FOREIGN DIRECT INVESTMENT AND EXPORT UPGRADING

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Abstract—This study presents evidence suggesting that attracting foreign direct investment (FDI) offers potential for raising the quality of exports in developing countries. Our analysis relates unit values of exports at the four-digit SITC level to data on sectors treated by investment promotion agencies as a priority in their efforts to attract FDI. The sample covers 105 countries from 1984 to 2000. The findings are consistent with a positive effect of FDI on unit values of exports in developing countries. The evidence for high-income economies is ambiguous. There is no indication that FDI increases the similarity of export structure of developing and developed economies.

I. Introduction

WHILE export-led growth has often been cited as the engine behind the Asian miracle, recent research has shifted the focus of the debate away from the mere fact of exporting and toward the importance of export composition for growth. For instance, one of the recent stylized facts of development is the finding that countries promoting exports of more sophisticated goods grow faster (Rodrik, 2006; Hausmann, Hwang, & Rodrik, 2007).[1]

If "you become what you export" is indeed true, introducing measures facilitating export upgrading becomes a key policy issue. The importance of product upgrading and climbing up the export value chain has been instinctively accepted by politicians. To quote Ross Perot's famous line, politicians tend to believe that it is better to make computer chips than potato chips. Such beliefs are also partially responsible for the recent revival of interest in industrial policy. However, export upgrading, especially in a developing country, is not a trivial task given the resources and time needed to build up the capital stock, the skills of the labor force, and the reputation in foreign markets and considering the appropriability issues that Hausmann and Rodrik (2003) pointed out.

This study argues that policies aimed at attracting FDI inflows can boost a country's ability to upgrade its export basket. The entry of multinationals can affect the composition of exports through two channels. First, multinationals using a country as an export platform can engage in production of more sophisticated or higher-unit-value goods than those previously exported by the host country.[2] Second, the presence of multinationals can lead to knowledge spillovers to local firms in the same industry (i.e., multinationals may engage in "cost discovery," to use Hausmann and Rodrik's terminology) or to local firms in the supplying sectors, which can facilitate product upgrading. For instance, in a recent World Bank survey, 24% of local enterprises in the Czech Republic and 15% in Latvia reported that they have learned about the availability of new technologies by observing multinational enterprises operating in their country and their sector. Half of suppliers of multinationals surveyed in the Czech Republic reported improving their quality control systems in response to the request of their multinational customers (Javorcik, 2008).[3]

To examine whether FDI is a catalyst for upgrading the export portfolio, we use information on exports of 105 countries during the 1984–2000 period. A cross-country analysis of the relationship between upgrading export products and FDI poses two challenges. First, in order to distinguish the effects of FDI inflows from all other country-specific shocks and policies, one would ideally like to use sector-level information on FDI inflows. Unfortunately, such data are difficult to come by, particularly in a developing country context. To the best of our knowledge, the only

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[1] Others suggest that it is the sophistication of the export structure combined with the ability to export to industrial countries that matters for growth (see Mattoo & Subramanian, 2009).

The argument made by Hausmann et al. (2007) is based on the cost discovery mechanism of Hausmann and Rodrik (2003). An entrepreneur who attempts to produce a good for the first time in a developing country faces uncertainty about the underlying cost structure of the economy. If the project is successful, other entrepreneurs learn that the product in question can be profitably produced and follow the incumbent's footsteps. In this way, the returns to the pioneer investor's cost discovery become socialized. If the incumbent fails, the losses remain private. This knowledge externality means that investment levels in cost discovery are suboptimal unless the industry or the government finds some way in which the externality can be internalized. In such a setting, the range of goods that an economy produces and exports is determined not just by the fundamentals but also by the number of entrepreneurs engaging in cost discovery. The larger this number is, the closer the economy can get to its productivity frontier. When there is more cost discovery, the productivity of the resulting set of activities is higher in expectational terms.

[2] A comparison of unit values of new export products introduced by foreign and domestic producers operating in Mexico (normalized by the mean price of all exported goods within the same product category) indicates that foreign establishments tend to export higher-unit-value products (Iacovone & Javorcik, 2008). Wang and Wei (2008) reach a similar conclusion and find that after they control for processing trade, exports by foreign-invested firms in China tend to have systematically higher unit values than indigenous firms, suggesting that they produce higher-end product varieties. FDI may also lead to a greater volume of exports. For instance, Arnold and Javorcik (2009) show that foreign acquisitions in Indonesia lead to large increases in the export intensity in the acquired plants.

[3] In the same survey, a quarter of local suppliers of multinationals operating in the Czech Republic reported that the knowledge gained by doing business with a multinational helped them become an exporter, 12% said that they started supplying foreign sister companies of their multinational customer, and 9% benefited from the multinational customer recommending them to other companies abroad.

sufficiently comprehensive data set on sectoral FDI figures for a large number of countries is available from the U.S. Bureau of Economic Analysis (BEA). This data set, however, covers only the U.S. FDI. Although the U.S. FDI is likely to constitute a considerable share of total FDI in certain countries, in others it might not. Using direct FDI measures would therefore be likely to give a less-than-complete picture of the actual foreign presence in many country-sector combinations.[4] The second challenge in the analysis is to identify the direction of causality. FDI may promote upgrading of export products but it may also be attracted to countries and sectors that are already exporting higher-value products.

To address these challenges, our study uses a new data set on industry-level targeting done by national investment promotion agencies (IPAs) rather than the data on actual FDI inflows. The information on whether a particular country has been targeting a particular sector in an effort to attract FDI, the timing of such activities, and the list of priority sectors is available from the World Bank Census of Investment Promotion Agencies covering over one hundred countries around the world. Sector targeting is considered to be best practice by investment promotion professionals, as it is believed that more intense efforts concentrated on a few priority sectors are likely to lead to greater FDI inflows than less intense across-the-board attempts to attract FDI (Loewendahl, 2001; Proksch, 2004). Indeed, in the World Bank Census, a vast majority of IPAs reported being involved in sectoral targeting. A difference-in-differences analysis by Harding and Javorcik (2011) shows that targeting a particular sector by a national IPA leads to more than a doubling of FDI inflows into the sector.

Our empirical analysis, based on export data from Feenstra et al. (2005), also follows the difference-in-differences approach. We ask whether sectors that were chosen by IPAs as targeted industries for attracting FDI exhibited higher unit values of exports in the post-targeting period relative to the pre-targeting period and relative to sectors that were not awarded the priority status. In other words, we compare unit values of exports in the priority sector before and after targeting starts to unit values in nontargeted sectors during the same period. Unit values of export products are calculated at the four-digit Standard International Trade Classification (SITC) level, while sector-targeting information is available at the three-digit level of the North American Industry Classification System (NAICS).[5] To take into account country endowments and other time-invariant unobservables that could influence unit values of exports from a particular country-sector combination, the empirical specification includes country-sector fixed effects. In other words, our analysis focuses on within-country-sector variation in unit values. To control for differences in unit values among products (e.g., the fact that pencils have lower unit values than computers), the empirical specification includes product-year fixed effects. These fixed effects also control for factors that might cause the relative price of pencils to computers to change over time. Finally, the empirical model includes country-level controls.

The results suggest a positive relationship between FDI and unit values of exports in developing countries. We find a positive and statistically significant association between a sector being targeted (proxied by an indicator variable or by the number of years the targeting has been in place) and unit values of exported products. This result can be found in a contemporaneous specification as well as the specifications with one, two, or three lags. To check that our results are not subject to a reverse causality problem, we estimate a placebo regression and show that the sectors that will be targeted next period (or in two or three periods, depending on the specification) do not have higher unit values before the start of targeting.

The magnitude of the effect is economically meaningful. We find that exports of targeted sectors enjoy a unit value premium of about 11%. To put this figure into perspective, consider Slovenia targeting Transportation Equipment Manufacturing (NAICS 336). Doing so would increase the unit value of its exports of Motor Vehicles for the Transport of Goods (SITC 7821) above the level found in Bulgaria, Mexico, and Israel. Similarly, if Slovenia targeted the Chemical Industry (NAICS 325), the unit value of its exports of Mineral or Chemical Fertilizers, Nitrogenous (SITC 5621) would increase above the unit value of exports originating from Norway, Netherlands, Canada, South Korea, and Singapore, among others. Although we also find a positive correlation between FDI and unit values of exports from high-income countries, this result is less robust.

Next we ask whether the association between FDI and unit values tends to be stronger in differentiated products. Differentiated products, defined based on Rauch's (1999) classification, are the goods lacking a reference price because of their intrinsic features or the goods whose price is not set on organized exchanges. Women's Skirts and Blouses (SITC 8434 and 8435) are an example of differentiated products, while Cement and Printing Paper (SITC 6412 and 6612) are not. In the developing country subsample, we find no difference between the effect of FDI on differentiated and homogeneous products. In the developed country subsample, FDI matters only for differentiated products. A likely explanation for this finding is that in developed countries, there is little room for increasing the quality of exported homogeneous goods as these countries already possess sophisticated technologies for production of goods such as cement or paper. In contrast, FDI inflows into developing countries may facili-

[4] In addition, the time period covered by the BEA data is quite short, as the FDI stock information starts in 1989. Moreover, in some cases, figures in particular country-industry-year cells are suppressed for confidentiality reasons.

[5] Examples of four-digit SITC products include SITC 8434 (Skirts, Women's of Textile Fabric), SITC 8435 (Blouses of Textile Fabric), SITC 6412 (Printing Paper and Writing Paper, in Rolls or Sheets), and SITC 6612 (Portland Cement, Ciment Fondu, Slug Cement).

tate quality increase in both homogeneous and differentiated products.[6]

We also check whether the effects of FDI are more pronounced in the case of final products, as opposed to intermediate inputs and raw materials. It turns out that the effect of FDI manifests itself mostly in the case of final goods when developing countries are considered. If the seller's reputation matters more in the case of final products than in intermediates, it may be much easier for multinationals than for indigenous producers to obtain higher prices.

A series of robustness checks confirms our baseline findings. We show that the results are robust to controlling for the gross fixed capital formation in the sector, which suggests that the effect is not driven by FDI that just brings in new capital. To attenuate the concern that export unit values may be influenced by transfer pricing, we show that the effect of targeting does not depend on the corporate tax rate in the host country or the tariff level in the main export markets. Further, we find that FDI not only leads to increasing the unit values in absolute terms but also brings the host country's export basket closer to the technological frontier (defined as the 95th percentile of the distribution of the unit values in a given product and time period). Our conclusions are also confirmed when we use sector targeting as an instrument for the presence of U.S. investors. Finally, our results for developing countries are robust to using the most disaggregated trade figures available, the data on U.S. imports broken down by 10-digit HS codes, and to instrumenting for the choice of priority sectors.

We also extend our analysis to examine whether FDI increases the "sophistication" of the host country's exports. To measure export sophistication, we use the index proposed by Hausmann et al. (2007), which captures the income level associated with a particular export basket and the measure of export dissimilarity between the export basket of a given country and that of high-income economies proposed by Wang and Wei (2008). In both cases, our measures of export sophistication vary by country, sector, and year. We find no evidence suggesting that FDI boosts the sophistication of the host country's exports, which is in line with Wang and Wei's findings for China.

While our results on the positive relationship between FDI and unit values of exports cannot distinguish between upgrading due to exporting by multinationals themselves or due to indigenous producers learning from foreign investors, they suggest that FDI can play an important role in helping developing countries improve the quality of their exports. They also indicate that the fears that FDI will relegate developing countries to producing only simple low-value-added products are not warranted.

[6] Rauch (1999) argues that search costs for differentiated goods exceed those of homogeneous or reference-priced goods, since information is not as easily collected and compared in differentiated goods industries. If multinational corporations enjoy a better reputation than national producers do, it may be easier for them to convince potential foreign buyers about the quality of their export products.

Our study is related to two strands of the existing literature. The first strand documents quality differences among exports originating in different countries (Schott, 2004; Hummels & Klenow, 2005). Schott (2004) finds a positive association between country-level capital and skill abundance and unit values of exports. To the extent these country characteristics are proxies for producer productivity, this finding is inconsistent with new trade theory, which suggests a negative relationship between productivity and prices. Our study is complementary to the research mentioned. Its novelty lies in testing how access to developed countries' technologies and know-how through inflows of FDI affects unit values of exports from developing countries hosting foreign investors. FDI flows are an important aspect of globalization, yet to the best of our knowledge, our study is the first attempt to examine the impact of FDI on unit values of exports in a wide range of countries. Our results indicate that the mapping between unit values and producer characteristics is at least two-dimensional. On the one hand, FDI presence may put a downward pressure on unit values of exports due to the superior productivity of foreign affiliates. On the other hand, FDI presence may lead to an upgrading of production and marketing techniques, and thus increasing the ability of exporters to obtain higher prices in foreign markets. Our findings are consistent with the latter force being dominant in developing countries. In high-income economies, the dominant effect varies depending on the context. Our results not only have policy implications, but also offer a potential explanation for the relatively fast narrowing of the quality gap documented by Hallak and Schott (2011) during the period of rapid globalization between 1989 and 2003.

The second strand of the literature relevant to our work provides a motivation for why we would expect a positive link between the presence of FDI and unit values of exports. The literature includes work suggesting that foreign affiliates tend to export higher-unit-value products (Wang & Wei, 2008; Iacovone & Javorcik, 2008) and the studies documenting superior performance of foreign affiliates (for a review, see Arnold & Javorcik, 2009). The literature also encompasses studies examining export externalities associated with the presence of multinationals. In a widely cited paper, Aitken, Hanson, and Harrison (1997) use panel data on 2,104 Mexican manufacturing plants from the period 1986 to 1990 to demonstrate that the presence of exporting multinationals in the same region reduces the costs of exporting for Mexican firms. No such externalities are found for exporting firms in general. Based on detailed Chinese trade statistics identifying the type of exporters and their location, Chen and Swenson (2007) find that the presence of multinationals in the same industry is associated with more and higher-unit-value trade transactions by Chinese firms. Using the same data set, Swenson (2007) shows that the positive association between the presence of multinationals and new export connections by private Chinese exporters may be driven by information spillovers. Finally,

this literature also includes work on intra- and inter-industry productivity spillovers generated by foreign affiliates (for a review of the former, see Görg & Strobl, 2001; for evidence on the latter, see Javorcik, 2004; Blalock & Gertler, 2008; and Javorcik & Spatareanu, 2008, 2009, 2011). To the best of our knowledge, our study is the first contribution to the literature on FDI and the quality of exports based on data from a large number of countries.

This paper is structured as follows. The next section describes the data and the empirical strategy. Section III presents the empirical findings, and section IV concludes.

II. Data and Empirical Strategy

A. Trade Data

We use cross-country export data compiled by Feenstra et al. (2005) for the period 1984 to 2000.[7] The data are available at the four-digit SITC Rev. 2 classification, which includes 726 codes in our sample. The codes describe quite narrow product categories, and thus we believe this is a suitable level of aggregation for our analysis.[8] Here are some examples of code descriptions from two industries: Woven Cotton fabrics (652) and Woven Fabrics (653):

Examples of Four-Digit SITC Products	
6521	Cotton fabrics, woven, unbleached, not mercerized
6522	Cotton fabrics, woven, bleached mercerized, dyed, printed
6531	Fabrics, woven of continuous synthetic textile materials
6532	Fabrics, woven containing 85% of discontinuous synthetic fibers
6534	Fabrics, woven, of discontinuous synthetic fibers
6535	Fabrics, woven of containing regenerated textile materials
6536	Fabrics, woven containing 85% of discontinuous regenerated fibers
6538	Fabrics, woven of discontinuous regenerated fibers
6539	Pile & chenille fabrics, woven of man-made fibers

Unit values are calculated by dividing the export value by the quantity of exports. The value of exports is measured in current U.S. dollars. For some country-product-year combinations, there are multiple observations on values and corresponding quantities, as, for instance, some exports may be measured according to weight and some according to the number of units. In such cases, we follow Schott (2004) and calculate the unit value as the weighted average, where the shares of total country-product-year value are used as weights.[9]

To assess which countries had the largest increase in the absolute unit value over time, we considered the change in the unit value of product p exported by country c between 1984 and 2000 (the first and the last year of the sample). We focused on countries that exported at least twenty products in both years. The largest average increases in the unit values were registered by Malta (159%), Ireland (153%), Japan (146%), Denmark (145%), and Norway (142%). Among the top ten countries, Bangladesh (141%) was the only developing country. The ranks between 11 and 15 were occupied by developing countries: China (134%), Sri Lanka (134%), Kenya (132%), Hungary (131%), and Romania (131%). Many of the developing countries mentioned were also very successful at attracting FDI.

We also considered the largest increase in the relative unit value, where the relative unit value was defined as the ratio of the unit value of product p exported by country c at time t to the average unit value found for all exporters of product p at time t. The largest average increase in the relative unit value was registered by Malta (130%), followed by Ireland (123%), Sri Lanka (118%), Denmark (117%), Japan (116%), Cuba (115%), Bangladesh (114%), China (112%), the United Kingdom (115%), and Iceland (111%).

Since our proxy for the presence of FDI is available in the NAICS (1997) classification, we use a concordance between NAICS and SITC classification.[10] Thus, the term *sector* refers in the paper to the three-digit NAICS aggregates, while the term *product* is used to denote four-digit SITC codes.

The trade in agricultural products tends to be more restricted than trade in manufactured products; therefore, we exclude the following NAICS sectors: Crop Production (111), Animal Production (112), Forestry and Logging (113), and Fishing, Hunting and Trapping (114). We also exclude Oil and Gas Extraction (211) and Mining except Oil and Gas (212) because we believe that unit values in these sectors may be driven primarily by the quality of the natural resource endowments.[11] This leaves us with 23 sectors with nonmissing unit value observations. These sectors are listed in the online appendix table A1 along with the average, the minimum and the maximum number of distinct products available per sector across different years.

In table 1, we present figures documenting the dispersion of unit values exported by different countries within each SITC product code in year 2000. The first set of figures lists the ratio of the median unit value of product p exported by high-income countries in 2000 to the median unit value of product p exported by developing countries in 2000.[12] The

[7] For additional information on the data set, see http://cid.econ.ucdavis.edu/data/undata/FAQ_on_NBER-UN_data.pdf and http://cid.econ.ucdavis.edu/data/undata/undata.html.

[8] We return to the aggregation issue in section IIIE.

[9] Dropping country-product-year combinations for which quantities are reported in multiple units would not change the conclusions of this study.

[10] The concordance comes from http://www.nber.org/lipsey/sitc22naics97.

[11] One may argue that the room for quality upgrading may be limited in nonmanufacturing sectors, which include Electric Current (NAICS 221); Ships, Boats and Other Vessels for Breaking Up (NAICS 483); and Motion Picture and Sound Recording Industries (NAICS 512). Dropping these three sectors (which amounts to losing 112 to 168 observations in the developing country subsample and 451 to 495 observations in the high income group) would not change the conclusions of this study.

[12] The definition of developing countries is based on the World Bank classification as of July 2006. For a recent list, see http://data.worldbank.org/about/country-classifications/country-and-lending-groups.

TABLE 1.—UNIT VALUES OF EXPORTS IN 2000

SITC Code	SITC Code Description	Median Unit Value for High-Income Countries/ Median Unit Value for Developing Countries	90th Percentile Unit value/ 10th Percentile Unit Value
Products with the highest ratio of the medians			
9610	Coin (other than gold) not being legal tender	48.29	107
7914	Railway and tramway passenger coaches and luggage Vans	15.19	839
6253	Tyres, pneumatic, new, of a kind used on aircraft	15.15	33
7938	Tugs, special purpose vessels, floating structures	11.12	454
5157	Sulphonamides, sultones and sultams	10.97	177
7612	Television receivers, monochrome	10.32	92
7126	Steam and other vapour power units, steam engines	9.67	89
7911	Rail locomotives, electric	7.11	722
7764	Electronic microcircuits	7.02	135764
5233	Salts of metallic acids; etc.	6.64	432
Products with the median ratio of the medians			
8731	Gas, liquid, electricity meters	1.49	26
7423	Rotary pumps	1.49	33
Products with the lowest ratio of the medians			
6121	Articles of leather and of composition leather	0.51	9
6891	Tungsten, molybdenum, tantalum and magnesium, unwrought	0.50	21
5122	Cyclic alcohols and their halogenated derivatives	0.46	32
2117	Sheepskins and lambskins without wool on, raw	0.45	8
7761	Television picture tubes, cathode-ray	0.41	46
8830	Cinematographic film, exposed and developed	0.38	209
5414	Vegetable alkaloids, natural or reproduced by synthesis	0.33	88
2919	Materials of animal origin, n.e.s.[a]	0.33	43
2652	True hem, raw or processed but not spun	0.26	33
2814	Roasted iron pyrites, whether or not agglomerated	0.19	162

[a]n.e.s: for not elsewhere specified.

highest values of the ratio suggest that the median industrial country's exports of product p have a unit value an order of magnitude higher than those exported by the median developing economy. These high values of the ratio are found primarily in Machinery and Transport Equipment and Chemicals and Related Products. The median value of the ratio is 1.49 and is found in Gas, Liquid, Electricity Meters and Rotary Pumps.[13] All of these products are relatively R&D intensive, hence, the large differences in unit values between rich and poor countries do not come as a surprise.

The lowest values of the ratio suggest an overlap in the distribution of quality of products exported by the two groups. There exist products where the median developing country exports of product p have a higher unit value than the median high-income-country exports of product p, though the differences here are much smaller. These low values of the ratio are found mostly in Crude Materials as well as in Chemicals and Related Products.

The second column of figures in table 1 lists the ratio of the 90th percentile to the 10th percentile of the distribution of unit values of product p exported by all countries in 2000. The figures document a wide dispersion of unit values exported by different countries. As evident from the last column, the 90th percentile unit value is often two orders of magnitude higher than the 10th percentile value, even in products with low values of the ratio of the median reported in the first column.

B. *Using Information on Investment Promotion Activities to Proxy for FDI Inflows*

We exploit data from the 2005 Census of Investment Promotion Agencies to proxy for inflows of FDI to a given sector in a given country in a given year. The census includes information on whether a country was concentrating its FDI promotion activities on selected priority sectors (so-called sector targeting) rather than trying to attract all types of foreign investors. Sector targeting, which investment promotion professionals view as the best practice, has been practiced by more than half of the countries surveyed in the census. For countries engaged in sector targeting, our data include information on what sectors were targeted and the year when targeting started and ended. Using a difference-in-differences approach, Harding and Javorcik (2011) show that targeting a particular sector by a national IPA leads to more than doubling of FDI inflows into the sector. Therefore, we believe the information on targeted sectors is a good proxy for inflows of FDI.[14]

Based on the census data, we construct two variables: (a) an indicator variable, $Sector\ targeted_{sct}$, equal to 1 if sector s was a priority sector in country c's efforts to attract FDI in year t, and 0 otherwise, and (b) a continuous variable, $Length\ of\ Sector\ Targeting_{sct}$, defined as the number of

[13] As Schott (2004) argued, the lower unit values of developing countries' exports point to specialization within sectors. Schott interprets his finding—within-product specialization rather than between-product specialization—as support for the view that capital- and skill-abundant countries use their endowment advantage to produce higher-unit-value varieties.

[14] Charlton and Davis (2007) draw similar conclusions for OECD countries.

years country c has treated sector s as a priority sector prior to (and including) year t.[15] We think of *Sector Targeted* as a proxy for additional FDI inflows taking place in a given time period and of *Length of Sector Targeting* as a proxy for the stock of FDI.

There are two advantages to using information on targeted sectors instead of the information on actual FDI inflows. The first advantage is the data coverage in terms of geography and time period. Figures on sector-specific FDI inflows are not readily available for developing countries. In our analysis, we are particularly interested in exploring the link between FDI and unit values of exports in a developing country context. We believe that the effects of FDI are likely to be more pronounced in low-income economies, which often lag in terms of technological capabilities. The most comprehensive source of sectoral FDI figures is the U.S. Bureau of Economic Analysis (BEA). Unfortunately, BEA collects information on only the U.S. FDI and thus gives a less-than-complete picture of the actual foreign presence in many countries. It also covers a relatively short time period (the data with wide country coverage start in 1989) and suppresses quite a few country-sector-year cells for confidentiality reasons. The information is suppressed if the number of investments made in a particular country-sector-year combination was small, which means that we would often miss the information on the entry of the first few foreign investors, which are likely to have the most pronounced effect.

The second advantage of using information on investment promotion efforts is that our proxy attenuates endogeneity concerns. Country-sector combinations with high unit value of exports might attract FDI with greater ease than the sectors with relatively low unit values. This would manifest itself as a positive association between FDI inflows and unit values, but the direction of causality would run from high unit values to high FDI inflows. By employing information on sector targeting, we attenuate the potential reverse causality problem. Targeting is a policy tool based on many factors, and thus the choice of priority sectors is less likely to be driven by the quality of exports from that sector. Nevertheless, we test whether this is true and show that our assumption is reasonable.

Table A2 in the online appendix presents detailed information on the sample used in the empirical analysis. It lists the minimum and maximum number of sectors available for each country, the number of observations, and the number of observations pertaining to targeted sectors. Our data on investment promotion efforts include 88 countries whose IPAs responded to the question on targeting and 17 countries that did not have an investment promotion agency in 2004 and thus are treated as not engaged in targeting, which gives us 105 countries. Of 88 countries, 27 reported having been engaged in targeting and provided the exact timing information on at least one priority sector. In our analysis, we include all country-sector combinations for nontargeted sectors and all country-sector combinations for priority sectors for which the exact information on the timing of targeting is available.[16] This leaves us with 105 countries, for 27 of which we capture active targeting policies taking place during the time period considered.

Our data set also includes information on population size and GDP per capita taken from the World Bank's World Development Indicators (WDI) and inflation figures provided by the IMF's International Financial Statistics. The summary statistics are presented in table 2.

C. Empirical Strategy

To examine the relationship between the quality of exported products and FDI, we use the difference-in-differences approach. We ask whether sectors that were chosen by IPAs as targeted industries for attracting FDI exhibited higher unit values of exports in the post-targeting period relative to the pre-targeting period and relative to sectors that were not awarded priority status. In other words, we compare unit values of exports in priority (treated) sectors before and after targeting starts to unit values in nontargeted (control) sectors during the same time period. More specifically, we estimate the following model:

$$\begin{aligned}\ln Unit\_Value_{pct} = {} & \alpha + \beta\, Sector\_Targeted_{sct} \\ & + \pi \ln Export\_Value_{pct-1} + X_{ct}\theta \\ & + \gamma_{cs} + \gamma_{pt} + \varepsilon_{pct}, \end{aligned} \tag{1}$$

where $Unit\_Value_{pct}$ is the unit value (value of exports/quantity of exports) of product p exported by country c at time t, which is our measure of export quality.[17] Products

[15] We include *Length of Sector Targeting* in the log form (adding one before taking the log).

[16] In other words, if we know that a particular country targeted a particular sector but do not have the exact timing of targeting, we exclude the country-sector combination from the sample. Thus, our sample includes country-sector combinations with (a) the exact information on the timing of targeting is available, (b) no targeting taking place, and (c) countries in which there is no IPA and hence it is assumed that no targeting efforts are made. The results are robust to restricting the analysis to the subsample of countries for which the exact information on the timing of targeting is available or to the subsample of countries for which the exact information on the timing of targeting is available and countries with no IPA.

[17] Although unit values are imperfect proxies for product quality, they have been widely used in the literature (see e.g., Schott, 2004; Hallak, 2006). Unit values of exports may vary for reasons other than quality, such as production costs or market power. Unit values may also be noisy due to both aggregation and measurement error. To the extent that product costs vary by country and affect the unit values of all products produced by country c in year t, they will be taken out by country-specific controls, such as the GDP per capita, which tends to be a good proxy for wage costs. To the extent that market power of country c in sector s does not vary over time, it will be taken out by country-sector fixed effects. If market power is country product rather country sector specific, it is relevant to mention that our results are robust to controlling for country-product fixed effects. The same holds for measurement error if it is specific to country-product and time invariant. Aggregation is probably the most difficult issue to deal with. However, we do show in the online appendix that our conclusions are robust to using the most disaggregated trade data available (figures on U.S. imports based on ten-digit HS classification). For alternative approaches to measuring quality, see Hallak and Schott (2011) and Khandelwal (2010).

TABLE 2.—SUMMARY STATISTICS

Variable	Observations	Mean	S. D.	Minimum	Maximum
Developing					
In Unit value	135,489	1.029	1.848	−11.860	11.110
Sector targeted	135,489	0.057	0.233	0.000	1.000
Length of sector targeting	135,489	0.192	0.944	0.000	19.000
In Export value	135,489	−5.569	2.025	−9.220	2.950
In GDP per capita	135,489	7.717	0.897	4.455	9.413
In Population	135,489	17.060	1.576	11.961	20.956
Inflation	135,489	1.105	5.266	−0.176	237.731
Corporate tax rate	123,343	34.175	8.610	15.000	75.000
High income					
In Unit value	150,302	1.519	1.890	−9.634	11.252
Sector targeted	150,302	0.032	0.175	0.000	1.000
Length of sector targeting	150,302	0.090	0.605	0.000	21.000
In Export value	150,302	−4.449	2.246	−9.220	3.733
In GDP per capita	150,302	9.742	0.524	7.737	10.708
In Population	150,302	16.325	1.262	12.384	18.659
Inflation	150,302	0.048	0.165	−0.032	3.738
Corporate tax rate	149,963	35.081	8.913	9.800	55.000

are defined at the four-digit SITC level. $Sector\_Targeted_{sct}$ is a dummy taking the value 1 if country c's investment promotion agency considered sector s, to which the product p belongs, as a priority (targeted) sector for attracting FDI inflows at time t and 0 otherwise. Sectors are classified according to the three-digit NAICS 1997 classification. $Sector\_Targeted_{sct}$ also takes the value of 0 if country c did not have an investment promotion agency at time t. A positive coefficient on $Sector\_Targeted_{sct}$ will indicate an increase in export unit values of products belonging to the targeted sector s, a shift in the composition of the sector's exports toward higher-unit-value products, or both.

The empirical specification incorporates a number of controls, including the size of the exporting industry proxied by the value of country c's exports of product p at time $t-1$ ($Export\_Value_{pct-1}$) and several country-level characteristics (X_{ct}). As suggested by the findings of Hummels and Klenow (2005), we control for the size of the exporting economy with the logarithm of the population size. To control for the level of development, we include the logarithm of the GDP per capita (in current USD). Finally, to take into account macroeconomic stability and changes in the general price level in the exporting country, we add inflation.

Our specification also includes country-sector (γ_{cs}) and product-year (γ_{pt}) fixed effects. The former take out all time-invariant characteristics specific to a particular country-sector combination that might be important for unit values. Examples of such characteristics include availability of natural resources or climatic conditions. In other words, our analysis focuses on within-country-sector variation in unit values. Because there are large differences in unit values between products (e.g., pencils are cheaper than computers) we include product-year fixed effects. These fixed effects not only absorb unit value differences across products but also take out all observed and unobserved global factors that might change the relative unit values over time. For instance, if the relative price of computers to pencils goes down in year t due to technological progress or changes in demand, this effect will be absorbed by the product-year fixed effect.

Our variable of interest, *Sector_Targeted*, is at the country-sector-year level, and our dependent variable is at the more disaggregated country-product-year level. Therefore we cluster standard errors at the country-sector-year level, as Moulton (1990) suggested.

III. Results

A. Baseline Results

The results presented in table 3 are consistent with higher export unit values being found in sectors that are experiencing an increased foreign presence. We find a positive and statistically significant coefficient on the *Sector Targeted* variable in the subsample of developing countries (columns 1–4). This is true in a specification with the contemporaneous indicator *Sector Targeted*, as well as in the specifications where the variable of interest enters as the first, second, or third lag.

The magnitude of the effect is economically meaningful: targeted sectors are found to export products whose unit values are 11% higher than the average unit value of the same product observed in a given year.[18] This magnitude is plausible as it captures the average effect found during the duration of targeting. It is also sensible when one considers the following thought experiments. If Slovenia targeted Transportation Equipment Manufacturing (NAICS 336), it would increase the unit value of its exports of Motor Vehicles for the Transport of Goods (SITC 7821) beyond the level found in Bulgaria, Mexico, and Israel. Similarly, if Slovenia targeted the Chemical Industry (NAICS 325), the unit value of its exports of Mineral or Chemical Fertilizers, Nitrogenous (SITC 5621) would increase above the unit

[18] This figure is based on the coefficient from the first specification: $\exp(.103) - 1 = .11$.

TABLE 3.—UNIT VALUES AND SECTOR TARGETING

	Developing Countries				High-Income Countries			
	1	2	3	4	5	6	7	8
Sector targeted	0.103***				0.013			
	(0.018)				(0.018)			
L. Sector targeted		0.084***				0.029*		
		(0.019)				(0.017)		
L2. Sector targeted			0.069***				0.037*	
			(0.022)				(0.020)	
L3. Sector targeted				0.047**				0.044*
				(0.022)				(0.025)
L. Export value	−0.001	−0.001	−0.001	−0.001	0.019***	0.019***	0.020***	0.021***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
L. GDP per capita	0.143***	0.142***	0.141***	0.138***	0.237***	0.237***	0.228***	0.217***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.021)	(0.021)	(0.020)	(0.020)
Population	−0.657***	−0.639***	−0.609***	−0.627***	−0.335***	−0.339***	−0.349***	−0.330***
	(0.071)	(0.071)	(0.071)	(0.073)	(0.071)	(0.070)	(0.070)	(0.070)
Inflation	−0.000	−0.000	−0.000	−0.001	0.008	0.008	0.010	0.006
	(0.001)	(0.001)	(0.000)	(0.001)	(0.016)	(0.016)	(0.016)	(0.015)
Observations	135,489	135,489	119,526	112,255	150,302	150,302	143,094	140,047
R^2	0.78	0.78	0.80	0.81	0.83	0.83	0.84	0.85

Robust standard errors are reported in brackets. Significance at the ***1%, **5%, and *10% level. The dependent variable is the log of the unit value of exports of the four-digit SITC product *p* from country *c* in year *t*. The sample covers the years 1984–2000. *Sector Targeted* is a dummy taking 1 if the country sector *cs* was targeted by the country's IPA in year *t* and 0 if the sector was not targeted in year *t* or if the country did not have an IPA in year *t*. The targeting information is available at the three-digit NAICS 1997 level. Export value is at the four-digit SITC level and is measured in current USD. GDP per capita is measured in current USD and inflation in percent. Export value, GDP per capita, and population all enter in natural logs. *LX* means lagged X periods. All regressions include product-year and country-sector fixed effects. Standard errors are clustered at the country-sector-year level.

value of exports originating from Norway, The Netherlands, Canada, South Korea, and Singapore, among others.[19]

In contrast to the strong association found for developing countries (significant at the 1% level), the results for developed countries (columns 5–8) are less robust. The contemporaneous effect is not statistically significant, and lags are significant only at the 10% level. The magnitude of the coefficients is also much smaller. A weaker and quantitatively smaller effect for developed countries is consistent with the view that foreign presence is closing a technology gap. For a developed economy, there is less of a technology gap to close, and the foreign presence has a minor effect on the unit values of exports.[20]

As for the other controls, we find that a positive correlation between GDP per capita and unit values, which, as expected, suggests that more developed countries export more sophisticated products. The data also indicate a negative correlation of the population size with export unit values, which is consistent with the finding of Hummels and Klenow (2005) that more labor-abundant countries tend to export lower-priced products. Additionally, in the developed country subsample, we find that products with a higher volume of exports tend to have higher unit values.

In the online appendix, we test the robustness of our results. First we show that excluding the volume of exports from the regression has no effect on the estimated coefficients (see online appendix table A3). Then we focus on the argument of Bertrand, Duflo, and Mullainathan (2004) that estimations with a difference-in-difference method using panel data are likely to be subject to serial correlation problem, which means that their standard errors could be severely underestimated. We take Bertrand et al.'s advice on how this problem could be remedied and conduct two robustness checks. In online appendix table A4, we demonstrate that our results remain highly significant for developing countries, though not for high-income economies, if we cluster standard errors on country-sector level (instead of country-sector-year combinations as in the baseline model).[21] In online appendix table A5, we follow their advice and ignore the time-series information when computing standard errors. We do so by regressing the logarithm of the export unit values on control variables (other than the variable of interest) and the fixed effects. We keep the residuals only for sectors that were designated by their countries as priority sectors in investment promotion efforts. We divide these residuals into two groups: residuals from the years before targeting started and residuals from the post-targeting years. Then we calculate the average for each country-sector combination for the pre- and post-targeting period. Finally, we regress the two-period panel of mean residuals on the dummy denoting the post-targeting period. As evident from online appendix table A5, the dummy

[19] The first thought experiment is based on 1994 figures, the second on 1996 figures.

[20] The lack of strong results for high-income countries may be due to FDI having two opposite effects on unit values of exports. On the one hand, FDI may lead to exporting of higher-quality (higher-unit-value) products. On the other hand, if multinationals are more productive than local producers, they may be able to produce and export the same products at lower prices. To shed some light on this question, we augmented our specification by controlling for labor productivity in sector *s* of country *c* at time *t* (using the value added per worker reported in the World Bank's Trade, Production, and Protection database). The results, not reported to save space, show a positive link between FDI and export quality in both developing and high-income countries. In most cases, the magnitude of the effect is larger for developing countries.

[21] Our results are also robust to clustering at the sector level.

TABLE 4.—UNIT VALUES AND THE LENGTH OF SECTOR TARGETING

	Developing Countries				High-Income Countries			
	1	2	3	4	5	6	7	8
Length of sector targeting	0.072***				0.016			
	(0.013)				(0.013)			
L. Length of sector targeting		0.065***				0.024*		
		(0.015)				(0.015)		
L2. Length of sector targeting			0.063***				0.029	
			(0.020)				(0.021)	
L3. Length of sector targeting				0.047**				0.025
				(0.022)				(0.029)
L. Export value	−0.001	−0.001	−0.001	−0.001	0.019***	0.019***	0.020***	0.021***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
L. GDP per capita	0.143***	0.142***	0.142***	0.138***	0.238***	0.238***	0.228***	0.217***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.021)	(0.021)	(0.020)	(0.020)
Population	−0.659***	−0.642***	−0.617***	−0.632***	−0.335***	−0.338***	−0.348***	−0.330***
	(0.071)	(0.071)	(0.071)	(0.074)	(0.070)	(0.070)	(0.070)	(0.070)
Inflation	−0.000	−0.000	−0.000	−0.001	0.008	0.008	0.010	0.006
	(0.001)	(0.001)	(0.000)	(0.001)	(0.016)	(0.016)	(0.016)	(0.015)
Observations	135,489	135,489	119,526	112,255	150,302	150,302	143,094	140,047
R^2	0.78	0.78	0.80	0.81	0.83	0.83	0.84	0.85

Robust standard errors are reported in brackets. Significance at the ***1%, **5%, and *10% levels. The dependent variable is the log of the unit value of exports of the four-digit SITC product *p* from country *c* in year *t*. The sample covers the years 1984–2000. *Length of Sector Targeting* is the number of years the country sector *cs* has been targeted by the country's IPA in year *t*. *Length of Sector Targeting* equals 0 if the sector was not targeted in year *t* or if the country did not have an IPA in year *t*. The targeting information is available at the three-digit NAICS 1997 level. Export value is at the four-digit SITC level and is measured in current USD. GDP per capita is measured in current U.S. dollars and inflation in percent. Length of sector targeting, export value, GDP per capita, and population all enter in natural logs. *LX* means lagged X periods. All regressions include product-year and country-sector fixed effects. Standard errors are clustered at the country-sector-year level.

remains positive and significant in the developing country subsample. We therefore feel confident that our baseline results are not subject to the autocorrelation problem.

Returning to our baseline specification, in table 4 we include the length of sector targeting instead of the indicator variable. It is intuitive to expect that the sectors targeted for a longer time period will attract larger inflows of FDI by virtue of greater effort on the part of an investment promotion agency. The results confirm our earlier conclusions. We find a strong positive association between sector targeting and unit values in developing countries but not in developed countries. Taken together, tables 3 and 4 point to a weaker, if any, effect of foreign presence on unit values of exports in developed countries.

One may be concerned about investment promotion agencies choosing to target sectors with higher unit values of exports. To attenuate this concern, we estimate a "placebo" regression, which includes an additional regressor taking on the value of 1 for the year immediately preceding the first year of targeting sector *s* by country *c* and 0 otherwise. A positive and statistically significant coefficient on this dummy would indicate that targeted sectors had higher unit values (relative to other sectors) even before targeting started. The first column of table 5, however, indicates that this is not the case in the developing country subsample. The dummy is not statistically significant. Moreover, the *F*-test reported at the bottom of the table indicates that the difference between the coefficients on the dummy and the *Sector Targeted* variable is statistically significant. In the second column, we repeat the exercise asking whether targeted sectors exhibited higher unit values during the two-year period preceding targeting. In columns 3 and 4, we do so for the three- and four-year periods, respectively. We find no indication that the sectors with higher unit values were chosen for targeting in developing countries. The additional regressors are negative, not statistically significant, and the *F*-tests reject the equality between the coefficients on each dummy and *Sector Targeted*. This exercise gives us confidence that it is the FDI presence that is leading to higher unit values of exports rather than the other way around. In the developed country subsample, the coefficients on neither the pre-targeting period nor the post-targeting periods are ever statistically significant.

Because our results are in line with FDI inflows leading to higher unit values of exports in developing countries, the natural question to ask next is whether this effect is due to additional investment in physical assets or to the knowledge and know-how that foreign investors bring. To examine this question, we control for investment (gross fixed capital formation) taking place in a given sector in a given country at time $t - 1$. The data on investment come from the World Bank's Trade, Production and Protection database (described in Nicita & Olarreaga, 2007) and enter in the log form. As evident from table 6, there is no statistically significant relationship between lagged investment and unit values of exports, and the link between sectors targeted by investment promotion efforts and unit values of exports remains positive and statistically significant.

Our results are consistent with the presence of FDI leading to higher unit values of host country exports. Foreign companies can affect the quality of a sector's exports in several ways. First, they can move the sector along the intensive margin by exporting relatively larger quantities of higher-valued products than domestic firms. Second, multinationals can induce movement along the extensive margin

TABLE 5.—ARE SECTORS WITH HIGHER UNIT VALUES OF EXPORTS CHOSEN FOR TARGETING?

	Developing Countries				High-Income Countries			
	1	2	3	4	5	6	7	8
Sector targeted	0.105***	0.102***	0.091***	0.099***	0.011	0.012	0.013	0.009
	(0.020)	(0.020)	(0.022)	(0.022)	(0.018)	(0.018)	(0.018)	(0.018)
1 year before sector targeting	0.010				−0.022			
	(0.039)				(0.023)			
1 and 2 years before sector targeting		−0.002				−0.007		
		(0.022)				(0.017)		
1, 2, and 3 years before sector targeting			−0.018				0.000	
			(0.020)				(0.014)	
1, 2, 3, and 4 years before sector targeting				−0.005				−0.010
				(0.018)				(0.013)
L. Export value	−0.001	−0.001	−0.001	−0.001	0.019***	0.019***	0.019***	0.019***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
L. GDP per capita	0.143***	0.143***	0.142***	0.142***	0.236***	0.237***	0.237***	0.236***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.021)	(0.021)	(0.021)	(0.021)
Population	−0.659***	−0.656***	−0.644***	−0.653***	−0.335***	−0.335***	−0.335***	−0.336***
	(0.072)	(0.072)	(0.071)	(0.071)	(0.071)	(0.071)	(0.070)	(0.070)
Inflation	−0.001	−0.000	−0.001	−0.000	0.008	0.008	0.008	0.008
	(0.001)	(0.001)	(0.001)	(0.001)	(0.016)	(0.016)	(0.016)	(0.016)
Observations	135,489	135,489	135,489	135,489	150,302	150,302	150,302	150,302
R^2	0.78	0.78	0.78	0.78	0.83	0.83	0.83	0.83
Test of equality of coefficients F-statistics	7.74	24.75	33.44	33.69	1.46	0.65	0.39	1.01
p-value	0.01	0.00	0.00	0.00	0.23	0.42	0.53	0.31

Robust standard errors are reported in brackets. Significant at the ***1%, **5%, and *10% levels. The dependent variable is the log of the unit value of exports of the four-digit SITC product p from country c in year t. The sample covers the years 1984–2000. *Sector Targeted* is a dummy taking 1 if the country-sector cs was targeted by the country's IPA in year t, and 0 if the sector was not targeted in year t or if the country did not have an IPA in year t. The variable *1 and 2 Years before Sector Targeting* is a dummy variable equal to 1 in year $t-1$ and $t-2$ if targeting of sector started in year t, and 0 otherwise. The other versions of this variable are defined in an analogous way. The targeting information is available at the three-digit NAICS 1997 level. Export value is at the four-digit SITC level and is measured in current USD. GDP per capita is measured in current USD and inflation in percent. Export value, GDP per capita, and population all enter in natural logs. *LX* means lagged X periods. All regressions include product-year and country-sector fixed effects. Standard errors are clustered at the country-sector-year level.

TABLE 6.—IS IT ABOUT FDI OR ANY INVESTMENT? CONTROLLING FOR GROSS FIXED CAPITAL FORMATION (GFCF) IN THE SECTOR

	Developing Countries				High-Income Countries			
	1	2	3	4	5	6	7	8
Sector targeted	0.116***				0.015			
	(0.018)				(0.019)			
L. Sector targeted		0.076***				0.034		
		(0.018)				(0.022)		
L2. Sector targeted			0.063***				0.051**	
			(0.020)				(0.025)	
L3. Sector targeted				0.055**				0.072**
				(0.023)				(0.034)
L.GFCF	−0.001	−0.001	−0.002*	−0.001	−0.002**	−0.002**	−0.002**	−0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
L. Export value	−0.005	−0.005	−0.003	−0.004	0.013***	0.013***	0.013***	0.014***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
L. GDP per capita	0.134***	0.131***	0.115***	0.114***	0.230***	0.231***	0.232***	0.219***
	(0.015)	(0.015)	(0.015)	(0.016)	(0.023)	(0.023)	(0.022)	(0.021)
Population	−0.855***	−0.818***	−0.785***	−0.827***	−0.334***	−0.345***	−0.362***	−0.330***
	(0.078)	(0.078)	(0.079)	(0.083)	(0.076)	(0.077)	(0.075)	(0.075)
Inflation	0.001	0.001	0.001	0.000	0.002	0.002	0.005	0.003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.016)	(0.016)	(0.016)	(0.015)
Observations	79,281	79,281	70,543	66,799	112,062	112,062	106,624	104,192
R^2	0.80	0.80	0.82	0.83	0.85	0.85	0.86	0.86

Robust standard errors are reported in brackets. Significant at the ***1%, **5%, and *10% levels. The dependent variable is the log of the unit value of exports of the four-digit SITC product p from country c in year t. The sample covers the years 1984–2000. *Sector Targeted* is a dummy taking 1 if the country-sector cs was targeted by the country's IPA in year t and 0 if the sector was not targeted in year t or if the country did not have an IPA in year t. The targeting information is available at the three-digit NAICS 1997 level. Export value is at the four-digit SITC level and is measured in current USD. GDP per capita is measured in current USD and inflation in percent. GFCF, export value, GDP per capita, and population all enter in natural logs. *LX* means lagged X periods. All regressions include product-year and country-sector fixed effects. Standard errors are clustered at the country-sector-year level.

by producing higher-quality or higher-priced versions of the already exported product categories or by introducing new, higher-value products to the country's export basket.[22] Third, multinationals can facilitate movement of local producers along either the intensive or the extensive margin through knowledge spillovers. Because trade statistics available to us do not distinguish between exports by domestic and foreign companies, our analysis captures the sum of all these effects.

The ability of multinationals to produce higher-unit-value goods stems from their possession of intangible assets, which can take the form of advanced technologies,

[22] As mentioned earlier, the superior productivity of foreign companies documented in the literature (e.g., Arnold & Javorcik 2009) may manifest itself in their ability to produce higher-quality products at equal cost.

established brand names, or superior management techniques. According to the U. N. Commission on Trade and Development (UNCTAD, 2005), multinationals are responsible for most of the world's research and development (R&D) activities. In 2002, 700 firms, 98% of which are multinational corporations, accounted for 46% of the world's total R&D expenditure and 69% of the world's business R&D. Considering that there are about 70,000 multinational corporations in the world, this is a conservative estimate. Similarly, more than 80% of global royalty payments for international transfers of technology in 1995 were made from subsidiaries to their parent firms (UNCTAD, 1997).

Higher product quality can also be achieved by utilizing advanced management techniques. For instance, Sutton (2005) gives an example of organizational changes introduced by a foreign investor in its Chinese affiliate. A shift in work practices involved a move away from traditional notions of inspection at the end of the production line to a system in which each operator along the line searched for defects in each item as it arrived and as it departed. Such constant monitoring resulted in a lower share of defective items produced because it allowed for a quick identification and rectification of sources of defects. Sutton (2005) reports that an executive based at the world headquarters of a multinational car seat maker remarked that he would expect to be able to achieve world-class quality standards at a greenfield plant in any country within one year of its establishment. But if he was operating in a joint venture with an established local seat maker, this process might take three years. The difference reflects the slowness of "relearning": if established routines are in place, it is hard to change them; beginning from scratch is easier.[23]

To the extent that FDI in developing economies might be correlated with increased use of inputs from developed economies, unit values might rise as a result of input value rather than value added in the host country.[24] Could this scenario explain our findings? Although a full-fledged analysis of this question is beyond the scope of our study, we examined whether imported intermediate inputs tend to have higher unit values if they belong to a sector targeted by the investment promotion agency. This approach relies on the observation that most inputs are supplied within sectors if the sectors are defined at a relatively aggregated level, as is the case in our data set. We did not find robust evidence suggesting that targeted sectors attract imports of higher-unit-value inputs in the developing country subsample.

B. What Types of Products Are the Most Affected?

Next we examine whether the association between FDI and unit values tends to be stronger in differentiated products. Differentiated products are the goods lacking a reference price because of their intrinsic features or the goods whose price is not set on organized exchanges. Examples of differentiated products include Women's Skirts and Blouses (SITC 8434 and 8435), while nondifferentiated products include Cement and Printing Paper (SITC 6412 and 6612). The classification of differentiated products was compiled by Rauch (1999) and is based on four-digit SITC Rev. 2 classification. Rauch suggested two definitions, a conservative and a liberal one, in order to account for the ambiguities arising in the classification. The conservative definition minimizes the number of commodities that are classified as homogeneous goods, while the liberal definition maximizes this number. We employ the liberal definition and hypothesize that differentiated products offer more room for quality upgrading, and thus the effect of FDI could be stronger in those product categories.

The results in table 7 show different patterns present in the developing and developed country subsample (columns 1–2 and 5–6, respectively). In developing countries we find no statistically significant difference between the effect of FDI on differentiated and homogeneous products, while in the developed countries, FDI matters only in the differentiated product category. A possible explanation for this finding is that in developed countries, there is little room for upgrading of exported homogeneous goods because these countries already have access to sophisticated technologies for production of goods such as cement or paper. In contrast, FDI inflows into developing countries may facilitate upgrading of both homogeneous and differentiated products.

In columns 3–4 and 7–8 of table 7, we ask whether the effects we attribute to FDI differ between exports of final goods, intermediate inputs, and raw materials. To check this, we interact our variable of interest with an indicator for final goods compiled by the WTO Trade Policy Review Division based on the U.N. classification of Broad Economic Categories.[25] Note that this classification differs from the one focusing on differentiated products. Not all final products are differentiated goods (beer and tomatoes are a case in point). Similarly, not all differentiated products are final goods (examples are silk yarn and leather). As evident from the table, FDI appears to be affecting mostly the unit values of final goods rather than unit values of all products exported from developing countries. If the seller's reputation matters more in the case of final products than in intermediates, it may be much easier for multina-

[23] The figures collected by Sutton (2005) support the increase in quality, though taking place at a somewhat slower pace. A multinational seat maker operating on a greenfield site in India experienced an initial level of its external defect rate of 2,085 parts per million (ppm) (as compared to a "world-class threshold" of 100 ppm). In its third year of operation, this rate had fallen to 65 ppm, close to the 50 ppm level regarded as "award class" by multinational seatmakers.

[24] There exists microevidence suggesting that producers acquired by a multinational increase their reliance on imported intermediates (Arnold & Javorcik, 2009), that firms that pay higher import prices charge higher export prices (Manova & Zhang, 2009), and that larger plants charge more for their outputs and pay more for their material inputs (Kugler & Verhoogen, 2012).

[25] We are grateful to Francis Ng from the World Bank for sharing with us the classification of products according to their state of processing.

TABLE 7.—ARE THE EFFECTS STRONGER FOR DIFFERENTIATED PRODUCTS AND FINAL GOODS?

	Developing Countries				High-Income Countries			
	1	2	3	4	5	6	7	8
Sector targeted	0.096***				−0.022			
	(0.022)				(0.018)			
Sect targ × differentiated product	0.014				0.036			
	(0.027)				(0.028)			
L. Sector targeted		0.076***				−0.016		
		(0.023)				(0.019)		
L. Sector targ × differentiated product		0.005				0.062**		
		(0.028)				(0.031)		
Sector targeted			0.039*				0.005	
			(0.023)				(0.019)	
Sector targ × final product			0.097***				0.013	
			(0.028)				(0.026)	
L. Sector targeted				0.023				0.014
				(0.024)				(0.019)
L. Sector target × final product				0.091***				0.023
				(0.029)				(0.025)
L. Export value	−0.004*	−0.004*	−0.001	−0.001	0.013***	0.013***	0.019***	0.019***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
L. GDP per capita	0.135***	0.134***	0.142***	0.141***	0.231***	0.232***	0.237***	0.237***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.022)	(0.022)	(0.021)	(0.021)
Population	−0.639***	−0.618***	−0.654***	−0.635***	−0.353***	−0.354***	−0.335***	−0.339***
	(0.071)	(0.071)	(0.071)	(0.071)	(0.073)	(0.073)	(0.071)	(0.070)
Inflation	0.000	0.000	−0.000	−0.000	0.012	0.012	0.008	0.008
	(0.001)	(0.001)	(0.001)	(0.001)	(0.016)	(0.016)	(0.016)	(0.016)
Observations	126,013	126,013	135,489	135,489	137,061	137,061	150,302	150,302
R^2	0.77	0.77	0.78	0.78	0.83	0.83	0.83	0.83

Robust standard errors are reported in brackets. Significant at the ***1%, **5%, and *10% levels. The dependent variable is the log of the unit value of exports of the four-digit SITC product *p* from country *c* in year *t*. The sample covers the years 1984–2000. *Sector Targeted* is a dummy taking 1 if the country-sector *cs* was targeted by the country's IPA in year *t* and 0 if the sector was not targeted in year *t* or if the country did not have an IPA in year *t*. The targeting information is available at the three-digit NAICS 1997 level. The dummy for differentiated products takes the value 1 if Rauch (1999) classified the four-digit SITC code as a differentiated product according to the liberal definition and 0 otherwise. The dummy for final goods is defined at the four-digit SITC level. Export value is at the four-digit SITC level and is measured in current USD. GDP per capita is measured in current USD and inflation in percent. Export value, GDP per capita, and population all enter in natural logs. *LX* means lagged X periods. All regressions include product-year and country-sector fixed effects. Standard errors are clustered at the country-sector-year level.

tionals than for indigenous producers to obtain higher prices for products of equal quality, and thus we would expect to see a more pronounced effect of FDI in final goods. As before, we find no statistically significant relationship for the developed country subsample.

C. *Is Transfer Pricing a Concern?*

Anecdotal evidence and the existing empirical literature suggest that multinational corporations tend to engage in transfer pricing to shift profits to lower tax locations and save on import duties (Swenson, 2001; Clausing, 2003; Bernard, Jensen, & Schott, 2006). Given this evidence, one may wonder whether the effect of FDI on unit values of exports could reflect transfer pricing activities of multinational corporations. We check this possibility by adding to the model an interaction between the host country's tax rate and the dummy for targeted sectors as well as the tax rate itself (see table 8). We expect that higher tax rates would give multinationals an incentive to underprice their exports in order to shift the profits out of the country. The data on tax rates come from the World Tax Database available from the Ross School of Business at the University of Michigan.[26] We use the highest corporate tax rate reported in the database. We find a positive correlation between the corporate tax rate and the unit value of exports, which is the opposite of what the presence of transfer pricing would suggest. The interaction term does not reach conventional significance levels in two of four regressions. More important, controlling for tax rate strengthens our previous results on the positive link between FDI and quality of exports.

The statutory tax rates do not take into account special fiscal incentives that may have been awarded to foreign investors. To take fiscal incentives into account, we estimate a variant of the baseline specification in which we allow an interaction between the *Sector Targeted* variable and a dummy taking on the value of 1 if country *c* offered foreign investors tax holidays or reduced tax rates at time *t* and 0 otherwise. The information on tax incentives comes from the IPA Census. The specification also includes the fiscal incentive dummy itself. The results, not reported to save space, produce no evidence suggestive of transfer pricing in developing countries. They also support our conclusion of a positive relationship between the presence of FDI and unit value of exports in developing countries.[27]

In an additional exercise, not reported to save space, we check whether our results are robust to controlling for tar-

[26] See: http://www.bus.umich.edu/OTPR/otpr/introduction.htm.

[27] There is not enough variation in the data to allow us to estimate a similar specification on the high-income subsample.

TABLE 8.—CONTROLLING FOR THE EFFECTS OF THE CORPORATE TAX RATE

	Developing Countries		High-Income Countries	
	1	2	3	4
Sector targeted	0.156**		0.432***	
	(0.064)		(0.110)	
Sector targeted × Tax rate	−0.000		−0.012***	
	(0.002)		(0.003)	
L. Sector targeted		0.235**		0.237**
		(0.104)		(0.113)
L. Sector targeted × Tax rate		−0.004		−0.006*
		(0.003)		(0.003)
Tax rate	−0.000	−0.000	0.001**	0.001**
	(0.001)	(0.001)	(0.001)	(0.001)
L. Export value product	−0.002	−0.002	0.019***	0.019***
	(0.002)	(0.002)	(0.002)	(0.002)
L. GDP per capita	0.216***	0.214***	0.244***	0.241***
	(0.018)	(0.018)	(0.021)	(0.021)
Population	−0.182	−0.116	−0.323***	−0.330***
	(0.122)	(0.123)	(0.070)	(0.071)
Inflation	0.000	0.000	0.009	0.009
	(0.001)	(0.001)	(0.016)	(0.016)
Observations	123,343	123,343	149,963	149,963
R^2	0.77	0.77	0.83	0.83

Robust standard errors are reported in brackets. Significant at the ***1%, **5%, and *10% levels. The dependent variable is the log of the unit value of exports of the four-digit SITC product *p* from country *c* in year *t*. The sample covers the years 1984–2000. *Sector Targeted* is a dummy taking 1 if the country-sector *cs* was targeted by the country's IPA in year *t* and 0 if the sector was not targeted in year *t* or if the country did not have an IPA in year *t*. The targeting information is available at the three-digit NAICS 1997 level. *Tax Rate* is defined as the highest corporate tax rate prevailing in country *c* at time *t*. Export value is at the four-digit SITC level and is measured in current USD. GDP per capita is measured in current USD and inflation in percent. Export value, GDP per capita, and population all enter in natural logs. *LX* means lagged X periods. All regressions include product-year and country-sector fixed effects. Standard errors are clustered at the country-sector-year level.

iffs in export markets. We augment the baseline specification with the average applied tariff faced by country *c* in the U.S. or the EU or both at time *t* and with the interaction between the tariff(s) and the *Sector Targeted* variable. The information on tariffs comes from the World Bank's WITS database. We still find strong evidence of a positive relationship between FDI and export quality in developing countries and less robust evidence for high-income economies. While the interaction terms are never statistically significant in the former subsample, the negative coefficients (though often insignificant) found in the latter are suggestive of transfer pricing taking place in high-income economies.[28]

D. A Further Robustness Check

Our earlier work (Harding & Javorcik, 2011) based on a difference-in-differences approach has convincingly shown that the sectors prioritized in investment promotion efforts receive more than double the amount of FDI inflows received by other industries. This gives us confidence that we can interpret our findings of a positive link between sector targeting and export unit values as consistent with FDI inflows leading to export upgrading. Nevertheless, as an additional robustness check, we perform an instrumental variable analysis in order to show a positive relationship between the variation in FDI attributable to investment promotion efforts and unit values of exports.

The information on FDI presence at the required level of disaggregation is available only for the United States and is much more limited in terms of the time period and the number of countries covered (we lose 40,000 to 60,000 observations in the developing country subsample). We consider several measures of FDI: the value of FDI inflows, the value of assets of U.S. affiliates operating in each host country in a given sector, and the value of sales and employment of such affiliates. All data come from the BEA. We instrument for each measure of FDI using our *Sector Targeted* dummy. As shown in the earlier version of this study, in six of eight specifications, our instrument is positively and significantly linked to the FDI presence in a host country. The second-stage regressions confirm our earlier conclusions. We find a positive and statistically significant link between FDI presence and unit values of exports in the developing countries, but not in high-income economies. Because these estimates represent the effect of FDI originating only from the United States, they are not directly comparable to the earlier findings, which capture the effect of investment promotion on FDI originating from all parts of the world.

E. Are Our Conclusions Robust to Using More Disaggregated Data?

In a final set of robustness checks, presented in online appendix B, we examine whether our conclusions are robust to using more disaggregated data, namely, information on trade flows reported at the ten-digit level of the Harmonized System (HS). These figures, collected by the same agency (U.S. Customs), are also more consistent across exporting countries than the SITC figures collected by national customs services that vary in terms of quality and the level of computerization. The higher level of disaggregation and greater consistency come at a price of restricting the analysis to exports destined only for the U.S. market, as data at a

[28] Ideally we would also like to control for variation in related-party trade at the sector or the product level. Unfortunately, such information is not available to us.

similar level of detail are not readily available for other markets, and a slightly lower number of countries in the sample (76 developing and 23 high-income countries).

The data, available from the NBER, are described in Feenstra (1996, 1997) and Feenstra, Romalis, and Schott (2002) and have been extended to 2006. The ten-digit HS classification includes 21,741 codes, of which we observe 17,720 codes in our sample spanning the 1989–2006 period. The higher level of disaggregation of the HS data (relative to the SITC data) means that it is not computationally feasible to include product-year fixed effects, as was done in our baseline specification. Therefore, we normalize the unit value of exports by the average price observed in a given year in the relevant country grouping. When we consider the developing country subsample, the relevant average unit values are calculated based on exports of developing countries, and in the case of the high-income-country subsample, the average is taken over exports of high-income countries (see online appendix B for details). Our specification controls for the lagged exports to the United States of a given product by a given country, sector targeting, and country-level controls defined as in the baseline specification. We include country-sector fixed effects in the model and cluster standard errors at the country-sector-year level.

Although we expect results similar to those obtained before, we do not necessarily expect them to be identical. The key difference between this data set and the data set used previously (besides the level of aggregation) is the destination of exports. Our baseline data cover worldwide exports of each country destined for developed and developing country markets, while the current data are restricted to exports to one high-income country.

The results based on the U.S. import data are consistent with a positive impact of FDI inflows on the quality of exports originating in developing countries. The opposite pattern is found for high-income economies (see online appendix table B2). As shown in online appendix table B3, in two of the "placebo" specifications (analogous to those in table 5) estimated for developing countries, we cannot reject the hypothesis that the effect of targeting is felt prior to the actual targeting taking place. For developed countries, we are not able to reject the hypothesis in any of the specifications.[29] These placebo results suggest that endogeneity may be a problem; hence, we instrument for the choice of targeted sectors. Our instruments rely on the assumption that national IPAs emulate the actions of their competitors in other countries (see online appendix B for details). The IV analysis confirms the positive relationship between FDI and the quality of exports in developing countries (see online appendix table B4). In the high-income subsample, we find a negative link between FDI and the unit value of exports, though the estimated coefficients are not statistically significant in lagged specifications (see online appendix table B5).

Finding a positive relationship between FDI and export upgrading in developing countries using two very different data sets in terms of the agencies collecting the data, the export markets, the composition of exporters, the time period, and, most important, the level of aggregation gives us confidence in our findings. Our confidence is strengthened by the robustness of our conclusions to the instrumental variable approach.

As for the high-income subsample, we speculate that there are two competing effects. FDI can lead to upgrading of export quality (which manifests itself in higher unit values)/or increasing production efficiency (which manifests itself in lower unit values of exports), or both. Which of the two effects dominates depends on the set of countries and the export markets considered.

F. Does FDI Bring Exports Closer to the Quality Frontier?

We have demonstrated that FDI can contribute to increasing unit values of a country's exports. But does it also contribute to closing the gap to the quality frontier? To answer this question, we consider the dependent variable expressed relative to the quality frontier. The frontier is defined as the 95th percentile of the distribution of unit values of product p exported at time t by all countries in the data set. The new dependent variable is then defined as the log of the ratio of the unit value of product p exported by country c at time t to the frontier unit value at time t. The higher the value of the dependent variable, the closer the exporter is to the quality frontier. A positive coefficient on sector targeting would suggest that FDI brings exporters closer to the frontier.

In all but one specification presented in table 9, we find a positive and statistically significant coefficient on sector targeting. For developing countries, the coefficient is significant at the 1% or the 5% levels. In the high-income grouping, the significant coefficient is found in three of four specifications, and significance reaches only the 10% level. These results suggest that FDI not only increases export quality in absolute terms but also helps countries close the gap to the quality frontier.

G. Does FDI Increase Export Sophistication?

Previous work examining changes in a country's export basket distinguished between the quality and the sophistication of a country's exports (see Hausmann et al., 2007; Wang & Wei, 2008). So far our study has focused on the quality aspect. In this section, we extend our analysis by examining the link between FDI and export sophistication.[30]

We do so first by following the approach of Hausmann et al. and constructing a measure of the "income level of a

[29] The latter was also true in table 5, but there the effect of targeting was not statistically significant.

[30] We are grateful to an anonymous referee for suggesting this extension.

TABLE 9.—DOES SECTOR TARGETING BRING COUNTRIES CLOSER TO THE QUALITY FRONTIER?

	Dependent Variable: ln(Unit Value$_{pct}$/95th Percentile Unit Value$_{pt}$)							
	Developing Countries				High-Income Countries			
	1	2	3	4	5	6	7	8
Sector targeting	0.103***				0.013			
	(0.018)				(0.018)			
L. Sector targeting		0.084***				0.029*		
		(0.019)				(0.017)		
L2. Sector targeting			0.069***				0.037*	
			(0.022)				(0.020)	
L3. Sector targeting				0.047**				0.044*
				(0.022)				(0.025)
L. Export value	−0.001	−0.001	−0.001	−0.001	0.019***	0.019***	0.020***	0.021***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
L. GDP per capita	0.143***	0.142***	0.141***	0.138***	0.237***	0.237***	0.228***	0.217***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.021)	(0.021)	(0.020)	(0.020)
Population	−0.657***	−0.639***	−0.609***	−0.627***	−0.335***	−0.339***	−0.349***	−0.330***
	(0.071)	(0.071)	(0.071)	(0.073)	(0.071)	(0.070)	(0.070)	(0.070)
Inflation	−0.000	−0.000	−0.000	−0.001	0.008	0.008	0.010	0.006
	(0.001)	(0.001)	(0.000)	(0.001)	(0.016)	(0.016)	(0.016)	(0.015)
Observations	135,489	135,489	119,526	112,255	150,302	150,302	143,094	140,047
R^2	0.51	0.51	0.55	0.56	0.55	0.55	0.57	0.58

Robust standard errors are reported in brackets. Significant at the ***1%, **5%, and *10% levels. The dependent variable is the log of the ratio of the unit value of exports of the four-digit SITC product *p* from country *c* in year *t* to the 95th percentile of the distribution of unit values of product *p* exported by all countries in the data set in year *t*. The sample covers the years 1984–2000. *Sector Targeted* is a dummy taking 1 if the country-sector *cs* was targeted by the country's IPA in year *t* and 0 if the sector was not targeted in year *t* or if the country did not have an IPA in year *t*. The targeting information is available at the three-digit NAICS 1997 level. Export value is at the four-digit SITC level and is measured in current USD. GDP per capita is measured in current USD and inflation in percent. Export value, GDP per capita, and population all enter in natural logs. *LX* means lagged X periods. All regressions include product-year and country-sector fixed effects. Standard errors are clustered at the country-sector-year level.

country's exports" (*EXPY* in the authors' terminology). In the work of Hausmann et al., *EXPY* is a country-level measure defined as a weighted average of the GDP per capita level associated with each product exported, where the weights are the value shares of each product in the country's total exports. In our paper, the variation in investment promotion activities is at the sector level; hence, we have created a sector-level equivalent of *EXPY*. In other words, in our analysis, *EXPY* varies by country, sector, and year. We experiment with two variants of this measure: (a) *EXPY* based on the GDP per capita level associated with each product as reported by Hidalgo et al. (2007),[31] (b) *EXPY* calculated using the GDP per capita level associated with each product exported constructed using trade figures for 2000 from our data set.

We estimate the following equation:

$$\ln EXPY_{sct} = \alpha + \beta\, Sector\_Targeted_{sct} + \pi \ln Export\_Value_{sct-1} + X_{ct}\theta + \gamma_{cs} + \gamma_t + \varepsilon_{sct}, \quad (2)$$

which includes the same independent variables as the baseline specification, equation (1), as well as country-sector and year fixed effects.

We do not find any evidence of sector targeting being significantly correlated with the sophistication of the sectoral exports measured by *EXPY*. This is true for both variants of the measure, contemporaneous or lagged sector targeting (first, second, or third lag), and both the developing and high-income-country subsample.

Second, we use Wang and Wei's *EDI* index to capture the lack of export sophistication. This index, adapted to the context of our study, measures the dissimilarity between the product structure of a country sector's exports and that of the same sector in high-income economies. It is defined as

$$EDI_{sct} = 100\left(\sum_{p\in s} abs\left(s_{pct} - s_{pt}^{HI}\right)\right)$$

$$\text{where } s_{pct} = \frac{E_{pct}}{\sum_{p\in s} E_{pct}},$$

where s_{pct} is the share of four-digit SITC product p in the sector s exports from country c at time t. s^{HI} is the average share of four-digit SITC product p in sector s exports from high-income countries at time t. The greater the value of the index, the more dissimilar is the export structure of country c and high-income countries. If country c and high-income countries have identical export structures, the index will take on the value of 0. If there is no overlap between the two export structures, the index will be equal to 200. Thus, the smaller the value of the index, the more sophisticated the export structure of country c. The average value of the index for developing countries in our sample is 84, while for high-income countries, it is 69. Following Wang and Wei, we take the log of the index.[32]

[31] Data downloaded from http://www.nd.edu/~networks/productspace/proximity.htm.

[32] As *EDI* takes on the value of 0 for some high-income countries, we add 1 before taking the log.

To examine the link between FDI and export sophistication, we regressed the logged index on the set of explanatory variable listed in equation (2). The results, not reported to save space, indicate that there is no statistically significant correlation between *Sector Targeted* and the export dissimilarity index. This is true for contemporaneous or lagged sector targeting (first, second, or third lag), and both the developing and high-income country subsample.

The results of both exercises are consistent with the findings of Wang and Wei, who analyze the overlap between China's export structure and that of high-income countries and also use the unit value to measure the quality of Chinese exports. They conclude that FDI plays no role in increasing the similarity of Chinese exports to those of advanced countries, even though it contributes to raising the unit values of Chinese exports.

To summarize, while the results of our study are consistent with FDI inflows leading to upgrading the quality of the host country's export basket, we find no evidence that FDI increases the similarity between the developing and the high-income export structure.

IV. Conclusion

The recent literature has postulated that the quality of a country's export basket has strong implications for its future economic growth (Hausmann et al., 2007). This view has given impetus to policymakers, particularly those in developing countries, to search for measures helping exporters climb up the value-added ladder. However, little evidence of successful interventions has been discovered.

This study argues that the policies aimed at attracting FDI inflows offer a potential recipe for upgrading export structure in developing countries. The results of our empirical analysis suggest a positive relationship between FDI and export quality. The magnitude of the effect is economically meaningful. Sectors prioritized in national efforts to attract FDI are found to have 11% higher unit values of exported products than other sectors. These findings are robust to using two different data sets, including highly disaggregated figures on U.S. imports, and to instrumenting for the choice of priority sectors.

Our findings are in line with the entry of foreign investors leading to an increase in the quality of exports in developing countries in both absolute terms and as in terms of bridging the distance to the quality frontier. There is little indication, however, that inflows of FDI make a developing country's export structure more similar to that of high-income countries. In sum, our findings suggest that attracting FDI inflows can be a viable strategy for low- and middle-income countries wishing to upgrade the quality of their export basket.

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