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CLIMBING THE RUNGS OF THE QUALITY LADDER: FDI AND DOMESTIC EXPORTERS IN ROMANIA*

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This article argues that inflows of foreign direct investment can facilitate export upgrading in host countries. Using customs data merged with firm-level information for 2005–11, it shows a positive relationship between the quality of products exported by Romanian firms and the presence of multinational enterprises (MNEs) in the upstream (input-supplying) industries. Export quality is also positively related to MNE presence in the downstream (input-sourcing) industries and the same industry, but these relationships are less robust. These conclusions hold both when the product quality is proxied with unit values and when it is estimated following the approach of Khandelwal *et al.* (2013).

Economic growth is positively correlated with the sophistication and the quality of the export structure at the country level (Hausmann *et al.*, 2007; Hidalgo and Hausmann, 2009). From an individual firm's perspective, reaching a certain quality threshold is a precondition for successful exporting (Brooks, 2006; Verhoogen, 2008; Sutton, 2012; Iacovone and Javorcik, 2012; Hallak and Sivadasan, 2013), which, in turn, may open doors to learning from exporting (Van Biesebroeck, 2005; De Loecker, 2007; Atkin *et al.*, 2017). Given the positive link between export quality and economic prosperity, it is not surprising that upgrading of the industrial structure in general, and of the export structure in particular, is a major objective of industrial policies in countries around the world. This is particularly true in countries trying to escape the 'middle income trap'.[1]

This article argues that export upgrading can be facilitated by inflows of foreign direct investment (FDI). More specifically, we document a positive relationship between the quality of products exported by local firms and the presence of multinational enterprises (MNEs) in the upstream (input-supplying) industries. A similar, though less robust, relationship is found for FDI

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The authors requested a data exemption on the grounds that access to the data is restricted but nevertheless provided access to the data to the journal for the sole purpose of replicating the results based on their codes. The codes are available on the Journal website.

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[1] For instance, the South African National Industrial Policy Framework states: 'Given the "competitiveness squeeze" that South African industry finds itself in, industrial upgrading is a logical progression in order to avoid cut-throat price competition as certain parts of manufacturing are becoming increasingly commoditised, particularly due to a combination of global trade liberalisation and pressure from Chinese and Indian firms in particular' (Republic of South Africa, 2007). The Comprehensive National Industrial Strategy of the Philippines mentions: 'Upgrading and transforming industries would enable the movement of workers from the informal to the formal sector, as well as from low-value added activities to high-value added activities where wages and compensation are much higher' (Republic of the Philippines, 2016).

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in downstream (input-sourcing) industries and the same industry.[2] The export quality is captured using unit values and the approach of Khandelwal *et al.* (2013) and our evidence comes from Romania, a middle-income country in Eastern Europe.

MNEs play a central role in the global value chains. Their know-how, technology and marketing prowess represent a powerful source of knowledge for indigenous firms in countries where MNEs establish their affiliates. MNE presence can facilitate performance improvements in indigenous firms through a number of channels. First, the presence of foreign firms in the *upstream industries* may provide indigenous producers with more diverse and higher quality intermediates and capital goods and in this way allow them to increase their productivity, upgrade the quality of their products and broaden their product range. For instance, Javorcik *et al.* (2008) report that small Mexican producers meet with their input suppliers (usually foreign affiliates) every six months to learn about the possibilities of upgrading their products. Suppliers provide the necessary inputs and often prepare a new formula for the product based on these inputs.[3]

Second, in their quest for cheaper and higher quality inputs, MNEs in the *downstream industries* may provide their local suppliers with expertise, training and incentives for quality improvements and possibly even cooperate on development of new and higher quality products. Many MNEs subject their potential suppliers to technical audits and require improvements in performance or product quality as a pre-condition for receiving a contract. The resulting product upgrading and improved performance may then be reflected not only in the domestic firms' sales to the MNEs but also in the local firms' exports.[4]

Finally, domestic firms may learn from MNEs operating in the *same industry*. Either by observing the foreign firms or through hiring former MNE employees, they may learn about procedures that improve the quality and standardisation of their products, their marketing skills and reliability of their shipments.[5] Domestic firms may also learn about the profitability of various export opportunities by observing their foreign peers' exports, and this knowledge may persuade them to make investments into quality upgrading, developing new products or even moving to different broad product categories.[6]

Our analysis focuses on Romania—a manufacturing-intensive economy in Eastern Europe—at the time of massive inflows of FDI linked to its accession to the European Union. We draw on an

[2] However, in most specifications, we cannot reject the equality of the upstream and downstream effects.

[3] Amiti and Konings (2007), Bas and Strauss-Kahn (2015) and Goldberg *et al.* (2010) provide evidence on the importance of access to imports of diverse and high-quality inputs for productivity, export quality and product scope, respectively.

[4] There is substantial anecdotal evidence suggesting that these effects take place. A survey among Czech manufacturing firms analysed by Javorcik (2008) shows that 40% of domestic suppliers receive some kind of assistance from their MNE customers, including personnel training (19%), provision of inputs (10%), help with quality assurance (10%) and help with finding export opportunities (7%). Even more remarkably, 50% of domestic firms selling to MNEs report they have had to improve product quality in order to become suppliers. Furthermore, Javorcik *et al.* (2017) show that presence of MNEs stimulates domestic firms in the supplying sectors to introduce more complex products where complexity is measured using an indicator due to Hidalgo and Hausmann (2009).

[5] However, this may be the weakest of the three channels discussed, given the mixed evidence on the link between FDI inflows and productivity of domestic firms in the same industry: Haskel *et al.* (2007) and Keller and Yeaple (2009) find positive effects, but Aitken and Harrison (1999), Javorcik (2004), Javorcik and Spatareanu (2008; 2011) fail to do so. A new generation of studies uses matched employer–employee data to provide evidence consistent with knowledge spillovers through labour mobility (see Poole, 2013 and Balsvik 2011).

[6] Aitken *et al.* (1997) demonstrate that the presence of exporting MNEs in the same region reduces the costs of exporting for Mexican firms. Using detailed Chinese trade statistics, Swenson and Chen (2012) find that the MNE presence is associated with more and higher unit value trade transactions by Chinese firms in the same sector, while Swenson (2008) shows that it stimulate new export connections by Chinese exporters. Using cross-country data, Harding and Javorcik (2012) find that sectors targeted by national investment promotion efforts tend to subsequently increase the unit values of exports.

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annual panel of Romanian firms matched with detailed customs data recording Romanian exports at the level of the firm, eight-digit HS (Harmonised System) product classification, destination country and year. We focus on the period 2005–11, which is determined by the data availability. We measure 'product upgrading'—within-product improvements in export quality—in two ways: (*i*) we apply the approach of Khandelwal *et al.* (2013) which builds on the work of Khandelwal (2010); and (*ii*) we focus on unit values of exports.[7]

Our empirical strategy follows the literature on FDI spillovers (Javorcik, 2004) and relies on the assumption that domestic firms are more likely to buy inputs from MNEs if MNEs account for a larger share of the domestically sold output in the upstream industries, i.e., the industries from which the domestic firms source inputs. Similarly, we assume that domestic firms are more likely to supply MNEs when foreign firms account for a larger share of output in their downstream industries, i.e., the industries to which they sell inputs, according to the Romanian input-output tables. Finally, we expect the effect of foreign presence on domestic firms in the same sector to increase with the MNE share in the sectoral output.

In our analysis, we relate the quality of product p exported by firm i located in Romanian region r to country c at time t to the lagged proxies for FDI spillovers relevant to firm i. We control for time-invariant unobservables specific to a particular firm exporting a particular product to a particular destination. We also control for region-year unobservables and for linear trends specific to each industry and region. Thus, our results are identified based on industry-specific variation in FDI presence observed over time that cannot be captured by broad factors specific to Romanian regions or by trends in individual industries located in particular regions.[8]

Our results show a positive and statistically significant relationship between the within-product quality upgrading in goods exported by Romanian firms and the increased presence of MNEs in upstream (input-supplying) industries. This relationship is robust across specifications in levels and in short and long differences. We find similar relationships for FDI in downstream (input-sourcing) manufacturing industries and in the same industry, although these are somewhat less robust. Our results hold for both measures of quality and when foreign affiliates are defined based on different ownership thresholds. Moreover, they do not seem to be driven by reverse causality or by third factors, such as, international demand for particular products, demand from downstream sectors or exporter entry and exit. The estimated coefficients are not only statistically significant, but also economically meaningful. The estimates in levels suggest that the average increase in the foreign presence in the upstream industries observed over the period studied translates into a circa 4% increase in the quality of domestic firms' exports. A similar magnitude is found for the average increase in MNE presence in the downstream industries.

Although our data do not allow us to directly observe links between local firms and multinationals, we find that the observed effects are stronger in cases where the impact of FDI spillovers is more likely to manifest itself. For instance, if the positive results for downstream (input-sourcing) FDI are indeed due to Romanian exporters supplying inputs to MNEs located in Romania, we should see the MNE presence in the downstream sectors affecting mainly Romanian exports of intermediates or capital goods. This is indeed the case. The effect of downstream FDI is large and statistically significant for non-final products, whereas for final products it is not significantly

[7] Despite their shortcomings, export unit values have been extensively used as a proxy for quality, see, for example, Schott (2004); Hallak (2006); Bas and Strauss-Kahn (2015).

[8] While we are unable to pin down the exact source of this variation, it is likely to be driven by idiosyncratic location decisions by MNEs made against the background of broad trends such as Romania's EU entry, the economic crisis and the government policy in Romania and in countries with which Romania competes for FDI.

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different from zero. The estimates suggest that the 6.5-percentage-point increase in downstream FDI observed during the period studied is associated with an 8.8% increase in unit values and an 8.4% increase in the alternative export quality measure pertaining to exports of intermediates and capital goods. In contrast, FDI in input-supplying sectors (upstream FDI) matters for both final and non-final products.

In another exercise, we conjecture that MNEs are more likely to contract suppliers who can provide them with higher-quality inputs and, therefore, we should expect that firms that were able to export higher quality products to begin with would tend to benefit more from the presence of FDI in the downstream (input-sourcing) sectors. Again the estimation results support this view. In contrast, the initial export quality does not seem to matter when it comes to Romanian firms benefiting from the presence of FDI in the upstream (input-supplying) industries, which is consistent with our priors. Observing the expected patterns while examining the more nuanced predictions boosts our confidence that the link between the quality of exports and the presence of FDI works through the anticipated channels.[9]

Overall, our results suggest that FDI promotion policies, particularly those aimed at attracting foreign investors into industries that supply inputs to domestic firms, have the potential to serve as an engine of export upgrading.

Our results also reconcile the common finding that access to diverse and high-quality inputs is important for firm performance (e.g., Amiti and Konings, 2007; Goldberg *et al.*, 2010; Manova and Zhang, 2012) with the quantitatively limited effect of upstream FDI on productivity typically found in the FDI spillovers literature (see survey by Havranek and Irsova, 2011). They indicate that while the effect of upstream FDI on productivity may be small, it has a sizeable effect on the quality of exported products.

This article is structured as follows. The next section introduces the context of the study, giving a brief overview of trends in FDI and exports in Romania in the period considered. The data and the empirical strategy are described in Section 2. Section 3 discusses the results. Section 4 concludes.

1. FDI and Exports in Romania

Romania is an interesting country for studying the effect of FDI on manufacturing firms for at least three reasons. First, manufacturing plays a comparatively large role in the Romanian economy. In fact, the share of manufacturing value added in Romanian GDP in 2004 (the last year available in the World Development Indicators) was at 30% the largest in the European Union (EU), five percentage points ahead of the second largest figure found in the Czech Republic. Second, Romania entered the European Union in 2007 and its entry was accompanied by the highest inflows of FDI in the country's modern history. The Online Appendix Table B.1 shows the evolution of FDI inflows for ten post-communist members of the EU for years 2003–12. Between 2004 and 2008 the average annual FDI inflows amounted to over 7% of Romanian GDP. Our data cover most of the high-inflow period as well as the crisis years 2009 and 2010, when the FDI inflows fell below 3% of GDP. The only two countries in the region with higher

[9] The lack of information on actual sourcing relationships between domestic and foreign firms means that the FDI proxies ignore the substantial heterogeneity in the exposure of different firms to MNEs. This could result in mismeasurement of the FDI presence and, consequently, an underestimation of the impact of FDI due to an attenuation bias.

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Table 1. *Share of Output Due to Foreign-Owned Firms (%).*

		Own FDI		Upstream FDI		Downstream FDI	
Year	Industries (1)	Mean (2)	SD (3)	Mean (4)	SD (5)	Mean (6)	SD (7)
2005	58	55.2	27.0	56.7	10.4	55.7	10.5
2006	58	54.7	26.3	55.7	9.7	55.7	10.8
2007	58	57.4	24.9	58.3	8.6	56.6	10.2
2008	58	58.8	24.3	60.2	9.2	59.0	10.4
2009	58	61.1	24.3	62.1	7.8	61.2	10.6
2010	58	62.5	24.1	64.4	7.1	62.2	9.9

Notes: Upstream and downstream FDI output shares are defined based on equations (3) and (2) in Section 2. SD stands for standard deviation.

proportional FDI inflows in the studied period are Estonia and Bulgaria, the latter being another EU entrant from 2007.

A substantial part of FDI inflows entered the manufacturing sector. This is reflected in columns 2 and 3 of Table 1, which summarises the share of output due to foreign-owned firms in 58 manufacturing industries during our sample period. In line with the aggregate data, the average share of output due to foreign firms increased from 55% in 2005 to 63% in 2010. Seventeen of 58 manufacturing industries in our sample saw an increase of foreign output share of more than ten percentage points. As illustrated in Figure B.1 in the Online Appendix, the increase was largest for computers and office machinery (79 percentage points), other chemicals (52), agricultural machinery (39), foundry (34) and basic chemicals (32). Large industries with a significant increase in foreign presence included electric machinery (18), textiles (15) and metal structures and products (14). The only industry with a large decrease in foreign presence was stone processing, representing less than 0.1% of the aggregate manufacturing output. For the evolution of foreign presence in individual sectors, see Figure B.2 in the Online Appendix.

The third reason for Romania being an interesting case to study is that with the GDP per capita (adjusted for the purchasing power parity) at only 36% of the EU average in 2005, it had a large potential for improvement of its manufacturing performance. Figure 1 displays unit values of Romanian exports relative to unit values of exports by the 15 old members of the EU (EU15). The relative unit values are shown separately for exports by foreign-owned and domestic producers. The figure shows that in 2005 domestic exporters in a median Romanian industry exported at less than 70% of unit values seen in EU15 countries. The gap was substantial also for foreign-owned exporters, with unit values at 82% of the EU15 level. But Romania was catching up. Between 2005 and 2011, the relative unit values increased for both domestic and foreign-owned exporting from Romania. In particular, with a 16-percentage point increase in relative unit values, domestic exporters almost caught up with the foreign-owned ones and erased a half of the gap with respect to EU15. Figure B.3 in the Online Appendix shows five-year changes in the median relative unit values of exports by domestic firms for industries where the change exceeded ten percentage points in either direction. Important export industries with significant increases in the relative unit values included radio, TV and ICT equipment; footwear; apparel; and basic chemicals.

To summarise, Romania is an emerging economy with a strong manufacturing focus. During the period under study, it received large FDI inflows, which coincided with a significant increase in the export unit values relative to the EU15. The latter development was particularly pronounced in the case of exports by domestic firms. In the following sections, we examine the connection between the two phenomena.

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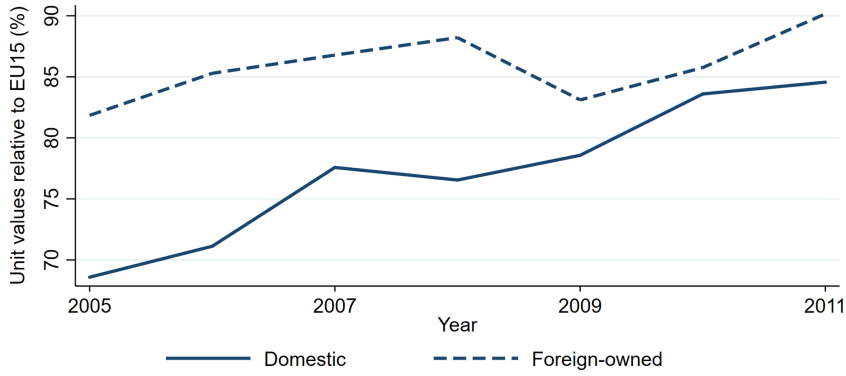

Fig. 1. *Unit Values Relative to EU15.*
Notes: Lines represent medians of relative unit values across 58 manufacturing industries. For each industry, the relative unit values are calculated as the ratio of unit values of exports by domestically-owned or foreign-owned Romanian firms to unit values of exports by EU15 countries for a median product. Information on Romanian exports comes from Romanian customs data described in Section 2; information on EU15 exports comes from Eurostat. Each product is assigned to the industry with highest number of exporter-destination pairs for that product. Only eight-digit products exported by both Romania and EU15 in all years are included.

2. Data and Empirical Strategy

2.1. *Data*

Our analysis is based on rich firm-level data for Romania compiled from two sources. The first source, the Structural Business Statistics (SBS), is available for 2005–10. It is an annual survey conducted by the Romanian National Statistical Institute among all Romanian firms with at least 20 employees and a subsample of smaller firms. Each firm is sent a questionnaire which it is obliged to fill in. The questionnaire covers the standard variables pertaining to firm's operations, profits and losses. All monetary variables are reported in current Lei. The ownership information collected in the survey allows us to distinguish between purely domestic firms, wholly foreign-owned firms and firms with mixed ownership. We do not observe the exact ownership shares among the mixed firms. Fortunately, national tax identifiers assigned to individual firms allow us to match our data to the commercial database Amadeus compiled by the Bureau van Dijk. We manage to match ownership from Amadeus to about 80% of firm-year observations in our sample.[10] For the unmatched firms we use the SBS ownership dummies. We follow the standard practice by defining a firm as foreign if the share of foreign ownership exceeds 10%, though in the robustness check we consider definitions based on the 25 and 50% thresholds.[11]

The SBS data are matched with the Romanian customs data for years 2005–11 using the firm tax identifiers. The customs data contain information on annual exports at the firm-product-destination level. The data cover all exports to countries outside the EU and over 95% of exports

[10] 3% of the observations are not found in Amadeus and further 16% are in Amadeus but with no ownership information.

[11] A vast majority of firms appearing as mixed in the SBS data have foreign ownership above the 10% threshold. Therefore, the mixed ownership cases for which it is not possible to find information in the Amadeus are treated as foreign.

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to EU member countries. Starting from 2007, when Romania joined the EU, intra-EU exports are not processed at the customs but instead have to be reported to the Intrastat. Firms with annual exports below 900,000 Lei (approx. $250,000) are exempt from the reporting obligation and therefore do not appear in the customs data. Products are defined in terms of the eight-digit EU Combined Nomenclature (CN8), which is based on the six-digit Harmonised System classification and is further disaggregated with two additional digits. Export values are recorded in current Lei. Besides export values, there are two variables measuring the physical quantity of exports. One measures it in kilograms and the other in supplementary units. Supplementary units may represent pieces, litres, square metres or other units. Where both measures of physical quantity are available, we use supplementary units.[12]

We construct some of our variables with the help of the Romanian input-output tables for 2002 prepared by the National Statistical Institute. They use Lei at current prices as units, and they are defined in terms of the Romanian industrial classification where each manufacturing industry corresponds to one or several three-digit NACE (rev. 1.1) industries. The SBS data state the four-digit NACE codes, which allows us to match the firm-level data with the input-output tables. We use words 'industry' and 'sector' as synonyms in our analysis, and we use them to refer to the 58 manufacturing industries as defined in the Romanian industrial classification.[13]

To compare Romanian export unit values to those of EU15 and to control for fluctuations in international prices of individual products, we use EU trade data from Eurostat. They include country-level export flows for each CN8 product in each year.

2.2. *Empirical Strategy*

Our goal is to examine the link between upgrading by Romanian firms and the presence of foreign affiliates in the country. Therefore, next we explain how we measure the MNE presence in the same, downstream and upstream sectors. Following the literature on FDI spillovers, we proxy for the presence of foreign firms in an industry (*Own FDI*) with their share in the total industry output. Let J_{st} denote the set of all manufacturing firms operating in Romania in sector s in year t, f_{jt} a dummy for whether firm j is foreign-owned in year t and Y_{jt} the total output of the firm. Then we define own-sector FDI presence as

$$Own\ FDI_{st} = \frac{\sum_{j \in J_{st}} f_{jt} Y_{jt}}{\sum_{j \in J_{st}} Y_{jt}}. \tag{1}$$

In order to identify vertical spillovers from MNEs in downstream sectors, we rely on the assumption that a domestic firm is more likely to supply MNEs and benefit from vertical spillovers if foreign firms account for a larger share of output in the downstream industries, i.e., industries supplied by the industry of the domestic firm. Following Javorcik (2004), we exclude sales of inputs within the firm's own sector as this effect is already captured by the *Own FDI* variable. This means that *Downstream FDI* will be capturing a lower bound on the effect of FDI in the input-sourcing industries. Define α_{sd} as the share of intermediate inputs supplied by industry s

[12] See Subsection A.1 in the Online Appendix for more details on the construction of unit values.

[13] See Subsection A.2 in the Online Appendix for more details on how we determine the industry affiliation of each firm.

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which is sold to downstream industry d, according to the input-output matrix. Define further S as the set of all manufacturing sectors. Then the proxy for downstream FDI is defined as

$$Downstream\ FDI_{st} = \sum_{d \in S, s \neq d} \alpha_{sd} Own\ FDI_{dt}. \tag{2}$$

Similarly, we proxy for access to inputs produced by MNEs by assuming that a domestic firm is more likely to buy inputs from an MNE if foreign firms account for a larger share of output in the upstream industries, i.e., industries from which the industry of the domestic firm sources inputs. Define α_{su} as the share of the intermediate inputs purchased by industry s from the upstream industry u. Again, we exclude input sourcing within the same sector, so that the coefficient on *Upstream FDI* should be interpreted as a lower-bound estimate. Define $Own\ FDI^{*}_{st}$ in the same way as $Own\ FDI_{st}$ but only counting domestically sold output. Then the upstream FDI is defined as

$$Upstream\ FDI_{st} = \sum_{u \in S, s \neq u} \alpha_{su} Own\ FDI^{*}_{ut}. \tag{3}$$

The inability to observe buyer–supplier relationships between domestic firms and foreign affiliates has been a shortcoming of the entire literature on FDI spillovers. The few studies that are able to observe linkages between firms are either restricted to a particular industry (Chung *et al.*, 2003) or cover a small number of firms (Javorcik and Spatareanu, 2009). Measuring foreign presence at the industry level masks the fact that FDI is likely to have highly heterogeneous effects across firms. It can be expected to boost performance of those local firms that actually start buying inputs from the multinationals, manage to become their suppliers or are in a position to learn from them. At the same time, firms that do not benefit from such relationships might, if anything, be worse off due to the intensified competition for inputs and outputs, both with the multinationals and with the domestic firms that benefit from the FDI presence. Our estimates capture average relationships across these different types of firms; the actual effects will be stronger for some firms and weaker for others. The failure to properly account for the differential exposure of the different domestic firms could result in an attenuation bias and underestimation of the effects associated with FDI. In Subsection 3.2, we attempt to at least partially account for the heterogeneity by exploring observed characteristics that make domestic firms more or less likely to benefit from the FDI presence.

Our analysis relates the presence of foreign firms to product quality of domestic exporters. We measure within-product quality improvements using two complementary approaches. The first approach is to analyse export unit values of narrowly defined products. This is the most common approach used in the literature (see, for example, Schott, 2004; Hallak, 2006; Bas and Strauss-Kahn, 2015), but it is exposed to the risk that high unit values reflect high markups rather than superior quality. Our second approach uses the methodology of Khandelwal *et al.* (2013) which builds on the work of Khandelwal (2010).[14] Khandelwal *et al.* (2013) identify the relationship between quantity and price by assuming specific elasticities of substitution. We use the estimates of Broda and Weinstein (2006) and allow the elasticity of substitution to differ

[14] Khandelwal (2010) combines information on prices and physical quantities to infer quality, based on the insight that ability of an exporter to sell a higher quantity at a given price should imply higher quality.

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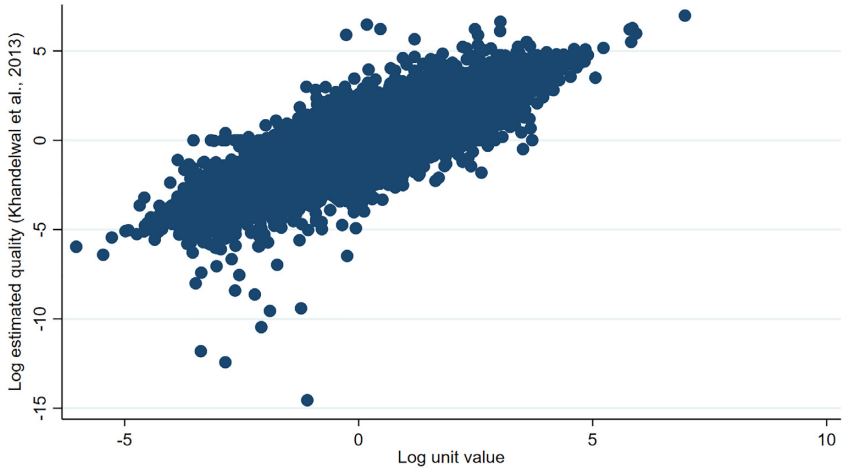

Fig. 2. *Unit Values and Estimated Quality in Levels (2005–11).*
Notes: For each firm-product-destination-year observation, the figure plots logarithm of export unit values and the logarithm of quality estimated as in Khandelwal *et al.* (2013) assuming two-digit-HS-specific σ_s based on estimates of Broda and Weinstein (2006). Product-specific means are subtracted from both variables to account for inherent differences between products.

across HS two-digit product classes.[15] We can then infer quality as the OLS residual $\hat{e}_{ipct}$ from estimating

$$\log q_{ipct} + \sigma_s \log p_{ipct} = \alpha_p + \alpha_{ct} + \sigma_s \alpha_{ct} + e_{ipct} \tag{4}$$

where q_{ipct} and p_{ipct} are the quantity and the price, respectively, of exports of product p by firm i to destination country c in year t, σ_s represents elasticity of substitution in industry s, α_p captures time-invariant product characteristics, and α_{ct} represents destination-year effects to capture aggregate incomes and price indices in destination countries.[16] The two measures of quality are tightly related. Across our sample, their correlation is 0.91 in levels and 0.90 in first differences.[17] The relationship between the two measures is also illustrated in Figure 2 for levels and Figure 3 for first differences.

Our baseline empirical specification takes the following form:

$$\begin{aligned} \ln Quality_{ipct} = {} & \beta_1 Upstream\ FDI_{s,t-1} + \beta_2 Downstream\ FDI_{s,t-1} + \beta_3 Own\ FDI_{s,t-1} \\ & + \gamma_{ipc} + \gamma_{rt} + \gamma_{sr} \times t + \epsilon_{ipct}, \end{aligned} \tag{5}$$

where *Quality* is proxied using the two measures described above, which vary at the level of the firm, product, export destination and year. The explanatory variables include the lagged proxies

[15] Fan *et al.* (2015) also rely on estimates by Broda and Weinstein (2006) aggregated to the HS two-digit, and, as an alternative approach, they infer quality directly from their data using an instrumental variable approach. They find that both approaches lead to highly similar results.

[16] For more details, see Khandelwal *et al.* (2013). One difference is that, as they focus only on clothing and textile exports, they assume a homogenous σ. Allowing σ_s to vary across industries necessitates adding the interaction term $\sigma_s \alpha_{ct}$ in equation (4) to capture the fact that the destination price index will have different effects on sales across industries with different elasticities of substitution.

[17] For the correlation in levels we substract product-specific means to account for the fact that unit values of cars are not directly comparable to unit values of roses.

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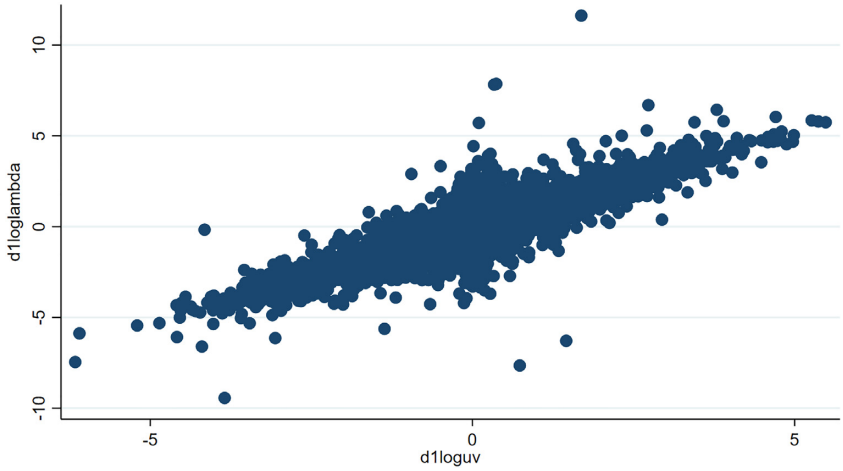

Fig. 3. *Unit Values and Estimated Quality in First Differences (2006–11).*
Notes: For each firm-product-destination-year observation, the figure plots annual log changes in export unit values and annual log changes in quality estimated as in Khandelwal *et al.* (2013) assuming two-digit-HS-specific σ_s based on estimates of Broda and Weinstein (2006).

for FDI presence in downstream and upstream sectors and in the same sector. The specification in equation (5) controls for firm-product-destination fixed effects, which capture the fact that a kilogram of caviar has a different value than a kilogram of flour and that firms may tailor product quality depending on the destination. These fixed effects also take into account any time-invariant characteristics specific to firm, product and destination combinations. In addition, the model controls for any effects that are common to all firms in a given region in a particular year.[18] It also controls for linear time trends specific to each combination of an industry and a region. The effect of FDI is identified based on variations from these trends.

We also estimate specifications in differences, as in equation (6). In these specifications, time-invariant firm-product-destination characteristics are differenced out. On top of that, we control for region-specific shocks occurring in particular years as well as idiosyncratic trends (captured by industry-region fixed effects π_{sr}). We employ first to fourth differences, where n-th difference for variable X in time t is defined as $\Delta \ln X_t = \ln X_t - \ln X_{t-n}$.

$$\Delta \ln Quality_{ipct} = \delta_1 \Delta Upstream\ FDI_{s,t-1} + \delta_2 \Delta Downstream\ FDI_{s,t-1} + \delta_3 \Delta Own\ FDI_{s,t-1} + \pi_{rt} + \pi_{sr} + \eta_{ipct}. \quad (6)$$

Our analysis is performed on a sample of domestically-owned manufacturing firms. In all specifications, we lag the FDI indices by one year. This allows for some time gap between the increase in foreign presence and its effect taking place. It also somewhat mitigates the concern, discussed in the next section, that reverse causality might be driving our results. The FDI indices vary only with industry and year, but our outcome variables also vary across products and destinations. Therefore, we cluster standard errors to allow for correlation between error terms within the same industry and year.

[18] Regions are defined at the NUTS2 level, which includes eight regions.

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Table 2. *Exported Product Quality and FDI: Levels and First to Fourth Differences.*

	(1) Levels	(2) First diff.	(3) Second diff.	(4) Third diff.	(5) Fourth diff.
A. Unit values					
Upstream FDI $(s, t-1)$	0.463***	0.336***	0.255**	0.759***	0.794***
	(0.113)	(0.110)	(0.112)	(0.189)	(0.221)
Downstream FDI $(s, t-1)$	0.594**	0.096	1.345***	0.399	1.115
	(0.293)	(0.242)	(0.379)	(0.605)	(0.795)
Own FDI $(s, t-1)$	0.168	0.209*	0.043	0.495***	0.529***
	(0.110)	(0.120)	(0.107)	(0.181)	(0.194)
R^2	0.068	0.009	0.011	0.007	0.006
N	146,760	51,573	30,151	17,872	10,040
B. Khandelwal et al. (2013)					
Upstream FDI $(s, t-1)$	0.543***	0.502***	0.307**	0.626**	1.444***
	(0.137)	(0.137)	(0.127)	(0.265)	(0.282)
Downstream FDI $(s, t-1)$	0.645*	0.022	2.069***	0.260	−0.272
	(0.367)	(0.320)	(0.480)	(0.756)	(0.922)
Own FDI $(s, t-1)$	0.259	0.162	0.336	0.541	0.409*
	(0.174)	(0.165)	(0.235)	(0.328)	(0.244)
R^2	0.018	0.002	0.005	0.004	0.002
N	146,760	49,598	28,558	16,766	9,281

Notes: *** 1%, ** 5%, * 10%. Standard errors, reported in parentheses, have been clustered on industry-year combinations. In panel A, the dependent variable is the logarithm of export unit values. In panel B, the dependent variable is the quality estimated as in Khandelwal *et al.* (2013) assuming two-digit-HS-specific σ_s based on estimates of Broda and Weinstein (2006) (see Section 2 for more detail). The dependent variables are employed in levels or first to fourth differences as stated in the column headers. The n-th difference for variable X in time t is defined as $X_t - X_{t-n}$. Observations are defined at the firm-product-destination-year level. The specification in column 1 includes region-year and firm-product-destination fixed effects; the specifications in columns 2–5 include region-year and industry-region fixed effects.

3. Results

3.1. *Baseline Results*

The estimation results are presented in Table 2, where Panel A displays the results for export unit values and Panel B the results for the quality estimates based on the Khandelwal *et al.* (2013) approach. In each panel, column 1 shows the results of a specification in levels, while the following columns show the results from estimation in first to fourth differences.

The most robust finding emerging from our analysis is that the quality of domestic firms' exports is positively correlated with the foreign presence in the upstream (input-supplying) industries. The estimated coefficients on *Upstream FDI*$_{st}$ are positive and statistically significant at the 1% or the 5% level for both measures of quality in all specifications. The magnitude of the estimated coefficient tends to increase with longer differencing.[19] It is also economically meaningful. The estimates can be read (for small changes in FDI) as the percent change in export quality in response to a one percentage point increase in FDI

[19] The magnitudes of the estimated coefficients for each FDI proxy vary substantially across specifications. This could raise a concern that the results are driven by particular observations. To check if that is the case, we re-estimate the specification in levels on the subsamples of data used to estimate the differenced specifications reported in columns 2–5 of Table 2. The new results, reported in Online Appendix Table B.2, are much more stable than the results from the differenced specifications shown in Table 2. This suggests that the fluctuations in the magnitudes of the coefficients are mainly due to the different specifications rather than due to a sensitivity of the results to particular observations.

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Table 3. *Exported Product Quality and FDI: Alternative Foreign Ownership Thresholds.*

	UV			Khandelwal *et al.* (2013)		
	(1) 10%	(2) 25%	(3) 50%	(4) 10%	(5) 25%	(6) 50%
Upstream FDI $(s, t-1)$	0.463***	0.396***	0.324***	0.543***	0.432***	0.378***
	(0.113)	(0.106)	(0.114)	(0.137)	(0.124)	(0.138)
Downstream FDI $(s, t-1)$	0.594**	0.652**	0.785**	0.645*	0.699*	0.889**
	(0.293)	(0.313)	(0.346)	(0.367)	(0.393)	(0.431)
Own FDI $(s, t-1)$	0.168	0.002	−0.034	0.259	−0.009	−0.052
	(0.110)	(0.086)	(0.088)	(0.174)	(0.178)	(0.180)
R^2	0.068	0.068	0.068	0.018	0.018	0.018
N	146,760	146,760	146,760	146,760	146,760	146,760

Notes: *** 1%, ** 5%, * 10%. Standard errors, reported in parentheses, have been clustered on industry-year combinations. In columns 1–3, the dependent variable is the logarithm of export unit values. In columns 4–6, the dependent variable is quality estimated as in Khandelwal *et al.* (2013) assuming two-digit-HS-specific σ_s based on estimates of Broda and Weinstein (2006); see Section 2 for more detail. Observations are defined at the firm-product-destination-year level. The specification includes firm-product-destination and region-year fixed effects and industry-region linear time trends. Different columns compare estimates based on FDI variables defined based on 10%, 25% and 50% foreign ownership thresholds.

presence. Over the studied period, foreign presence in upstream industries grew on average by 7.7 percentage points. This corresponds to a 3.6% and a 4.2% increase in the quality of exports proxied by unit values and the alternative measure, respectively (based on estimates from column 1).

FDI in the downstream (input-sourcing) industries as well as FDI in the same industry are also positively correlated with export upgrading in domestic firms. These results are, however, less precisely estimated and appear as statistically significant only in some specifications. In particular, *Downstream FDI* is statistically significant only in levels and second differences (for both quality measures), while *Own FDI* bears a statistically significant coefficient in long differences and two other specifications. When we consider the estimates in column 1, our results are consistent with the 6.5-percentage-point increase in downstream FDI observed over the period under study translating into about a 4% increase in the quality of domestic exporters for both quality proxies. Importantly, in most specifications, we do not reject the equality of *Upstream FDI* and *Downstream FDI* coefficients. This suggests that our results should not be interpreted as indicating a stronger relationship of export quality with upstream FDI than with downstream FDI but merely as providing a more robust evidence for the former relationship than for the latter.[20]

In our baseline specification, we defined firms as foreign-owned if their foreign ownership share exceeded 10%. In Table 3 below, we compare the baseline results with the results based on alternative ownership thresholds, namely 25 and 50%. Our results are robust to the alternative definitions. In all specifications, we find positive and statistically significant coefficients on *Upstream FDI* and *Downstream FDI*. No significant results are found for MNE presence in the same sector.

[20] A large number of coefficients estimated in Table 2 may raise concerns associated with multiple hypotheses testing. Adjusting the significance levels following Benjamini and Hochberg (1995) or the Holm-Bonferroni method (Holm, 1979) would not change the conclusions of this paper.

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Table 4. *Exported Product Quality and FDI by Stage of Production.*

	UV		Khandelwal *et al*. (2013)	
	(1) Non-final	(2) Final	(3) Non-final	(4) Final
Upstream FDI ($s, t-1$)	0.593***	0.290**	0.567***	0.542***
	(0.174)	(0.112)	(0.197)	(0.171)
Downstream FDI ($s, t-1$)	1.301***	−0.343	1.243**	−0.261
	(0.462)	(0.235)	(0.545)	(0.389)
Own FDI ($s, t-1$)	0.012	0.294***	0.139	0.362
	(0.180)	(0.113)	(0.190)	(0.239)
R^2	0.067	0.093	0.026	0.030
N	67,618	75,059	67,618	75,059

Notes: *** 1%, ** 5%, * 10%. Standard errors, reported in parentheses, have been clustered on industry-year combinations. In columns 1 and 2, the dependent variable is the logarithm of export unit values. In columns 3 and 4, the dependent variable is quality estimated as in Khandelwal *et al.* (2013) assuming HS two-digit-specific σ_s based on estimates of Broda and Weinstein (2006); see Section 2 for more detail. Observations are defined at the firm-product-destination-year level. The specification includes firm-product-destination and region-year fixed effects and industry-region linear time trends. The stage of production classification comes from the WTO Trade Policies Review Division. We consider products non-final if they are classified as intermediary inputs or capital goods.

3.2. *Testing Additional Predictions*

Although our data do not allow us to directly observe which firms actually buy from or supply MNEs, we can examine if the observed effects are stronger in cases where the impact of FDI spillovers is more likely to manifest itself. To that effect we undertake two exercises.

First, we split products into two groups: (*i*) intermediate and capital inputs, and (*ii*) final products.[21] If the positive results for downstream FDI are due to exporters supplying inputs to MNEs located in Romania, we should see the effect of MNE presence in input-sourcing sectors mainly for the non-final products (i.e., intermediate inputs and capital goods). Table 4 below shows that this is indeed the case. The effect of *Downstream FDI* is large and significant for non-final products, whereas for final products it is not significantly different from zero. The magnitude of the estimated effect for non-final products is economically meaningful. The estimates suggest that the 6.5-percentage-point increase in downstream FDI observed during the period studied is associated with an 8.8% increase in unit values and an 8.4% increase in the alternative export quality measure. In contrast, we would expect FDI in input-supplying sectors (*Upstream FDI*) to matter for final as well as non-final products. And this is what we find. The presence of MNEs in the input-supplying industries is positively associated with increases in unit values and quality of exports of both non-final and final products. For the former, the increase in upstream FDI observed in the period under study is associated with both measures of export quality increasing by about 4.5%. For the latter, the magnitudes are 2.3% for unit values and 4.3% for the alternative quality measure. As far as FDI in the same sector is concerned, it appears to matter for final goods, but the estimated coefficient is statistically significant only in one regression.

In the second exercise, we examine whether the observed effects are stronger for firms that are more likely to be affected. MNEs are more likely to contract suppliers which can provide them with higher quality inputs. Therefore, we expect that firms that were able to export higher quality products to begin with would tend to benefit more from the presence of FDI in the downstream (input-sourcing) industries. In contrast, access to inputs produced by MNEs is likely to benefit all

[21] We rely on a stage-of-processing classification prepared by the WTO Trade Policies Review Division.

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Table 5. *Exported Product Quality and FDI by Initial Unit Values.*

	Unit values		Khandelwal *et al.* (2013)	
	(1) High	(2) Low	(3) High	(4) Low
Upstream FDI $(s, t-1)$	0.334**	0.634***	0.481***	0.710***
	(0.159)	(0.154)	(0.173)	(0.172)
Downstream FDI $(s, t-1)$	0.920***	0.032	0.708*	0.265
	(0.350)	(0.368)	(0.418)	(0.437)
Own FDI $(s, t-1)$	0.137	0.277**	0.276	0.106
	(0.136)	(0.118)	(0.198)	(0.180)
R^2	0.067	0.081	0.026	0.022
N	74,020	72,740	73,401	73,359

Notes: *** 1%, ** 5%, * 10%. Standard errors, reported in parentheses, have been clustered on industry-year combinations. In column 1, the dependent variable is the logarithm of export unit values. In column 2, the dependent variable is quality estimated as in Khandelwal *et al.* (2013) assuming two-digit-HS-specific σ_s based on estimates of Broda and Weinstein (2006); see Section 2 for more detail. Observations are defined at the firm-product-destination-year level. The specification includes firm-product-destination and region-year fixed effects and industry-region linear time trends. Firms with high initial unit values are defined as those with above-median initial unit values in the estimation sample. Initial unit values are calculated as weighted mean unit value percentile across each firm's products and destinations in the firm's first year in the sample, using export shares of each product-destination as weights. The unit value percentiles are calculated across all firm-product-destination observations for each product, destination and year.

firms. To test these conjectures, we split the sample into firms exporting relatively high quality versus relatively low quality products at the beginning of the sample period.[22] Table 5 shows that the results for downstream FDI are indeed driven by firms with relatively high initial export quality, while the results for upstream FDI are positive irrespective of the initial export quality.

Observing the expected patterns while examining the more nuanced predictions boosts our confidence that the link between the quality of exports and the presence of FDI works through the channels we intend to capture.

3.3. *Alternative Explanations*

Although our results are consistent with Romanian firms benefitting from knowledge spillovers via access to better inputs and advice obtained from MNEs producing them, know-how received while supplying MNEs and demonstration effects from MNE presence in the same sector, there exist possible alternative explanations. First, one could potentially argue that the causality runs in the opposite direction, since FDI may be more likely to flow to industries with substantial demand for high-quality foreign inputs or industries for whom high quality domestic inputs are available. Insofar as these location factors are time-invariant, they are captured by firm-product-market fixed effects in the specification in levels and they get differenced out in the other specifications. Furthermore, if MNEs perceive them as evolving over time in a linear fashion, they would be captured by industry-region-specific trends in the differenced specifications. The potential problem is also mitigated by lagging the explanatory variables. However, reverse causality could

[22] For each firm-product-destination-year observation, we calculate its percentile in the distribution of all unit values for the same product and destination in the same year. For each firm, we then calculate the weighted mean of these percentiles across all its products and destinations in the first year the firm appears in the sample, using shares of each product-destination in the firm's exports as weights. We then define a dummy equal to unity for observations with above-median values of the weighted means. We conduct analogous calculations for the alternative measure of quality.

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Table 6. *Exported Product Quality and FDI: Strict Exogeneity Test.*

	(1) UV	(2) Khandelwal *et al.* (2013)
Upstream FDI $(s, t-1)$	0.483***	0.589***
	(0.121)	(0.141)
Upstream FDI (s, t)	0.079	0.107
	(0.155)	(0.171)
Upstream FDI $(s, t+1)$	0.239	0.071
	(0.186)	(0.221)
Downstream FDI $(s, t-1)$	0.483	0.977*
	(0.490)	(0.570)
Downstream FDI (s, t)	0.377	1.192
	(0.744)	(0.811)
Downstream FDI $(s, t+1)$	−0.404	−0.092
	(0.534)	(0.618)
Own FDI $(s, t-1)$	−0.031	−0.243
	(0.123)	(0.166)
Own FDI (s, t)	−0.241*	−0.243
	(0.126)	(0.162)
Own FDI $(s, t+1)$	−0.023	−0.198
	(0.122)	(0.146)
R^2	0.057	0.029
N	104,875	104,875

Notes: *** 1%, ** 5%, * 10%. The table reports strict exogeneity test described by Wooldridge (2010). Standard errors, reported in parentheses, have been clustered on industry-year combinations. In column 1, the dependent variable is the logarithm of export unit values. In column 2, the dependent variable is the quality estimated as in Khandelwal *et al.* (2013) assuming two-digit-HS-specific σ_s based on estimates of Broda and Weinstein (2006) (see Section 2 for more detail). Observations are defined at the firm-product-destination-year level. The specification includes firm-product-destination and region-year fixed effects and industry-region linear time trends.

still be a problem if MNEs enter Romania in industries where there is a growing demand from domestic firms for high-quality inputs or where high-quality domestic suppliers are increasingly becoming available and if these dynamics are not captured by the linear trends. To shed light on this possibility we perform the strict exogeneity test suggested by Wooldridge (2010). It entails estimating a specification where, in addition to the lagged FDI variables, we include their contemporaneous and lead values. If foreign firms' entry into Romania is a consequence of quality upgrading in upstream and downstream industries, the coefficients on the lead values should be statistically significant.

Table 6 presents the test results. The positive coefficients on upstream and downstream FDI seem to be driven by their lagged values. Most importantly, the leads for all three FDI measures bear insignificant coefficients, suggesting that reverse causality is not driving our results. The results further suggest that, if anything, FDI may be more likely to flow to industries with lower unit values of exports.

Additional analysis, reported in Online Appendix Table B.3, shows that our conclusions are robust to allowing for a partial adjustment in the export quality. More specifically, we estimate a dynamic specification featuring a lagged dependent variable among the explanatory variables. Estimates based on a generalised-method-of-moments (GMM) estimator by Arellano and Bond (1991), as well as on a fixed-effects estimator, indicate that there is a positive and statistically significant relationship between the quality of Romanian firm exports (measured by either quality proxy) and FDI presence in upstream industries. The long-term semi-elasticities implied by the

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GMM estimates are either similar or slightly smaller than those found in the static estimation.[23] The other two measures of FDI presence are not statistically significant in the GMM specifications.

Another potential alternative explanation is that a shock in the international market is driving both FDI inflows to Romania and unit values of Romanian exports. Imagine there is a global positive shock to demand for agricultural machines. As a result, foreign producers of agricultural machines and of the inputs used to manufacture agricultural machines decide to expand their production and invest in Romania. At the same time, the demand shock leads to higher prices for such machines and their inputs, including the prices faced by Romanian exporters. It would then be incorrect to interpret the resulting correlation between unit values of Romanian exporters and the upstream, downstream or same sector foreign investments as evidence of spillovers. Fortunately, we can easily test for this case by including the international price of each product as a control. Column 2 in Table 7 shows the results of an estimation, where we control for unit values of exports by the other EU members. Doing so has virtually no effect on the estimated coefficients on FDI variables when compared to the baseline results reproduced in column 1. Hence an international shock driving both foreign investment to Romania and unit values of Romanian firms does not seem to explain our results.

Yet another potential alternative explanation for our results is related to domestic, rather than international, demand. Foreign investment in downstream industries could lead to an increase in their demand for inputs. If supply of these inputs is relatively inelastic, at least in the short term, upstream domestic firms might react to the increased demand by increasing prices of both their domestic sales and their exports. In such case, the correlation between foreign presence in downstream industries and export prices of upstream firms would reflect a price increase in reaction to an increased demand rather than a quality improvement. To test for this possibility, we follow Javorcik (2004) and define an index capturing input demand by downstream industries. Column 3 of Table 7 shows that when we include this index in the estimation, it indeed has a strong positive effect on export unit values. However, its inclusion actually makes the coefficients on downstream FDI slightly larger and more precisely estimated, suggesting that downstream demand is not driving our results.

It is also possible that as foreign-owned firms enter upstream or downstream industries, domestic firms that are unable to improve their product quality are forced to exit the market. In such a case, the observed results on the quality of exports by Romanian firms would be driven by differential entry and exit rather than by spillovers. We explore this possibility by restricting the estimation sample to firms continuously exporting throughout the sample period (see column 4 of Table 7). The results remain robust. Thus differential entry/exit patterns are unlikely to represent mechanisms behind the positive effect of FDI on export unit values.

Finally, we consider the possibility that the estimated positive association between export quality and upstream FDI is driven by a concurrent increase in availability of imported intermediate inputs. Therefore, in the last column of Table 7, we control for the value of industry-level imports. Imports appear to be strongly positively correlated with quality. However, the coefficient on upstream FDI, although slightly reduced, remains statistically significant at the 1% level for both measures of quality. The coefficient on downstream FDI is also slightly reduced and remains statistically significant only when export quality is measured with unit values.

[23] The long-term effects in the dynamic equation can be calculated as the short term effects divided by one minus the coefficient on the lagged dependent variable. This gives $0.359/(1 - 0.198) = 0.448$ for the unit values and $0.370/(1 - 0.106) = 0.414$ for the alternative export quality measure.

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Table 7. *Exported Product Quality and FDI: Alternative Explanations.*

	(1) Baseline	(2) Price control	(3) Demand control	(4) Cont. firms	(5) Import control
A. Unit values					
Upstream FDI $(s, t-1)$	0.463***	0.459***	0.376***	0.392***	0.329***
	(0.113)	(0.114)	(0.108)	(0.121)	(0.106)
Downstream FDI $(s, t-1)$	0.594**	0.593**	0.700**	0.914***	0.506*
	(0.293)	(0.294)	(0.276)	(0.315)	(0.287)
Own FDI $(s, t-1)$	0.168	0.166	0.177*	0.078	0.173
	(0.110)	(0.110)	(0.107)	(0.094)	(0.115)
Log UV of EU exports (p, t)		0.028***			
		(0.010)			
Log downstr. demand $(s, t-1)$			0.170**		
			(0.066)		
Log industry imports (s, t)					0.136***
					(0.020)
R^2	0.068	0.069	0.069	0.077	0.069
N	146,760	146,758	146,760	84,851	146,760
B. Khandelwal et al. (2013)					
Upstream FDI $(s, t-1)$	0.543***	0.539***	0.485***	0.524***	0.442***
	(0.137)	(0.138)	(0.136)	(0.149)	(0.139)
Downstream FDI $(s, t-1)$	0.645*	0.643*	0.715**	0.782*	0.579
	(0.367)	(0.368)	(0.360)	(0.425)	(0.364)
Own FDI $(s, t-1)$	0.259	0.257	0.265	0.129	0.262
	(0.174)	(0.174)	(0.171)	(0.194)	(0.182)
Log UV of EU exports (p, t)		0.027**			
		(0.012)			
Log downstr. demand $(s, t-1)$			0.112		
			(0.079)		
Log industry imports (s, t)					0.102***
					(0.031)
R^2	0.018	0.019	0.019	0.020	0.019
N	146,760	146,758	146,760	84,851	146,760

Notes, *** 1%, ** 5%, * 10%. Standard errors, reported in parentheses, have been clustered on industry-year combinations. In panel A, the dependent variable is the logarithm of export unit values. In panel B, the dependent variable is the quality estimated as in Khandelwal *et al.* (2013) assuming two-digit-HS-specific σ_s based on estimates of Broda and Weinstein (2006) (see Section 2 for more detail). Observations are defined at the firm-product-destination-year level. All specifications include firm-product-destination and region-year fixed effects and industry-region linear time trends. International unit values are based on exports of 27 EU countries (excl. Romania) as reported by Eurostat. For each product and year, they are calculated by summing export value and quantity over all countries and then dividing value by quantity. Downstream demand is defined as a weighted mean of output across downstream industries. The output is deflated by industry-specific deflators. The weights are given by the intermediate inputs from the upstream industry corresponding to one unit of output in each downstream industry. Column 4 includes only firms exporting throughout the sample period.

4. Conclusion

Economic development is inseparably related to structural change and upgrading of industrial production and exports. Many countries use industrial policy and trade policy to facilitate such upgrading, but our knowledge of factors that can contribute to this goal is limited.

This study suggests that FDI inflows can stimulate domestic firms to upgrade the quality of their exports. Using a panel of all Romanian firms with more than 20 employees, matched with detailed customs data and observed over the period 2005–11, we find evidence consistent with the view that FDI inflows have facilitated export upgrading by Romanian firms. The most

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robust effect seems to have been exerted by FDI in the input-supplying industries, but FDI in the input-sourcing or the same industry also seems to have had a positive (though a less robust) effect. These findings hold when we proxy for export quality using unit values or estimate quality following Khandelwal *et al.* (2013). The estimated effects suggest that the increases in foreign presence in the input-supplying manufacturing industries over the period studied corresponded to an approximately 4% increase in the quality of exports by local firms. A similar magnitude is found for FDI in the input-sourcing industries. Although we do not claim that FDI was the only, or even the most important, contributor to export upgrading in Romanian manufacturing, the combined estimated effect of the FDI increases is of a similar magnitude as a half of the total catch-up relative to EU15 in terms of unit value registered by exports of Romanian firms over the same period.

Overall, our findings indicate that when policymakers are looking for effective and actionable policies aimed at quality upgrading among domestic exporters, they should consider FDI promotion and, in particular, efforts to bring foreign investors into industries which are likely to supply inputs to domestic firms.

OECD; CERGE-EI
University of Oxford; CEPR

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Online Appendix
Replication Package

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