm level heterogeneity in productivity and fixed costs of exporting and show that only the most productive firms export. Helpman et. al. (2004) show in turn that of those firms that serve foreign markets, only the most productive engage in FDI. It is conceivable that some firms even in developing countries are so productive that they can incur the fixed costs of exporting and investing abroad. Furthermore, if the fixed costs of penetrating foreign markets vary across destinations, say by per capita income of the destination country, then it is possible for productivity differences across developing country firms to result in the phenomenon we document of "uphill" flows.

External policies could be another cause of uphill flows. One factor may have been international patterns of protection, in particular rich country barriers against imports of less skill intensive products and developing country barriers against imports of more skill intensive products. Thus, the larger developing countries may have been inhibited from exploiting their natural comparative advantage, i.e. exporting less-skill intensive products to richer countries and more skill-intensive products to poorer countries. Put differently, if there is learning by doing, it is possible that increases in uphill sophisticated exports have been possible because protection allowed domestic producers to catch up with foreign producers in terms of competitiveness.

Uphill flows and growth

Standard theories of trade—Hecksher-Ohlin, intra-industry, and even the new heterogenous firm-based models—primarily see the gains from trade in static welfare rather than dynamic growth (Bernard et. al., 2007). Our results are more in the spirit of the endogenous growth theories which see trade as affecting the incentives and opportunities for dynamic benefits such as technology acquisition and learning-by-doing. While a large part of the benefits of trade has traditionally been seen as access to imports and inward FDI, there is a growing recognition that exporting and outward FDI may also confer important benefits.

We have not examined in any detail the channels through which uphill exports of sophisticated goods and services affect overall economic performance. One possibility is that our measure of destination may actually capture a finer degree of product differentiation, in horizontal or vertical terms. For example, Schott (2005) established that even when developing exports fall within the same product categories as rich country exports, they tend to have lower unit values and may be located lower on quality ladders. In other words, what we identify as uphill flows may just be an alternative or complementary measure for product quality/sophistication. Our findings could then be seen as adding to the evidence on such quality mattering for economic performance (Hausman et al. 2007).

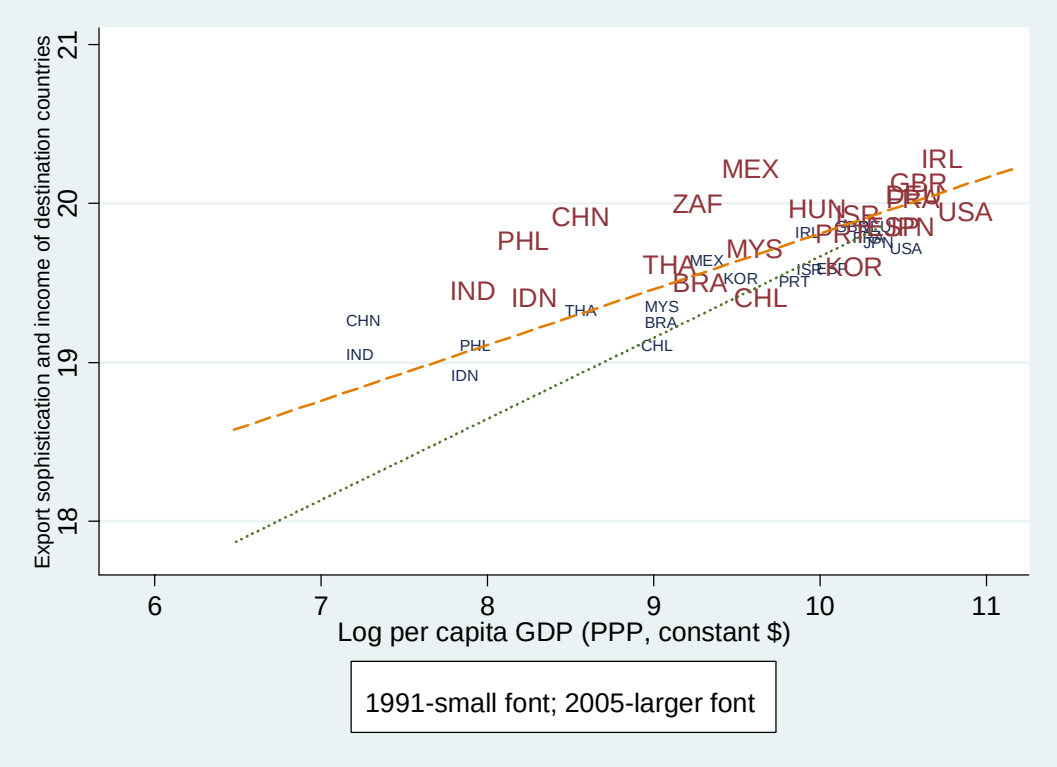
Another possibility is that final exports of sophisticated goods by a country may reflect merely its comparative advantage in the final "assembly" stage rather than a deeper sophistication in its production processes. For example, a significant proportion of China's uphill exports of sophisticated goods contain imports of sophisticated components from rich countries. On the one hand, this could indicate that we are mismeasuring sophistication. On the other hand, our measure could capture the extent of a country's participation in modern global production chains which confer benefits in terms of knowledge of markets, just-in-time capability, improved production technology etc. Thus, what we capture—imperfect though it undoubtedly is—may provide clues about an additional channel through which the impact of global integration is felt. As noted in the introduction, there is now increasing evidence supporting these channels. (Javorcik (2006)).

In principle, these benefits can also arise from sales to foreign firms located abroad. Recently, de Loecker (2007), working with micro data of Slovenian firms, has demonstrated that productivity gains are higher for firms exporting towards high income regions. Moreover, exports of goods to high income destinations is frequently associated with being part of global production chains that confer important benefits (Hoekman and Javorcik, 2007.)

Further, uphill flows could affect growth through induced changes in economy-wide skill acquisition and hence in long run endowments, creating a self-reinforcing and virtuous cycle. Again a relevant example is India. Educational attainment in India, especially at the primary and secondary levels, was disappointing until the early 1990s. In the last fifteen years, though, educational indicators have improved markedly. While greater government attention has been important, a key change has been the increased the demand for education due to the higher returns to human capital which in turn is a consequence of increased skill-intensive and uphill specialization (the derived demand for skills and hence education is arguably a function not just of what is sold but also to whom it is sold). This demand has elicited a supply response, largely from the private sector leading to a more rapid spread of education and skills (Kremer et. al. 2005).

Finally, if there are benefits from uphill flows, in some circumstances, significant development benefits might derive not from deifying comparative advantage but from defying it.

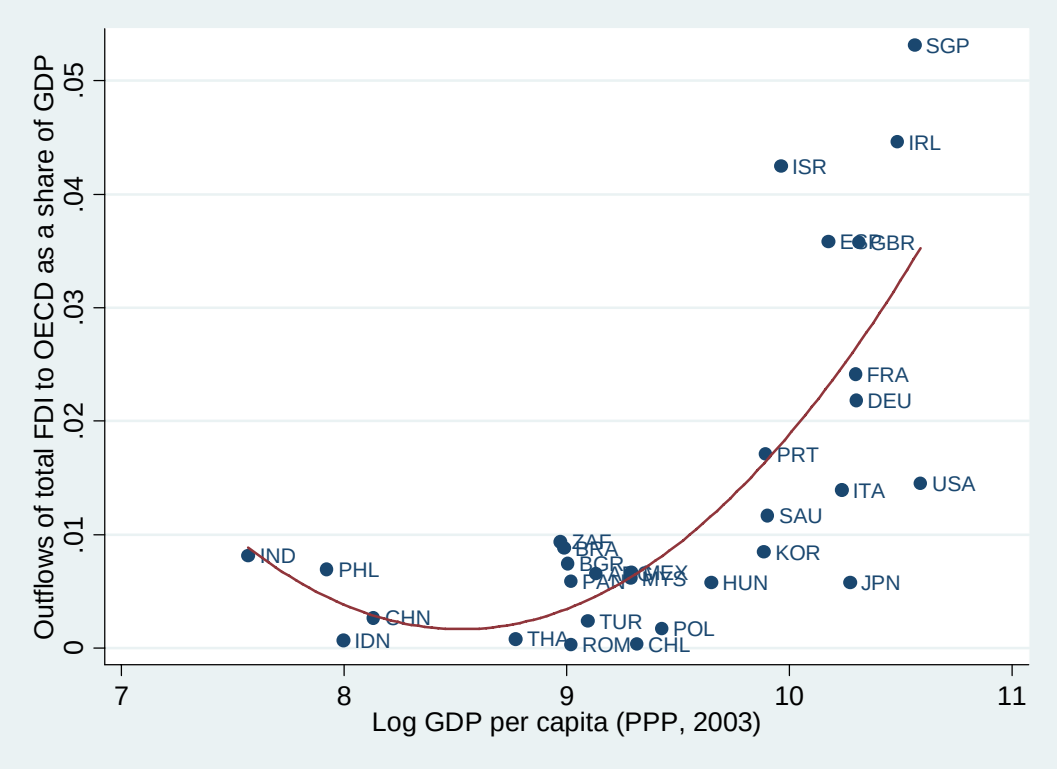
Chart 1: Defying Comparative Advantage (Exports), 1991 and 2005



Source: UN COMTRADE

This chart plots a measure that combines the sophistication of a country's exports with the average income level of the destination countries of these exports (described in greater detail in the text). The dotted (dashed) line is the fit of the relationship between this measure and per capita GDP in 1991 (2005). The fit is based on a larger sample of countries than shown by the country symbols in the text. The smaller (larger) font relates to observations for 1991 (2005).

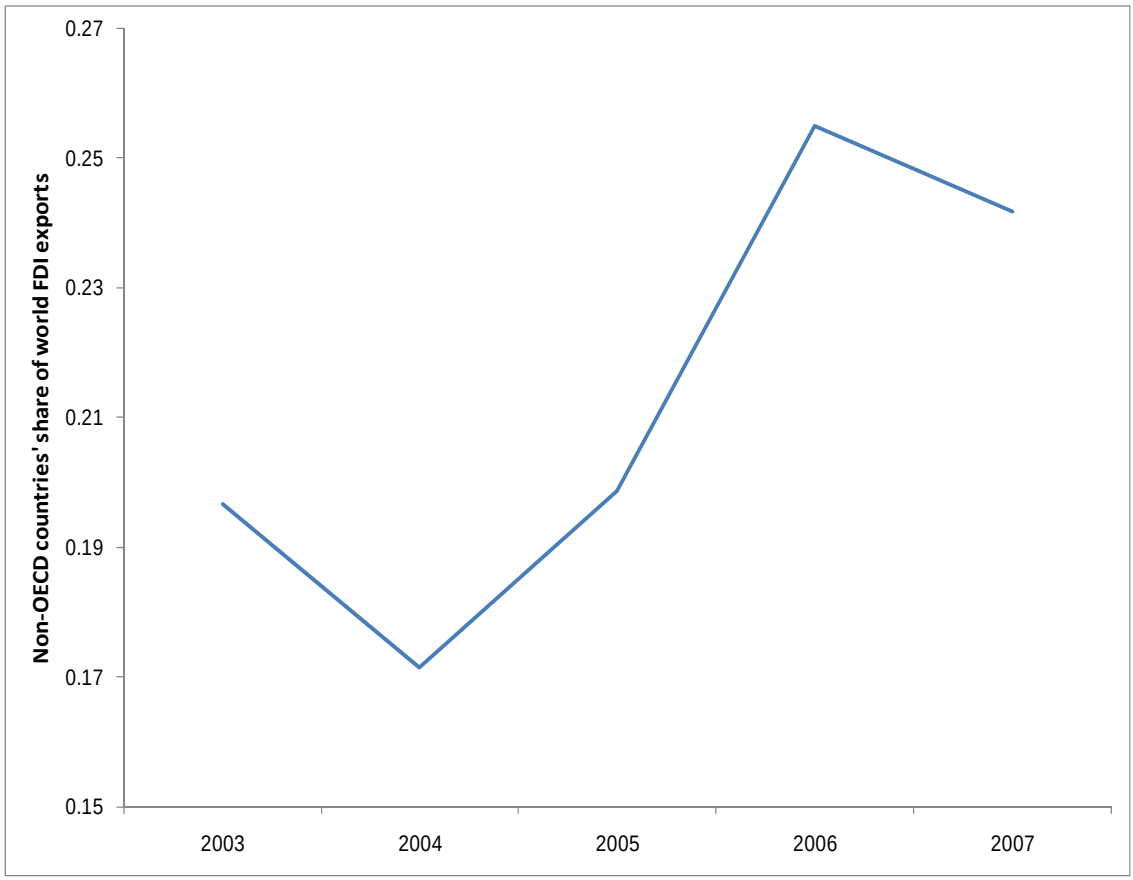
Chart 2: Defying Comparative Advantage (FDI) (2003-2007)



Sources: Thomson Financial SDC Platinum database and Financial Times' FDI Intelligence database.

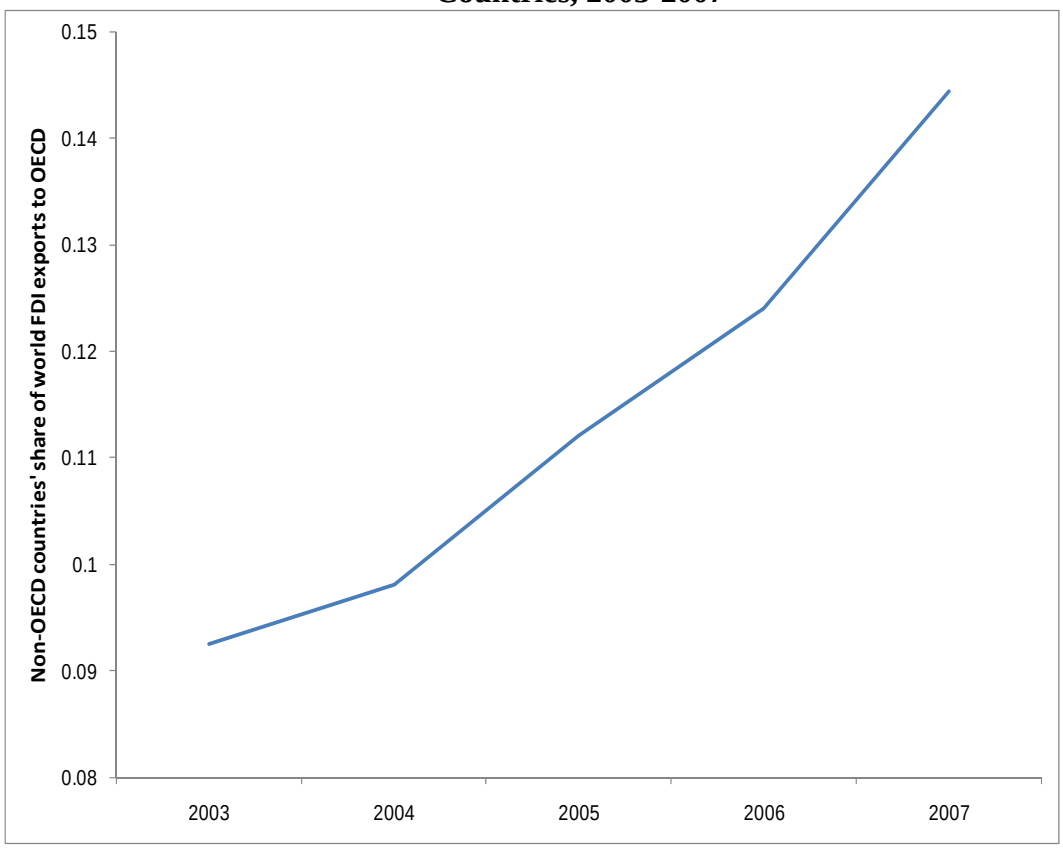
This chart plots FDI outflows from a country to OECD countries as a share of its GDP (averaged over the period 2003-2007) against its per capita income. The sample comprises selected industrial and emerging market countries.

Chart 3A: Share of Non-OECD Countries in World FDI Exports, 2003-2007



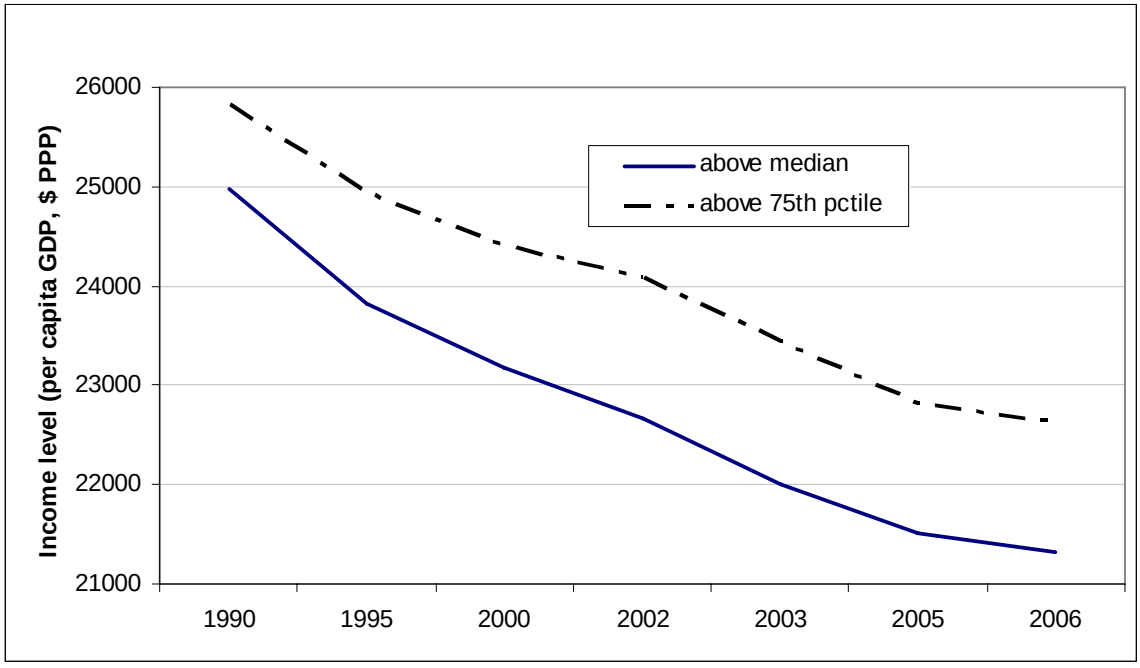
Sources: Thomson Financial SDC Platinum database and Financial Times' FDI Intelligence database.

Chart 3B: Share of Non-OECD Countries in World FDI Exports to OECD Countries, 2003-2007



Sources: Thomson Financial SDC Platinum database and Financial Times' FDI Intelligence database.

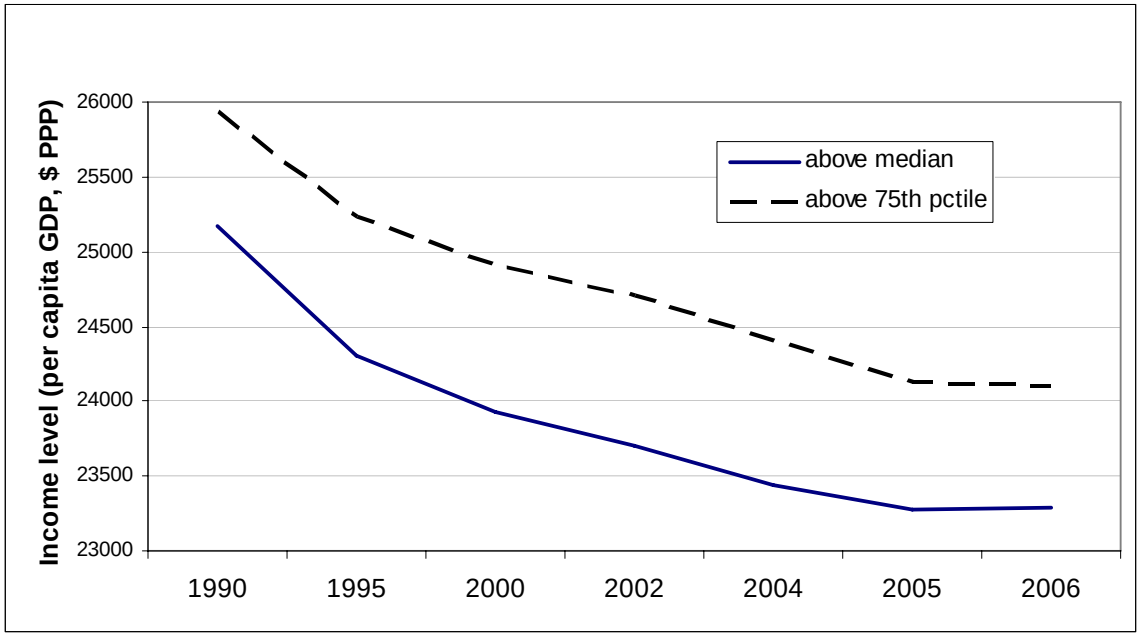
Chart 4A: Average income level of world exports of sophisticated products, 1990-2006



Source: UN COMTRADE.

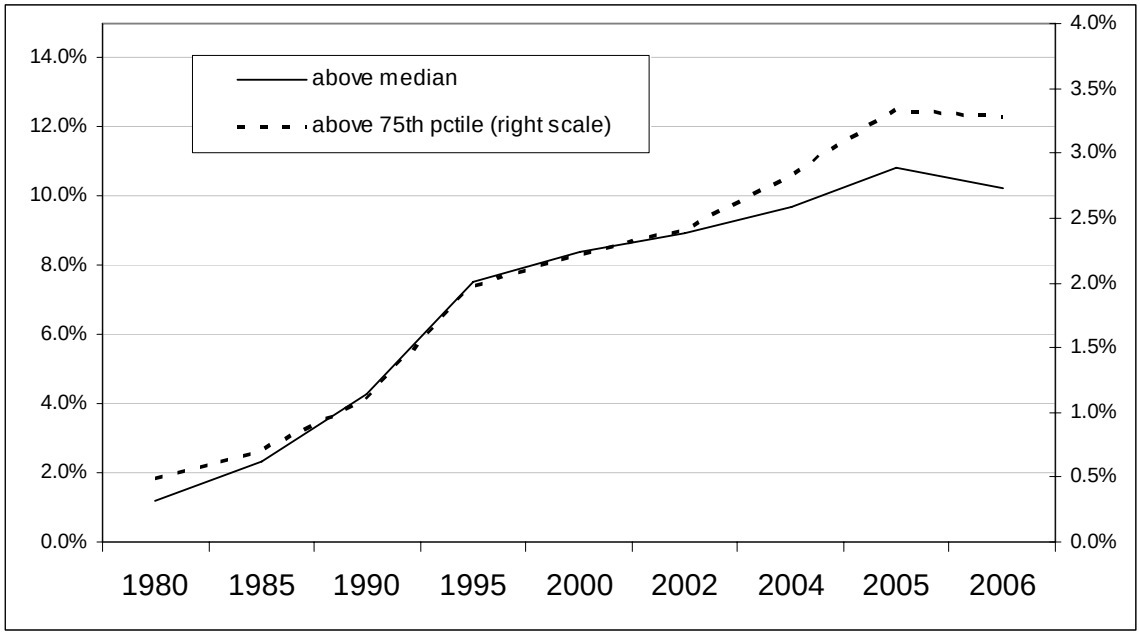
There are two definitions of sophisticated products. The first covers exports that lie above the median value of PRODY (defined in the text) calculated for 1990. The second covers exports that lie in the top 25th percentile of PRODY values. For each definition, we compute the weighted average of per capita GDP of the exporting countries, with the weights being the share of each country in the total exports of sophisticated products.

Chart 4B: Average income level of world exports of sophisticated products, 1990-2006 (excluding China)



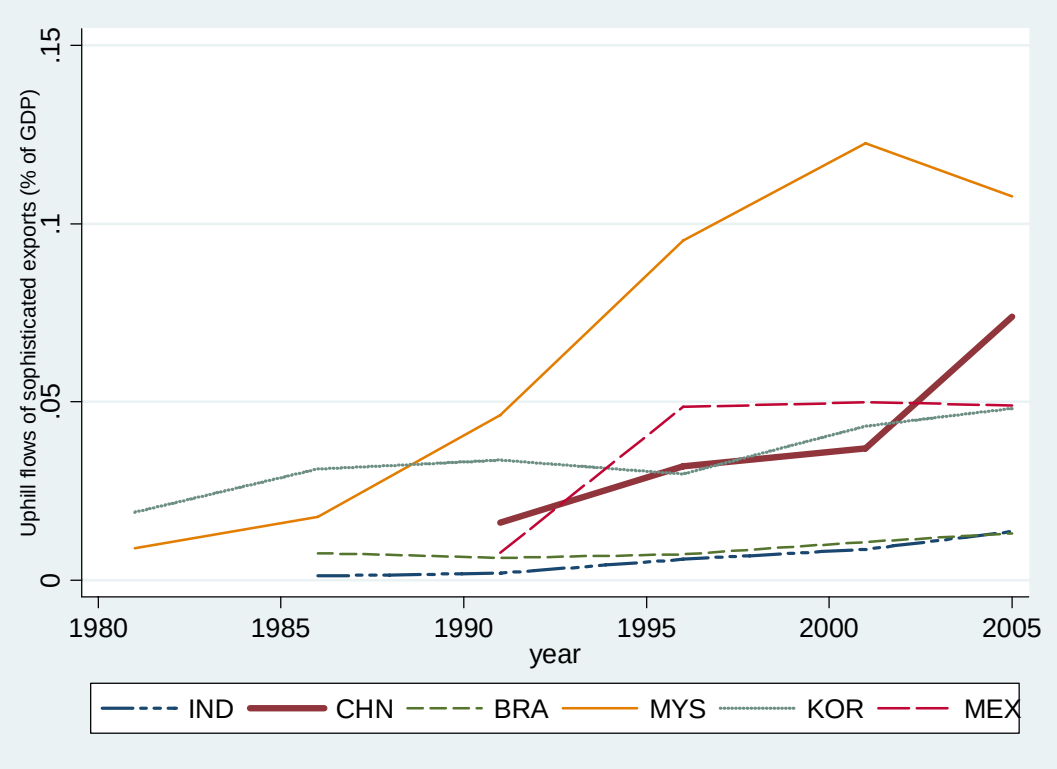
See note to Chart 4A above.

Chart 4C: Uphill flows of sophisticated exports from non-OECD Countries, 1990-2006



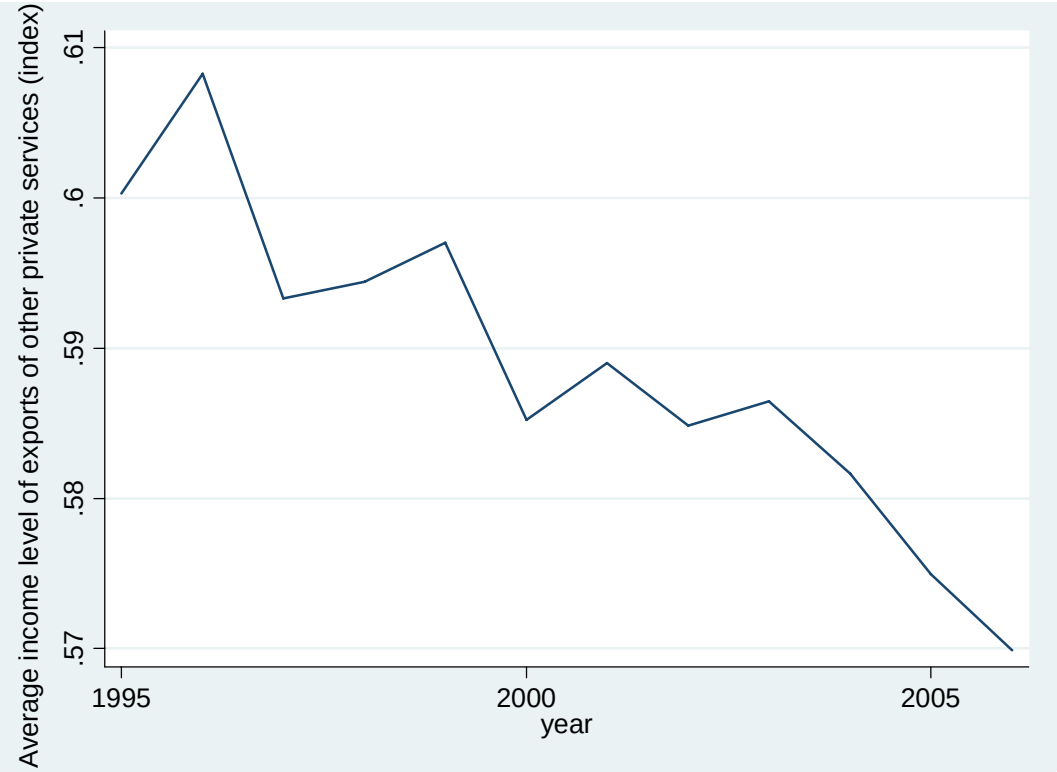
For each country, the measure of uphill flows is exports of sophisticated goods to countries richer than itself as a share of its total sophisticated exports. These are added for all non-OECD countries.

Chart 4D: Uphill flows of sophisticated exports as a share of source country GDP, 1980-2005



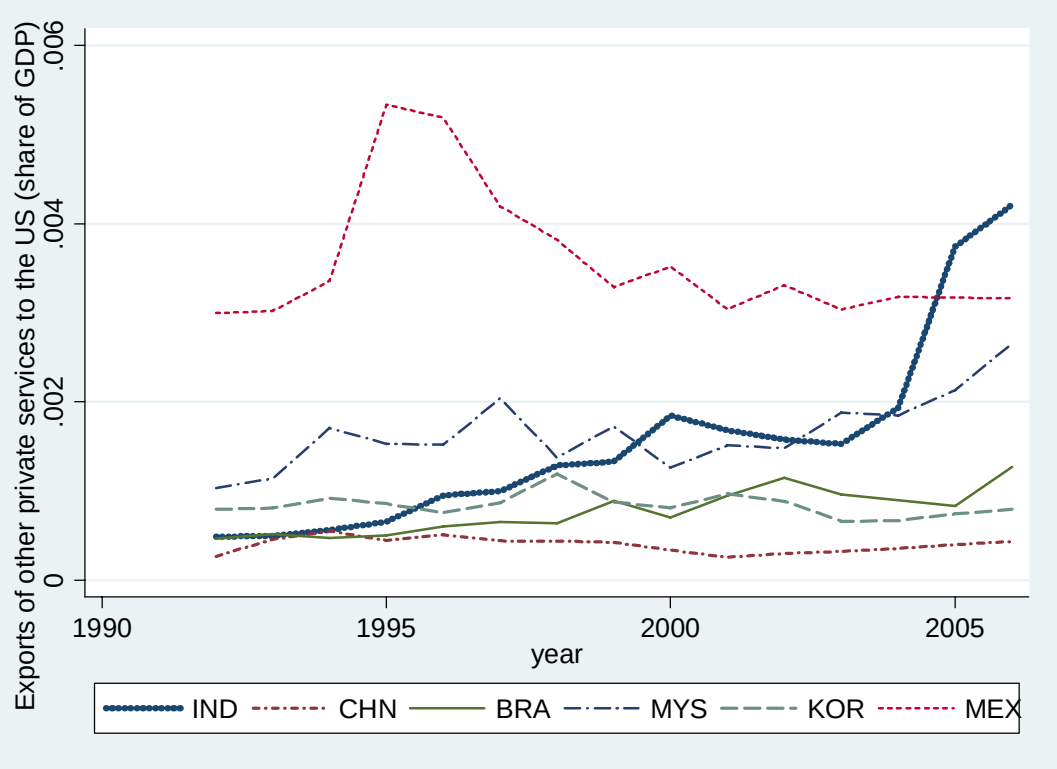
The measure of uphill flows is the value of exports of sophisticated products as a share of a country's GDP (all measured in current dollars).

Chart 5A: Average income level of world exports of other private services, 1995-2006



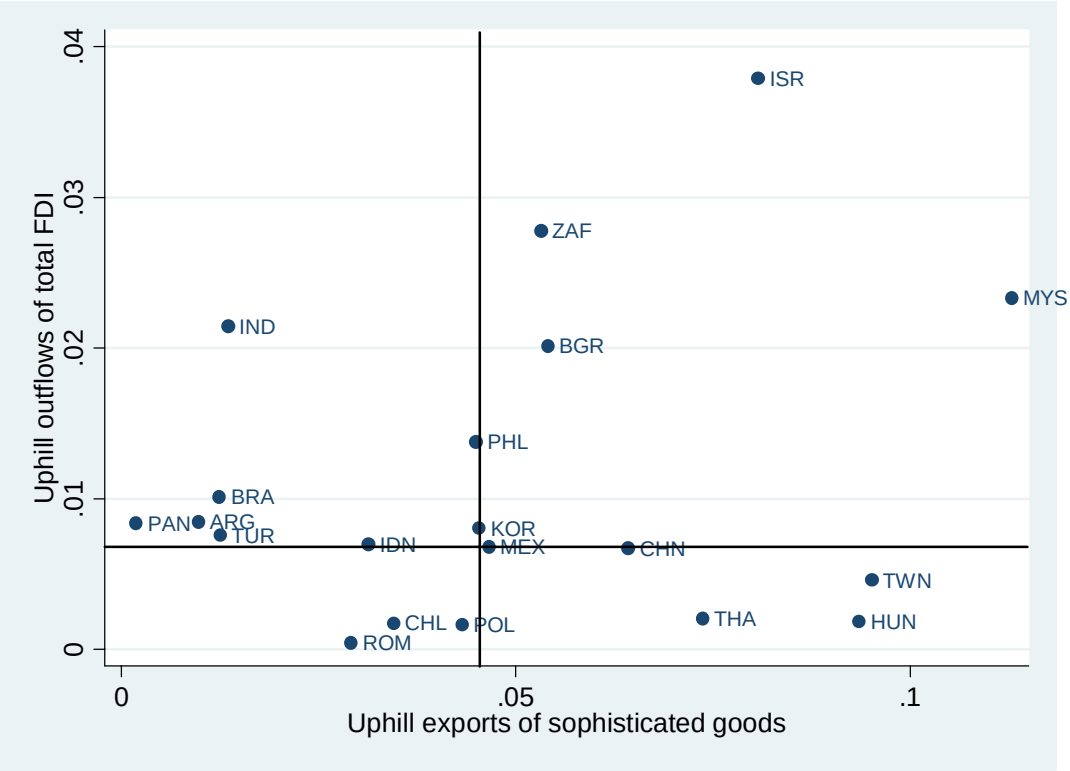
Source: IMF Balance of Payments Statistics.
Other private services exports are services other than transport and travel and cover most skill-intensive business services. We compute the weighted average of per capita GDP of the exporting countries, with the weights being the share of each country in the total exports of other private services.

Chart 5B: Exports to the U.S. of other private services as a share of source country GDP, 1990-2006



Source: U.S. Bureau of Economic Analysis.
See Note to Chart 5A above.

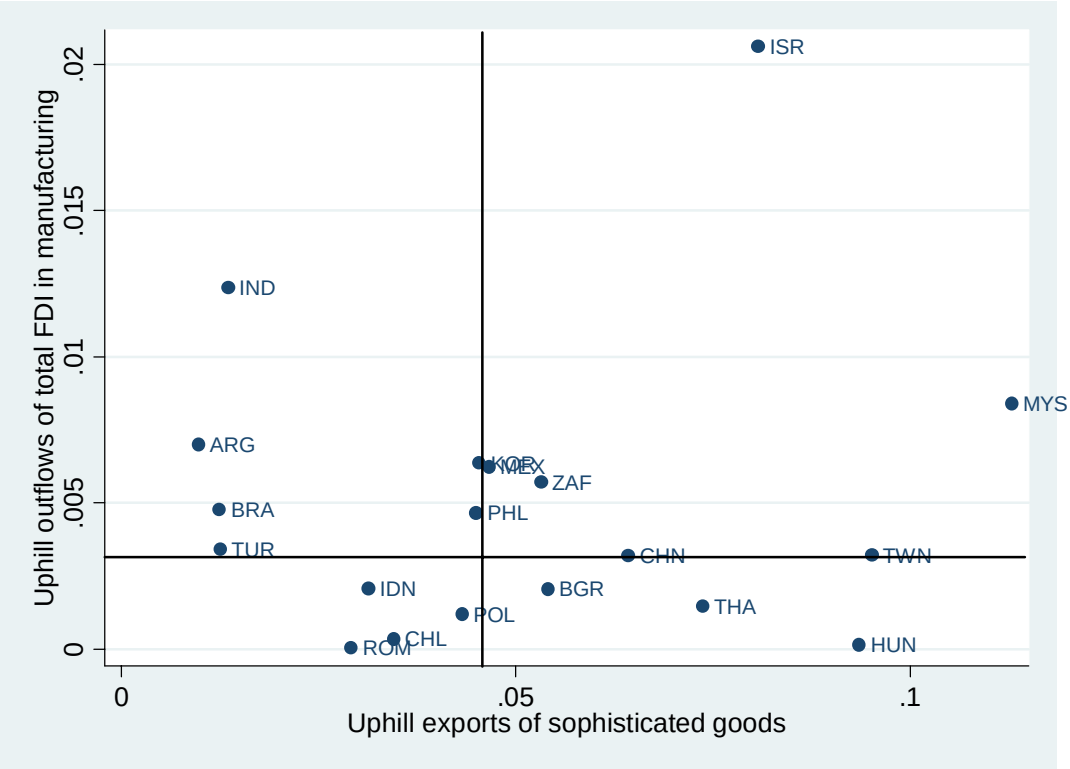
Chart 6A: Uphill Flows of FDI and Exports of Sophisticated Goods (Averages for 2003-2007)



Sources: UN COMTRADE, Thomson Financial SDC Platinum database, and Financial Times' FDI Intelligence database.

Uphill outflows of FDI (measured as FDI outflows of a country to countries with a higher per capita GDP (PPP) than itself) and exports of sophisticated goods are all expressed as a share of a country's GDP.

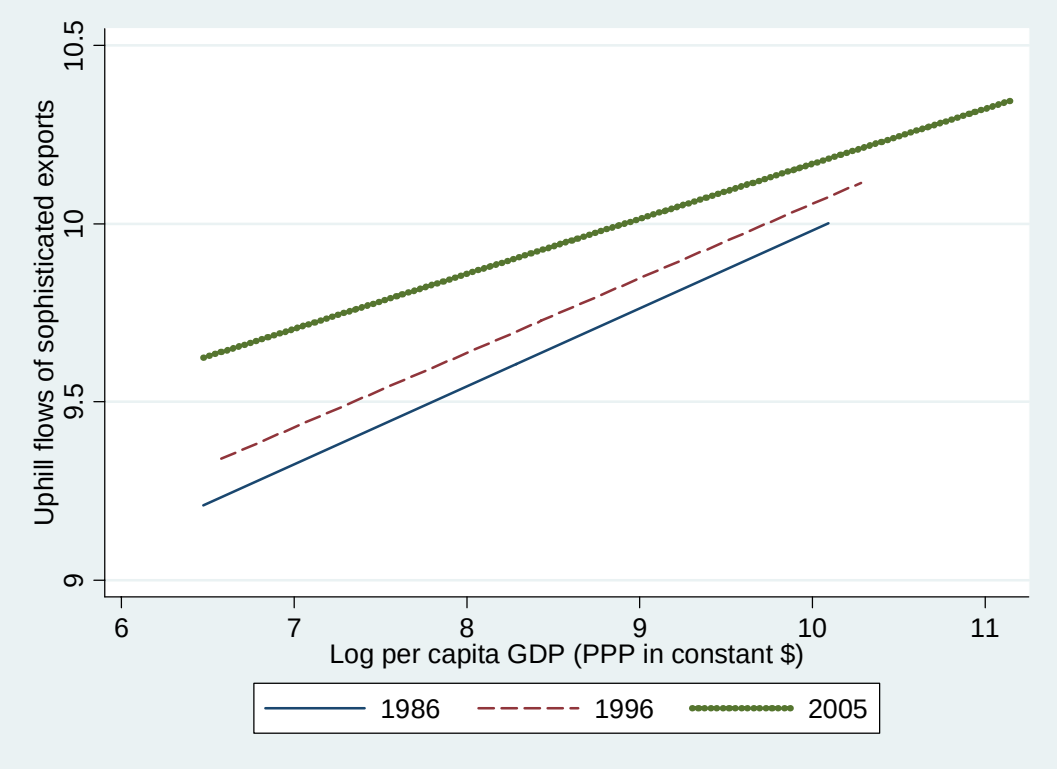
Chart 6B: Uphill Flows of FDI in Manufacturing and Exports of Sophisticated Goods (Averages for 2003-2007)



Sources: UN COMTRADE, Thomson Financial SDC Platinum database, and Financial Times' FDI Intelligence database.

Uphill outflows of FDI in manufacturing and exports of sophisticated goods are all expressed as a share of a country's GDP.

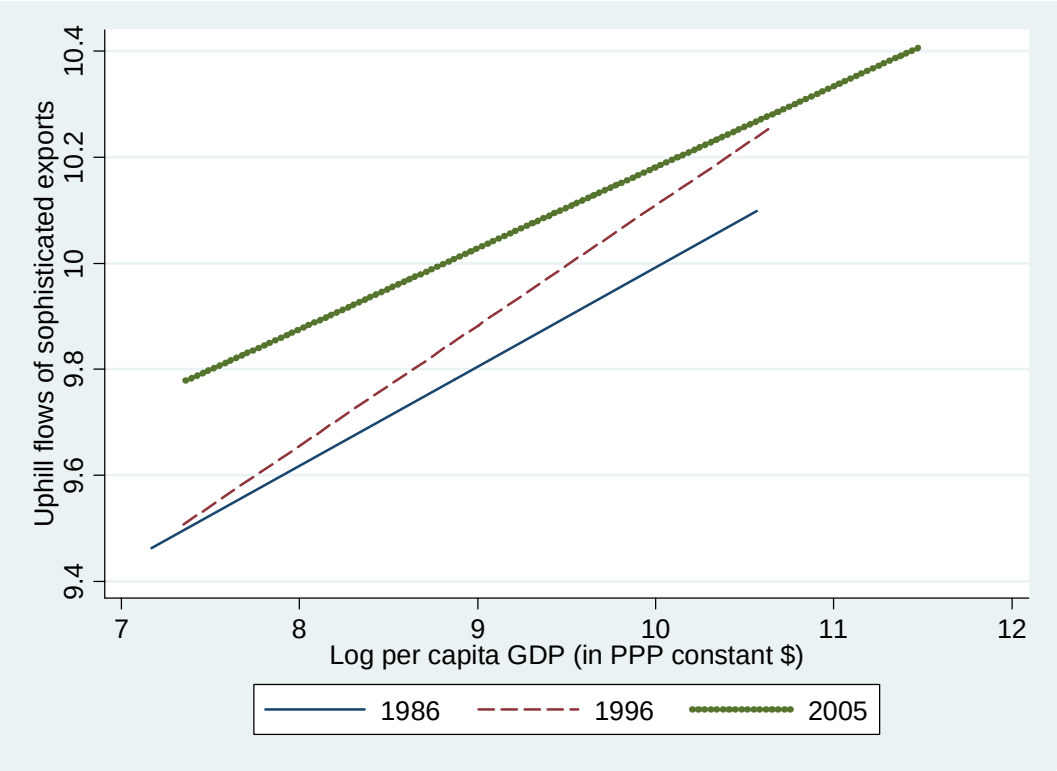
Chart 7A: Uphill Flows of Sophisticated Exports and Per Capita GDP, 1986, 1996, and 2005



Source: UN COMTRADE

Uphill flows are measured as the average income level of all the destination countries which receive a country's sophisticated exports (defined here as above-median PRODY exports), where the weights are each destination country's share in total exports of the sending country. The sample is kept constant for all three periods.

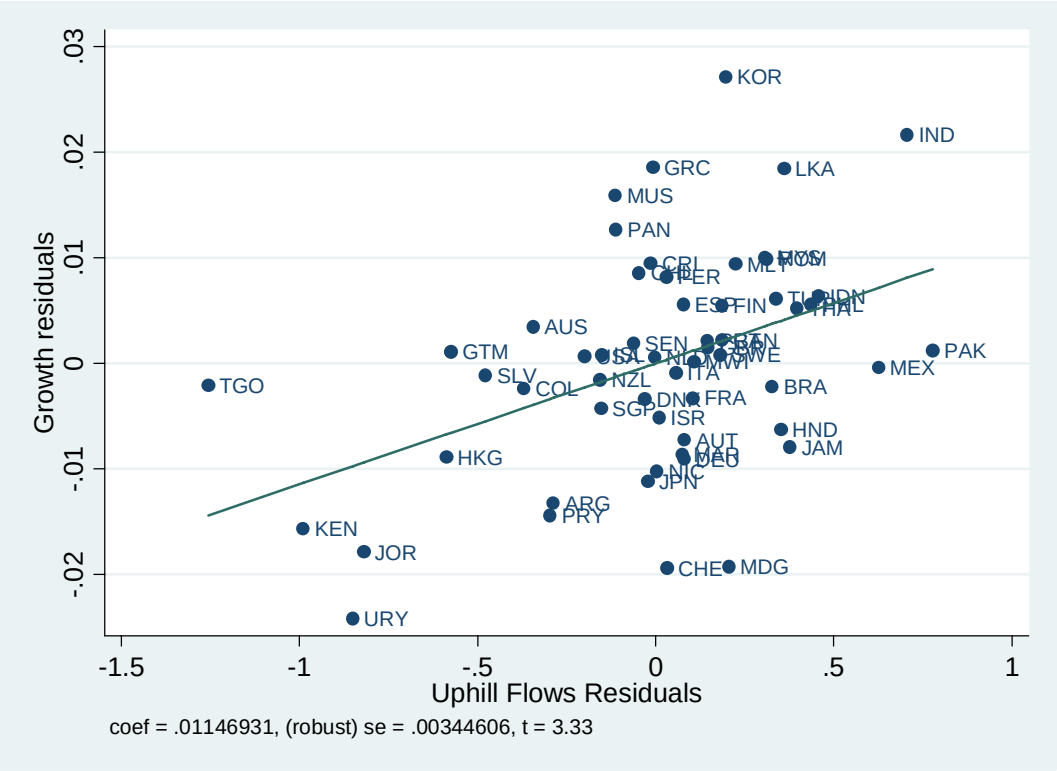
Chart 7B: Uphill Flows of Sophisticated Exports and Per Capita GDP, 1986, 1996, and 2005 (Controlling for other factors)



This chart is the same as Chart 7A above, except that it includes for each year for which the relationship is plotted, controls for area, population and remoteness (all in log terms).

Remoteness (due to Berthelon and Freund (2008)) is measured as $remote_j = \frac{1}{\sum_{k}^{N} \frac{GDP_k}{D_{kj}}}$ $j \neq k$, where D is distance and there are k foreign countries.

Chart 8: Cross-Section Regression. Scatter Plot of Growth on Uphill Flows



This is the partial scatterplot of the regression in column 2 of Table 1A. Controls include initial income, institutional quality, primary school enrollment, and capital stock.

Table 1A: Growth and Uphill Flows of Sophisticated Exports (Cross-Sectional Regressions; Scale-free measure of Uphill flows)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variable	Dependent variable is Annual average growth 1994-2003						
Initial per capita GDP (log)	-0.013*	-0.007	-0.007	-0.003	-0.008	-0.004	-0.009
	(0.007)	(0.005)	(0.005)	(0.005)	(0.005)	(0.007)	(0.006)
Uphill flows for 1990 (median sophistication)	0.017***	0.011***					0.014*
	(0.005)	(0.003)					(0.008)
Years of primary schooling	-0.004	-0.015	-0.015	-0.003	-0.015	-0.011	-0.015*
	(0.013)	(0.009)	(0.009)	(0.011)	(0.009)	(0.010)	(0.009)
Capital stock	-0.000	0.000	-0.000	-0.001	-0.000	-0.000	0.000
	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Institutional quality (Rule of law)	0.009***	0.008***	0.008***	0.008***	0.009***	0.008***	0.008***
	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
Uphill flows for 1990 (75th percentile sophistication)			0.011***				
			(0.003)				
Uphill flows for 1990 of sophisticated relative to unsophisticated products						0.007*	
						(0.004)	
Sophistication of exports					0.013**		
					(0.006)		
Average income level of destination of sophisticated (median) exports					0.011***		
					(0.004)		
Uphill flows for 1995 (median sophistication)				0.007**			
				(0.003)			
Observations	58	56	56	60	56	56	55
Adjusted R-squared	0.260	0.321	0.303	0.224	0.308	0.205	0.328
F-test	5.60	7.19	8.33	7.01	6.01	5.80	5.00

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Columns 2 onward exclude China and Ireland. Column 7 is an IV estimation with population and area (logs) serving as instruments for uphill flows.

Table 1B: Growth and Uphill Flows of Sophisticated Exports (Cross-Sectional Regressions; Sophisticated exports to richer countries scaled by GDP)

	(1)	(2)	(3)
Variable	Dependent variable is Annual average growth 1994-2003		
Initial per capita GDP (log)	-0.001	-0.000	-0.000
	(0.005)	(0.005)	(0.005)
Downhill export flows of sophisticated (median) products (as share of GDP)	-0.099**	-0.087**	-0.112**
	(0.047)	(0.035)	(0.050)
Uphill export flows of sophisticated (median) products (as share of GDP)	0.263***	0.122**	0.096*
	(0.080)	(0.048)	(0.048)
Years of primary schooling	-0.001	-0.009	-0.009
	(0.017)	(0.013)	(0.013)
Capital stock	-0.003	-0.001	-0.000
	(0.006)	(0.004)	(0.004)
Institutional quality (Rule of law)	0.010***	0.010***	0.010***
	(0.003)	(0.003)	(0.003)
Exports of Non-sophisticated (median) products (share of GDP)			0.024
			(0.022)
Observations	61	59	59
Adjusted R-squared	0.314	0.236	0.235
F-test	6.17	7.90	7.89

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Columns 2 and 3 exclude China and Ireland.

Table 2A: Growth and Uphill Flows of Sophisticated Exports
(Panel Regressions; Scale-free measure of uphill flows)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variable	OLS	OLS	OLS	OLS	Fixed effects	IV	IV
Per capita GDP (log)	-0.006**	-0.006**	-0.005**	-0.004*	-0.033***	-0.015*	-0.015*
	(0.003)	(0.003)	(0.002)	(0.002)	(0.007)	(0.009)	(0.009)
Uphill flows (median sophistication)	0.011***	0.011***			0.001	0.024***	
	(0.003)	(0.003)			(0.005)	(0.009)	
Years of primary schooling	0.009**	0.009**	0.009**	0.010**	0.040**	0.013	0.012
	(0.004)	(0.004)	(0.005)	(0.005)	(0.017)	(0.020)	(0.020)
Uphill flows (75th percentile sophistication)			0.010***				0.025***
			(0.003)				(0.009)
Uphill flows of sophisticated relative to unsophisticated products				0.009***			
				(0.003)			
Observations	267	267	266	267	267	256	255
Adjusted R-squared	0.076	0.106	0.090	0.080	0.117	0.005	-0.045
F-test	7.07	4.44	4.74	3.79	7.96	3.25	2.79
Number of countries					65		

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
The instruments for uphill flows in columns 6 and 7 are population and remoteness (in logs).
All columns, except column 1, include time effects. Fixed effects included only in column 5.

Table 2B: Growth and Uphill Flows of Sophisticated Exports
(Panel Regressions; Sophisticated exports to richer countries scaled by GDP)

Variable	(1) Random effects	(2) Fixed effects	(3) Fixed effects	(4) Fixed effects	(5) Fixed effects
Per capita GDP (log)	-0.007***	-0.063***	-0.063***	-0.060***	-0.042***
	(0.003)	(0.012)	(0.012)	(0.012)	(0.008)
Uphill export flows of sophisticated (median) products (as share of GDP)	0.229***	0.231***	0.226**		
	(0.055)	(0.085)	(0.090)		
Downhill export flows of sophisticated (median) products (as share of GDP)	-0.024	0.056	0.063		
	(0.031)	(0.049)	(0.052)		
Years of primary schooling	0.019***	0.021	0.021	0.022	0.052***
	(0.007)	(0.019)	(0.019)	(0.020)	(0.018)
Exports of non-sophisticated (median) products (as share of GDP)			0.012		
			(0.035)		
Uphill export flows of sophisticated (75th percentile) products (as share of GDP)				0.264	0.489**
				(0.197)	(0.205)
Downhill export flows of sophisticated (75th percentile) products (as share of GDP)				0.059	0.081
				(0.127)	(0.151)
Exports of non-sophisticated (75th percentile) products (as share of GDP)				0.037	0.034
				(0.034)	(0.036)
Observations	258	258	258	258	258
Number of rcode	64	64	64	64	64
R-squared	0.13				
Adjusted R-squared		0.288	0.285	0.271	0.171
F-test		5.92	5.19	4.82	5.59

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All columns, except column 1, include time effects

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Appendix: Foreign Direct Investment Data[11]

To what extent do we see uphill flows of foreign direct investment (FDI) in the available data, and how have these flows changed in recent years? To pursue this question, we examined merger and acquisition (M&A) FDI data from Thomson Financial's SDC database from January 1995 to December 2007 and data on greenfield investment from the Financial Times' FDI Intelligence, which is a private organization that compiles proprietary data on such investments.

Data Source

UNCTAD's World Investment Report (WIR) database includes coverage of both total FDI and M&A inflows and outflows for each country, but the *published* dataset does not break these *flows* down on a bilateral basis – data on countries of origin are not available for inflows, while data on destination countries are not provided for outflows. While some UNCTAD-based datasets used by other researchers have endeavored to create this bilateral breakdown, these datasets generally examine FDI stocks rather than flows, and have reliable data across a broad range of countries only for a few years, generally between 2003 and 2005.

By contrast, reasonably comprehensive and highly granular coverage is available for M&A and greenfield FDI in the form of commercial financial databases. Such databases report information at the individual transaction level, enabling analysis on three principal axes: source countries of flows, destination countries of flows, and industry sectors of flows. For this analysis, the SDC Platinum database was chosen for its comprehensive dataset, including hundreds of thousands of cross-border M&A transactions from 1985 up until the present date.

The FDI Intelligence database produced by the Financial Times has tracked greenfield foreign direct investment throughout the world since 2003. Greenfield direct investment is defined as the expansion or creation of physical facilities in any location other than the headquarters of a company. For each greenfield investment project the database has the actual or estimated investment in dollars terms and the actual or estimated jobs created from the project. Every project is assigned to a source market and a destination market, and also disaggregated to the level of an industry sector, industry cluster or business activity, in increasing order of disaggregation. The database is being updated on a continuing basis, and currently holds data on more than 78,800 projects.

For the purposes of the paper, we focused on the period 2003-2007. Taken at the industry sector level, this gives 35,045 source-destination-industry observations totaling $4.3 trillion in value. Collapsing across industry sectors to arrive at aggregate numbers for source markets yields 9,263 bilateral greenfield investment projects over this period, for a total of 132 source markets and 184 destination markets.

[11] This appendix has been prepared by Janak Mayer.

Combining the greenfield FDI data with the M&A data from the Thomson Financial SDC Platinum Database gives 10,457 bilateral recorded investment projects in either or both categories, with a total value over the whole period of $7.5 trillion.

Timeframe

In seeking to examine uphill flows of FDI, the years of greatest interest are evidently the most recent ones. While the major East Asian countries have had a significant presence as exporters of FDI for some time, only since the turn of the millennium have the four BRIC countries joined them in this regard, and only since 2002 have net FDI outflows for these four countries combined amounted to more than 2% of total world FDI flows. Major oil-exporting countries like Saudi Arabia, Mexico and the United Arab Emirates (UAE) have joined these ranks even more recently. The overall period chosen analysis for this study was thus that covering the years from 2003 to 2007 inclusive.

Data Coverage

For the purpose of M&A analysis, only completed transactions where transaction value was disclosed and recorded, and where the stake acquired in the target company met or exceeded 10 percent were included. Accurate recording of transaction values is clearly essential to any calculation of flows, while stakes below 10% are considered to small to be classified as FDI under most definitions. Including only disclosed-value transaction eliminates a little over half the transactions recorded in the database, since many transactions are for unlisted companies, or for other reasons do not face strict disclosure requirements. The dataset resulting from these selection criteria includes some 37,963 deals, totaling $8.4 trillion in value.

Comparison of the data set resulting from this selection with M&A data and total FDI data provided in aggregate form in UNCTAD's World Investment Report (WIR) demonstrates that the overall transaction coverage provided by the SDC Platinum database over this time period is strong. Only between 2000 and 2002 is the total value of M&A transactions reported in the SDC database below that reported in the WIR; in these years coverage remains above 80%, while in all the remaining years the SDC dataset captures a bigger total transaction volume than that reported by WIR.

While the overall volume of transactions captured by the SDC-based dataset is higher than that reported by UNCTAD, for certain years and certain categories, the coverage is lower. Thus, while compared with UNCTAD, SDC data report higher M&A FDI inflows into OECD countries (see below for notes on country groupings) for all years except 2000-02, OECD outflow volumes reported are routinely lower than those reported by UNCTAD.

Country Groupings and Data Overview

OECD membership was the principal determinant used to distinguish between developed and emerging countries. Although Mexico and Korea are now both OECD members, for the purposes of this analysis both were included in the emerging countries grouping

rather than the OECD grouping. Offshore financial centers (OFCs) as well as Mauritius were excluded from the analysis.