Export Upgrading and FDI: New Evidence from Brazil

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This study presents additional evidence of the role of FDI flows in export upgrading. Using industry-level data on Brazilian FDI inflows, we show that FDI inflows promote export upgrading. Most importantly, we show that export sophistication occurs through the upgrading of goods exported to the same foreign market. We show that upgrading occurs in all sectors and that sophistication is slightly stronger for low-tech products. Keywords: Export Upgrading, FDI flows, sectoral evidence

I. Introduction

Export diversification and upgrading have been associated with faster economic growth (Hausmann and Rodrik (2007) , Rodrik (2007)), having a positive effect on GDP per capita and human capital. The transition of developing economies from exporting low-quality goods to high-quality goods is considered a necessary condition for economic development and growth. (Kremer (1993), Verhoogen (2008)).[1]

FDI activity and flows have been found to improve firm performance, especially productivity: it leads to an increase in the same-industry productivity through competition, innovation and technology spillovers; it also improves productivity across industries through either backward or forward linkages spillovers (Javorcik (2004)). Additionally, it has been argued that FDI inflows can improve a country's ability to climb in the quality ladder of exports. (Harding and Javorcik (2012)).

We relate FDI inflows in a given industry to export upgrading in that same industry. FDI inflows may contribute to the increase in the quality of the products produced by the specific firm or even by affecting the entire industry receiving this foreign investment through spillovers. Moreover, upgrading may occur either within firm or across firms within the same industry or sector. That is what we investigate in this work.

Using industry-level data on FDI inflows from Brazil, we test whether FDI inflows promote export upgrading and we find that they do. More specifically, we explore the upgrading of exports to each foreign market, i.e., whether exports to the same destination increase their quality level. To circumvent issues related

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[1] For an endogenous growth model that emphasize the importance of quality see **?**.

to FDI inflows endogeneity we use FDI outflows from advanced economies as an instrument and we are able to find that FDI inflows promote export upgrading.

We find that upgrading occurs in all industries although the results suggest a stronger effect for low-tech products. We also find some heterogeneous effects associated with industries and countries of destination of exports. Exports to Latin America amd the U.S. benefited from upgrading coming from FDI flows especially for medium and low-tech products. On the other hand, exports to the advanced economies were affected across sectors during the 2006-2009 period.

Our work is related to several strands of the literature. First, it is related to the studies about the impact of FDI on a country's performance. The empirical literature on the FDI impact on economic growth has been mixed. Macro studies in particular have not found a significant effect. Alfaro and Sayek. (2010) show that the effect of FDI may depend on the host countries economic environment. In particular, they show that countries that are more financially developed are the ones that benefit more from the FDI flows.

Some studies that consider aggregate productivity have also found that the effect of FDI may not be so relevant or even have found no effect of FDI inflows on productivity. Demir and Duan (2018) using bilateral FDI inflows analyze the impact of North-South and South-South flows and do not find any effect of FDI on the productivity of the host country as well as on the productivity gap between the countries involved. Gunby and Reed (2017) stress the presence of an effect of FDI flows to firm productivity but question the quantitative importance of this effect in aggregate terms, i.e., for the aggregate productivity.

Colen and Guariso (2016), using the signing of investment agreements as a shock, test whether sectors that are more capital-intensive, having higher sunk costs, are more affected than other sectors. They do find that there is a stronger effect on FDI inflows for those sectors with higher sunk costs for former Soviet Union countries in Central and Eastern Europe.

Another related strand of the literature refers to export diversity, upgrading and sophistication. Amiti and Khandelwal (2013) investigate the relationship between import competition and export upgrading. They find that lower tariffs are related to quality upgrading in sectors closer to the world quality frontier, while not promoting quality upgrading in sectors that are further away from the frontier. This suggests the presence of heterogeneous impact of import competition on export upgrading.

Amighini and Sanfilippo (2014) investigate whether the origin of the FDI matters for the export upgrading effect of the FDI. They find that South-South FDI flows promote export diversification in low-tech industries such as agro-industry and textiles and also increasing the quality of exports in the manufacturing sectors.

Sheng and Yang (2016) develop a model that accounts for institutional reforms - including ownership liberalization - on export diversification. They test empirically their model using data for China from 1997 to 2007 to find that these

reforms did, in fact, increase the extensive margin of exports, which implied a expansion of the export basket of China.

Zhu and Fu (2013) investigate the determinants of export upgrading using a cross-country panel dataset over the 1992−2006 period. They find that the export sophistication of a country depends on a variety of factors: as capital deepening, engagement in knowledge creation, transfers via investment in education, R and D, imports and also foreign direct investment.

The closest work to ours is probably Harding and Javorcik (2012). They explore the impact of a FDI promotion program to the upgrade of exports for a large cross-country panel. They evaluate the impact of having a FDI promotion program on export prices adopting as the measure of quality the export unit-values at the 4-digit industry level. For the estimation, they use the variation over time and across countries of origin to identify this effect. They show that FDI promotion do increase export unit-values in manufacturing, what is interpreted as generating export upgrading in quality.

Our work focuses on the impact of FDI inflows on export upgrading. We stress the sophistication of exports that occurs due to the upgrading of exports to a given foreign market. Our work complements Harding and Javorcik (2012). We explore the within-industry variation of the export price to a given foreign market over time to identify this effect. We use a destination-industry-level panel from 2002 to 2009 from Brazil and we adopt as a measure of quality the export unit-value for each destination.

We find that FDI inflows are associated with an increase in the quality of exports. Furthermore, we obtain that upgrading was driven mainly by the medium-low and low-tech goods exported to Latin America and the U.S.. Selling high-tech goods to advanced economies also promoted upgrading, but only in certain periods.

The paper is organized as follows. Section II presents a theoretical framework to guide in our empirical strategy. Section III contains the data description and it explains our empirical strategy. The empirical results are presented in section IV. Section V concludes.

II. Quality upgrading and Foreign Direct Investment- Theoretical Framework

In this section, we discuss a theoretical framework to illustrate the channel through which FDI inflows may lead to product upgrading and to export upgrading, in particular .

Following a model of monopolistic competition where consumers have "love-for-variety"preferences, we get the following price-setting rule:

$$ExportPrice_{pdt} = Mark - Up(\sigma_{dt}) * MC(Q_p, w, \phi, \delta)$$

where p , d and t index product, country of destination and time, respectively. The $Mark - Up(\sigma_{dt})$ depends on the elasticity of the demand of the destination

country (σ_{dt}) which may vary over time; $MC(Q_p, w, \phi, \delta)$ corresponds to the firm marginal cost of production.

The marginal cost of production may depend on the quantity sold by the firm or be constant. It depends on the cost of inputs, here represented by w, on the firm productivity level, ϕ, and on the quality (δ) of the product produced.

The decision about the quality of the product depends on the costs involved. These costs may be modeled as being increasing in the level of investment and variable costs of production, such as having to hire more qualified workers. Foreign investment, namely FDI, could finance this investment in quality. In this case, receiving FDI inflows could lead to higher export prices, since higher quality goods are more expensive. This is the channel we emphasize in this work.

Spillovers from FDI activity, by inducing an improvement in the sector productivity, could allow firms to invest in higher quality goods, which might not have been possible otherwise. As Verhoogen (2008) points out, quality comes together with higher productivity - productivity being a complement to quality - and ultimately with imported inputs. FDI, then, could act on this front. Hence, this is another possible channel through which FDI could generate export upgrading.

In the same direction, Amiti and Khandelwal (2013) emphasize the role of import competition to promote export upgrading. The presence of FDI may impact the economy in a similar fashion as a trade liberalization through the competition channel. Foreign firms may entail competition in the domestic market forcing domestic producers to improve their products and possibly to start producing goods of quality higher than before. Because they would be producing higher quality goods, they would also export more sophisticated products.

On the other hand, foreign direct investment could induce firms to improve their techniques of production and even the organization of the firm. Both of these mechanisms would generate an increase in firm productivity. In this case, FDI inflows would reduce costs of production, which could lead to lower export prices.

Therefore, if FDI predominantly contributes to the increase in the quality of the products produced it should increase the export price of a good. On the other hand, if the foreign investment contributed mainly to improve the firm productivity then it could reduce the price at which it is able to sell in the foreign market. We test which effect is stronger in our sample.

III. Data and Empirical Strategy

A. Data

Trade Data

We use export data from UN-COMTRADE from 2002 to 2009 reported by Brazil[2] including the export value and the quantity exported which allows us to compute the export unit value which is our measure of export price. The data was collected at the four-digit SITC Rev.3 classification including only manufacturing, which corresponds to SITC 5 to 8. We have 700 codes in our sample. It is at a fairly disaggregated level and extensively used in the literature. [3]

In contrast to previous studies, we use data not only at the product-level but also by the country of destination of Brazilian exports. This data allow us to identify whether there is upgrading over time for the same product. In addition to that, we can investigate whether where you export to matters for quality upgrading.

Our measure of export upgrading is the export unit value which is calculated as the ratio between the value of export divided by the quantity (weight) exported. The value of exports is reported in US dollars. The vast majority of units of quantity reported in the dataset corresponds to weight, which led us to adopt weight as a measure of quantity[4]. Additionally, a large body of literature uses this as a measure of quantity. Nevertheless, we attempt to alleviate measurement problems by including product fixed effects in all of our specifications. Finally, since the unit-values at the product level are known to be noisy, we follow Hallak and Schott (2011) and trim the data by excluding the 5% observations on each tail of the distribution.

FDI Data and Instruments

We use data on annual FDI inflows obtained from the Brazilian Central Bank from 2002 to 2009. The FDI inflows are obtained at the industry specific-level in an equivalent classification of the ISIC-Revision 3 at the two-digit level. Unfortunately, information of the FDI inflows are not available at a more disaggregate level.

To mitigate endogeneity issues with the FDI inflows we use as instruments the FDI outflows from advanced economies. We consider two flows: US total FDI outflows and the European Union countries total FDI outflows as reported by the

[2]We use the data reported by Brazil to capture only the f.o.b. prices instead of using what is reported by the importing countries. Although the latter are allegelly more reliable, they are only reported c.i.f. which includes additional costs that we want to avoid.

[3]Harding and Javorcik (2012) use similar data in their analysis of quality upgrading.

[4]Using weight as the measure of quantity may bring some problems, as for instance, one could consider that higher quality goods are lighter than lower quality in some contexts. However, this is the unit available and we also introduce product fixed effects to avoid inconsistency of units across products.

OECD website in the table "Outward FDI flows by Industry", which is reported in US millions of dollars.

Since the FDI information is at the sector-level we cannot include in our regressions sector-year fixed effects to control for sector-specific supply shocks. To control for that, we include in our data set information on domestic operational costs, investment, output and the number of establishments at the sector-level obtained from the Brazilian Manufacturing Census made available on-line from IBGE (Brazilian Statistical Office) for the 2002-2009 period. The investment variable helps to disentangle the effect of foreign investment from investment alone.

This information is used to control for possible sector-specific supply shocks that may vary over time. We construct a measure of firm average cost by dividing total operational costs by the quantity produced. Additionally, we compute an average investment level variable as the ratio of the investment to the industry total output. We explore the variation over time on these two variables to capture any supply shock that could increase the export price and that would not be related to the FDI inflows.

To account for demand shocks, additional data is incorporated to our data set from the IDSB UN Database (2012). The desired information was to get the apparent consumption of the countries of destination of Brazilian exports to control for sector-specific demand shocks that may vary over time. Unfortunately, this data was available only for a limited number of countries and years. Instead, we use the total imports (world imports) reported in the IDSB UN of each country of destination to capture this demand shock. This data is available at the ISIC Revision 3 at the four-digit industry and it was converted to the four-digit SITC classification to match our original data on FDI inflows.

To analyze whether export upgrading is more intense in high or low tech sectors we use the OECD classification of technology intensity[5]. From the ISIC Revision 3 classification we were able to map the products into 4 categories: high, medium-high, medium-low and low-tech. We use this information to investigate heterogeneous effects of the FDI inflows.

We observe that the mean of the log of FDI outflows of the European Union countries and the United States are close, 8.42 and 7.67 for the E.U. and the US, respectively. The standard deviations are almost identical, equal to 1.2.

Regarding the technological level, we have that 10 percent of our sample includes high-tech goods, whereas 36 percent corresponds to medium-tech goods. Medium-low tech goods respond for 18 percent and 23 percent goes to low tech-goods.

Most of the products are sold to emerging economies, which account for 56 percent of the sample. Latin American countries account for approximately 39 percent of our sample, while Mercosur corresponds to 12 percent. European Union countries are the destination of 23 percent of the Brazilian exports. Asia and the USA together respond to approximately 12 percent of the sample.

[5]For more information on the classification see https://www.oecd.org/sti/ind/48350231.pdf

B. Empirical Strategy

Baseline specification

To examine whether FDI can contribute to the upgrading of exports we use detailed information on industry-level FDI inflows for Brazil during the period 2002-2009. Our empirical analysis is based on the relationship between export unit-values (at the industry-destination-level), as a measure of quality of exports, and the FDI inflows received in a specific sector. In particular, we look at the unit-values at the product-destination level across years. Unit values of exports are used at the 4-digit Standard International Trade Classification (SITC) level and vary across destinations. FDI inflows are obtained at a 2-digit industry-level over the period.

The use of FDI inflows variable to capture causality poses a challenge due to the possible presence of reverse causality. Higher quality products could attract more FDI inflows which would make FDI inflows endogenous. We deal with this issue by using FDI outflows from advanced economies as an instrument for the FDI inflows.

To account for any unobservables that may affect the export price and not be related to quality but which are common to any destination-product combinations and constant over time, we include destination-product fixed effects in our specification. For instance, these fixed effects would capture the fact that Brazil might always export higher quality goods to Denmark.

To capture the change in the quality of products over time in a foreign market due to FDI inflows we include product-destination fixed effects. In that way, we explore the variations in FDI inflows within product over time and how they affect the unit-value of exports. This also allows us to control for differences in units across products.

To control for possible demand shocks of the foreign markets, we include destination-year fixed effects. This should capture any aggregate demand shock from any destination that varies over time. It should also capture any change in the mark-up as modeled before. Additionally, we control for industry-specific demand shocks that vary over time by including in our specifications the log of world imports of each country of destination. Our hypothesis here is that Brazil does not account for the majority of imports of the world imports for most economies in the sample.

To control for supply shocks, we include average costs at the industry level and in some specifications the investment per output at the industry-level. Since the FDI inflows vary only by industry and time, we cannot include industry-year fixed effects.

Following Harding and Javorcik (2012), we measure export upgrading by the export unit-value at the product-level. However, differently from them, we have the unit value at the product-destination level since we want to investigate the upgrading to each destination market. Harding and Javorcik (2012) instead have a panel of countries and the unit-value they use is at the origin-product level.

Our main specification is described below:

$$ln(UV)_{pdt} = \alpha + \beta_1 ln(FDI)_{i,t-k} + \beta_2 X_{pdt} + \delta_{id} + \delta_{dt} + \epsilon_{idt} \tag{1}$$

where $ln(UV)_{pdt}$ is the log of the export unit-value at the product-destination-year level, product being defined as 4-digit level; $ln(FDI)_{i,t-k}$ is the FDI inflows at the industry i in year $t-k$; X_{pdt} include different controls, such as costs of operation and investment at the sector level and the level of world imports; δ_{id} are industry-destination fixed effects; δ_{dt} are export destination-year fixed effects; δ_{st} are sector-year fixed effects and ϵ_{idt} is the error term.

Heterogeneity Effects

To further investigate the effects of FDI inflows, we test whether it varies according to the destination markets. We, then, interact the FDI inflows variable with a dummy for the different regions. We consider Asia, Latin America, Mercosur and the United States.

The specification, then, becomes:

(2)
$$ln(UV)_{pdt} = \alpha + \beta_1 ln(FDI)_{i,t-k} + \beta_2 ln(FDI)_{i,t-k} * D_d^{Region} + \beta_3 X_{pdt} + \delta_{id} + \delta_{dt} + \epsilon_{idt}$$

where the variables were defined previously and *Region* refers to a dummy for the region of the destination.

The coefficient β_2 is the parameter of interest. It captures the differential impact that a region may suffer from FDI inflows. If β_2 is positive, it means that FDI had a differential and greater positive impact in the respective region. The total impact of the FDI is captured by $\beta_1 + \beta_2$ for the corresponding region.

We also analyze whether the sector matters for the impact of the FDI inflows. To test for that, we include in our regression the interaction of the inflows with dummies of the level of technology of the sectors according to the OECD classification. We consider high-tech, medium-high, medium-low and low tech goods.

The specification in this case becomes:

(3)
$$ln(UV)_{pdt} = \alpha + \beta_1 ln(FDI)_{i,t-k} + \beta_2 ln(FDI)_{i,t-k} * Tech_p + \beta_3 X_{pdt} + \delta_{id} + \delta_{dt} + \epsilon_{idt}$$

where $Tech$ refers to the level of technology of the sector of the good produced.

Finally, we test whether the market of destination combined with the technology of the product matter. We interact the destination dummies with the levels of technology mentioned above to assess if there is some heterogeneity.

The specification then becomes:

$$ln(UV)_{pdt} = \alpha + \beta_1 ln(FDI)_{i,t-k} Tech_p + \beta_2 ln(FDI)_{i,t-k} * Tech_p * D^{Region} +$$

$$\beta_3 ln(FDI)_{i,t-k} D^{Region} + \beta_4 X_{pdt} \delta_{id} + \delta_{dt} + \epsilon_{idt} \tag{4}$$

where variables were defined previously.

In this case, the parameter of interest, β_2, if positive indicates that export sophistication is larger for products sold to that region of a certain technology.

IV. Results

A. Baseline Results

Table 2 presents the results for the OLS regressions. The first four columns stress the importance of the of the different fixed effects. We emphasize the results for the lagged FDI inflows since they are the main flow in our specifications. Without any fixed effects and controlling only for the lagged export value, FDI inflows appear with a negative sign. When one controls for product-destination fixed effects, the effect of lagged FDI inflows are not negative anymore- as it is the case when including only the destination-year fixed effects- but positive and statistically different from zero. The inclusion of both fixed effects and of the controls affects slightly the coefficient (from 0.01 to 0.008) and it is significant only at 10 percent. Contemporaneous FDI inflows appear as positively related to export prices and statistically significant and its coefficient is close to the lagged FDI flows.

Table 3 shows the results for the regressions when FDI outflows from advanced economies[6] are used as instruments. The results suggest that the FDI inflows have a positive impact on the quality of exports, here measured as the unit-value of exports. In fact, this is true for the contemporaneous flows and for the recent FDI inflows. They are also robust to the instrument used - columns (1) to (3) show the results when both U.S. and EU FDI outflows are used as instruments whereas columns (4) to (6) show the results when only EU FDI outflows are included.

The estimated coefficients for the controls present the expected signs and are consistent with the literature. We observe that, as expected, the value of exports in the previous period is negatively related to the export price which suggests that larger export sales are related with lower prices. By including this variable, we are able to control for that.

A positive demand shock, captured by an increase in imports from other countries, have a positive impact on export prices: the higher the demand the higher is the export price (columns (1) and (2)). The average cost variable, when statistically significant, also has a positive sign indicating that a higher cost of production implies a higher price.

These results suggest a positive relationship between FDI inflows and unit values of exports. This is especially true in the short-term: larger FDI inflows increase unit values of exported products in a one to two years horizon (Table 3). Most importantly, our results complement the previous literature by showing

[6]Different specifications were tested: either using only USA flows, EU flows or both. The results presented correspond to the case when both flows are included unless otherwise stated.

that even when considering exports to the same foreign market we identify this export upgrading. This result is in accordance with the idea that foreign direct investment provides an incentive to move exports up in the quality ladder, in particular, of the same product being sold to a country.[7]

B. Heterogeneity Results

On average, our results suggest that FDI inflows do promote export upgrading as showed in the previous section. In this section, we present some evidence that FDI tends to affect all destinations in a similar manner.

Our preferred specification corresponds to the one with the lagged FDI inflow since we would expect the FDI flow to affect upgrading not immediately, especially, it would not appear in contemporaneously in the data[8]. With regards to the lagged FDI inflows, we do not observe any differential impact of FDI on the export price (Table 4 -Columns (2), (5) and (8); Table 5 - Columns (2) and (5)). The coefficient of the interactions are never significantly different to zero. The same is true if we consider the twice lagged FDI inflow, as is evident in Tables 4 and 5.

Exporting to emerging economies, Latin America, U.S. or countries belonging to Mercosur[9] are not affected differently by the lagged FDI inflows.

Results for the contemporaneous FDI inflows, however, do suggest that the impact of FDI on upgrading of exports may occur mainly due to emerging economies, Latin American countries or Mercosur. One possible explanation for this is that it might be easier or faster for Brazil to upgrade exports first to closer countries. Over time, firms would adjust and upgrading would tend to dissipate to other destinations.

Another important set of heterogeneous results refer to the upgrading depending on the nature of the exported product. We analyze, in particular, the technological level of the corresponding industry. Tables 6 and 7 present the results where the the reference (omitted) category is high-tech products.

We find that, for high and medium-high tech goods, a 100% increase in the FDI inflows cause a 3.8% increase in the quality of the product being exported. Medium-low and low-tech products suffer an increase somewhat larger, of around 4.3% and 4.5%, approximately 20 % higher. (Table 6, Column (1)).

To further investigate where this effect is coming from, we explore the destination dimension as a source of heterogeneity. In accordance with the results we found before, there is no heterogeneity coming from exporting to different regions or countries, which is showed in Table 6 (Columns (2) to (4)).

[7]We have also included the lagged total investment - not foreign - in the regressions of our specifications, obtained from the Brazilian Statistical Office. But since investment was never significant we present our results without including this variable.

[8]Our results are not very sensitive to the time frame.

[9]Mercosur is a customs union established in 1990. The countries belonging to Mercosur correspond to Brazil, Paraguay, Uruguay and Argentina.

In addition, we consider two different periods of time: 2002 to 2005 and 2006 to 2009. We find that for the 2002-2005 period, most of the upgrading comes from the medium-high, medium-low and low-tech industries and not from the high-tech ones (Table 7, column (2)). For the 2006-2009 period, however, we obtain that the upgrading operates in all sectors. We see that the interaction of the FDI inflows with the dummy for this period is positive and statistically significant and it corresponds to a 4% increase in the unit value of exports when there is a 100% increase in the FDI flows.(See column (3) of Table 7). The other coefficients that correspond to the interaction with the additional dummy of the sector are not statistically different from that, implying that all industries are affected positively and in the same magnitude.

Lastly, we analyze the impact for different countries of destination. We find that when selling to Latin America in the 2002-2005 period the high-tech industries are not affected by the FDI inflows but all other industries, namely the medium-high, medium-low and low tech, are positively affected and in a similar magnitude. For the low-tech sector, for instance, a 100% increase in the FDI inflows cause a 1% increase in the export price. However, we do not find any upgrading for the years 2006 to 2009.

Regarding other regions, we grouped together the U.S., the more advanced economies in Asia and Australia and New Zealand to investigate the occurrence of export upgrading. We observe that, contrary to what we got for Latin America, the export upgrading is, in fact present, but only for the 2006-2009 period. Most importantly, FDI seems to impact all sectors equally in terms of export upgrading,except for the medium-high tech sector, similar to what we obtained for the entire sample (Table 7, column (3)).

When selling to Europe, the upgrading generated by the FDI inflows seems to happen as a combination of the results obtained for Latin America and the other regions. The results follow the patterns described in the previous discussions but the coefficients are statistically significant only at the 10% level.

Overall, our results indicate that upgrading occurs mainly in the industries of lower technology, especially for the U.S. and Latin America. Quality upgrading is also present in exports to advanced economies, in general, and across all sectors similarly. Therefore, we can say that our results indicate that FDI flows help to improve the quality of exports of a country and that this impact is heterogeneous and depends on the sector and the market of destination.

V. Conclusion

In this work, we study the effect of FDI flows on export upgrading. The matter is relevant since the sophistication of exports is associated with economic growth. Despite that, the empirical evidence on the impact of FDI for different economic outcomes is mixed. Specially some macro studies fail to find a positive significant impact of FDI. We make a new attempt to test for the importance of FDI, in our case, to the export upgrading.

We combine data from an industry-level panel on FDI inflows from Brazil with a panel of export prices at the destination-industry-level to investigate whether FDI inflows promote export upgrading and we find that they do. To deal with issues concerning the endogeneity of FDI inflows to export prices, we use FDI outflows from advanced economies as an instrument. We find that FDI inflows promote export upgrading and that there are important heterogeneous effects present. On average, upgrading was relevant for the 2002-2005 period. However, the upgrading seems to happen differently across time. At the beginning of the decade, from 2002 to 2005, the sophistication was due to medium and low-tech goods whereas the upgrading for the 2006-2009 period occurred mainly for high tech goods.

Moreover, where you export to seems to matter also. Exports to Latin America and the U.S. benefited from upgrading coming from FDI flows especially for medium and low-tech products. On the other hand, exports to the advanced economies were affected mostly in the high-tech sector and during the 2006-2009 period.

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Table 1—Summary Statistics

Variable	Number of Obs.	Mean	Std. Dev.	Min	Max
Ln(Exp Unit-Value)	93,213	2.19	1.61	-3.95	14.10
Ln(ExportValue)	93,213	12.15	2.43	6.68	21.44
Ln(AvgCost)	75,258	-0.67	0.18	-1.43	-0.30
Ln(WorldImp)	80,775	13.14	2.17	2.92	18.85
Ln(FDI Outflows EU)	69,270	8.42	1.21	4.21	11.55
Ln(FDI Outflows USA)	82,110	7.67	1.23	2.20	9.66
High	93,213	0.10	0.30	0	1
Medium-High	93,213	0.36	0.48	0	1
Medium-Low	93,213	0.18	0.39	0	1
Low	93,213	0.23	0.42	0	1
EU	93,213	0.29	0.45	0	1
USA	93,213	0.04	0.20	0	1
Asia	93,213	0.08	0.28	0	1
Latin America	93,213	0.39	0.49	0	1
Mercosur	93,213	0.12	0.33	0	1
Emerging	93,213	0.56	0.50	0	1

Note: Trade data from UN-COMTRADE; FDI data from Brazilian Central Bank; demand shocks come from IDSB UN Database (2012). The summary statistics are calculated for the sample that excludes the outliers.

Table 2—OLS Regressions

Dep.Var.: Ln(Unit-Value)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$Ln(FDI)_{t-1}$	-0.413**	0.011*	-0.394**	0.008+	0.008+		
	(0.006)	(0.005)	(0.006)	(0.005)	(0.005)		
$Ln(FDI)_t$						0.016*	
						(0.006)	
$Ln(FDI)_{t-2}$							0.002
							(0.006)
$Ln(Exports)_{t-1}$	-0.138**	0.006	-0.147**	-0.029**	-0.030**	-0.030**	-0.023**
	(0.003)	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	(0.006)
$Ln(WorldImp)_t$					0.023**	0.023**	0.020*
					(0.008)	(0.008)	(0.009)
$Ln(AvgCost)_t$					0.073**	0.069**	0.042
					(0.026)	(0.026)	(0.027)
Prod.-Dest. FE	NO	YES	NO	YES	YES	YES	YES
Dest.-Year FE	NO	NO	YES	YES	YES	YES	YES
R-squared	0.181	0.935	0.230	0.943	0.943	0.943	0.949
N.observations	38248	35735	38248	35733	35733	35733	29326

Note: Table reports regressions of the log of the export unit-values on FDI inflows. The first three columns report the OLS regressions. All regressions are OLS regressions that include the lagged log of the exported value as regressor. Columns (5) to (7) include also the log of world imports and the log of average cost as regressors. The columns also vary according to the FDI inflows included: columns (1) to (5) include the lagged FDI inflow whereas columns (6) and (7) include the contemporaneous value and the FDI lagged twice, respectively. Finally, different fixed effects are included. Robust standard errors are clustered. Significance: + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

TABLE 3—IV REGRESSIONS

Dep.Variable: Ln(Exp. UV)	(1)	(2)	(3)	(4)	(5)	(6)
$Ln(FDI)_t$	0.066**			0.048**		
	(0.019)			(0.017)		
$Ln(FDI)_{t-1}$		0.045*			0.049**	
		(0.019)			(0.018)	
$Ln(FDI)_{t-2}$			0.074**			0.136**
			(0.025)			(0.034)
$Ln(Exports)_{t-1}$	-0.018**	-0.029**	-0.025**	-0.018**	-0.027**	-0.023**
	(0.004)	(0.005)	(0.005)	(0.003)	(0.004)	(0.005)
$Ln(WorldImp)_t$	0.018*	0.023**	0.012	0.024**	0.022**	0.012
	(0.008)	(0.008)	(0.009)	(0.007)	(0.008)	(0.009)
$Ln(AvgCost)_t$	0.071+	0.068*	0.018	0.049	0.061*	0.033
	(0.037)	(0.026)	(0.027)	(0.036)	(0.026)	(0.028)
Prod*Dest FE	YES	YES	YES	YES	YES	YES
Dest.*Year FE	YES	YES	YES	YES	YES	YES
Under-Identif.						
K-P LM st.	2965.0	2821.7	1663.7	3421.6	2753.3	995.4
K-P LM p-value	0	0	0	0	0	0
Weak Instrument						
K-P rk Wald F	1080.6	972.72	515.6	2535.4	2002.07	613.38
K-P LM p-value	0	0	0	0	0	0
R-squared	0.934	0.943	0.951	0.936	0.945	0.953
N.Obs.	42760	35733	27336	46766	39645	29437

Table reports regressions of the log of the export unit-values at the destination-product level on FDI inflows and the listed controls. All regressions include product-destination and destination year fixed effects. The first three columns report the results when both U.S. FDI outflows and EU FDI outflows are used as instruments. Columns (4) to (6) report the results when only EU flows are included as instrument. The number of observations compared to Table 2 is reduced due to the inclusion of controls and due to the availability of FDI outflows from advanced economies.Under-Identification and Weak Instruments tests correspond to Kleibergen-Paap LM statistics.Robust standard errors are clustered. Significance: + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

Table 4—Heterogeneity Results - Destinations

Dep.Variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$Ln(UV)$	Emerging	Emerging	Emerging	Lat. Am.	Lat. Am.	Lat. Am.	Asia	Asia	Asia
$Ln(FDI)_t$	0.020			0.038			0.037*		
	(0.032)			(0.026)			(0.017)		
$Ln(FDI)_t$*D_R	0.082*			0.073*			-0.009		
	(0.038)			(0.035)			(0.075)		
$Ln(FDI)_{t-1}$		0.050			0.061*			0.040*	
		(0.033)			(0.027)			(0.019)	
$Ln(FDI)_{t-1}$*D_R		-0.010			-0.038			0.068	
		(0.039)			(0.036)			(0.088)	
$Ln(FDI)_{t-2}$			0.094*			0.084*			0.079**
			(0.047)			(0.037)			(0.025)
$Ln(FDI)_{t-2}$*D_R			-0.033			-0.025			-0.004
			(0.054)			(0.047)			(0.105)
$Ln(ExpValue)_{t-1}$	-0.018**	-0.029**	-0.025**	-0.018**	-0.029**	-0.025**	-0.031**	-0.029**	-0.029**
	(0.004)	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
$Ln(WorldImp)_t$	0.017*	0.023**	0.012	0.017*	0.024**	0.012	0.016+	0.023**	0.015
	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)	(0.009)
$Ln(AvgCost)_t$	0.071+	0.067*	0.019	0.070+	0.066*	0.019	0.073+	0.067*	0.010
	(0.037)	(0.027)	(0.027)	(0.037)	(0.027)	(0.027)	(0.038)	(0.026)	(0.027)
Prod*Dest FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Dest.*Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
R-squared	0.934	0.943	0.951	0.934	0.943	0.951	0.943	0.943	0.953
N.Obs.	42760	35733	27336	42760	35733	27336	36259	35733	26760

Table reports regressions of the log of the export unit-values at the destination-product level on FDI inflows and the listed controls. All regressions include product-destination and destination year fixed effects. Under-Identification and Weak Instruments tests were performed and the results are similar to Table 3, which indicates that the instruments are valid. (Kleibergen-Paap statistics were calculated).Robust standard errors are clustered. Significance: + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

Table 5—Heterogeneity - U.S. and Mercosur

Dep.Variable:	(1)	(2)	(3)	(4)	(5)	(6)
Ln(UV)	USA	USA	USA	Mercosur	Mercosur	Mercosur
$Ln(FDI)_t$	0.063**			0.028		
	(0.019)			(0.019)		
$Ln(FDI)_t$*D_R	0.071			0.065+		
	(0.088)			(0.035)		
$Ln(FDI)_{t-1}$		0.044*			0.043*	
		(0.019)			(0.021)	
$Ln(FDI)_{t-1}$*D_R		0.004			0.012	
		(0.089)			(0.039)	
$Ln(FDI)_{t-2}$			0.069**			0.082**
			(0.025)			(0.028)
$Ln(FDI)_{t-2}$*D_R			0.177			-0.012
			(0.127)			(0.050)
$Ln(ExpValue)_{t-1}$	-0.018**	-0.029**	-0.025**	-0.032**	-0.029**	-0.028**
	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
$Ln(WorldImp)_t$	0.018*	0.023**	0.012	0.014+	0.023**	0.015
	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)	(0.009)
$Ln(AvgCost)_t$	0.070+	0.068*	0.019	0.077*	0.068*	0.011
	(0.037)	(0.026)	(0.027)	(0.037)	(0.026)	(0.027)
Prod*Dest FE	YES	YES	YES	YES	YES	YES
Dest.*Year FE	YES	YES	YES	YES	YES	YES
R-squared	0.934	0.943	0.951	0.944	0.943	0.953
N.obs.	42760	35733	27336	36259	35733	26760

Table reports regressions of the log of the export unit-values at the destination-product level on FDI inflows and the listed controls. Each column is the result of a different regression. D_R corresponds to the region dummy as indicated at the top of the Table: Emerging Economies, Latin America and Asia, respectively. All regressions include product-destination and destination year fixed effects. Under-Identification and Weak Instruments tests were performed and the results are similar to Table 3, which indicates that the instruments are valid. (Kleibergen-Paap statistics were calculated).Robust standard errors are clustered. Significance: + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

Table 6—Heterogeneity - Industry and Region

Dep.Var.:	(1)	(2)	(3)	(4)
$Ln(Unit-Value_t)$	All	Asia	Lat. America	USA
$Ln(FDI)_{t-1}$	0.038**	0.039**	0.050*	0.039**
	(0.014)	(0.014)	(0.021)	(0.014)
$Ln(FDI)_{t-1}$*Med-High	0.003	0.004+	0.001	0.004+
	(0.002)	(0.002)	(0.003)	(0.002)
$Ln(FDI)_{t-1}$*Med-Low	0.005+	0.007*	0.005	0.006+
	(0.003)	(0.003)	(0.004)	(0.003)
$Ln(FDI)_{t-1}$*Low	0.007*	0.007*	0.006	0.009**
	(0.003)	(0.003)	(0.004)	(0.003)
$Ln(FDI)_{t-1}$*Region		0.002	-0.029	-0.026
		(0.070)	(0.026)	(0.058)
$Ln(FDI)_{t-1}$*Med-High*Region		-0.005	0.004	-0.012
		(0.009)	(0.004)	(0.008)
$Ln(FDI)_{t-1}$*Med-Low*Region		-0.019	0.002	-0.004
		(0.015)	(0.006)	(0.012)
$Ln(FDI)_{t-1}$*Low*Region		0.003	0.004	-0.024*
		(0.014)	(0.005)	(0.012)
$Ln(ExpValue)_{t-1}$	-0.029**	-0.029**	-0.029**	-0.030**
	(0.005)	(0.005)	(0.005)	(0.005)
$Ln(AvgCost)_t$	0.068**	0.069**	0.067*	0.068**
	(0.026)	(0.026)	(0.026)	(0.026)
$Ln(WorldImp)_t$	0.021*	0.021*	0.021*	0.021*
	(0.009)	(0.009)	(0.009)	(0.009)
Prod*Dest FE	YES	YES	YES	YES
Dest.*Year FE	YES	YES	YES	YES
R-squared	0.943	0.943	0.943	0.943
N	35733	35733	35733	35733

Table reports regressions of the log of the export unit-values at the destination-product level on FDI inflows and the listed controls. All regressions include product-destination and destination year fixed effects. The first three columns report the results for the trimmed data. Columns (4) to (6) report the results for the entire sample. The number of observations compared to Table 2 is reduced due to the inclusion of controls and due to the availability of FDI outflows from advanced economies.Robust standard errors are clustered. Significance: + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

TABLE 7—HETEROGENEITY: TECHNOLOGY, DESTINATIONS AND PERIODS

Dep.Var.:	(1)	(2)	(3)	(4)	(5)
$Ln(Unit-Value)$	All	All	Lat.America	Advanced	Europe
$Ln(FDI)_{t-1}$	0.017	0.009	0.009	0.007	-0.005
	(0.012)	(0.011)	(0.014)	(0.031)	(0.026)
$Ln(FDI)_{t-1}$*Med High		0.004*	0.006*	-0.001	0.007
		(0.002)	(0.003)	(0.005)	(0.004)
$Ln(FDI)_{t-1}$*Med Low		0.006*	0.008*	-0.007	0.012+
		(0.003)	(0.004)	(0.008)	(0.007)
$Ln(FDI)_{t-1}$*Low		0.008**	0.010**	-0.008	0.014+
		(0.003)	(0.004)	(0.008)	(0.007)
$Ln(FDI)_{t-1}$*D1	0.033**	0.040**	0.023	0.107**	0.058+
	(0.008)	(0.014)	(0.019)	(0.041)	(0.030)
$Ln(FDI)_{t-1}$*Med High*D1		-0.004**	-0.002	-0.007*	-0.005+
		(0.001)	(0.001)	(0.003)	(0.003)
$Ln(FDI)_{t-1}$*Med Low*D1		-0.002	-0.003+	-0.001	0.000
		(0.001)	(0.002)	(0.004)	(0.003)
$Ln(FDI)_{t-1}$*Low*D1		-0.002	-0.002	0.008	-0.003
		(0.002)	(0.003)	(0.006)	(0.004)
Medium-High		0.019	0.013	0.068	0.002
		(0.033)	(0.046)	(0.066)	(0.063)
Medium-Low		-0.014	0.078	-0.068	-0.097
		(0.056)	(0.070)	(0.139)	(0.118)
Low		0.034	0.092	0.017	0.029
		(0.049)	(0.060)	(0.122)	(0.114)
$Ln(ExpValue)_{t-1}$	-0.028**	-0.029**	-0.022**	-0.029**	-0.033**
	(0.005)	(0.005)	(0.008)	(0.011)	(0.008)
$Ln(AvgCost)_t$	0.063*	0.062*	0.091**	0.044	-0.002
	(0.026)	(0.027)	(0.035)	(0.077)	(0.059)
$Ln(WorldImp)_t$	0.023**	0.020*	0.027*	0.025	0.015
	(0.008)	(0.009)	(0.011)	(0.023)	(0.024)
R-squared	0.943	0.943	0.952	0.939	0.933
N.Obs.	35733	35733	14014	5498	10805

Table reports regressions of the log of the export unit-values at the destination-product level on FDI inflows and the listed controls. All regressions include product-destination and destination year fixed effects. The first three columns report the results for the trimmed data. Columns (4) to (6) report the results for the entire sample. The number of observations compared to Table 2 is reduced due to the inclusion of controls and due to the availability of FDI outflows from advanced economies.Robust standard errors are clustered. Significance: + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.