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Microeconomic Mechanisms Behind Export Spillovers from FDI: Evidence from Bulgaria

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Abstract

This paper studies how the presence of multinational enterprises affects the export performance of Bulgarian manufacturing firms - Export spillovers from FDI. Using export data at the firm/product/destination level for the period 2004-2006, we find positive forward spillover on export value and quantity, related to quality upgrading. Conversely, we find negative (or insignificant) backward and horizontal spillover on export flows, related to quality downgrading. When aggregating data at the firm level and considering that a firm can operate in several sectors, we show that the presence of foreign input suppliers allows domestic firms to export additional varieties of lower quality and upgrade the average quality of existing varieties, whereas the presence of foreign customers generates the opposite effect.

Keywords: Export spillover, FDI, Multi-product firms, Unit value, Quality.

JEL: F14, F23, F61.

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1. Introduction

Foreign Direct Investment (FDI) has been considered to be one of the most important catalysts for economic growth and development. For this reason, policy-makers from emerging and developing countries have adopted policies aimed at attracting FDI. However, the overall opinion on whether or not the host economy always benefits from the presence of foreign firms is not finalised. The extensive microeconomic literature investigating how inward FDI affects domestic firms' productivity reaches mixed conclusions (Görg and Greenaway, 2004).

The presence of multinationals (MNEs) within an industry may improve the performance of domestic producers through either competition or learning effects, i.e. local firms might be pushed to increase their efficiency in order to face foreign competition, or adopt better technologies employed by foreign competitors (*horizontal* or *intra-industry spillovers*). However, several studies have found that these spillovers might be irrelevant, or even negative, when the spillovers occurring due to buyer/supplier linkages between foreign and domestic firms (*vertical* or *inter-industry spillovers*) are taken into consideration. The presence of foreign firms in upstream sectors could positively influence domestic firms' performance in downstream sectors, by supplying a larger number and/or a higher quality of intermediate inputs (*forward spillovers*). At the same time, the presence of foreign-owned affiliates in downstream sectors may lead to productivity improvements for local firms in upstream sectors, because the foreign firms can demand higher standards for their intermediate inputs, and therefore push the domestic input suppliers to improve production efficiency and/or the quality of output (backward spillovers) .[1] A recent meta-analysis of these studies shows that vertical spillovers are more important than horizontal ones, while backward spillovers appear to be larger than forward spillovers (Havranek and Irsova, 2011).

The main purpose of this paper is to empirically investigate whether, and how, inward FDI influences export performance, i.e. firms' ability to serve international markets via the trade channel (*export spillovers from FDI*). It has been argued that a large presence of foreign multinationals might positively affect firm level export performance thanks to technological spillovers, as explained above, and information spillovers, via horizontal and vertical linkages. In other words, the presence of multinationals may reduce the costs of production, and/or more specifically the costs related to exporting. The amount of firm level literature on export spillovers from FDI is much smaller than that on productivity spillovers; and mainly focuses on horizontal linkages, providing mixed results.[2] Only a few studies consider export spillovers through vertical linkages. Using firm level panel data from the UK, Kneller and Pisu (2007) find that domestic firms' export decisions are only affected by MNEs through positive backward spillovers, whereas domestic firms' export share in total sales is positively affected by horizontal (export-related) and backward spillovers, but negatively by forward spillovers. Using firm level data from China for the period 2000-2003, Chen et al. (2013) show positive backward technology spillovers on domestic firms' export value, and positive horizontal export-related information spillovers on the export share of total sales.

Using panel data on Bulgarian exports at the firm/product/destination level, this study aims to explore the microeconomic mechanisms behind firm level aggregate export spillovers from FDI, and to provide interesting new

[1] See Görg and Greenaway (2004) for more details.

[2] Using cross-section data at the firm level, Aitken et al. (1997) demonstrate that the probability of domestic firms exporting is positively influenced by the presence of exporting multinational enterprises in the same industry and region. Using firm level panel data from the UK, Greenaway et al. (2004) find that MNEs' exports have a positive impact on domestic firms' export decisions, but no effect on how much they export (i.e. firm level export-to-sales ratios). Ruane and Sutherland (2005) find that domestic firms' export decisions and export intensities are negatively related to MNEs' export intensity, using panel data from Ireland. Exploring similar data from Spain, Barrios et al. (2003) find no significant evidence of export spillovers from FDI, in terms of both probability of exporting and export intensity at the firm level.

insights in the context of an emerging economy.[3] The majority of existing studies are based on firm level aggregate export data from developed countries, and have shortcomings due to data unavailability. Firstly, they have not been able to account for either product or destination heterogeneity, although firm level export performance may depend on the characteristics of both products and countries a firm is involved with, in addition to firm-specific characteristics. Secondly, they have been unable to determine whether the change in export value is mainly due to a change in product quantity and/or a change in price (unit value), and whether the price adjustment is mainly caused by a change in quality. Finally, spillover variables for each firm are usually measured by considering only the main sector of the firm, although many studies argue that a large amount of export flows are concentrated within multi-product firms that are often active in several industries (Bernard et al., 2007; Mayer and Ottaviano, 2007).

In this paper, we attempt to address all these issues using detailed data on Bulgarian manufacturing exports for the period 2004-2006. Bulgaria in this period is a very interesting case, because the country was further liberalising both its trade and investment regimes, with a view to becoming an official member of the European Union in January 2007. In Bulgaria this period was characterised by fast economic growth, accompanied by a dramatic increase in exports, and significant FDI inflows.

First, we analyse export spillovers from FDI at the firm level following the standard approach, i.e. by relating firm level aggregate export value to industry level spillovers from FDI, taking into account the main sector of each firm over the sample period. These "benchmark" results suggest that Bulgarian manufacturing firms enjoy positive forward export spillovers, whereas both horizontal and backward export spillovers appear not to be statistically significant.

Next, we explore the linkage between exports and inward FDI by using firm/product/destination level data (i.e. variety level data), which enable us to account for product heterogeneity, country heterogeneity, as well as firm heterogeneity. We find positive forward spillovers from FDI on export revenues, which are associated with an increase in quantity without any change in price. Conversely, both horizontal and backward spillovers negatively affect export sales, although less robustly, without price changes. Relying on the standard literature on quality and trade, where the unit value of a product would proxy its quality (Schott, 2004), we might conclude that these results do not provide evidence of quality effects from FDI spillovers. However, when disentangling the quality component from unit values, as in Khandelwal et al. (2013), we find significant effects on quality with no change in prices, i.e. quality upgrading from forward spillovers and quality downgrading from both horizontal and backward spillovers. Overall, these results seem to suggest that existing varieties at the firm/product/destination level have their quality increased by the use of more and/or better intermediate inputs from foreign-owned suppliers, and reduced in quality when firms are unable to supply foreign-owned customers and face tougher competition by FDI. These results are found to be relatively stronger for differentiated goods, intermediate goods, OECD destinations, EU destinations, and large exporting firms.

Finally, we aggregate firm/product/destination data at the firm level in order to investigate whether inward FDI affects export performance of existing exporters differently when accounting for the multi-sector dimension of spillover variables for each firm. Surprisingly, we find a negative forward spillover on export value, rather than a positive one, which takes effect through a decrease in quantity and an increase in average export price within the firm, associated with a decrease in average quality. Conversely, we find that backward spillovers lead firms to sell more at lower average prices, without any change in average quality. These results suggest that previous firm level

[3] Previous studies on spillovers from FDI in Bulgaria focus on the effects on firm productivity, rather than export performance (Monastiriotis and Alegria, 2011).

studies on export spillovers could have reached different conclusions if the "real" presence of multinationals was accounted for in each domestic firm, i.e. by considering all sectors in which each firm produces.

It is worth noting that these findings might be due to the entry/exit of export varieties within firms, and not just to changes in existing varieties. Indeed, when we exclude the possibility of a change in the product/destination mix within a firm, the results turn out to be in line with our firm level "benchmark" findings, i.e. we show positive forward spillovers on firm level export revenue and quantity, and additionally negative backward spillovers on export value. Both vertical spillovers seem to occur without any change in average price. Nevertheless, when focusing on the quality measure, we document within-firm quality upgrading from forward spillovers, and within-firm quality downgrading from backward spillovers. Therefore, the presence of foreign suppliers seems to allow firms to export additional varieties of lower quality, and upgrade the quality of existing export varieties, whereas the presence of foreign customers leads firms to drop marginal varieties of lower quality and downgrade the quality of remaining existing varieties.

The remainder of the paper is organised as follows. Section 2 discusses the related literature. Section 3 highlights the Bulgarian macroeconomic context with a primary focus on exports and inward FDI. Section 4 describes the data and provides the preliminary statistics. Section 5 presents the main econometric analysis of the microeconomic linkages between exports and FDI. Section 6 provides robustness checks, and section 7 concludes the paper.

2. Related literature

This paper contributes to the empirical literature on firm level export spillovers from FDI, and provides interesting new microeconomic insights because of the recent availability of more disaggregated trade data for different dimensions, i.e. firm, product and destination country. To the best of our knowledge, Bajgar and Javorcik (2016)'s work is most closely related to ours, because they also explore the linkage between inward FDI and exports by using firm/product/destination level data for the Romanian manufacturing sector. Bajgar and Javorcik (2016) find that unit values are positively affected by backward spillovers and (less robustly by) forward spillovers, concluding that quality upgrading occurs via both vertical spillovers from FDI. Unlike their work, we explore more generally the spillover effects from FDI on total export value at the firm/product/destination level, by disentangling the quantity and the unit value channels. Moreover, we go further by measuring quality following Khandelwal et al. (2013)'s approach, rather than using unit value as a quality proxy, in order to separate the quality effect from the competitiveness effect.

This paper is also related to the body of research examining the determinants of firm level export performance, and more specifically, those factors which enable firms to produce goods of higher quality. Kugler and Verhoogen (2012), using data on Colombian manufacturers, show that firms producing high quality products tend to use higher price inputs. Amiti and Khandelwal (2013) find that lower import tariffs are associated with quality upgrading for products close to the world quality frontier, whereas lower tariffs discourage quality upgrading for products away from the frontier. Fieler et al. (2014) find that lower import tariffs lead exporters to upgrade product quality, increasing the domestic supply of high-quality intermediates. Bas and Strauss-Kahn (2015) find that a reduction in input tariffs allows Chinese firms to access high-quality inputs, implying quality upgrading of their exported products. We contribute to this literature by considering the role of inward FDI in affecting the price and the quality of exported varieties.

This study also relates to the literature investigating the export performance of firms which supply a wide variety of products to the export market. Manova and Yu (2017) find that the more expensive products account for the largest share of revenues for Chinese multiproduct firms. Moreover, exporters focus on their most expensive goods, drop cheaper goods, and earn lower revenues in destinations where they sell fewer kinds of products. Using data from Mexico, Eckel et al. (2015) find that manufacturers producing more expensive varieties generate higher export revenues worldwide. Our contribution to this literature comes from considering how the presence of foreign MNEs at the industry level might affect the export outcomes of multiproduct firms (i.e. revenues, quantity, prices, and quality), rather than focusing on the relationship between these outcomes.

3. Bulgarian context

In the period 2004-2006, Bulgaria was on a successful recovery path characterised by rapid economic growth and low inflation. From 2001 onwards, the country experienced positive average growth in real GDP, above 4%. At the same time, unemployment was declining.

Following accession to the WTO in December 1996, the Bulgarian government implemented several economic reforms, including trade policy liberalisation. The liberalisation of the trade regime was the deepest and the most comprehensive in the region. After the agreement between Bulgaria and the European Union, signed in 1993, both partners gradually eliminated import duties and non-tariff measures on manufactured goods and services. These changes significantly improved the access of Bulgarian exports to the EU market. In 2000, the country was officially invited to start negotiations to accede to the European Union. This spurred additional economic reforms, including further trade liberalisation (WTO, 2003; 2009). Bulgaria joined the EU in 2007. Since the beginning of the 2000s, Bulgarian firms have been highly involved in the international trade of goods and services. Trade in goods increased from 87% of GDP in 2001 to more than 111% in 2006. [4] Both exports and imports as a percentage of GDP grew steadily at more than 10% per annum from 2001 to 2006. [5]

Bulgarian governments also managed to significantly liberalise the investment regime. Under the reformed legislation, foreign investors were granted the same treatment as domestic ones. No limitations were imposed on the share of foreign participation in newly formed companies, while the transfer of capital abroad was not restricted. At the same time, the majority of state-owned enterprises in the manufacturing sector were privatised. The consequence of these reforms was an unprecedented inflow of FDI between 2003 and 2008. The average FDI inflow in the period reached almost 28% of GDP in 2003. Even if the majority of FDI was directed to the non-tradable sector, FDI in the manufacturing sector was more than 5.5% of GDP in 2006. Interestingly, Bulgaria was one of the major recipients of FDI among the former members of the Eastern bloc joining the EU.[6] The inflow of foreign direct investment in Bulgaria during 2006 went up by EUR 1 billion, and reached EUR 4.5 billion (16.8% of GDP). So, Bulgaria's accession to the EU on 1st January 2007, intensive restructuring, and high returns on investment attracted a large amount of financial resources in the period 2001-2006, with foreign direct investments and external loans contributing to Bulgaria's economic growth. [7]

[4] Data obtained from World Bank's World Integrated Trade Solution (WITS) Database.
[5] Exports of goods and service as percentage of GDP grew from 35% in 2001 to 47% in 2006. Imports as a percentage of GDP went from 44% to 64% in the same period.
[6] Bulgaria and Romania joined the EU in 2007. Czech Republic, Hungary, Estonia, Latvia, Lithuania, Poland, Slovakia, and Slovenia entered the Union in 2004.
[7] Bulgarian National Bank, 2007, "Economic Review," 1/2007.

4. Data and preliminary analysis

4.1. Data sources

The empirical analysis carried out in the following sections is mainly based on data from the Exporter Dynamics Database (EDD) compiled by the World Bank, which contains comparable information on trade flows for a group of developing and developed economies (Fernandes et al., 2016). In this paper, we focus on data from Bulgarian firms exporting manufactured products for the period 2004-2006. The database was assembled by obtaining customs data, which reports annual information on total value and quantity of trade flows by the identification code of the exporting firm, HS6-96 product codes, and export destination. The monetary value of export flows is measured in Free on Board (FOB) US Dollars (USD); therefore it does not include any cost associated with shipping and freight. Export quantities are measured in kilograms.

These very detailed export data are merged, using concordance tables across different sector classifications, with industry level information on the presence of foreign firms obtained from the Orbis database, managed by Bureau van Dijk. This database provides economic and financial data at the firm level, such as ownership status, total revenues and the firm's main sector of activity at the four-digit level of the NACE classification for Bulgaria and several other countries.

4.2. Export performance

The left side of **Table A.1** shows that in 2004, Bulgarian exports comprised 120,712 varieties (i.e. firm-product-destination triplets), which concerned about 3,990 products traded by 18,977 firms to 201 destinations. The number of varieties increased to 127,868 in 2006, which is associated with an increase in the average export value of about 6%, mainly due to a positive change in average price (i.e. unit value)[8] of about 16%, as the average quantity decreased by approximately 10%. These changes might be due to the entry/exit of varieties in the international market. The right side of **Table A.1** shows the balanced panel of 28,437 varieties, concerning 2,360 products exported by 4,348 firms to 138 destinations, which exhibit on average a larger value and quantity of export flow in 2004, while the average price remains similar to that of the unbalanced panel. However, it is worth noting that the positive change in revenues over time is on average larger (by about 9%), and essentially due to a change in unit value. Thus, to the extent that unit value is considered a proxy for product quality, we can highlight that Bulgarian varieties increased in quality over time, as on the one hand the quality of existing varieties was upgraded, and on the other hand the entering (exiting) varieties were of a higher (lower) quality.

Since this study focuses on within-variety changes, the next summary statistics tables are based on the balanced panel of firm/product/destination triplets. In **Table A.2,** we split the sample into differentiated and non-differentiated goods, following Rauch (1999)'s classification, to assess whether there are differences in trade outcomes linked to product characteristics. We expect that differentiated varieties are on average more expensive than the other varieties, because they are more likely to have higher quality, and therefore changes in their unit values should mostly be due to changes in quality. First, it is worth noting that the majority of the sample concerns differentiated goods. Only about 15% of varieties are homogeneous or reference-price goods, which on average exhibit smaller unit value, but larger export quantity. While differentiated varieties follow the general trend, i.e. an

[8] In the text, we use price and unit value as synonymous, i.e. both refer to the value/quantity ratio.

increase in average revenue of 9%, mainly caused by a change in average price, non-differentiated varieties on average show a larger positive change in export value over time (about 16%), due to both price (about 10%) and quantity (about 5%) changes. Thus, while differentiated varieties seem to upgrade their quality, homogeneous and reference-price varieties appear to become less competitive over time.

Table A.3 presents separately final, intermediate, and capital goods, according to the BEC classification; they represent 45.8%, 43.8% and 10.4% of incumbent export varieties, respectively. We expect that capital goods have the largest average value, because they are relatively more costly than the other product categories, and final goods have on average higher revenues and prices than intermediate goods, because final goods are produced by combining intermediate goods with other factors of production. These patterns are reflected in this table. Moreover, it is worth noting that the value of both capital and intermediate goods on average increased by about 14% in the period under observation, because of changes in both quantity and price. Conversely, the export value of final goods increased relatively less (about 4%), because of a positive change in price only, since the export quantity on average decreased. Therefore, although all product categories seem to upgrade their quality, we observe an export reallocation, in terms of quantity, from final to both intermediate and capital categories, which suggests that Bulgaria is becoming relatively more competitive in the upstream stages of production along the global value chain rather than in the downstream stages.

In **Table A.4** and **Table A.5**, we present descriptive statistics for trade flows with respect to export destination. In particular, we report statistics for exports to OECD and non-OECD countries in Table A.4, and to EU and non-EU countries in Table A.5. Exports to developed economies account for about two-thirds of incumbent varieties, and on average exhibit larger export sales, in terms of both value and quantity, and higher prices. These patterns are consistent with the hypothesis that varieties exported to developed countries have higher quality than those exported to developing countries. However, it is worth noting that the revenues from varieties exported to non-OECD destinations increased on average relatively more (17% versus 5%), because of positive changes in both quantity and price. Conversely, the quantity exported to the OECD on average fell over time, while the positive change in unit value was similar in the two geo-economic areas. Therefore, it seems that Bulgarian exports were reallocated from developed to developing economies.

From Table A.5, it appears that almost two-thirds of exported incumbent varieties are oriented to the European Union, and are on average associated with higher revenues and prices, compared to varieties exported to the non-EU area. Surprisingly, over the three-year period before the accession to the EU, revenues increased on average relatively less for exports towards the EU area (4% versus 19%), although changes in unit values were similar in the two areas. These patterns are mainly due to export quantity reallocation from EU to non-EU countries.

In **Table A.6**, we split the sample according to the initial firm size, identifying three groups of firms: small, medium, and large, i.e. firms with initial level of total export value below the 25th percentile, between the 25th – 75th percentiles, and above the 75th percentile, respectively. This table shows that the majority of exported varieties are from large firms (56.0%), 36.8% from medium firms, and only 7.2% from small firms. Large firms' varieties on average have a larger export value and quantity compared to other varieties, whereas large firms' prices appear to be lower than small firms but higher than medium firms. The opposite patterns appear for small firms' varieties. Therefore, while export flows, in terms of value and quantity, increase with firm size, the unit value seems to follow a U-shape trend with respect to firm size, perhaps because small firms are less efficient than medium firms, which in turn produce lower quality products than large firms.

When looking at the changes over the period 2004 to 2006, we can see that export value at the firm/product/destination level dramatically increased for small firms (about 52%), associated with an increase in both quantity (40%), and price (13%). Conversely, the export value increased relatively less for large firms (about 8%), mainly due to a positive change in price (9%), since the related export quantity on average remained unchanged. Medium firms' varieties had a smaller positive change in value (about 2%), due to a larger decline in quantity (5%). Therefore, it appears that a quantity reallocation from both large and medium firms' varieties to small firms' varieties occurred over time, even if both categories exhibited positive change in prices, possibly due to variations in product quality.

4.3. Foreign presence through horizontal and vertical linkages

To obtain a proxy for the presence at the industry level of foreign competitors within the manufacturing sector, we employ firm level data from the Orbis database managed by Bureau van Dijk. We first identify foreign-owned firms by considering the nationality of the global ultimate owner (GUO), as defined by Orbis. Then, by using data on firm level revenues, we measure the foreign presence at the four-digit NACE industry level as the share of foreign firms' sales in total sales (Horizontal spillover):

$$Hspill_{jt} = \left(\frac{Foreign\ firms'sales}{All\ firms'sales}\right)_{jt}$$

Using the Bulgarian input/output table at the 2-digit IO industry-level and the related concordance table with 2-digit NACE level classification, we obtain a proxy for vertical spillovers. [9] More specifically, the presence of foreign-owned suppliers (forward spillover) and the presence of foreign-owned customers (backward spillover) for each sector are quantified as follows:

$$Fspill_{st} = \sum_{u \neq s} (w_{us} * Hspill_{ut})$$

$$Bspill_{st} = \sum_{k \neq s} (w_{sk} * Hspill_{kt})$$

Where w_{us} represents the share of intermediate inputs purchased by industry s from industry u, w_{sk} is the share of intermediate inputs sold by industry s to industry k. [10] In order to merge this information with our firm/product/destination trade data, we convert these indexes into the four-digit ISIC3 level.

[9] Note that 2-digit IO codes correspond to 2-digit NACE codes, but some 2-digit NACE codes correspond to a single 2-digit IO code (such as 10-11-12; 13-14-15; 31-32), therefore the number of IO industries (19) is smaller than the number of 2-digit NACE industries (24).

[10] In line with previous studies (Javorcik, 2004), we exclude intra-industry supplies when measuring vertical spillovers at the 2-digit sector level to prevent the problem of double-counting. However, it is worth noting that vertical spillovers may be underestimated. Alfaro and Charlton (2009) find that many vertical subsidiaries are only visible at the four-digit level because the intermediate goods they supply are so close to their parent companies' final goods that they appear to be the same goods at the two-digit level. One way to overcome this problem is by using an I/O table at the 4-digit sector level. Unfortunately, a more disaggregated I/O table for Bulgaria is not available.

The left panel of **Table A.7** presents the simple means of horizontal spillovers at the 2-digit ISIC3 level. First, it appears that horizontal spillover within the manufacturing sector was on average around 21% in 2004. Interestingly, horizontal spillover shows a significant heterogeneity at the industry level. The sectors that exhibit the highest presence of foreign firms are: Coke, refined petroleum products and nuclear fuel; Tobacco products; and Basic metals; whereas the sectors with the lowest presence of foreign firms are: Publishing, printing and reproduction of recorded media; Machinery and equipment; and Other transport equipment. Intra-industry spillovers increased on average by 1.7% over the period 2004-2006. However, it is worth noting that while two-thirds of sectors report an increase in the presence of foreign-owned firms (e.g. Machinery and equipment; Coke, refined petroleum products and nuclear fuel; and Other non-metallic mineral products), one-third of sectors report a decrease (e.g. Tobacco products; Textiles; Basic metals).

The remaining columns of **Table A.7** show that the presence of foreign suppliers is relatively higher than the presence of foreign customers in 2004 (14.0% versus 7.9%), and this pattern holds for the majority of industries (except for Coke, refined petroleum products and nuclear fuel, and Basic metals). Both vertical spillovers increase over time, but forward spillover increases (e.g. Machinery and equipment; Electrical machinery and apparatus; and Fabricated metal products, except machinery and equipment) on average more than backward spillover (e.g. Fabricated metal products, except machinery and equipment; Electrical machinery and apparatus; and Machinery and equipment).

4.4. Export spillovers from FDI: Firm-level standard approach

In order to explore the linkages between exports and inward FDI, we merge firm/product/destination export data with industry spillover data, employing the concordance table between the six-digit HS96 classification and the four-digit ISIC3 classification. **Table A.8** displays the summary statistics of the main variables used for our investigation for the period under analysis.

The majority of the previous studies which explored export spillover from FDI are based on firm level aggregate export data combined with industry level information on spillover from FDI, by considering the main sector of the firm (Kneller and Pisu, 2007; Chen et al., 2013). [11] Therefore, before exploiting more disaggregated data on exports within firms, we first focus on the following "benchmark" specification which is in line with the existing firm level literature:

$$\ln v_{ft} = \beta_1 Hspill_{st} + \beta_2 Fspill_{st} + \beta_3 Bspill_{st} + \alpha_f + \alpha_t + \varepsilon_{ft}. \quad (1)$$

Where v_{ft} is total export value for firm *f* in year *t*, while all spillover variables refer to the firm's main sector *s* that in our context corresponds to the firm's four-digit ISIC sector which had the largest export value in the period 2004-2006. We also include firm fixed-effects α_f, and time fixed-effects α_t, to control for time-invariant firm characteristics and common macroeconomic shocks across firms. The term ε_{ft} denotes the error. **Table 1** presents the results. For all the specifications we cluster standard errors at the sector level. The estimated coefficients suggest

[11] Some studies compute spillovers at the sector/region level, giving more emphasis on agglomeration economies (Aitken and Harrison, 1999; Girma and Wakelin, 2002). Unfortunately, we cannot explore the geographic dimension as our export database does not include information about firm location.

that Bulgarian manufacturing firms enjoy positive forward export spillovers, whereas both horizontal and backward export spillovers are statistically not significant.

These firm level results might suffer from several shortcomings. First, they do not account for product and/or destination heterogeneity. Second, we cannot determine whether the change in export value is mainly due to a change in quantity or in price (unit value), and whether the price adjustment is due to a variation in product quality. Finally, spillover variables for each firm are measured by considering only the main sector of the firm, and not all the sectors the firm is involved in. In the next section, we attempt to address all these issues using detailed data on exports at the firm/product/destination level.

5. Microeconomic export spillovers from FDI

This section investigates how inward FDI influences exports within the Bulgarian manufacturing sector, by disentangling several channels and mechanisms. Section 5.1 presents an analysis at the firm/product/destination level, and sheds light on the microeconomic linkages between exports and inward FDI. In section 5.2, we collapse data at the firm level to assess whether export spillover form FDI occurs within the firm when considering a multi-sector measure of spillover for each firm involved in more than one sector.

5.1. Firm/product/destination analysis

5.1.1. Export revenues: Quantity versus Price

This section explores how industry level spillovers from FDI are related to several indicators of a firm's export performance in a given destination/product pair. We use the following econometric specification:

$$\ln Y_{fidt} = \gamma_1 Hspill_{st} + \gamma_2 Fspill_{st} + \gamma_3 Bspill_{st} + \alpha_{fid} + \alpha_t + \varepsilon_{fidt} \quad (2)$$

Where Y_{fidt} represents total revenue (v), or alternatively, total quantity (q) and price (p), i.e. unit value, of a specific variety, i.e. 6-digit HS96 product i sold by firm f in the country destination d, in year t. Our main explanatory variables are the industry level spillover variables computed in the previous section. We also include year fixed-effects α_t to control for common time-varying factors across varieties, as well as firm/product/destination fixed-effects α_{fid} to consider time-invariant characteristics related to a specific product sold by a given firm in a particular destination. ε_{fidt} denotes the error term.

The first three columns of **Table 2** display results based on an unbalanced panel of varieties, where standard errors are clustered at the industry/year level. The results confirm that when considering both product heterogeneity and country heterogeneity in addition to firm heterogeneity, only export forward spillovers from FDI turn out to be positive and statistically significant, leading to an increase in both value and quantity without any change in price. Conversely, both horizontal and backward spillovers have no role in explaining changes in exports, in terms of value, quantity and price. Since these findings may be affected by the entry/exit of varieties, in the following three specifications we focus on a balanced panel and find similar results. By relying on the standard literature on quality and trade – where the unit value of a variety would proxy its quality (Schott, 2004) – these

findings would provide evidence of no quality effect from FDI spillovers. We further investigate this in the following section.

5.1.2. Disentangling Quality from Unit Value

The quality of products traded between country pairs is associated with several characteristics of the trading partners. Recent studies have found that richer countries consume and export higher quality products than developing countries (Hummels and Klenow, 2005; Schott, 2004). The ability of emerging markets to transition from low-quality to high-quality products is considered a signal for export success and economic development (Hallak and Sivadasan, 2014).

The recent debate on quality and trade highlights that a change in a variety's unit value does not necessarily reflect a variation in product quality since the unit value might incorporate other price determinants, such as the marginal cost of production. In the spirit of Khandelwal (2010), Khandelwal et al. (2013) relax the quality equals unit value assumption, assigning higher quality to exports with higher market shares in a given destination, conditional on price. In other words, quality is considered as any attribute of the good, other than price, which increases consumer demand.

Following Khandelwal, et al. (2013), we are able to disentangle the quality component from the unit value. More specifically, we first estimate the following equation:

$$\ln q_{fidt} + \sigma \ln p_{fidt} = \alpha_i + \alpha_{dt} + \xi_{fidt}. \quad (3)$$

Where q_{fidt} and p_{fidt} are respectively the quantity and the price of a 6-digit HS96 product i sold by firm f in destination market d in year t. Moreover, σ represents the elasticity of substitution at the 3-digit industry level, calculated as the average of country-specific elasticities estimated by Broda et al (2006); α_i and α_{dt} are respectively product fixed effects and country/year fixed effects which capture variation across products as well as yearly country-specific demand characteristics. We obtain the natural log of quality for each product i sold by firm f to destination d as $\ln \lambda_{fidt} = \widehat{\xi_{fidt}}/(\sigma - 1)$.

Table A.9 presents summary statistics of our product quality estimates with unit value.[12] The left section of the table is based on the unbalanced panel of varieties. First, it can be noted that quality represents on average a very small component of unit value for Bulgarian exported varieties. This is not surprising since we are dealing with an emerging economy, which is still one of the least developed countries in the EU. Second, while the unit value on average increases over time, quality decreases. This suggests that Bulgarian varieties suffer from loss of competitiveness and quality downgrading. However, these trends might be due to the entry/exit dynamics of exported varieties, i.e. the entry of less competitive and low-quality varieties and/or the exit of more competitive and high-quality varieties in the international market. Given this, in the right section of the table we restrict our sample to the balanced panel, i.e. to trade flows of incumbent firms constantly exporting a specific product to a given destination. Our concerns are partially confirmed, since the average unit value is slightly lower and the quality is

[12] Note that the number of observations is slightly smaller as the quality measure is missing in some cases. The quality measure computed according to Khandelwal et al. (2013) relies on 3-digit level import elasticities for each importing country, estimated by Broda et al. (2006). Unfortunately, import demand elasticities are not available for some firm-product-destination triplets.

slightly higher than previously. Nevertheless, we observe that prices on average increased by about 9%, while the average quality decreased by 10% during the period 2004-2006.

When using this estimated quality measure as a dependent variable in equation (2), the results reported in **Table 3** suggest that despite no change in unit values, spillovers from FDI significantly affect the quality of exported varieties, through both horizontal and vertical linkages. More specifically, we find quality upgrading from forward spillovers and (more robustly) quality downgrading from both horizontal and backward spillovers. Therefore, Bulgarian varieties of lower quality are supplied to the foreign market when the presence of multinationals within the same sector or downstream sectors increases, which suggests that domestic firms are unable to face tougher foreign competition, and are unable to supply intermediate inputs to multinationals. On the contrary, a larger presence of multinationals in upstream sectors leads Bulgarian firms to export varieties of higher quality, which suggests that domestic firms in downstream sectors benefit from the access to the more sophisticated input varieties provided by foreign suppliers.

5.2. Firm-level analysis

In this section, we collapse data at the firm level in order to investigate whether export spillovers from FDI occur differently within the firm, when considering the multi-sector measure of spillovers. Unlike the standard literature on export spillovers from FDI based on firm level data, our spillover indexes take account of the fact that some firms might sell several products in different sectors. In other words, each firm is not simply associated with the spillover measure of its main sector as in Table 1, but it is now associated with the simple average of the spillover measures of all sectors the firm is actually involved in. Similarly, the average unit value (average quality) within firm is computed as the simple mean of unit values (qualities) across varieties.

The results based on the balanced panel are presented in the left section of **Table 4,** and show that export spillovers from FDI on sales are still statistically significant via forward linkages, but the related sign is surprisingly opposite with respect to the one presented in Table 1. Therefore, when taking into account the multi-sector dimension of spillovers within firm, Bulgarian firms reduce total export revenue due to a higher presence of foreign-owned firms in upstream sectors. This effect seems to be due to a decrease in total quantity and an increase in average price across varieties within firm, associated however with a decline in average quality. Moreover, we find positive backward spillovers in terms of both value and quantity, associated with a fall in average price across varieties within firm, without any change in average quality. Thus, these findings suggest that exporters increase their sales thanks to average competitiveness gains within firm from backward spillovers, and decrease their sales due to average competitiveness losses and quality downgrading within firm from forward spillovers.

It is important to note that these results may still be affected by a change in the variety (product/destination pair) mix within firm. For example, the result regarding the increase in average price across varieties within firm from forward spillovers may be due to the entry of high-priced varieties and/or the exit of low-priced ones, rather than an actual increase in the price of firms' incumbent varieties. Therefore, we now pre-balance firm/product/destination triplets before collapsing the data at the firm level. The results displayed in the central panel of Table 4 show that when excluding the hypothesis of a change in the variety mix, the findings in Table 1 are confirmed, i.e. we still observe positive forward spillovers on export value, which mainly occur through the quantity channel, since the impact on average unit values is not statistically significant. Nevertheless, when using Khandelwal et al. (2013)'s approach to estimate product quality, we obtain evidence that existing exporters increase

on average the quality of their incumbent exported varieties due to forward spillovers. Additionally, we find negative backward spillovers on export value, associated with a fall in average quality.

Finally, in the right panel of the table, we check whether the latter results are robust by computing a weighted average spillover within firm, using the initial export shares of single varieties, in order to give relatively more weight to the spillovers related to the core products than those for the marginal products within a firm's exported product range. Likewise, the average unit value (average quality) within firm is now computed as the weighted mean of unit values (qualities) across varieties, using initial export revenue shares as weights. A similar approach was adopted by Manova and Zhang (2012) when computing the average price across varieties for each firm. Again, we find evidence of positive export spillovers and quality upgrading effects through the forward linkages, as well as negative export spillover and quality downgrading effects through the backward linkages. Moreover, we observe a quality downgrading effect from horizontal spillovers. Therefore, the presence of foreign suppliers seems to allow firms to export additional varieties of lower quality, and upgrade the quality of existing export products, whereas the presence of foreign customers leads firms to drop marginal varieties associated with lower quality and downgrade the quality of remaining incumbent varieties.

6. Robustness checks

This section provides additional investigations on our main results at the firm/product/destination level presented in Table 2 and Table 3. More specifically, we start exploring whether there is any difference in our findings due to product characteristics. We first run econometric specifications by splitting the sample into differentiated and non-differentiated goods, classified according to the Rauch (1999) classification. We then rely on the Broad Economic Categories (BEC) classification, breaking them down into final, intermediate and capital goods. We then check whether our findings are driven by differences across groups of importing markets, estimating our model separately for OECD, non-OECD, EU, and non-EU countries. Finally, we provide a sensitivity analysis, by controlling for changes in trade reforms, and attempt to address the possible endogeneity of our explanatory variables. In all the following specifications, we focus on incumbent firms in each product/destination pair, by using the balanced panel.

Differentiated goods versus non-differentiated goods. Following the literature investigating the role of firm level determinants for product quality, we assess whether the results are robust across different types of products. We first rely on the classification proposed by Rauch (1999), and divide HS6 products exported by Bulgarian firms into two groups: differentiated and non-differentiated goods. It is important to stress that the great majority of trade flows under investigation is composed of differentiated products. Since we expect export spillovers to have a prominent role for those products that are perceived by the final consumer as not being direct substitutes, we expect to find more statistically significant coefficients, particularly for the estimates using the data for differentiated products. The results in **Table 5** highlight that spillover effects exclusively concern differentiated goods. The positive forward spillover on value, quantity and quality is strongly confirmed for differentiated goods, without any change in price. Moreover, both horizontal and backward spillovers are now found to be negatively and significantly associated with export sales and product quality. These results suggest that while Bulgarian firms are able to use better intermediate inputs from foreign suppliers, they are unable to become input suppliers for foreign-owned firms, and suffer

competition from FDI. Since we find no evidence of FDI spillovers on non-differentiated goods, in the following robustness checks we focus only on the differentiated goods trade flows.

Final goods, intermediate goods and capital goods. In **Table 6,** we separate the effects across different BEC categories: final goods, intermediate goods, and capital goods. In particular, we expect that forward spillovers will be relatively stronger for final goods, while backward spillovers should be more important for intermediate goods. We find that the documented effects on export value and quantity mainly concern intermediate goods, associated with quality downgrading from backward spillovers only. In other words, producers of intermediate inputs become more export integrated along global value chains owing to FDI in upstream sectors, and less export integrated because of quality downgrading effects from FDI in downstream sectors. These findings seem to suggest that foreign suppliers of intermediate inputs follow their MNE customers to Bulgaria, implying some negative effects for domestic producers of intermediates in the more upstream stages of the supply chain, and positive effects for domestic producers of intermediates in the more downstream stages. Moreover, we also find evidence that Bulgarian producers of final goods are only subject to quality downgrading from backward spillover. Therefore, to the extent that some finished goods represent inputs for other firms, this result confirms that when potential multinational customers settle in Bulgaria, forcing some domestic customers to exit the market, they are more likely to rely on foreign finished goods, pushing domestic producers of finished goods to decrease their quality-upgrading investments. Finally, Bulgarian producers of capital goods seem to enjoy quality upgrading from forward spillovers, suggesting that the presence of foreign input suppliers helps domestic firms to produce capital goods of higher quality.

OECD versus non-OECD. Spillover effects from FDI on export outcomes might be driven by demand characteristics in specific importing markets (Hallak, 2006; Bernard et al. 2007; Baldwin and Harrigan, 2011; Manova and Zhang, 2012). We expect that our results will be stronger for exports oriented to emerging and developing economies, as the latter are more likely to compete with Bulgaria. Yet, at the same time, we have to take into consideration that the positioning of Bulgarian firms in the global value chain might play a role in explaining our findings (Sutton, 2007). Indeed, as for other emerging economies, Bulgarian firms are expected to export intermediates for industries based in developed countries.

In order to consider how heterogeneity across destinations affects our findings, we estimate equation 2 using data for exports to OECD countries only and then compare the results with those obtained using data on exports to non-OECD countries. The findings, reported in **Table 7**, show that trade flows to the OECD are the principal driver of the results reported in Table 5. For exports to the OECD we find positive forward spillovers and negative backward spillovers, in terms of both value and quantity, which are respectively associated with efficiency gains and quality losses. For exports to non-OECD countries, we only find evidence of positive price effects from forward spillovers and negative price effects from backward spillovers, which are mostly due to changes in product quality. Finally, negative horizontal spillovers, in terms of revenues, are found only for OECD destinations, these are linked to a reduction in quality. Therefore, while the presence of foreign suppliers leads to an increase in efficiency for varieties oriented to developed economies, and an increase in quality for varieties oriented to developing economies, the presence of foreign customers (foreign competitors) leads to quality downgrading, especially for varieties oriented to economies similar to (dissimilar from) Bulgaria.

EU versus non-EU. Our results might be expected to be more relevant for European Union destinations, because we are analysing the three years before Bulgaria joined the EU. When splitting our sample according to EU destination status in **Table 8**, we first note that vertical spillovers, in terms of both value and quantity, mainly impact exports to the European Union, whereas horizontal spillovers exclusively affect non-EU exports. These patterns highlight the fact that Bulgarian firms were already highly vertically integrated with firms located in EU economies in the years preceding Bulgaria's accession to the EU, and were mainly horizontally competing with firms from the rest of the world. In particular, we find stronger positive forward spillovers, in terms of both revenues and quantity, associated with efficiency gains for EU-oriented exports, whereas for exports to other destinations we document only a positive effect on quality. Conversely, backward spillovers are found to be negative on export sales to the EU, related to quality losses, while only a negative effect on quality is obtained for exports to non-EU economies. Finally, varieties exported to non-EU destinations are negatively affected by the presence of foreign-owned competitors, in terms of value, price and quality.

Consequently, while the presence of foreign suppliers in Bulgaria leads to efficiency improvements for varieties oriented to more-integrated foreign economies, and quality upgrading for varieties directed to less-integrated foreign economies, the presence of foreign customers leads to quality downgrading for varieties oriented to both groups of countries. Finally, tougher competition from FDI results in a reduction in quality for varieties oriented to less-integrated economies.

Small Firms, Medium Firms and Large Firms. Several empirical studies on spillovers from FDI argue that the capacity to absorb the more sophisticated technology, which arises from both horizontal and vertical linkages with multinationals, might be heterogeneous across domestic firms. On the one hand, we expect that large firms are on average relatively more productive, and therefore are more likely to be positively affected by spillovers from FDI, because they have the required capacity to absorb multinational knowledge (Cantwell, 1989). At the same time, small firms could suffer negative spillovers, because in losing their domestic market share, they are pushed up the average cost curve (Aitken and Harrison, 1999; Girma, 2005). On the other hand, it could be argued that small firms are likely to benefit more from spillovers from FDI as they have more room for improvement compared to large firms (Findlay, 1978). Therefore, we split the sample according to the initial firm size, i.e. firm export value in 2004, into three groups: small firms (1st quartile), medium firms (2nd and 3rd quartiles) and large firms (4th quartile). **Table 9** displays the results.

First, it is worth noting that the findings in Table 5 mainly concern large firms' varieties, i.e. negative horizontal and backward spillovers and positive forward spillovers (in terms of both value and quantity), associated with quality downgrading from the former and quality upgrading from the latter. Conversely, small firms' varieties exhibit the opposite effect in terms of quantity compared to those in Table 5, this is associated with competitiveness losses from forward spillover and competitiveness gains from backward spillover. Finally, for medium firms' varieties we find evidence of quality downgrading from backward spillovers.

It is interesting to note that forward spillovers result in a decrease in efficiency for small firms, and an increase in quality for large firms, which is associated with sales reallocation, in terms of quantity, from small to large firms. These results seem to be in line with the first hypothesis (Cantwell, 1989), and in particular with a recent work by Imbruno et al. (2015) which studies theoretically and empirically, using Italian data, how the presence of foreign input suppliers can differently affect firms' efficiency, depending on firms' capacity to absorb inputs from foreign suppliers. Imbruno et al. (2015) show that while the most productive firms benefit from positive

forward spillovers because they are able to use multinational inputs, the other firms might be hurt by negative forward spillovers as they would suffer a reduction in domestic input varieties, implying business reallocation towards more productive firms. With our results, we additionally find that the most productive firms can also upgrade the quality of their products due to the presence of foreign suppliers.

Conversely, the results about both horizontal and backward spillovers seem to be more coherent with the second hypothesis (Findlay, 1978), as both generate negative quality effects for large firms, and the latter spillovers also generate positive competitiveness effects for small firms, implying sales reallocation, in terms of quantity, from large to small firms. Therefore, it appears that the presence of foreign competitors mainly hurts their similar counterparts, the large firms. Indeed, in theory, the large firms which lose market share would be pushed to reduce their quality-upgrading investments, resulting in a further decrease in their sales to the advantage of smaller firms which are not involved in quality-upgrading activities. Similarly, the presence of foreign customers is detrimental mainly to the largest domestic input suppliers, which are more likely to be engaged in quality-upgrading activities, and is associated with sales reallocation, in terms of quantity, from large to small suppliers. This might occur because the majority of domestic suppliers are unable to switch to the multinational technology which they need to serve foreign firms, and at the same time, they suffer from a reduction in business from their large domestic-owned customers. Consequently, the largest input suppliers would be induced to decrease their quality-upgrading investments, implying a further reduction in their sales to the advantage of smaller suppliers which are not engaged in quality-upgrading activities.

Additional controls: Trade policy reforms. As documented in section 2, several studies focus on the impact of trade reforms on export performance, unit value and quality, finding significant results. At the same time, trade liberalisation policies might also influence the presence of foreign firms within an economy. Du et al, (2014) argue that it is important to take account of changes in trade policies when studying spillover effects from FDI, as the results might be affected by omitted variables bias. Following the approach in their study on productivity spillovers from FDI in China, we include two additional variables in our specifications to control for import competition effect and the access to foreign intermediate inputs by the trade channel, i.e. output tariff and input tariff. The tariff data are obtained from the World Integrated Trade Solution (WITS), published by the World Bank. Output tariff is measured as the industry average of six-digit MFN tariffs weighted by their corresponding trade value. Following the previous literature (Amiti and Konings, 2007), input tariff is measured at the industry level, as the weighted average of output tariffs in upstream sectors, where the weights are from the Bulgarian input/output table. **Table 10** shows that our results on export spillovers from FDI are highly robust when controlling for changes in trade reforms, i.e. both the sign and the significance of coefficients in Table 5 are strongly confirmed. As regards tariff effects, we find evidence that input tariff liberalisation led to an increase in export performance, coherently with previous studies (Bas and Strauss-Kahn, 2015).

Endogeneity: Instrumental Variable approach. Considering that our spillover variables are measured at the industry level, and fixed effects at the firm/product/destination level are included in all specifications, our results are unlikely to be affected by omitted variables bias or reverse causality. While this problem is more obvious when making an industry level analysis, it is usually considered less relevant when using firm level data, because a single firm's export performance is unlikely to attract FDI flows for the whole of the firm's sector. Some firm level studies attempt to address this potential problem, and the most common method is by taking the first difference of the

econometric specification and including year dummies and/or taking the lagged spillover variables (Aitken and Harrison, 1999; Javorcik, 2004). Other studies implement an instrumental variable approach, by looking for instruments that are highly correlated with FDI spillovers, but uncorrelated with the dependent variable (Konings, 2001; Keller and Yeaple, 2009). Barrios et al. (2011) assess the spillover effects from FDI on Irish firms' productivity by addressing the endogeneity of the spillover variables due to reverse causality. They use the level of government grants to foreign firms in each four-digit sector, as well as the twice-lagged level, and the growth rate of the spillover variables as instruments. Haskel et al. (2007) investigate the effect of inward FDI on UK firms' performance relying on three instruments to address a similar endogeneity problem. They employ the lag of the explanatory variables, their initial value, and inward FDI to the US as instruments.

When exploring the linkage between unit value and FDI spillovers in Romania using similar data to ours, Bajgar and Javorcik (2016) estimate a specification in difference by also lagging the spillover variables. However, since this may be not enough to exclude reverse-causality, they also implement an endogeneity test proposed by Wooldridge (2010). This test is based on estimating a specification where lagged FDI variables are included as regressors together with their contemporaneous and lead values. By showing that the lead values of the FDI variables report statistically insignificant coefficients, they reach the conclusion that the reverse causality possibility can be ruled out. Unfortunately, the time period of our study is too short to implement a similar strategy. Therefore, we attempt to address the potential endogeneity problem by adopting an instrumental variable approach. We consider the lagged values of horizontal, backward, and forward spillovers from Romanian manufacturing industries, computed using weights obtained from the Bulgarian I/O table, as instruments for Bulgarian spillovers. Romania is an economy which has many features in common with Bulgaria, since both countries are located in South-East Europe, were centrally planned economies until 1990, and then started the transition to a market economy, becoming official members of the European Union in 2007. Thus, it is likely that both countries adopted similar policies to attract FDI across industries, implying similarities in the evolution of multinational firms over time. However, it is unlikely that Romanian spillovers at the industry level are directly correlated with Bulgarian export outcomes at the firm-product-destination level. Our identification strategy therefore relies on assuming that our dependent variables are affected by the instruments only through their correlation with the endogenous variables. A similar approach has been adopted in previous firm level studies on Bulgaria and other emerging economies.[13] The results are reported in **Table 11**, and each of the following specifications employs firm/product/destination fixed effects and year fixed effects. It is worth noting that instrumental variables enter all first-stage regressions with a positive and significant coefficient.[14] The value of the Kleibergen-Paap Wald F-statistic for the first-stage of the estimated model shows that the instruments are not weak. The p-value of the Anderson-Rubin Wald test confirms that our econometric model is identified. Moreover, the p-value of the Anderson-Rubin Wald test leads us to the reject the null-hypothesis that the coefficients for endogenous variables are jointly equal to zero. Table 11 shows that forward export spillovers are confirmed in terms of both revenues and quality, whereas the other spillover effects are confirmed only for quality. These results reiterate that while the presence of foreign-owned suppliers allows the Bulgarian economy to improve its export performance by upgrading the quality of varieties, the presence of both foreign-owned competitors and customers is detrimental, due to quality downgrading effects.

[13] Monastiriotis and Alegria (2011) use horizontal spillovers in Romania as instruments for horizontal spillovers in Bulgaria; Xu and Sheng (2012) use horizontal and vertical spillovers in East and South-East Asia as intruments for the corresponding spillovers in China.

[14] Tables related to the first stages are available upon request.

7. Conclusion

Using detailed microeconomic trade data for Bulgaria, we investigate how inward FDI affects export performance in the context of an emerging economy, considering both potential horizontal and vertical relationships between domestic firms and foreign counterparts. Our findings show that export spillovers from FDI via horizontal, forward and backward linkages generate heterogeneous effects across several components of export revenues.

When controlling for heterogeneity at the firm/product/destination level, we only find positive forward spillovers from FDI on export revenues, which is associated with an increase in quantity, without any change in price. However, when disentangling quality from unit value, we document quality upgrading from forward spillovers and quality downgrading from both horizontal and backward spillovers.

These results suggest that unlike Romania (Bajgar and Javorcik, 2016), Bulgaria was not mature enough, to fully benefit from the presence of multinationals during the period 2004-2006, to produce and export more sophisticated varieties. Instead, Bulgarian firms were probably pushed to decrease their quality-upgrading investments because of tougher foreign competition, and their inability to supply intermediate inputs to foreign-owned firms. As a result, the large presence of foreign competitors and customers in Bulgaria not only harms the host economy, but could also generate negative effects in the rest of the world, by downgrading the quality of exported Bulgarian varieties. These negative effects might occur because downstream multinationals prefer to import inputs, maybe because the majority of foreign direct investments come from nearby countries, such as Greece (Monastiriotis and Alegria, 2011), or because they purchase inputs from foreign-owned suppliers, which are more likely to follow their customers when the host economy is emerging/developing.

From our data, it appears that the presence of upstream MNEs was larger, and increased faster, than the presence of downstream MNEs, and this allowed domestic firms in downstream sectors to improve the quality of their products. These findings seem to relate most to Bulgarian exports in differentiated and intermediate goods. Interestingly, we find that the presence of foreign input suppliers leads to efficiency improvements for Bulgarian varieties oriented to OECD and EU markets, and quality upgrading for varieties oriented to non-OECD and non-EU markets. Considering all these results together, we can reach the conclusion that thanks to the presence of foreign suppliers, intermediate varieties produced in Bulgaria contribute to boost the efficiency of final varieties produced in developed and more integrated economies, and upgrade the quality of final varieties produced in developing and less integrated economies.

Finally, our results suggest that the effects are heterogeneous across firms depending on initial firm size. The presence of foreign suppliers benefits large downstream firms and hurts the small ones, implying business reallocations towards the large firms in downstream sectors. Conversely, the presence of foreign customers mainly hurts the large suppliers in upstream sectors, generating business reallocation towards the small suppliers. Considering the heterogeneous firms literature (since Melitz, 2003), these results indicate that while foreign suppliers contribute positively to the aggregate efficiency through business reallocation in Bulgaria, foreign customers contribute negatively.

Following our findings on Bulgaria, domestic policy-makers should define policies oriented to attract FDI in upstream sectors, as they generate the largest positive effects in the economy. At the same time, international policy-makers should emphasise the importance of establishing foreign intermediate production subsidiaries in an emerging country, like Bulgaria, because other countries would also benefit along international supply chains. Moreover, policies oriented to attract FDI in downstream sectors need to be complemented with innovation policies

aimed at decreasing the costs of quality-enhancing investments for Bulgarian firms, which would increase their ability to supply multinationals and to face the competition of MNEs operating in the same sectors.

To conclude, our findings suggest that detailed attention should be paid to the various mechanisms behind export spillovers from FDI in the host economy, since their relevance and magnitude may depend on the position of domestic-owned firms along the global value chain with respect to foreign multinationals.

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TABLES

Table 1: Firm linkage between exports and FDI spillovers (Benchmark)

VARIABLES	Unbalanced panel	Balanced panel
	Export value	Export value
	ln *v*	ln *v*
	(1)	(2)
Hspill	0.153	0.424
	(0.250)	(0.311)
Fspill	7.188***	6.355***
	(1.735)	(1.895)
Bspill	-4.108	-3.235
	(3.152)	(3.539)
No. of Observations	25,067	17,319
R-squared	0.873	0.871
Firm FE	YES	YES
Year FE	YES	YES

Note: FDI spillovers are related to the firm's main sector, identified as the firm's sector with its largest export revenues for the entire period. Standard errors are clustered at the sector level and reported in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 2: Firm/Product/Destination linkage between exports and FDI spillovers

VARIABLES	Unbalanced panel			Balanced panel		
	Export value	Export quantity	Export price	Export value	Export quantity	Export price
	ln *v*	ln *q*	ln *p*	ln *v*	ln *q*	ln *p*
	(1)	(2)	(3)	(4)	(5)	(6)
Hspill	-0.437	-0.342	-0.0951	-0.523	-0.452	-0.0710
	(0.339)	(0.361)	(0.117)	(0.391)	(0.399)	(0.128)
Fspill	4.675***	5.309***	-0.634	3.655**	4.040**	-0.385
	(1.589)	(1.868)	(0.713)	(1.618)	(1.882)	(0.796)
Bspill	-4.352	-5.486	1.134	-3.399	-3.108	-0.291
	(3.141)	(3.746)	(1.541)	(3.485)	(4.043)	(1.742)
No. of Observations	177,835	177,835	177,835	85,311	85,311	85,311
R-squared	0.909	0.930	0.932	0.904	0.928	0.941
Firm/prod/dest FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Note: Standard errors are clustered at the sector/year level and reported in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Firm/Product/Destination linkage between exports and FDI spillovers: Unit value versus Quality

VARIABLES	Unbalanced panel		Balanced panel	
	Export price	Export quality	Export price	Export quality
	ln *p*	ln λ	ln *p*	ln λ
	(1)	(2)	(3)	(4)
Hspill	-0.108	-0.331**	-0.0816	-0.375*
	(0.136)	(0.158)	(0.145)	(0.209)
Fspill	-0.646	1.867**	-0.371	1.712
	(0.723)	(0.933)	(0.796)	(1.177)
Bspill	1.277	-6.142***	-0.280	-7.504**
	(1.582)	(2.208)	(1.756)	(2.930)
No. of Observations	172,341	172,341	83,049	83,049
R-squared	0.932	0.801	0.941	0.799
Firm/prod/dest FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Note: Standard errors are clustered at the sector/year level and reported in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Firm linkage between exports and multi-sector spillovers from FDI

VARIABLES	Balanced panel (without pre-balancing) & simple average across varieties				Balanced panel (with pre-balancing) & simple average across varieties				Balanced panel (with pre-balancing) & weighted average across varieties			
	Export value (total)	Export quantity (total)	Export price (simple average)	Export quality (simple average)	Export value (total)	Export quantity (total)	Export price (simple average)	Export quality (simple average)	Export value (total)	Export quantity (total)	Export price (weighted average)	Export quality (weighted average)
	ln *v*	ln *q*	ln *ap*	ln *a λ*	ln *v*	ln *q*	ln *ap*	ln *a λ*	ln *v*	ln *q*	ln *ap*	ln *a λ*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Hspill	0.182	0.0725	0.0792	-0.0994	-0.218	0.00183	-0.116	-0.299	-0.304	-0.209	-0.0814	-0.437*
	(0.325)	(0.386)	(0.251)	(0.205)	(0.487)	(0.505)	(0.209)	(0.279)	(0.445)	(0.465)	(0.176)	(0.248)
Fspill	-2.813***	-6.013***	4.280***	-1.082*	6.678***	6.203***	0.255	2.025**	6.574***	6.326***	-0.197	3.015***
	(0.953)	(1.067)	(0.732)	(0.649)	(1.796)	(1.914)	(0.809)	(0.978)	(1.683)	(1.802)	(0.724)	(0.904)
Bspill	4.977***	7.722***	-2.450*	0.977	-6.144*	-5.720	-0.452	-4.469***	-5.898*	-5.813*	0.304	-4.841***
	(1.721)	(1.874)	(1.349)	(1.203)	(3.213)	(3.590)	(1.421)	(1.710)	(3.070)	(3.451)	(1.320)	(1.620)
No. of Observations	17,376	17,376	17,376	17,187	13,044	13,044	13,044	12,843	13,044	13,044	13,044	12,843
R-squared	0.870	0.910	0.897	0.714	0.929	0.958	0.976	0.880	0.929	0.958	0.979	0.893
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Note: Balanced panel of firms after balancing firm/product/destination triplets. Standard errors are clustered at the firm level and reported in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Firm/Product/Destination linkage between exports and FDI spillovers by Rauch, (1999)'s product classification

VARIABLES	Differentiated goods				Non-Differentiated Goods			
	Export value	Export quantity	Export price	Export quality	Export value	Export quantity	Export price	Export quality
	ln v	ln q	ln p	ln λ	ln v	ln q	ln p	ln λ
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Hspill	-1.013**	-1.003**	-0.00970	-0.414**	-0.151	-0.0738	-0.0774	-0.233
	(0.400)	(0.507)	(0.180)	(0.200)	(0.503)	(0.350)	(0.196)	(0.341)
Fspill	5.642***	5.841***	-0.199	2.311*	-1.141	1.561	-2.702	-3.423
	(1.629)	(1.892)	(0.808)	(1.370)	(7.442)	(6.210)	(2.388)	(5.430)
Bspill	-7.218*	-6.321	-0.898	-9.002**	19.69	11.67	8.028	0.972
	(3.935)	(4.315)	(1.645)	(3.701)	(15.06)	(12.68)	(5.173)	(10.96)
No. of Observations	69,264	69,264	69,264	69,264	11,823	11,823	11,823	11,823
R-squared	0.896	0.920	0.937	0.799	0.928	0.949	0.945	0.797
Firm/prod/dest FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: Balanced panel of firm/product/destination triplets. Standard errors are clustered at the sector/year level and reported in parentheses
*** p<0.01, ** p<0.05, * p<0.1.

Table 6: Firm/Product/Destination linkage between exports and FDI spillovers by BEC product classification

VARIABLES	Final goods				Intermediate goods				Capital goods			
	Export value	Export quantity	Export price	Export quality	Export value	Export quantity	Export price	Export quality	Export value	Export quantity	Export price	Export quality
	ln v	ln q	ln p	ln λ	ln v	ln q	ln p	ln λ	ln v	ln q	ln p	ln λ
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Hspill	-0.889	-1.019	0.130	-0.610	-1.260**	-1.234*	-0.0263	-0.480	0.213	0.393	-0.180	0.701
	(0.540)	(0.684)	(0.411)	(0.475)	(0.504)	(0.659)	(0.286)	(0.347)	(0.944)	(0.953)	(0.345)	(0.745)
Fspill	1.816	1.789	0.0270	-0.442	9.786***	10.97***	-1.181	1.930	6.363	5.509	0.854	9.533*
	(2.814)	(2.956)	(1.465)	(2.255)	(2.631)	(2.774)	(0.949)	(1.481)	(8.469)	(8.362)	(3.150)	(5.239)
Bspill	-0.896	2.527	-3.423	-8.000*	-18.60***	-19.10***	0.503	-11.36***	-18.78	-22.52	3.748	-26.69
	(3.121)	(4.078)	(2.446)	(4.673)	(5.998)	(6.361)	(3.015)	(4.280)	(16.59)	(14.38)	(5.596)	(17.37)
No. of Observations	31,227	31,227	31,227	31,227	29,088	29,088	29,088	29,088	8,553	8,553	8,553	8,553
R-squared	0.896	0.896	0.944	0.815	0.895	0.934	0.929	0.783	0.881	0.922	0.937	0.810
Firm/prod/dest FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Note: Balanced panel of firm/product/destination triplets, considering only differentiated goods. Standard errors are clustered at the sector/year level and reported in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Firm/Product/Destination linkage between exports and FDI spillovers by OECD/non-OECD destination

VARIABLES	OECD				Non-OECD			
	Export value	Export quantity	Export price	Export quality	Export value	Export quantity	Export price	Export quality
	ln v	ln q	ln p	ln λ	ln v	ln q	ln p	ln λ
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Hspill	-0.653*	-0.748	0.0955	-0.422*	-1.156	-0.830	-0.325	-0.596
	(0.360)	(0.468)	(0.209)	(0.217)	(0.946)	(0.946)	(0.251)	(0.412)
Fspill	5.910***	7.773***	-1.863***	1.485	3.843	0.983	2.860**	3.815**
	(1.579)	(1.764)	(0.714)	(1.185)	(2.725)	(2.469)	(1.364)	(1.915)
Bspill	-7.898**	-9.625**	1.727	-7.063**	-5.890	-0.707	-5.182*	-12.07**
	(3.631)	(4.149)	(1.578)	(3.058)	(6.759)	(5.812)	(2.858)	(5.207)
No. of Observations	48,225	48,225	48,225	48,225	20,694	20,694	20,694	20,694
R-squared	0.885	0.915	0.935	0.796	0.910	0.930	0.935	0.808
Firm/prod/dest FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: Balanced panel of firm/product/destination triplets, considering only differentiated goods. Standard errors are clustered at the sector/year level and reported in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Firm/Product/Destination linkage between exports and FDI spillovers by EU/non-EU destination

VARIABLES	EU				Non-EU			
	Export value	Export quantity	Export price	Export quality	Export value	Export quantity	Export price	Export quality
	ln v	ln q	ln p	ln λ	ln v	ln q	ln p	ln λ
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Hspill	-0.323	-0.475	0.152	-0.176	-1.845*	-1.435	-0.410*	-1.032**
	(0.356)	(0.427)	(0.220)	(0.228)	(1.009)	(0.987)	(0.227)	(0.503)
Fspill	7.013***	9.107***	-2.094**	1.341	3.267	0.799	2.468*	4.144**
	(1.832)	(1.953)	(0.874)	(1.361)	(2.552)	(2.675)	(1.333)	(2.067)
Bspill	-12.04***	-13.63***	1.594	-8.863***	-1.329	2.087	-3.416	-9.039*
	(4.074)	(4.741)	(2.147)	(3.308)	(5.519)	(5.116)	(2.824)	(5.230)
No. of Observations	45,819	45,819	45,819	45,819	23,100	23,100	23,100	23,100
R-squared	0.889	0.915	0.932	0.794	0.907	0.929	0.943	0.810
Firm/prod/dest FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: Balanced panel of firm/product/destination triplets, considering only differentiated goods. Standard errors are clustered at the sector/year level and reported in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Firm/Product/Destination linkage between exports and FDI spillovers by firm size

VARIABLES	Small Firms				Medium Firms				Large Firms			
	Export value	Export quantity	Export price	Export quality	Export value	Export quantity	Export price	Export quality	Export value	Export quantity	Export price	Export quality
	ln v	ln q	ln p	ln λ	ln v	ln q	ln p	ln λ	ln v	ln q	ln p	ln λ
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Hspill	2.227	3.017**	-0.789	-0.241	0.787	0.506	0.281	0.202	-2.529***	-2.423***	-0.106	-0.838***
	(1.515)	(1.316)	(0.561)	(0.815)	(0.623)	(0.570)	(0.273)	(0.383)	(0.501)	(0.649)	(0.222)	(0.210)
Fspill	-9.071	-12.46**	3.384**	-0.203	1.060	2.592	-1.533	1.141	10.29***	10.92***	-0.626	3.144**
	(5.653)	(5.236)	(1.648)	(2.782)	(3.243)	(3.608)	(1.470)	(2.183)	(2.397)	(2.719)	(0.996)	(1.285)
Bspill	6.979	11.34***	-4.364*	-3.372	-4.621	-2.935	-1.686	-12.95***	-12.11**	-14.52**	2.407	-7.098*
	(4.579)	(3.987)	(2.419)	(3.655)	(6.812)	(7.628)	(2.859)	(4.783)	(5.818)	(6.389)	(2.651)	(3.828)
No. of Observations	5,121	5,121	5,121	5,121	25,968	25,968	25,968	25,968	38,175	38,175	38,175	38,175
R-squared	0.827	0.902	0.949	0.835	0.896	0.927	0.937	0.784	0.890	0.912	0.933	0.800
Firm/prod/dest FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Note: Balanced panel of firm/product/destination triplets, considering only differentiated goods. Standard errors are clustered at the sector/year level and reported in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 10: Firm/Product/Destination linkage between exports, FDI spillovers and trade reforms

VARIABLES	Export value	Export quantity	Export price	Export quality
	ln v	ln q	ln p	ln λ
	(1)	(2)	(3)	(4)
Hspill	-1.093***	-1.081**	-0.0112	-0.361*
	(0.378)	(0.498)	(0.188)	(0.208)
Fspill	7.907***	7.734***	0.173	1.154
	(2.218)	(2.577)	(1.071)	(1.794)
Bspill	-8.552**	-7.416	-1.136	-8.333**
	(4.157)	(4.582)	(1.724)	(3.653)
Output tariff	0.366	0.847	-0.481	-0.850
	(1.832)	(1.900)	(0.648)	(1.156)
Input tariff	-29.84*	-26.57	-3.271	17.19
	(16.61)	(19.13)	(8.049)	(12.73)
No. of Observations	69,252	69,252	69,252	69,252
R-squared	0.896	0.920	0.937	0.799
Firm/prod/dest FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Note: Balanced panel of firm/product/destination triplets, considering only differentiated goods.
Standard errors are clustered at the sector/year level and reported in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 11: Firm/Product/Destination linkage between exports and FDI spillovers: I.V. Approach

	2nd Stage			
VARIABLES	Export value	Export quantity	Export price	Export quality
	ln v	ln q	ln p	ln λ
	(1)	(2)	(3)	(4)
Hspill	-13.47	-3.411	-10.06**	-15.90***
	(12.84)	(12.39)	(4.573)	(6.115)
Fspill	11.89*	8.832	3.060	9.822***
	(6.952)	(6.717)	(2.498)	(3.376)
Bspill	0.271	13.03	-12.76*	-26.16***
	(16.55)	(15.82)	(6.653)	(8.445)
No. of Observations	46,176	46,176	46,176	46,176
R-squared	0.930	0.949	0.951	0.837
Firm/prod/dest FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Kleibergen-Paap Wald F.	13.741			
Anderson-Rubin Wald test (p-value)	0.011			
Kleibergen-Paap LM statistic, (p-value)	0.000			

Note: Balanced panel of firm/product/destination triplets, considering only differentiated goods.
Robust standard errors are reported in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Appendix

Table A.1: Descriptive statistics at the firm/product/destination level

	Unbalanced panel			Balanced panel		
	2004	**2005**	**2006**	**2004**	**2005**	**2006**
	Mean	Mean	Mean	Mean	Mean	Mean
Value (log)	6.91	6.89	6.97	8.63	8.86	8.72
Quantity (log)	4.94	4.84	4.84	6.67	6.87	6.67
Price (log)	1.97	2.05	2.13	1.96	1.99	2.05
No. of Firms	18,977	18,999	19,000	4,348	4,348	4,348
No. of Products	3,990	3,990	3,990	2,360	2,360	2,360
No. of Destinations	201	201	201	138	138	138
No. of Firm/Prod./Destin triplets.	120,712	123,660	127,868	28,437	28,437	28,437

Table A.2: Descriptive statistics at the firm/product/destination level by Rauch (1999)'s product classification

	Differentiated goods			Non-Differentiated goods		
	2004	**2005**	**2006**	**2004**	**2005**	**2006**
	Mean	Mean	Mean	Mean	Mean	Mean
Value (log)	8.65	8.88	8.74	8.45	8.75	8.60
Quantity (log)	6.51	6.71	6.52	7.40	7.66	7.45
Price (log)	2.14	2.17	2.22	1.04	1.08	1.15
No. of Firm/Prod./Destin triplets	23,236	23,236	23,236	4,547	4,547	4,547

Table A.3: Descriptive statistics at the firm/product/destination level by BEC product classification

	Final goods			Intermediate goods			Capital goods		
	2004	**2005**	**2006**	**2004**	**2005**	**2006**	**2004**	**2005**	**2006**
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
Value (log)	8.77	9.01	8.81	8.39	8.63	8.53	8.98	9.19	9.11
Quantity (log)	6.80	7.01	6.76	6.61	6.82	6.65	6.23	6.39	6.30
Price (log)	1.96	2.00	2.04	1.78	1.81	1.88	2.75	2.80	2.82
No. of Firm/Prod./Destin triplets.	12,949	12,949	12,949	12,347	12,347	12,347	2,923	2,923	2,923

Table A.4: Descriptive statistics at the firm/product/destination level by OECD/non-OECD destination

	OECD			Non-OECD		
	2004 Mean	**2005** Mean	**2006** Mean	**2004** Mean	**2005** Mean	**2006** Mean
Value (log)	9.08	9.30	9.13	7.75	8.01	7.92
Quantity (log)	6.88	7.08	6.85	6.26	6.48	6.33
Price (log)	2.19	2.22	2.27	1.49	1.53	1.59
N. of Firm/Prod./Destin triplets.	18,899	18,899	18,899	9,322	9,322	9,322

Table A.5: Descriptive statistics at the firm/product/destination level by EU/non-EU destination

	EU			Non-EU		
	2004 Mean	**2005** Mean	**2006** Mean	**2004** Mean	**2005** Mean	**2006** Mean
Value (log)	8.91	9.13	8.95	8.15	8.43	8.34
Quantity (log)	6.76	6.95	6.72	6.54	6.77	6.62
Price (log)	2.15	2.18	2.23	1.62	1.66	1.72
No. of Firm/Prod./Destin triplets.	17,951	17,951	17,951	10,270	10,270	10,270

Table A.6: Descriptive statistics at the firm/product/destination level by Firm size

	Small Firms			Medium Firms			Large Firms		
	2004 Mean	**2005** Mean	**2006** Mean	**2004** Mean	**2005** Mean	**2006** Mean	**2004** Mean	**2005** Mean	**2006** Mean
Value (log)	6.95	7.48	7.47	8.08	8.26	8.1	9.21	9.44	9.29
Quantity (log)	4.91	5.42	5.31	6.16	6.31	6.11	7.22	7.42	7.22
Price (log)	2.03	2.07	2.16	1.91	1.95	2	1.98	2.02	2.07
No. of Firm/Prod./Destin triplets.	2,045	2,045	2,045	10,473	10,473	10,473	15,919	15,919	15,919

Table A.7: Spillovers from FDI

ISIC Rev.3		*Hspill*			*Fspill*			*Bspill*		
2-digit code	**Description**	2004	2005	2006	2004	2005	2006	2004	2005	2006
15	Manufacture of food products and beverages	0.247	0.267	0.248	0.052	0.054	0.057	0.015	0.016	0.016
16	Manufacture of tobacco products	0.733	0.695	0.659	0.053	0.054	0.058	0.013	0.013	0.014
17	Manufacture of textiles	0.213	0.184	0.189	0.062	0.065	0.068	0.042	0.044	0.047
18	Manufacture of wearing apparel; dressing and dyeing of fur	0.070	0.080	0.124	0.098	0.099	0.101	0.037	0.039	0.041
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	0.100	0.098	0.127	0.130	0.131	0.138	0.050	0.051	0.055
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0.113	0.127	0.135	0.146	0.156	0.164	0.081	0.086	0.097
21	Manufacture of paper and paper products	0.215	0.213	0.239	0.105	0.104	0.110	0.086	0.086	0.090
22	Publishing, printing and reproduction of recorded media	0.004	0.012	0.055	0.145	0.147	0.148	0.058	0.059	0.061
23	Manufacture of coke, refined petroleum products and nuclear fuel	0.896	0.969	0.978	0.012	0.012	0.013	0.045	0.047	0.049
24	Manufacture of chemicals and chemical products	0.239	0.237	0.235	0.058	0.061	0.061	0.103	0.106	0.113
25	Manufacture of rubber and plastics products	0.206	0.216	0.233	0.224	0.239	0.255	0.110	0.119	0.125
26	Manufacture of other non-metallic mineral products	0.095	0.120	0.165	0.159	0.171	0.181	0.089	0.097	0.101
27	Manufacture of basic metals	0.280	0.273	0.261	0.043	0.044	0.048	0.070	0.071	0.077
28	Manufacture of fabricated metal products, except machinery and equipment	0.070	0.067	0.089	0.243	0.270	0.287	0.136	0.150	0.158
29	Manufacture of machinery and equipment n.e.c.	0.062	0.101	0.146	0.235	0.265	0.283	0.139	0.151	0.158
30	Manufacture of office, accounting and computing machinery	0.245	0.265	0.241	0.180	0.200	0.212	0.098	0.105	0.110
31	Manufacture of electrical machinery and apparatus n.e.c.	0.208	0.230	0.217	0.215	0.243	0.260	0.117	0.128	0.136
32	Manufacture of radio, television and communication equipment and apparatus	0.175	0.190	0.184	0.188	0.210	0.223	0.108	0.117	0.122
33	Manufacture of medical, precision and optical instruments, watches and clocks	0.112	0.117	0.120	0.207	0.226	0.239	0.109	0.119	0.124
34	Manufacture of motor vehicles, trailers and semi-trailers	0.192	0.197	0.190	0.132	0.141	0.152	0.056	0.057	0.063
35	Manufacture of other transport equipment	0.028	0.027	0.027	0.199	0.214	0.230	0.089	0.095	0.101
36	Manufacture of furniture; manufacturing n.e.c.	0.122	0.118	0.132	0.182	0.189	0.201	0.078	0.081	0.086
	Manufacturing	**0.210**	**0.218**	**0.227**	**0.14**	**0.15**	**0.159**	**0.079**	**0.083**	**0.088**

Table A.8: Summary statistics at firm/product/destination level for the period 2004-2006

Variable	No. of Obs	Mean	Std. Dev.
Value (log)	372,240	6.92	3.11
Quantity (log)	372,240	4.87	3.35
Price (log)	372,240	2.05	1.83
Horizontal Spillover	372,240	0.17	0.15
Forward Spillover	372,240	0.15	0.09
Backward Spillover	372,240	0.08	0.05

Table A.9: Summary statistics at firm/product/destination level: Unit value versus Quality

	Unbalanced panel			**Balanced Panel**		
	2004	**2005**	**2006**	**2004**	**2005**	**2006**
	Mean	Mean	Mean	Mean	Mean	Mean
Price (log)	1.97	2.05	2.13	1.98	2.01	2.07
Quality (log)	0.03	-0.002	-0.023	0.33	0.32	0.23
No. of Firm/Prod./Destin triplets.	117,299	120,083	124,130	27,683	27,683	27,683

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