Multinational Networks and Trade Participation*

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Abstract

This paper provides a novel explanation for the dominant role of multinational corporations (MNCs) in international trade: after being acquired by an MNC, firms face lower trade frictions in and around the network of countries in which their parent has other affiliates. We develop a model of multinational ownership and trade participation that delivers affiliate-level gravity regressions isolating this "MNC network effect" from the other channels through which multinational ownership can affect firm outcomes. We bring the model to the data by combining rich information on the universe of Belgian firms and on MNCs' global networks. The results show that acquired firms are more likely to start exporting to, and importing from, countries that belong—or are exogenously added—to their parents' network. These network effects are larger in more geographically and culturally distant countries and dominate firm-level effects in explaining where new affiliates trade. We also provide evidence that the effects of MNC ownership extend beyond the boundaries of the multinational.

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1 Introduction

Multinational corporations (MNCs) dominate international trade, accounting for almost two thirds of the value of global trade flows (Miroudot and Rigo, 2021). In the United States, MNCs account for 72% of exports, 69% of imports, and 44% of sales, despite representing less than 0.3% of all firms (Antràs *et al.*, 2022). In Belgium, MNC affiliates represent only 1% of the entire population of firms, yet they are responsible for 60% of exports, 65% of imports, and 47% of sales.

In this paper, we set out a novel mechanism that contributes to this dominance. We show that multinational ownership reduces country-specific frictions, making it more likely for acquired firms to start trading with countries in which their parent has other affiliates.[1] We isolate this mechanism theoretically and empirically from firm-specific channels through which multinational ownership can affect affiliates' trade participation suggested in the literature, such as productivity increases due to technological or managerial transfers or alleviation of financial frictions.[2] We find that MNC network effects explain a larger share of the variance in new affiliates' entry in foreign markets than standard firm-year effects. Moreover, network effects are larger in countries that are more distant from the acquired firms, in terms of geography or language. We also show that the effects of MNC ownership are not confined to the boundaries of the multinational. For example, they extend to countries that are close—but do not belong—to the parental network.

The paper makes three contributions. First, we exploit rich firm-level data from the National Bank of Belgium (NBB), combining information on production, trade and Foreign Direct Investment (FDI), to document novel facts on the impact of multinational ownership on overall trade participation. We find find that after being acquired by an MNC, firms are more likely to export and import, have higher total values of exports and

[1] Much empirical work in international trade demonstrates that bilateral frictions hamper trade. Some of these frictions are product-country-specific, such as tariffs and various types of non-tariff barriers (e.g. rules of origins, product standards). For example, Caliendo and Parro (2015) and Conconi *et al.* (2018) respectively study the effects of tariff reductions and rules of origin following the entry into force of NAFTA. Others are country-specific, such as information frictions related to local market conditions and regulations, and tend to increase (decrease) with distance (common language). A large literature reviewed by Disdier and Head (2008) and Head and Mayer (2014) emphasizes the negative effect of distance on bilateral trade. Melitz and Toubal (2004) show that common language boosts trade by improving the ability to communicate and reducing information frictions.

[2] Existing work shows that MNCs can increase affiliates' productivity through transfers of technology or managerial know-how (Bloom *et al.*, 2012; Bircan, 2019); this can lead affiliates to select into the different margins of international trade (e.g., Melitz, 2003; Helpman *et al.*, 2004; Guadalupe et al, 2012; Antràs *et al.*, 2017). MNC ownership can also boost trade participation by alleviating the financial constraints of acquired firms (e.g., Harrison *et al.*, 2004; Manova *et al.*, 2015).

imports, and export to and import from more countries. Non-trade outcomes are also affected: acquired firms become larger (in terms of sales and employment) and more productive. These effects are identified comparing acquired firms with never acquired and not yet acquired firms and account for selection effects through re-weighting methods that allow us to create a group of untreated firms that is indistinguishable from the group of treated firms in terms of different moments of the distribution (mean, variance, and skewness) of a large set of observables.[3]

Second, we develop a theoretical model to isolate different mechanisms through which multinational ownership can increase affiliates' trade participation. Firms first minimize costs and select countries from which to import inputs in order to produce output. They then choose which countries to export their products to maximize profits. International trade incurs variable and country-specific costs of importing and exporting. In this setting, acquisitions can affect affiliates' export and import decisions at the extensive and intensive margins through two main channels: firm-specific channels (e.g., increased productivity through technology transfers) and firm-country specific channels (e.g., lower costs to enter countries in which the parent has a presence). The model delivers structural firm-level gravity equations that can be estimated to identify the network effects of multinational ownership.

Third, we bring the model to the data, combining NBB information on production, trade, and FDI with the Orbis and Historical Orbis datasets from Bureau van Dijk to construct the parental networks of multinational affiliates, i.e., the set of countries in which the foreign parent of each Belgian affiliate has a presence at the time of the acquisition.[4] By estimating firm-level gravity regressions with three-way fixed effects, we find evidence of "MNC network effects" at the extensive margin. Our baseline estimates imply that the probability that new affiliates start exporting to (importing from) a country in its parental network increases by 2.9 (1.6) percentage points, which corresponds to a 17% (16%) increase in the value of the unconditional probability of export (import) entry.

Decomposing the total variance of trade participation into its components indicates

[3]The weights used to construct the control group are based on a large set of firm-level time-varying characteristics. These variables capture differences across firms in terms of size and performance (e.g., lagged sales, in levels and growth rates), trade participation (e.g., lagged export and import values and number of export and import countries, in levels and in growth rates), and trade networks (e.g., average distance, longitude, latitude, and the GDP per capita of the countries with which a firm trades). Post re-weighting, various 'non-targeted' covariates, such as the number of imported and exported products, are indistinguishable across treated and untreated firms.

[4]Belgian affiliates are often part of large and diverse multinational networks, and the geographical structure of these networks varies significantly across parents. As an illustration, of the acquired Belgian firms that have their direct parents in the Netherlands, one parent firm has a presence in 63 countries and one other has a presence in 52 countries, with limited country overlap.

that MNC network effects explain around 4% (6%) of the total variance in affiliates' export (import) entry, dominating firm-year effects such as productivity increases that affect the probability of entry in any market. We find no evidence of network effects at the intensive margin: new affiliates do not significantly increase the value of their exports to (and imports from) countries they were already trading with before they were acquired. Overall, our analysis suggests that multinational ownership alleviates country-specific trade frictions that operate at the extensive margin: new affiliates face lower entry costs in the foreign markets where their parent already operates.

Our baseline results are identified exploiting geographical variation in the network structure of the parents of different affiliates. We also use within-affiliate network variation. In particular, we exploit the fact that some Belgian affiliates experience changes in their parental network after they are acquired, due to plausibly exogenous changes in their global ultimate owner. The results are in line with our baseline findings: post acquisition, affiliates are more likely to start exporting to and importing from countries exogeneously added to their parental network.

We further provide evidence that the effects of multinational ownership are not limited to the boundaries of the multinational, i.e., acquired firms do not simply starting trading with other affiliates of the same parent. Four sets of results support this argument. First, we find that the network effects increase with geographical or cultural distance of the foreign country from the country of the acquired firms, suggesting that MNC ownership alleviates trade frictions related to gravity. If the effects were driven by global supply chains within the multinational, we would expect a *decrease* with distance: new affiliates should be *less* likely to start exporting to and importing from other affiliates of their parent when these are further away.

Second, acquired firms are more likely to start trading not only with countries in which other affiliates are located, but also with countries that are close—but do not belong—to their parents' network. By definition, these "extended MNC network effects" operate outside the boundaries of the multinational, as they involve countries in which the parent has no presence. These extended network effects can be due to geographical or cultural closeness to the MNC affiliate, or similarity in market conditions and access, in a similar vein as the extended gravity effects shown in Morales *et al.* (2019, 2023).

Third, we find that network effects are persistent: firms continue to trade with countries that exit their parent's network following exogenous ownership changes. This confirms that the effects of multinational ownership are not restricted to trade between affiliates and suggests market entry costs are sunk after initial entry.

Finally, if the network effects were driven by supply chain linkages within MNCs, we

would expect them to be stronger when the activities of affiliates are vertically-related. We use Alfaro *et al.* (2019)'s methodology to construct measures of the relative position along supply chains between the acquired Belgian firms and other affiliates of the same parent. We show that the probability that an acquired firm starts exporting to (importing from) a country that belongs to its parental network does not depend on how upstream (downstream) its activities are relative to those of its parent's affiliates in that country.

Our paper is related to three main streams of literature. The first stream studies the effects of multinational ownership. Much of this literature focuses on productivity effects on acquired firms (e.g., Aitken and Harrison, 1999; Arnold and Javorcik, 2009),[5] or on the productivity spillovers of multinationals.[6] A few studies show that multinational ownership can alleviate the financial constraints faced by acquired firms (e.g., Harrison *et al.*, 2004; Manova *et al.*, 2015). Within this stream of literature, the closest papers to ours are Guadalupe *et al.* (2012) and Antràs *et al.* (2023). Using a panel dataset of Spanish manufacturing firms, Guadalupe *et al.* (2012) show that firms acquired by MNCs conduct more product and process innovation, adopting new machines and organizational practices, and are more likely to export through their parent's distribution network. Our paper emphasizes more general effects of multinational ownership on trade participation: new affiliates are more likely to start exporting to and importing from countries in which their parent already operates and other countries connected to them. Using cross-sectional data on U.S. firms' trade and multinational activity for 2007, Antràs *et al.* (2023) find that MNCs are more likely to trade with countries in which they have affiliates and with other countries in the same region. The panel structure of our data allows us to exploit changes in MNC ownership to identify network and extended network effects in isolation from firm-level effects. In terms of mechanisms, our analysis suggests that, after being acquired by a multinational, new affiliates face lower entry frictions in and around the network of countries in which their parent has existing affiliates.[7]

[5]Using data on Venezuelan plants, Aitken and Harrison (1999) find that foreign equity participation is positively correlated with plant productivity, but this relationship is only robust for small enterprises. Arnold and Javorcik (2009) use micro data from Indonesia to examine the relationship between MNC ownership and various aspects of plant performance. There is also evidence that affiliates of MNCs adopt better management practices (Bloom *et al.*, 2012).

[6]Haskel *et al.* (2007) and Keller and Yeaple (2009) document positive spillovers in the same industry in the United Kingdom and United States. Using firm-level data from Lithuania and Romania, respectively, Javorcik (2004) and Javorcik and Spatareanu (2008) find evidence of positive productivity spillovers from FDI, resulting from relationships between foreign affiliates and their local suppliers in upstream sectors. Alfaro-Ureña *et al.* (2022) study the effects of becoming a supplier to MNCs. Using tax firm-to-firm transactions data from Costa Rica, they show that domestic firms experience strong and persistent gains in performance after supplying to a first MNC buyer. Méndez and Van Patten (2022) study the effects of large-scale FDI in Costa Rica on the the development of local education and health infrastructure.

[7]Outside the literature on MNCs, our results resonate with those of Atalay *et al.* (2019), who find that

We also contribute to the literature on networks in trade. Some studies show that social and ethnic networks can reduce information frictions between buyers and sellers (e.g., Rauch, 1999; Rauch and Trindade, 2002). Others model frictions in networks (e.g., Jackson and Rogers, 2007; Chaney, 2014). Some of our results relate to the literature on extended gravity, which shows that reducing trade barriers in one country can increase entry in other connected countries (Albornoz, *et al.*, 2012; Morales *et al.*, 2019; Alfaro-Ureña *et al.*, 2023).[8] Ours is the first paper to identify the network and extended network effects of multinational ownership.

Finally, our paper is related to the literature on cross-border mergers and acquisitions (M&As). Most studies focus on a small number of M&As in specific industries.[9] For example, Ashenfelter and Hosken (2010) look at five consumer products mergers to assess the effectiveness of US horizontal merger policy. Miller and Weinberg (2017) study the price effects of MillerCoors, a joint venture of SABMiller PLC and Molson Coors Brewing that combined the operations of these brewers in the United States. Alviarez *et. al* (2021) study the competition effects of multinational acquisitions in beer and spirits. None of these papers examines how multinational acquisitions affect trade participation.

2 Data

This section describes our data sources, sample selection criteria, and how we construct foreign affiliates' multinational networks.

2.1 Datasets

NBB Datasets

We obtain information about the characteristics, ownership structure, and international trade activities of the universe of firms registered in Belgium between 1997 and 2014 from the National Bank of Belgium (NBB). The first set of firms' characteristics comes from the

U.S. establishments are more likely to ship to locations (ZIP codes) in which other establishments owned by the same firm are located, and the decay in trade volumes with distance is significantly reduced within firm boundaries. We show that similar effects apply to affiliates of MNCs, which are more likely to trade with countries in which their parent has a presence and that distance deters trade by less when countries are within MNC networks.

[8]There is also an emerging literature on the dynamics of buyer-seller relationships (e.g., Bernard and Moxnes, 2018; Bernard *et al.*, 2022). Other studies emphasize the role of managers in reducing search, information, and trust frictions in trade relationships (e.g., Mion *et al.*, 2014; Patault and Lenoir, 2022).

[9]One exception is the paper by Blonigen and Pierce (2016), who use confidential data from the U.S. Census Bureau to study the impact of domestic M&As on productivity and market power.

Annual Accounts, which contains information on the number of firms' full-time equivalent employees, labor cost, sales, value-added, input expenditure, and fixed assets. All flow variables are annualized to map to calendar years in the other datasets.

Ownership information comes from the annual Survey on Foreign Direct Investment, which is mandatory for all foreign-owned firms active in Belgium. This dataset allows us to identify Belgian affiliates of foreign multinationals: for each Belgian firm with a foreign parent, the survey reports the parent's equity share, location, name, and year of acquisition. We can distinguish Belgian firms with a foreign parent (inward FDI) from Belgian firms that own equity abroad (outward FDI).

Data on international trade in goods come from the Foreign Trade dataset. This provides information on firm-level exports or imports starting from 1993, collected separately for intra-EU (Intrastat) and extra-EU (Extrastat) trade. The Extrastat dataset is based on customs declarations and covers virtually all trade transactions. The Intrastat dataset covers all firms whose annual trade flows (overall receipts or shipments) exceed a certain threshold.[10] For each importer and/or exporter in Belgium, we observe the traded product (8-digit CN code), unit values (values over quantities), and destination or source country. We code the trade data at the firm-year-destination or firm-year level depending on the application.

Finally, we obtain information on the main economic activity (NACE code) of the firm from the Crossroads Bank for Enterprises (CBE). The CBE reports the main NACE code at the five-digit industry, which we aggregate to four and to two digits. All NACE codes are concorded over time and reported in the NACE Rev 2 (2008) version. We link all data sources using each firm's unique Enterprise Identification Number, allowing unambiguous merging across datasets.[11]

Bureau van Dijk Datasets

We gather information about the corporate structure of the multinational parents of each Belgian affiliate using the Orbis and Historical Orbis datasets from Bureau van Dijk (BvD).

[10] Thresholds are set by individual member states so that reported trade covers at least 97% of total dispatch value (intra-EU exports) and 93% of total arrival value (intra-EU imports). These thresholds can vary across member states, across arrivals and dispatches and over time, and can be found here: https://marosavat.com/intrastat-thresholds/.

[11] We impose two criteria to avoid losing observations due to missing values. First, we interpolate missing values in the annual accounts. However, we do so only if the length of the missing spell is no longer than three consecutive years. Second, some firms always appear in the annual accounts but are in the Foreign Trade dataset only in some years. This may happen if firms did not engage in international trade or if their activities did not exceed the minimum reporting threshold in those years. Since we cannot distinguish between these two cases, we treat all such missing trade values as zeros.

We use the first dataset to find the identifier of the Belgian firms' direct parents. We then use the second to find the countries where the multinational direct parents have other affiliates. Section 2.4 presents a detailed explanation of the construction of the multinational networks.

Other Data

We gather information about the characteristics of the countries in which the multinational parents of the Belgian firms are present from the CEPII gravity database. This dataset contains information about international trade flows between country pairs as well as the characteristics of each country, such as GDP per capita, population size, geographical coordinates, and distance from Belgium in kilometers. Information on the cultural distance from Belgium, measured as the share of people speaking French or Dutch in the other country, comes from Melitz and Toubal (2004).

2.2 Sample

The NBB dataset contains the universe of firms active in Belgium each year. Our goal is to identify the effect of switching from domestic to multinational ownership on the trade patterns of the acquired firms. In what follows, we describe the sample of acquired and non-acquired firms used to document the stylized facts about multinational ownership and trade participation in Section 3.

We apply several broad criteria to select the firms to include in our analysis. We exclude firms that do not report at least one full-time equivalent employee in at least one year. This removes small firms that are unlikely to be credible counterfactuals for those that are acquired. We also exclude firms operating in non-tradable and tradable service sectors. We exclude firms in non-tradable sectors because we do not expect to find any effect for them. While multinational ownership may affect trade participation of firms in the services sector, we exclude them because the NBB changed the data collection procedure for the trade of services in 2005, which limits their use for our purposes.[12] Our analysis thus focuses on firms that operate in tradable good sectors, i.e., those that report a NACE code in agriculture, mining and quarrying, or manufacturing as their main activity. Third, we exclude Belgian multinationals that engage in outward FDI. This allows us to focus on firms acquired by foreign multinationals and study changes in their trade

[12]The NBB provides a quasi-exhaustive picture of the firms, type of services, and destinations involved in services trade up to 2005. After 2005 the collection system has become survey-based (see Ariu *et al.*, 2020).

participation exploiting the Belgian firm-level trade data.[13]

We find 22,938 Belgian firms that satisfy the above sample selection criteria. Of these, 22,626 are always domestic and 312 are foreign affiliates for at least part of the sample period.[14] Section A-1.1 of the Appendix provides descriptive statistics on the sample of acquired and non-acquired included in the analysis of Section 3.[15] In line with previous literature (e.g., Arnold and Javorcik, 2009; Bloningen *et al.*, 2014; Guadalupe *et al.*, 2012; Bircan, 2019), Table A-1 shows that there are systematic differences between these two groups of firms in terms of the mean, variance, and skewness of a large set of observables. Similarly, Figure A-1 shows that future multinational affiliates outperform always-domestic firms in many dimensions, even before acquisition. In Section 3, we use re-weighting methods to address selection into multinational ownership.

2.3 New Foreign Affiliates

In our main empirical analysis, we focus on new foreign affiliates, i.e., firms that are acquired by a foreign multinational during our sample period. In Section 3, we compare the trade participation of firms that switched from domestic to foreign ownership with that of non-acquired firms, accounting for selection effects. In Section 5, we focus on the ownership switchers and exploit variation in the multinational network of their parents.

To identify new foreign affiliates, we apply three additional selection criteria. First, we exclude firms already under foreign control in 1997, for which we cannot determine the acquisition date. After imposing this criterion, we are left with 182 foreign affiliates. Second, since we are interested in the effects of changes from domestic to foreign ownership, we exclude firms that are "born" with foreign investment (greenfield FDI). Brownfield FDI is by far the most prevalent form of multinational entry, with around 95% of FDI in Belgium being via acquisition. After imposing this criterion, we are left with 174 distinct foreign affiliates. Last, we exclude firms that switch between domestic and foreign ownership multiple times to prevent the estimates from being affected by the reversal of their (treatment) status. 115 affiliates satisfy this additional criterion.

Focusing on firms that switched from domestic to foreign ownership only once during

[13] It would also be interesting to examine trade participation of firms that switch from being domestic to being owned by a Belgian multinational. However, the NBB data does not allow us to identify these firms.

[14] To define affiliates of foreign MNCs, we follow the International Monetary Fund (IMF) definition and consider a firm to be an affiliate of a foreign parent if at least 10% of its total equity in a given year is directly owned by a firm located outside Belgium. As discussed below, however, the average foreign ownership shares of affiliates in our sample is close to 90%.

[15] Acquired firms include the 115 new foreign affiliates described in Section 2.3. Non-acquired firms include 22,626 domestic firms that satisfy the criteria in Section 2.2.

our sample period allows us to cleanly identify the effects of MNC ownership on trade participation. Our main empirical analysis is based on the cross-country variation in the geographical presence of the affiliates' parents to identify the network and extended network effects of MNC ownership. Hence, despite the relatively small number of affiliates satisfying our selection criteria, the set of potential affiliate-country export and import partners is much larger, especially because countries enter and exit the MNC networks that we study over time.

Section A-1.2 of the Appendix presents descriptive statistics on the new foreign affiliates included in our analysis. As mentioned before, the NBB FDI survey provides the name of the direct parent (DP) of each affiliate, its home country, and the ownership share in the Belgian firm. In some cases, firms report more than one DP per year and the corresponding equity shares.[16] Table A-2 reports the number of affiliates by sector. The most common NACE sectors are those between C19 and C22, which involve the manufacturing of coke, chemicals, pharmaceuticals, and rubbers.

Table A-3 illustrates the distribution of average equity share across the years that foreign parents own their Belgian affiliates. Most affiliates in our sample are controlled by their multinational parent (the mean ownership share is 89.12% and the median is 99.98%). Figure A-4 illustrates the number of affiliates by country of the parent. Consistent with the empirical regularity that FDI follows gravity (e.g., Antràs and Yeaple, 2014), the Netherlands is the most frequent country DP headquarters country.

2.4 Multinational Network of Foreign Affiliates

We next describe how we combine data from the NBB and Bureau van Dijk (BvD) to construct the multinational network of each Belgian foreign affiliate. In our main empirical analysis, we focus on the network of the affiliate's direct parent. In robustness checks, we use information on the network of its global ultimate owner.

We construct the global footprint of each direct parent (DP) in two steps. First, we manually search for each DP's BvD identifier in the online version of the Orbis database. When looking at the 115 affiliates described in Section 2.3, we are able to match 127 of their 188 parents. Notice that the number of direct parents is larger than that of acquired firms, since some affiliates have multiple direct parents.

Second, we retrieve the corporate structure of each parent from Historical Orbis (HO).[17]

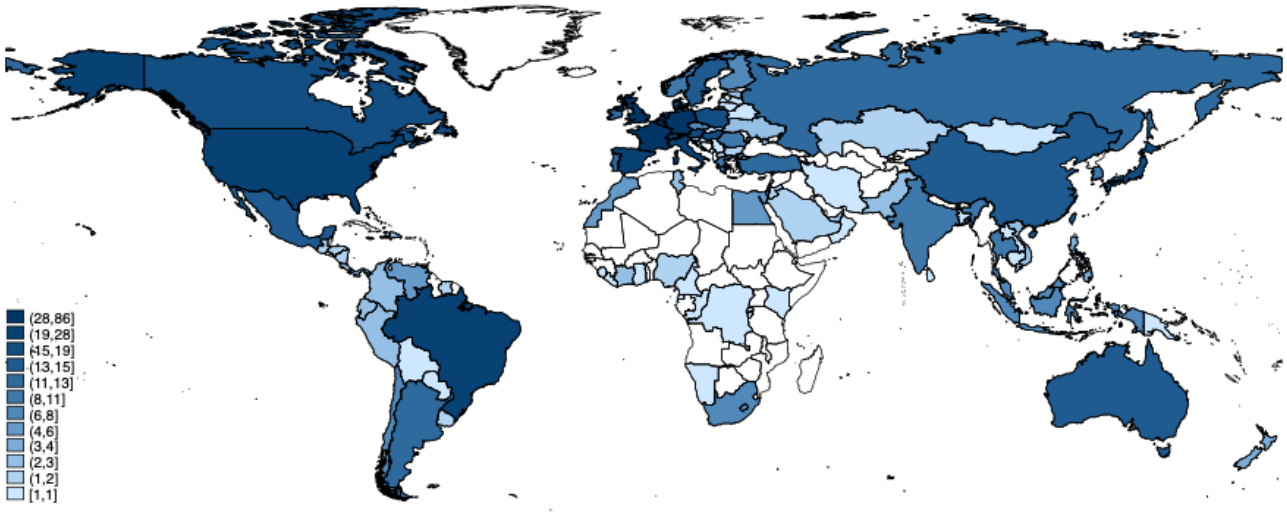
[16] For example, a Belgian firm producing fabricated metal products reports two DPs in 2010: one is located in Luxembourg has owns 72% of the shares, the other is located in France and owns the remaining 28% of the shares.

[17] This dataset provides information on ownership in each year from 2007. The files are arranged by

For each direct parent p, we define the binary indicator *In MNC Network*$_{cp}$, which is equal to 1 if p (the multinational parent acquiring firm i) has at least one subsidiary in country c and 0 otherwise. We code this variable for the year in which firm i is acquired.[18] Using this procedure, we can construct the network of the DPs of 92 affiliates in our sample.

Figure 1 illustrates the set of countries in which the DPs of new Belgian affiliates have a presence. Countries marked with darker colors are those in which more parents have affiliates. By construction, all parents have a presence in Belgium. There are some countries in which no parent has an affiliate (e.g., Angola, Libya, Mongolia). There is variation across the other countries. For example, 28 direct parents have at least one affiliate in the United States, while 16 direct parents have a presence in Japan.

Figure 1
Global Presence of Direct Parents



The figure illustrates the countries in which the parents of Belgian firms acquired during our sample period have a presence.

Figure 2 further illustrates the geographical variation of parents' networks by focusing on two affiliates, denoted by A and B. In both cases, the direct parent is located in the Netherlands. However, the parents' networks differ not only in size (63 countries for the direct parent of affiliate A, 52 for the direct parent of affiliate B), but also in their geographical structure: there are countries in which only the parent of affiliate A has a

country and by year. We look for the BvD identifiers of the DP in the relevant country-year shareholder HO files. This gives us a list of subsidiaries of the DP.

[18] None of the new affiliates has the same direct parent, so each parent p is associated with the acquisition of one Belgian affiliate i. If firm i was acquired before 2007 (the fist year of HO), we cannot measure its parental network at the time of the acquisition. In these cases, we use information for 2007.

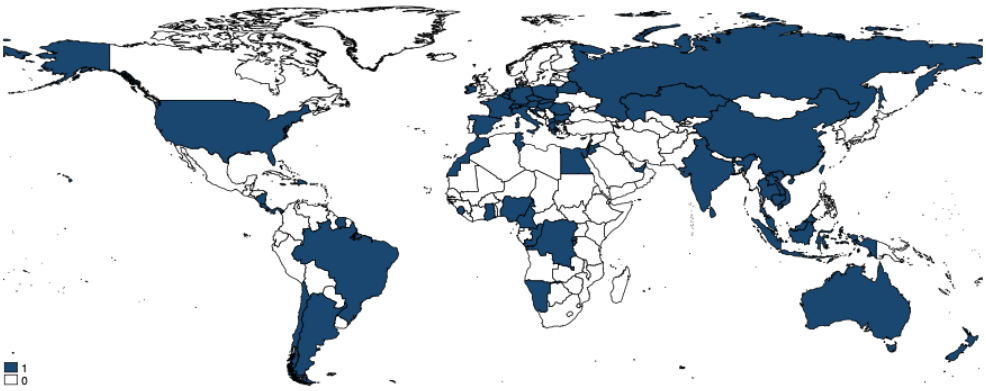
presence (e.g., Czech Republic, United Emirates, Nigeria); and others in which only the parent of affiliate *B* has a presence (e.g., Mexico, Canada, and Japan).

We also construct the multinational network of the global ultimate owner (GUO) of each foreign affiliate, using the subsidiary files in Historical Orbis to find the GUO of the DP of each Belgian affiliate. This is given by the BvD identifier of the firm that owns at least 25% of the DP. We collect this information for the GUOs of all Belgian firms acquired from 2007. For acquisitions made before 2007, we are restricted to finding the GUO of the DP in 2007, the earliest year of the subsidiary HO files.[19]

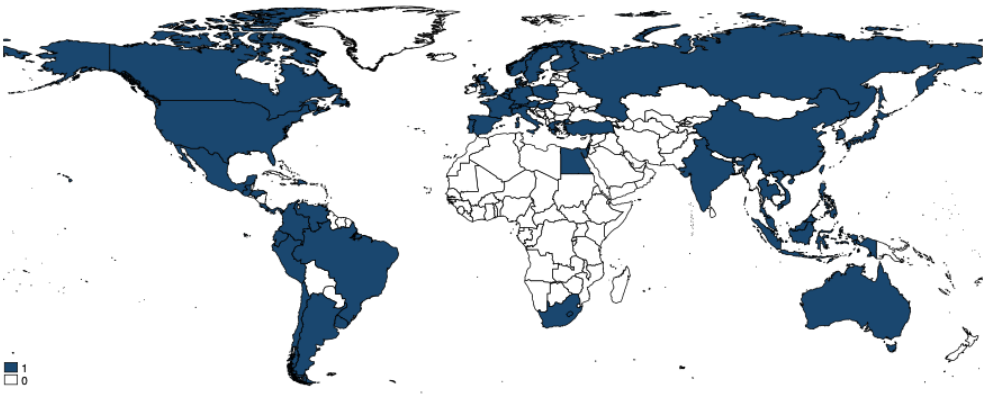
Figure 2

Comparing the Networks of two Affiliates with a Dutch Parent

Affiliate *A*



Affiliate *B*



The figure illustrates (in blue) the countries in which the Direct Parent of Belgian affiliates *A* and *B* have a presence.

To collect the multinational network of each GUO, we look for the BvD identifier in the HO files where the shareholder is the main unit of observation and that contain information on each subsidiary owned by a given shareholder. Of the 137 GUO BvD identifiers linked to new Belgian affiliates, we find subsidiary relationships for 125 of them in the

[19]For 24 of the 188 DPs of new Belgian affiliates, the DP and the GUO coincide.

shareholder HO files. We can map out the countries where each of the GUOs has a network presence using the BvD identifier of each subsidiary.

Section A-1.2 of the Appendix reports descriptive statistics of the multinational networks about Belgian affiliates DPs and GUOs in 2007 or in the year when the DP first acquired the Belgian affiliate, whichever is later. Table A-4 provides descriptive statistics about the variable *Network Size*$_p$, i.e., the number of countries c for which the variable *In MNC Network*$_{cp}$ is equal to 1. Direct parents have a presence in 10 countries on average, and the largest multinational network includes 75 countries. The network of the global parent is, by construction, larger (it includes an average of 24 and a maximum of 103 countries). Figure A-3 plots the cumulative distribution of the variable *Network Size*$_p$ for all direct parents of acquired Belgian firms (see Figure A-5 for the parents' networks).

3 MNC Ownership and Trade Participation: Stylized Facts

In this section, we use re-weighting methods to document stylized facts about how multinational ownership affects overall trade participation of acquired firms, after accounting for selection effects.[20]

The goal is to use observed data to approximate random assignment of multinational ownership to otherwise similar domestic firms. We Hainmueller (2012)'s entropy balance re-weighting algorithm for this purpose. The key advantage of this method is that unlike more standard algorithms, such as nearest-neighbor and propensity score matching, it guarantees that the treatment and control groups are similar not only in terms of average characteristics but also in higher moments of the distribution of their covariates. This further mitigates the concern that the post-acquisition changes in acquired firms' trade participation are due to pre-existing differential trends at the firm-level.[21] For each year, we consider firms acquired in that year as treated and never-acquired firms as control units. We pool treated and control units across all years and assign a weight to each firm based on a wealth of observed characteristics: fixed assets, number of employees (full-time equivalents), total sales, number of export and import countries, export and import

[20] In Appendix A-2.1, we report the results of event studies showing that new multinational affiliates increase trade participation along different margins. A key concern with these results is that they do not account for selection effects—observed or unobserved time-varying firm-level shocks that are correlated with the acquisition and the trade variables—are biasing the results. Evidence of selection effects is apparent from Table A-1, which shows that there are systematic differences between treated and control firms in terms of the mean, variance, and skewness of the distribution of many observable characteristics.

[21] See Egger and Tarlea (2020) for an example of the same re-weighting strategy. Table A-9 in the Appendix shows that the results are robust to using the more traditional propensity score re-weighting algorithm in Guadalupe *et al*. (2012).

values, in levels and also in growth rates, and characteristics countries with which they trade (i.e., distance from Belgium, GDP per capita in PPP, longitude, and latitude). All the variables refer to the year before the acquisition.

Entropy balance re-weighting allows us to create a group of treated firms that is indistinguishable from the group of untreated firms in terms of the different moments of the distribution of all variables after applying the re-weighting procedure (see Table A-5).[22] After re-weighting, the two groups are also similar in terms of the first three moments of the distribution of other characteristics that we do not target to create the weights (the number of exported and imported products, and other trade-related variables at the bilateral level), which further appeases the concern that our procedure may fail to account for unobserved heterogeneity (see Table A-6).[23]

We estimate the following equation on the weighted sample:

$$y_{it} = \theta MNC_{it} + \delta_i + \delta_t + u_{it}, \tag{1}$$

where y_{it} is the trade outcome of interest for firm i at time t, MNC_{it} indicates periods before and after i's acquisition by a foreign multinational. δ_i and δ_t are firm and year fixed effects, respectively. The identification assumption is that after re-weighting, and conditional on the fixed effects, multinational ownership is as good as randomly distributed among firms.

Table 1 shows the results of estimating equation (1). The coefficient on MNC_{it} is positive and significant at the 1% level across all specifications, indicating that MNC ownership increases new affiliates' trade participation. In terms of magnitude, the estimates imply that MNC ownership increases the probability of exporting (importing) by 4.6 (3.8) percentage points, increases the average value of exports and imports by 79% (82%), and increases the number of export (import) countries by 10% (12%).[24]

[22] The initial sample includes 22,357 single firms. Due to missing values in some characteristics (e.g., due to the non participation in trade of some domestic firms) 5,391 of them (24%) receive a positive weight. Among these are the 115 acquired firms. We assign a weight equal to 1 to each of them. All the other domestic firms get a weight between 0 and 1, and their sum is constrained to be equal to 1. The average weight among firms in the latter group is 0.017, and the standard deviation is 0.077.

[23] Table A-7 reproduces Table A-5 using the propensity score re-weighting algorithm used in Guadalupe *et al.* (2012). As expected, that algorithm accurately matches groups in terms of their average characteristics but not in terms of higher moments of their distribution.

[24] For the specifications in columns 2 and 3 and 5 and 6, the magnitude of the effects is given by $(exp(X)–1) \times 100$, where X is the estimated coefficient.

Table 1

MNC Ownership and Trade Participation
(Entropy Balance Re-Weighting)

	(1)	(2)	(3)
	Exporter Dummy	Export Values	Export Countries
MNC_{it}	0.046***	0.788***	0.108**
	(0.013)	(0.266)	(0.045)
	(4)	(5)	(6)
	Importer Dummy	Import Values	Import Countries
MNC_{it}	0.038***	0.819***	0.122***
	(0.010)	(0.229)	(0.033)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Estimator	OLS	OLS	OLS
Re-weighting	Yes	Yes	Yes
Observations	93,171	93,171	93,171

The table reports the results of estimating equation (1). We compute the entropy balance weights as a function of all the observables in Table A-5. Heteroscedasticity robust standard errors in parenthesis. Significance levels: *** 0.01, ** 0.05, * 0.1.

It is interesting to compare the results of Table 1 with the corresponding results in Table A-8, in which we estimate equation (1) without reweighting the sample. The coefficients are more than twice as large in Table A-8, emphasizing the importance of accounting for selection effects: for example, re-weighting decreases the coefficient of the exporter dummy decreases from 0.127 to 0.046; for the number of export countries (export values), the coefficient decreases from 2.259 to 0.788 (from 0.263 to 0.108).

Table 1 shows that new multinational affiliates increase all their margins of trade participation. We would also expect other firm-level outcomes to be affected. For example, firms that increase exports to foreign markets may increase their overall size (in terms of sales and employment) and become more productive. We can employ the entropy balance reweighing algorithm to study the effects of MNC ownership on other firm-level outcomes. The results reported in Table A-10 in the Appendix indicate that new affiliates become larger, in terms of both employment and sales, and increase value both added and productivity. Table A-11 reports the corresponding results without re-weight the sample. As expected, the coefficients are larger without re-weighting, again emphasizing the importance of accounting for selection effects.

4 A Model of Multinational Ownership and Trade

The previous section shows that MNC ownership increases new affiliates' overall trade, and also increases their productivity along with other affiliate outcomes. This section develops a theoretical model that allows us to identify our novel network mechanism: MNCs boosting trade in countries in which they have a presence by alleviating the trade frictions their affiliates had faced prior to acquisition. For example, in countries in which the parent already operates, multinational ownership can lower country-specific entry costs associated with learning about local market regulations. Crucially, the model allows us to tease apart the network-specific mechanism from more traditional affiliate-level mechanisms seen in the existing literature, such as an increase in productivity, itself, leading the firm to trade more.

4.1 Set Up

The economy consists of an infinite sequence of periods, denoted by t. In each period, each firm i makes two decisions. First, it decides to source inputs from to minimize their costs. Second, conditional on its sourcing decisions, it decides where to sell its final goods to maximize profits.[25] We solve the model by backward induction.

4.2 Production Technology

Firms produce output domestically, combining local labor and a bundle of foreign and domestic inputs with a Cobb-Douglas technology. The unit cost function of firm i at time t is:

$$c_{it} = \frac{w_t^{\alpha} \omega_{it}^{1-\alpha}}{A_{it}}, \quad \alpha \in (0,1). \tag{2}$$

Firms are price takers in both input markets. w_t is the cost of domestic labor and it is common across firms. ω_{it} is the unit cost of the bundle of inputs that firm i pays at time t. A_{it} is the firm-specific Hicks-neutral productivity term.

[25] We assume that individual firms solve their problems, even when they belong to a multinational group. However, as we clarify below, we let multinational-owned firms take into account group-level synergies when making their export and import decisions.

4.3 Exporting Decision

Extensive Margin

Firm i exporting to country c at time t faces the following CES demand:

$$q_{ict} = D_{ct} p_{ict}^{-\eta} \Phi_{ict}^{x} \quad \eta > 1. \tag{3}$$

D_{ct} is a demand shifter common to all firms exporting to c at time t, p_{ict} is the price that firm i charges to consumers in country c at time t, $|\eta|$ is the elasticity of demand. Φ_{ict}^{x} is a firm-specific export demand shifter possibly correlated with D_{ct} and p_{ict}.

Firms exporting to country c at time t face iceberg trade costs τ_{ct}, so their marginal cost of selling in c at time t is $\tau_{ct} c_{it}$. Firms are monopolistically competitive and charge fixed markups $\bar{\eta} = \eta/(\eta - 1)$ in each market. Firm i's variable profits from exporting to country c at time t are:

$$\pi_{ict} = (p_{ict} - \tau_{ct} c_{it}) q_{ict} = K D_{ct} \tau_{ct}^{1-\eta} c_{it}^{1-\eta} \Phi_{ict}^{x}, \tag{4}$$

where $K = (\bar{\eta} - 1)\bar{\eta}^{-\eta}$ is a constant. Firm i faces entry costs $F_{ict}^{x} = \bar{F}_{ict}^{x} \exp\{v_{ict}\}$ when exporting to country c at time t, where $\bar{F}_{ict}^{x}$ is a deterministic cost component and v_{ict} a stochastic one. Firm i exports to country c at time t if and only if it is profitable to do so, that is, if:

$$\underbrace{\log K}_{k} + \underbrace{\log(D_{ct} \tau_{ct}^{1-\eta})}_{\varphi_{ct}^{x}} + \underbrace{(1-\eta)\log c_{it}}_{\varphi_{it}^{x}} + \underbrace{\log \Phi_{ict}^{x}}_{\varphi_{ict}^{x}} \geq \underbrace{\log F_{ict}^{x}}_{f_{ict}^{x}} + v_{ict}. \tag{5}$$

Under the assumption that v_{ict} comes from a Gumbel distribution with unit scale, we can express the probability that firm i exports to country c at time t, i.e., the extensive margin of exports, as:[26]

$$\Pr\left(i \text{ exports to } c \text{ in } t\right) = \frac{\exp\left\{k + \varphi_{ct}^{x} + \varphi_{it}^{x} + \varphi_{ict}^{x} - f_{ict}^{x}\right\}}{1 + \exp\left\{k + \varphi_{ct}^{x} + \varphi_{it}^{x} + \varphi_{ict}^{x} - f_{ict}^{x}\right\}}. \tag{6}$$

Equation (6) states that conditional on φ_{ct}^{x} and φ_{it}^{x}, firms facing higher demand shocks relative to fixed entry costs in country c at time t are more likely to export.[27] As discussed

[26] Assuming a unit scale is not necessary but spares us additional notation. If v_{ict}^{x} came from a Gumbel distribution with scale, say, γ, each addendum in equation (6) should be divided by γ. Alternative distributional assumptions for v_{ict}, e.g., a log-normal distribution, can also be accommodated.

[27] Since we model the exporting decision as static, f_{ict}^{x} captures any fixed and sunk cost of exporting to country c in year t. We make this choice to keep exposition simple. It is straightforward to extend the model

in Section 4.5, we will let φ_{ict}^x and f_{ict}^x vary by MNC ownership and by country.

Intensive Margin

Conditional on exporting to country c, firm i's revenues in c at time t are given by:

$$p_{ict}q_{ict} = \tilde{K}D_{ct}\tau_{ct}^{1-\eta}c_{it}^{1-\eta}\Phi_{ict}^x \tag{7}$$

where $\tilde{K} = \bar{\eta}^{1-\eta}$ is a constant. Taking logs of equation (7) gives the following expression for the intensive margin of exports:

$$\log r_{ict} = \tilde{k} + \varphi_{ct}^x + \varphi_{it}^x + \varphi_{ict}^x. \tag{8}$$

where $\tilde{k} = \log \tilde{K}$. Equation (8) states that the export revenues of firm i from exporting to country c at time t depend on a country-year term common to all firms, a firm-year term, and the firm-country-year demand shifter.

4.4 Importing Decision

Extensive Margin

Firms import a bundle of intermediate inputs, each denoted by ν, to produce output. As in Eaton and Kortum (2002), intermediate inputs are produced in each country by perfectly competitive firms with labor under a constant-returns-to-scale technology. The productive efficiency of input ν sourced by firm i from country c at time t is:[28]

$$\omega_{ict}(\nu) = \frac{\exp\{\varphi_{ict}^m\}\exp\{a_{ict}(\nu)\}}{(w_{ct}\tau_{ct} \times F_{ict}^m)^{\frac{1}{2}}}. \tag{9}$$

w_{ct} is labor cost in country c at time t and τ_{ct} is the (iceberg) trade cost of shipping inputs from country c at time t. F_{ict}^m is the fixed entry cost that firm i incurs when importing from country c at time t. The term $(w_{ct}\tau_{ct} \times F_{ict}^m)^{\frac{1}{2}}$ denotes the (geometric) average of the variable and fixed costs of importing. φ_{ict}^m is an efficiency shifter common to all inputs that firm i sources from country c at time t, and it is possibly correlated with w_{ct}, τ_{ct}, and F_{ict}^m. $a_{ict}(\nu)$ is an input-specific idiosyncratic efficiency shock. Firms source each input ν

and allow firms to maximize their net present value when deciding whether to serve a country or not.

[28] The productive efficiency of input ν should be understood as the inverse of the cost at which firm i can source ν from country c at time t. We employ this notion to obtain an expression for the extensive margin of importing that resembles the expression for the extensive margin of exports given by equation (6). Our framework is consistent with the standard cost minimization approach in Eaton and Kortum (2002).

from the country c offering the highest productive efficiency at time t. Under the assumption that $a_{ict}(\nu)$ is drawn from a Gumbel distribution with scale one, we can express the probability that firm i sources from country c at time t as:[29]

$$\Pr\left(i \text{ imports from } c \text{ in } t\right) = \frac{\exp\left\{-\vartheta_{ct} + \varphi_{ict}^{m} - f_{ict}^{m}\right\}}{\sum_{c} \exp\left\{-\vartheta_{ct} + \varphi_{ict}^{m} - f_{ict}^{m}\right\}}, \tag{10}$$

where $\vartheta_{ct} = \frac{1}{2}\log w_{ct}\tau_{ct}$ and $f_{ict}^{m} = \frac{1}{2}\log F_{ict}^{m}$. Equation (10) states that conditional on φ_{ct}^{m} and φ_{it}^{m}, firms facing higher efficiency shocks relative to fixed entry costs are more likely to import inputs from country c at time t. As discussed in Section 4.5, we will let φ_{ict}^{m} and f_{ict}^{m} vary by MNC ownership and by country, depending on whether country c belongs to the network of the multinational parent.

Intensive Margin

The unit cost of a bundle of foreign inputs in equation (2) can be written:

$$\omega_{it} = \left(\int_{0}^{1} \omega_{it}(\nu)^{1-\beta} \mathrm{d}\nu\right)^{\frac{1}{1-\beta}}, \quad \omega_{it}(\nu) = \max_{k} \omega_{ikt}(\nu), \quad \beta > 1. \tag{11}$$

Let m_{it} be the total quantity of inputs that firm i sources at time t, and let i_{ict} be the expenditure on inputs from country c of firm i at time t. Using equation (10), i_{ict} can be expressed as:

$$i_{ict} = \frac{\exp\left\{-\vartheta_{ct} + \varphi_{ict}^{m} - f_{ict}^{m}\right\}}{\sum_{c} \exp\left\{-\vartheta_{ct} + \varphi_{ict}^{m} - f_{ict}^{m}\right\}} \omega_{it} m_{it}. \tag{12}$$

That is, total input expenditure is the product of the share of inputs that firm i sources from country c at time t, which is given by equation (10), and the total value of imports of firm i at time t, which is $\omega_{it} m_{it}$. Let the (geometric) average expenditure incurred by firm i when sourcing from country c at time t be:

$$n_{ict} = \left(i_{ict} F_{ict}\right)^{\frac{1}{2}}. \tag{13}$$

[29] As in equation (6), the unit scale assumption is not necessary but spares us additional notation.

Taking logs of equation (13), and substituting in equation (12), delivers the following expression for the intensive margin of imports:

$$\log n_{ict} = \underbrace{-\vartheta_{ct}}_{\varphi^m_{ct}} + \underbrace{\log \omega_{it} m_{it} + \log\left(\sum_c \exp\left\{-\vartheta_{ct} + \varphi^m_{ict} - f^m_{ict}\right\}\right)}_{\varphi^m_{it}} + \varphi^m_{ict}. \tag{14}$$

Equation (14) states that the average expenditure that firm i faces when importing from country c at time t depends on a country-year term common to all firms, a firm-year term, and the firm-country-year efficiency shifter.

4.5 Multinational Network Effects

On the export side, firms differ in terms of demand shifters (φ^x_{ict}) and entry costs (f^x_{ict}). On the import side, they differ in terms of efficiency shifters (φ^m_{ict}) and entry costs (f^m_{ict}). We hypothesize that MNC ownership may alter the level of each of these variables in countries in which the parent of firm i has a presence at time t. Concerning the exporting decision, we define:

$$\varphi^x_{ict} = \varphi^x_{ic} + f_x\Big(MNC_{i(p)t} \times In\ MNC\ Network_{cp}\Big) + \epsilon^x_{ict} \tag{15}$$

and

$$f^x_{ict} = g_x\Big(MNC_{i(p)t} \times In\ MNC\ Network_{cp}\Big). \tag{16}$$

The demand shifter φ^x_{ict} depends on three components. First, a firm-country term capturing, among others, the long-term appeal of firm i to costumers in country c. Second, a function $f_x(\cdot)$ which specifies if firm i belongs to the MNC network of parent p at time t ($MNC_{i(p)t} = 1$) and whether parent p has affiliates in country c ($In\ MNC\ Network_{cp} = 1$). All else equal, if $f_x(\cdot)$ is increasing in its argument, MNC ownership increases export revenues in countries belonging to the MNC network. Third, an idiosyncratic demand shifter ϵ^x_{ict}.

The fixed export cost f^x_{ict} is also a function of $MNC_{i(p)t} \times In\ MNC\ Network_{cp}$. All else equal, if $g_x(\cdot)$ is decreasing in its argument, MNC ownership fosters export entry in countries belonging to the MNC network.

Concerning the importing decision, we define:

$$\varphi^m_{ict} = \varphi^m_{ic} + f_m\Big(MNC_{i(p)t} \times In\ MNC\ Network_{cp}\Big) + \epsilon^m_{ict}. \tag{17}$$

and

$$f_{ict}^{m} = g_m\Big(MNC_{i(p)t} \times In\ MNC\ Network_{cp}\Big). \tag{18}$$

We let φ_{ict}^{m} depend on a firm-country term, whether firm i is owned by multinational p at time t and whether country c belongs to the MNC network, and an idiosyncratic efficiency shifter. All else equal, if $f_m(\cdot)$ is increasing in its argument, MNC ownership increases average import expenditure in countries belonging to the MNC network.

The fixed import cost f_{ict}^{m} is also a function of $MNC_{i(p)t} \times In\ MNC\ Network_{cp}$. All else equal, if $g_m(\cdot)$ is decreasing in its argument, MNC ownership fosters import entry in countries belonging to the MNC network.

4.6 Estimation

Estimating Equations for the Extensive Margin of Trade

We approximate equation (6) with a linear equation to obtain the following estimating equation for the extensive margin of exports:

$$\mathbf{1}\left(i\ exports\ to\ c\ in\ t\right) = k + \varphi_{ct}^{x} + \varphi_{it}^{x} + \varphi_{ic}^{x} + s_x\Big(MNC_{i(p)t} \times In\ MNC_{cp}\Big) + \epsilon_{ict}^{x}. \tag{19}$$

Similarly, we approximate equation (10) with a linear equation to obtain the following estimating equation for the extensive margin of imports:

$$\mathbf{1}\left(i\ imports\ from\ c\ in\ t\right) = \varphi_{ct}^{m} + \varphi_{it}^{m} + \varphi_{ic}^{m} + s_m\Big(MNC_{i(p)t} \times In\ MNC_{cp}\Big) + \epsilon_{ict}^{m}. \tag{20}$$

We define $s_x(\cdot) = f_x(\cdot) - g_x(\cdot)$ to clarify that multinational ownership can trigger entry into export markets by increasing firm revenues relative to entry costs. Similarly, we define $s_m(\cdot) = f_m(\cdot) - g_m(\cdot)$ to clarify that multinational ownership can induce entry into import markets by increasing input efficiency relative to entry costs. We estimate equations (19) and (20) using the sample of Belgian firms that are acquired by a foreign multinational during our sample period. We assume that these firms can potentially trade with all the countries in our dataset in every year. The estimation sample is thus a balanced panel at the firm-country-year level. While we employ a linear probability model as the baseline, in robustness checks, we use a logit model with high-dimensional fixed effects to estimate equations (19) and (20) exactly. In each case, we treat $s_x(\cdot)$ and $s_m(\cdot)$ as linear functions.

Estimating Equations for the Intensive Margin of Trade

The estimating equation for the intensive margin of exports corresponding to equation (8) is:

$$\log r_{ict} = \tilde{k} + \varphi^x_{ct} + \varphi^x_{it} + \varphi^x_{ic} + f_x\Big(MNC_{i(p)t} \times In\ MNC_{cp}\Big) + \epsilon^x_{ict}. \tag{21}$$

Similarly, the estimating equation for the intensive margin of imports corresponding to equation (14) is:

$$\log n_{ict} = \varphi^m_{ct} + \varphi^m_{it} + \varphi^m_{ic} + f_m\Big(MNC_{i(p)t} \times In\ MNC_{cp}\Big) + \epsilon^m_{ict}. \tag{22}$$

As before, we estimate equations (21) and (22) using the sample of MNC affiliates. However, in order to examine the intensive margin of trade, we restrict the analysis to the set of countries each firm had traded with at least once in the three years prior to the acquisition. We estimate equations (21) and (22) via OLS and also in this case, treat $f_x(\cdot)$ and $f_m(\cdot)$ as linear functions.

4.7 Identification Discussion

Equations (19) to (22) clarify that the treatment effect we are interested in is the post-acquisition change in trade participation of firm i with country c at time t. Since we restrict the estimation sample to MNC affiliates, the control group includes both not-yet-acquired firms and already-acquired firms trading with a country $k \neq c$ in year t. Identification hinges on the assumption that firm i would have not increased trade participation with country c in the MNC network relative to the control group in the absence of the acquisition.

Our identification strategy requires parallel trends after netting out all the possible pairwise fixed effects admitted by our three-dimensional panel. These fixed effects account for various alternative mechanisms that the previous literature has shown to affect trade participation at the firm level. The inclusion of country-year fixed effects accounts for the fact that all firms may change their trade patterns with a particular country over time due, for instance, to the entry into force of a new trade agreement between Belgium and that country. The inclusion of firm-year fixed effects allows us to control for the standard mechanisms through which MNC ownership can increase trade participation, e.g., productivity growth, lower financial and information constraints, and increased demand after acquisition. To the extent that these channels are firm-specific and time-varying they do not represent a threat to identification, and the $s_x(\cdot)$, $f_x(\cdot)$, $s_m(\cdot)$, and $f_m(\cdot)$ functions

capture any bilateral change in trade participation on top of standard firm-level channels. Finally, including firm-country fixed effects accounts for any reasons firms have systematic differences in trade activities with some countries.

Acquisitions must create value for the multinational, e.g., due to increased trade participation in countries belonging to the MNC network or synergies across affiliates. Our identification strategy can accommodate different motives for FDI (horizontal, vertical, and export-platform) and is consistent with changes in trade participation occurring both within and outside the multinational boundaries. The key identification assumption is that in the absence of the acquisition, firm i would have not increased its trade participation with countries belonging to p's network, compared to its trade with other countries, relative to the control group of non-acquired firms.

Bilateral selection effects are the main threat to our identification strategy. Our estimates would be upwards-biased if firm i is acquired because the parent knew that a firm would have started trading with (or increased its trade with) some specific countries, including those belonging to the MNC network, independent of the acquisition. In Section 5.2 we will exploit plausibly exogenous changes in the multinational network of Belgian affiliates to address this concern.

5 Network Effects of Multinational Ownership

This section presents our main empirical findings. Anecdotal evidence in our data suggests that network effects may help explain why trade participation increases after MNC acquisition. For example, a Belgian firm in our sample was acquired in 1999 by a direct parent located in Japan. Before 2000, this firm was not exporting at all. From 2000, it started exporting not only to Japan, but also to other countries in which its parent had affiliates, including the United States. This section establishes that this pattern is systematic.

5.1 Entry in Countries in the Parental Network

Our model suggests that we can identify the network effects of multinational ownership by estimating the firm-level gravity regressions on the set of new affiliates, i.e., Belgian firms that switched from being domestic to being owned by a foreign MNC during our sample period. We first examine the effects on the extensive margin of trade by estimating

$$Entry_{i(p)ct} = \beta_1(MNC_{i(p)t} \times In\ MNC\ Network_{cp}) + \delta_{it} + \delta_{ic} + \delta_{ct} + \varepsilon_{i(p)ct}, \qquad (23)$$

where $Entry_{i(p)ct}$ is a dummy variable equal to 1 from the first year t in which firm i (owned by parent p) exports to, or imports from, country c. The sample of countries includes all those in the data to which at least one affiliate exports or from which at least one affiliate imports. $MNC_{i(p)t}$ is a dummy variable equal to 1 after firm i is acquired by p. *In MNC Network*$_{cp}$ is a dummy variable equal to 1 if country c belongs to the set of countries in which the multinational parent has at least one affiliate firm.

We fully saturate the model by including δ_{it}, δ_{ic}, and δ_{ct} fixed effects to capture other mechanisms relating which MNC affiliation and trade. Crucially, δ_{it} allows us to control for firm-year-specific channels through which multinational ownership can lead to increased trade participation with all countries, for example, changes in productivity due to technology transfers from the new parent. δ_{ic} accounts for time-invariant gravity factors, such as distance, which affect all firms' trade with country c. Last, δ_{ct} controls for any possible changes in trade relations between Belgium and country c, for example, trade agreements negotiated between the EU and country c, that make trade with c more or less attractive from time t.

Table 2
Network Effects of MNC Ownership

	(1) Export Entry	(2) Import Entry
$MNC_{i(p)t} \times$ *In MNC Network*$_{cp}$	0.029***	0.016***
	(0.007)	(0.006)
Firm-Country FE	Yes	Yes
Firm-Year FE	Yes	Yes
Country-Year FE	Yes	Yes
Observations	236,256	236,256
Estimator	OLS	OLS

The table reports the results of estimating equation (23). In column 1, the dependent variable is *Export Entry*$_{i(p)ct}$, a dummy variable equal to 1 from the first year t in which firm i (owned by parent p) exports to country c. In column 2, the dependent variable is *Import Entry*$_{i(p)ct}$, a dummy variable equal to 1 from the first year t in which firm i (owned by parent p) imports from country c. $MNC_{i(p)t}$ is a dummy variable equal to 1 after firm i is acquired by p. *In MNC Network*$_{cp}$ is a dummy variable equal to 1 if country c belongs to the set of countries in which the multinational parent has a presence. Heteroscedasticity robust standard errors in parenthesis. Significance levels: *** 0.01, ** 0.05, * 0.1.

Our model implies that the β_1 coefficient in equation (23) should be positive and sig-

nificant if multinational ownership has a network effect on the probability affiliates enter new markets. Table 2 reports the results for export entry (column 1) and import entry (column 2). The coefficient of the interaction term $MNC_{i(p)t} \times In\ MNC\ Network_{cp}$ is positive and significant at the 1% level in both columns, providing evidence of *MNC network effects* on the extensive margin of trade: after being acquired, firm i is more likely to start exporting to and importing from a country that belongs to its parent p's network. In terms of magnitude, the coefficient in column 1 (2) indicates that the probability of export (import) entry increases by 2.9 (1.6) percentage points. This corresponds to a 17% (16%) increase in the unconditional probability of export import and entry (respectively equal to 17% and 9%).

To assess the importance of network effects compared to traditional firm-level mechanisms through which MNC ownership can affect trade participation, we decompose the total variance in $Entry_{i(p)ct}$ in equation (23) and compute the share that can be attributed to $MNC_{i(p)t} \times In\ MNC\ Network_{cp}$ and the different fixed effects. The Shapley decomposition (Huettner and Sunder, 2012) allows us to identify the contribution of MNC network effects. The results reported in Table A-12 show that firm-country fixed effects explain around 90% of the variation in export and import entry, confirming the central role of gravity. However, MNC network effects are quantitatively more important than firm-year effects in explaining where new affiliates enter: MNC network effects explain 3.91% and 5.76% of the total variation in the probability that a firm starts exporting to and importing from a country, respectively; by contrast, firm-year fixed effects explain 3.22% and 1.50% of the total variation, respectively. Country-year fixed effects account for the remaining part.

We have carried out a series of additional estimations to verify the robustness of the results in Table 2. First, instead of focusing on the network of the direct parent (DP) of each Belgian affiliate, we consider the network of its global ultimate owner (GUO). The results reported in Table A-13 show that our main results continue to hold when using this larger network. Second, we have employed an alternative econometric methodology. Table A-14 shows that the results of Table 2 are robust to using a logit model instead of a linear probability model.[30] Finally, Table A-15 shows that the results continue to hold if we exclude countries classified as tax havens by Dharmapala and Hines (2009).

We also examine whether multinational ownership affects the trade intensive margin. We focus on the set of countries each affiliate i was already trading with before

[30] We use the `feglm` command of the R package `fixest` o estimate logit with high-dimensional fixed effects.

being acquired.[31] We then re-estimate equation (23), replacing the dependent variable with $\log Export\ Value_{i(p)ct}$ (or $\log Import\ Value_{i(p)ct}$), the value of firm i's exports to (imports from) country c. The results reported in Table A-16 show that new affiliates do not significantly increase their export and import values in countries they were already trading with before being acquired by the multinational, in that the interaction between the dummy variables $MNC_{i(p)t}$ and $\times In\ MNC\ Network_{cp}$ is never significant.

Overall, the results presented in this section suggest that multinational ownership alleviates country-specific trade frictions that operate at the extensive margin: it lowers the costs of entering new markets in which the parent already has a presence, but has no effect on the value of trade with "old" destination and sourcing countries.

5.2 Addressing Identification Concerns: Exogenous Network Changes

As discussed in Section 4.7, bilateral selection effects are the main threat to our identification strategy. The estimates in Table 2 would be upwards-biased if firm i were acquired because the parent knew that it would have started trading with (or increased its trade) with countries belonging to the MNC network independently of the acquisition.

To address this concern, we follow an identification strategy similar to Atalay *et al.* (2019), exploiting plausibly exogenous changes in the multinational network of Belgian affiliates. As in the previous section, we consider the set of firms that were acquired by a foreign multinational during our sample period and always had the same direct parent (DP). Using information from Orbis M&A, we identify the subset of these firms that changed GUO during the period and exploit these ownership changes to identify network effects.[32] The key assumption is that the M&A activities that give rise to these GUO changes are not driven by the Belgian affiliates' trade patterns. Two arguments support the validity of this assumption: first, GUOs control Belgian affiliates only indirectly, through their DP; second, GUOs tend to be large companies, with many affiliates dispersed globally, so any corporate restructuring is unlikely to be driven by the patterns of one indirectly-controlled affiliate.

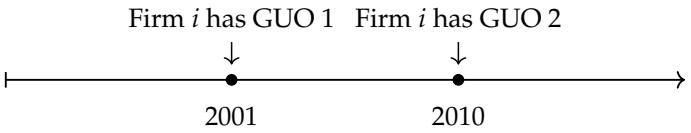
Figure 3 provides an example of firm i that changed GUO. This firm became foreign owned in 2001, when it was acquired by DP_i, which remained its direct parent until the

[31] A country c is classified as "old" for firm i if this was exporting to or importing from c in at least one of the five years before being acquired. This definition does not suffer from left censoring: the NBB trade dataset starts in 1993; even for firms acquired in 1998, we can thus observe exports and imports in the previous five years (see also Conconi *et al.*, 2016).

[32] We focus on ownership changes occurring between between 2007, which is the earliest year in which network data is available from Historical Orbis, and 2011, so that we can observe affiliates' trade patterns for at least three years after the change in GUO).

end of the sample. DP_i was originally controlled by a Swedish company (GUO 1), but in 2010, it was acquired by another Swedish company (GUO 2). As a result of this ownership change, several countries were added to firm i GUO's network (e.g., the United States, China, South Korea, India, Vietnam, Colombia). As mentioned above, the key identifying assumption is that the changes in GUO are not driven by the trading patterns of Belgian affiliates. In the example given in Figure 3, the assumption is that GUO 2 (which had 1,039 subsidiaries in 2010) did not acquire GUO 1 (which had 42 subsidiaries, including i's DP) to trade with particular countries through Belgian firm i.

Figure 3
An Example



To identify switches in GUO, we define the following ownership variables: $Old\ MNC_{i,t}$ is dummy variable equal to 1 in the years in which firm i has GUO 1; $New\ MNC_{i,t}$ is a dummy equal to 1 in the years in which firm i has GUO 2.

We construct GUO 1's network in the year in which it acquired firm i (if this occurred from 2007, the first year of Orbis M&A) or in 2007 (if the acquisition occurred in earlier years). To identify countries belonging to this network, we define the dummy variable $In\ Old\ MNC\ Network_{ic}$, which is equal to 1 if GUO 1 has subsidiaries in c. The network of GUO 2 is constructed using information from the year in which this became i's GUO. To identify countries belonging to this network, we define the dummy variable $In\ New\ MNC\ Network_{ic}$, which is equal to 1 if GUO 2 has subsidiaries in c.

By comparing the networks of the two GUOs, we construct the following dummy variables: $Only\ in\ Old\ MNC\ Network_{ic}$, which is equal to 1 if country c belongs to GUO 1's network but does not belong to GUO 2's network; and $Only\ in\ New\ MNC\ Network_{ic}$, which is equal to 1 if country c belongs to GUO 2's network but does not belong to GUO 1's network.

To identify network effects driven by exogenous network changes, we drop all countries that belong to the old GUO's network of each affiliate and estimate

$$Entry_{ict} = \alpha_1(New\ MNC_{i,t} \times Only\ In\ New\ MNC\ Network_{ic}) + \delta_{it} + \delta_{ic} + \delta_{ct} + \varepsilon_{ict}. \quad (24)$$

The dependent variable is a dummy equal to 1 from the first year i exports to/imports

from country c. The coefficient α_1 thus captures the probability that firm i starts trading with countries that are only in the new GUO's network after changing GUO relative to countries that belong to neither network.

Table 3
Network Effects of MNC Ownership (Exogenous Network Changes)

	(1)	(2)
	Export Entry	Import Entry
$New\ MNC_{it} \times Only\ In\ New\ MNC\ Network_{ic}$	0.024***	0.061***
	(0.008)	(0.009)
Firm-Country FE	Yes	Yes
Firm-Year FE	Yes	Yes
Country-Year FE	Yes	Yes
Observations	58,674	58,674
Estimator	OLS	OLS

The table reports the results of estimating equation (24). In column 1, the dependent variable is $Export\ Entry_{ict}$, a dummy variable equal to 1 from the first year t in which firm i exports to country c. In column 2, the dependent variable is $Import\ Entry_{ict}$, a dummy variable equal to 1 from the first year t in which firm i imports from country c. $New\ MNC_{i,t}$ is a dummy variable equal to 1 in the years in which firm i has GUO 2. $Only\ In\ New\ MNC\ Network_{ic}$ is a dummy variable equal to 1 if country c belongs to GUO 2's network of GUO2 but does not belong to the network of GUO 1. The sample excludes countries that belong to GUO 1's network (i.e. $In\ Old\ MNC\ Network_{ic} = 1$). Heteroscedasticity robust standard errors in parenthesis. Significance levels: *** 0.01, ** 0.05, * 0.1.

Table 3 reports the results of estimating equation (24). The α_1 coefficient is positive and significant at the 1% level for both export and import entry. Thus, when its DP has a new GUO, Belgian affiliates are more likely to start trading with countries that have been added to their network (e.g., the United States, China, South Korea, India, Vietnam, and Colombia in the example of Figure 3). These findings confirm that the estimates in Table 2 are robust to addressing concerns about the endogeneity of the affiliates' networks. The estimates indicate indicate that the probability that a new affiliate starts exporting (importing) to a country in its parental network increases by 2.4 (6.1) percentage points.[33]

[33]This corresponds to a 26% (100%) increase in the unconditional probability of export (import) entry, which is equal to 9% (5%).

5.3 The Role of Trade Frictions

If the network effects of MNC ownership are driven by a reduction in country-specific trade frictions, due to, for example, the cost of learning market-specific regulations, we would expect the MNC network effect to be stronger in countries that are geographically or culturally more distant from Belgium. As an example of why, imagine MNC affiliation removes all trade entry costs. This will have a disproportionate impact on the relative profitability of trading with more distant countries once affiliated because entry costs to these countries were initially higher for domestic firms due to gravity. To examine this in the data, we use two measures of distance between Belgium and country c. The first measure comes from the CEPII dataset (Mayer and Zignago, 2011) and is the geographical distance (in kilometres) between the capitals of the two countries. The second measure comes from Melitz and Toubal (2014) and is one minus the share of the population in country c that speaks one of the official languages of Belgium; it is thus a measure of the cultural distance between the two countries.

To study heterogeneous network results by distance we estimate

$$\begin{aligned} X_{i(p)ct} \quad = \quad & \beta_1 (MNC_{i(p)t} \times In\ MNC\ Network_{cp}) \\ & \beta_2 (MNC_{i(p)t} \times In\ MNC\ Network_{cp} \times \log Distance_c) \\ & \beta_3 (MNC_{i(p)t} \times \log Distance_c) \\ & + \delta_{it} + \delta_{ic} + \delta_{ct} + \varepsilon_{i(p)ct}. \end{aligned} \tag{25}$$

If MNC ownership alleviates country-specific trade frictions that increase with distance, the β_2 coefficient should be positive and significant.

The results from estimating equation (25) are reported in Table 4. There are fewer observations than in Table 2, due to the fact that the distance measures are not available for all countries. The β_1 coefficient is always positive and significant at the 1% level, confirming that MNC ownership increases the probability of export and import entry in country in which the parent has a presence. The coefficient β_2, on the triple interaction $MNC_{i(p)t} \times In\ MNC\ Network_{cp} \times \log Distance_c$, is also always positive and highly significant at the 1% percent level, indicating that the network effects are larger in countries that are further away, that is, those in which Belgian affiliates faced stronger trade frictions prior to the acquisition.

Table 4

Network Effects of MNC Ownership, The Role of Distance

	(1)	(2)	(3)	(4)
	Export Entry		Import Entry	
	Geogr. distance	Cultural ddistance	Geogr. distance	Cultural distance
$MNC_{i(p)t} \times In\ MNC\ Network_{cp}$	0.044***	0.039***	0.034***	0.027***
	(0.008)	(0.008)	(0.008)	(0.007)
$MNC_{i(p)t} \times In\ MNC\ Network_{cp} \times \log Distance_c$	0.019***	0.017***	0.028***	0.027***
	(0.004)	(0.006)	(0.004)	(0.005)
$MNC_{i(p)t} \times \log Distance_c$	-0.010***	-0.006***	-0.015***	-0.008***
	(0.002)	(0.001)	(0.002)	(0.001)
Firm-Country FE	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes
Observations	194,847	194,847	194,847	194,847
Estimator	OLS	OLS	OLS	OLS

The table reports the results of estimating equation (25). In columns 1 and 2, the dependent variable is $Export\ Entry_{i(p)ct}$, a dummy variable equal to 1 from the first year t in which firm i (owned by parent p) exports to country c. In columns 3 and 4, the dependent variable is $Import\ Entry_{i(p)ct}$, a dummy variable equal to 1 from the first year t in which firm i (owned by parent p) imports from country c. In columns 1 and 3, the variable $Distance_c$ measures the geographical distance (in kilometres) between the capital of Belgium and the capital of country c; in columns 2 and 4, it is one minus the share of the population in country c that speaks one of the official languages of Belgium. Heteroscedasticity robust standard errors in parenthesis. Significance levels: *** 0.01, ** 0.05, * 0.1.

5.4 Network Effects Beyond Firm Boundaries

The results above show that being acquired by an MNC increases the probability that a firm starts exporting to (and importing from) countries in which the parent has a presence. In principle, these network effects could be driven by intra-MNC supply-chain linkages, i.e., Belgian affiliates exporting their products to (importing their inputs from) more downstream (upstream) affiliates of the same parent. This is indeed what one would expect based on Atalay *et al.* (2019), who show that US establishments are more likely to ship to destinations (ZIP codes) in which other vertically integrated establishments of the same firm are located.

Unfortunately, the NBB does not collect transaction-level trade data, which would

allow us to observe intra-MNC trade. As discussed below, however, several of our findings suggest that the effects of MNC ownership on affiliates' trade participation extend beyond the boundaries of the multinational.

5.4.1 Heterogeneous Network Effects by Distance

The first finding against the idea that network effects are driven by intra-MNC supply-chain relationships is the fact, shown in Table 4, that they increase with geographical and physical distance from the Belgian affiliates. If the effects were driven by trade between vertically-related affiliates, we would expect them to *decrease* with distance (new Belgian affiliates should be *less* likely to start trading with other affiliates, if these are geographically and culturally more distant).

5.4.2 Extended Network Effects

As shown below, MNC ownership increases the probability that affiliates enter only in countries that belong to their parent's network, but also in countries that are close (but do not belong) to this network. By definition, these "extended network effects" cannot be driven by intra-MNC trade, since they involve countries in which the the multinational parent does not have an affiliate.[34]

The literature on extended gravity (e.g., Albornoz, *et al.*; 2012; Morales *et al.*, 2019; Alfaro-Ureña *et al.*, 2023) shows that firms are more likely to start exporting to markets that are close to prior destinations, i.e., share a common border or membership in a regional trade agreement. In line with these studies, we examine whether multinational ownership has extended network effects. If such effects are at work, a new Belgian affiliate may be more likely to enter not only countries that belong to the network of their parent (e.g., Argentina), but also nearby countries (e.g., Chile), even if the parent has no presence there. To verify this, we define the variable *Close to MNC network*$_{cp}$, which is equal to 1 if country c is close to — but does not belong to — the network of countries in which p has subsidiaries. We define two versions of this variable: the first is a dummy variable equal to 1 if c has common border with a country in the parental network but does not belong to the network;[35] the second is a dummy equal to 1 if c is in a regional

[34] These results echo Carballo *et al.* (2022)'s finding that new independent Uruguayan suppliers of MNCs are more likely to start exporting to countries in which the multinational operates, selling to both affiliates of the same multinational and also to independent firms.

[35] Formally, we define the dummy variable *Contiguous*$_{ck}$ as equal to 1 if countries c and k share a common border. In this case, *Close to MNC Network*$_{cp}$ is equal to 1 if *In MNC Network*$_{cp} = 0$, but there is at least one country k such that *Close*$_{ck} = 1$, and *In MNC Network*$_{kp} = 1$.

trade agreement (RTA) with a country in the parental network but does not belong to the network.[36]

To assess the existence of extended network effects, we include an interaction between the variables $MNC_{i(p)t}$ and *Close to MNC network*$_{ct}$ in equation (23), and estimate

$$\begin{aligned} X_{i(p)ct} &= \beta_1(MNC_{i(p)t} \times \textit{In MNC Network}_{cp}) \\ &\quad +\beta_2(MNC_{i(p)t} \times \textit{Close to MNC Network}_{cp}) \\ &\quad +\delta_{it} + \delta_{ic} + \delta_{ct} + \varepsilon_{i(p)ct}. \end{aligned} \tag{26}$$

The coefficients β_1 and β_2, respectively, capture any network and extended network effects of multinational ownership.

Table 5 reports the results of estimating equation (26). These provide evidence of extended network effects of multinational ownership: the coefficient of the interaction term $MNC_{i(p)t} \times$ *Close to MNC Network*$_{cp}$ is always positive and significant, indicating that new affiliates are more likely to start exporting to and importing from countries that are close to but do not belong to their parental network.

In terms of magnitude, the estimates of Table 5 indicate that affiliates increase their probability of exporting to (importing from) countries sharing a border with those in their parental network by about 2.4 (2.6) percentage points, corresponding to a 14% (26%) increase relative to the unconditional probability of exporting to (importing from) these countries. Similarly, the average increase in the probability of exporting to (importing from) countries that are not in their parental network but with whom Belgium has ever signed an RTA is 1.1 (17) percentage point, corresponding to a 14% (6%) increase relative to the unconditional probability of exporting to (importing from) these countries. As expected, network effects are stronger than extended network effects: in three of the four specifications (columns 1, 2, and 4), the coefficient of $MNC_{(i(p)t} \times$*In MNC Network*$_{cp}$ is significantly larger than the coefficient of $MNC_{(p)it} \times$*Close to MNC Network*$_{cp}$ (in the remaining specification, the coefficients are not statistically different from each other).

Table 5 thus shows that MNC ownership has both network and extended network effects. While the network effects may partly be driven by intra-firm trade, extended network effects operate *outside the boundaries of the multinational*, since they involve countries in which the parent has no presence.[37]

[36] Formally, we define the variable RTA_{ck} as equal to 1 if countries c and k are members of the same RTA. In this case, *Close to MNC Network*$_{cp}$ is equal to 1 if *In MNC Network*$_{cp} = 0$, but there is at least one country k such that $RTA_{ck} = 1$, and *In MNC Network*$_{kp} = 1$.

[37] We have verified that the results of Table 5 are robust to dropping countries that belong to the GUO's network when defining countries that are close to (but do not belong to) the DP's network.

Table 5
Extended Network Effects of MNC Ownership

	(1)	(2)	(3)	(4)
	Export Entry		Import Entry	
	Border	RTA	Border	RTA
$MNC_{(i(p)t}$ $\times$ *In MNC Network*$_{cp}$	0.039***	0.040***	0.022***	0.028***
	(0.007)	(0.007)	(0.007)	(0.007)
$MNC_{(p)it}$ $\times$ *Close to MNC Network*$_{cp}$	0.024***	0.011***	0.026***	0.017***
	(0.005)	(0.003)	(0.004)	(0.002)
Firm-Country FE	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes
Observations	194,847	194,847	194,847	194,847
Estimator	OLS	OLS	OLS	OLS

The table reports the results of estimating equation (5). In columns 1 and 2, the dependent variable is *Export Entry*$_{i(p)ct}$, a dummy variable equal to 1 from the first year t in which firm i (owned by parent p) exports to country c. log *Exports*$_{i(p)ct}$, the value of exports of firm i (owned by parent p) to country c in year t. In columns 3 and 4, the dependent variable is *Import Entry*$_{i(p)ct}$, a dummy variable equal to 1 from the first year t in which firm i (owned by parent p) imports from country c. Heteroscedasticity robust standard errors in parenthesis. In column 1 and 3 (column 2 and 4), the variable *Close to MNC Network*$_{cp}$ is equal to 1 if country c shares a common border (is a member of an RTA) with a country that belongs to p's network, but is not itself in the network. Heteroscedasticity robust standard errors in parenthesis. Significance levels: *** 0.01, ** 0.05, * 0.1.

5.4.3 Persistence of Network Effects

Another way to verify whether the effects of MNC ownership affiliates' trade participation extend beyond the firm boundaries is to examine their persistence. For this purpose, we again exploit the exogenous changes in GUOs' networks that were discussed in Section 5.2.

We focus on divestitures, i.e., cases in which GUO 1 sells i's DP to GUO 2, which can result in some countries being dropped from i's GUO network. As an example, in 2005, a Belgian firm i was acquired by DP controlled by GUO 1. In 2011, i's GUO 1 sold DP to GUO 2. As a result of this divestiture, several countries exited firm i's GUO network (in this case, Japan, Indonesia, and Tunisia).

We first consider countries in the old GUO's network (i.e. $In\ Old\ MNC\ Network_{cp} = 1$) and compare those dropped from i's network with those still in the network by estimating

$$Trade_{ict} = \alpha_1(New\ MNC_{i,t} \times Only\ in\ Old\ MNC\ Network_{ic}) + \delta_{it} + \delta_{ic} + \delta_{ct} + \varepsilon_{ict}, \quad (27)$$

where $Trade_{ict}$ is dummy equal to 1 if firm i trade with country c in year t. If network effects are persistent and not confined to MNC boundaries, α_1 should not be significant. This is indeed what the results of Table 6 shows: the coefficient of the interaction term $New\ MNC_{i,t} \times Only\ in\ Old\ MNC\ Network_{ic}$ indicates that affiliates are not significantly less likely to trade with countries dropped from their network compared to countries still in their network.

Table 6
Persistence of Network Effects of MNC Ownership
(Dropped vs Retained Network Countries)

	Exports	Imports
	(1)	(2)
$New\ MNC_{it} \times Only\ In\ Old\ MNC\ Network_{ic}$	-0.050	-0.022
	(0.038)	(0.035)
Firm-Country FE	Yes	Yes
Firm-Year FE	Yes	Yes
Country-Year FE	Yes	Yes
Observations	5,460	5,460
Estimator	OLS	OLS

The table reports the results of estimating equation (27). In column 1, the dependent variable is $Export_{ict}$, a dummy variable equal to 1 from if firm i exports to country c in year t. In column 2, the dependent variable is $Import_{ict}$, a dummy variable equal to 1 from if firm i imports from country c in year t. $New\ MNC_{it}$ is a dummy variable equal to 1 in the years in which firm i has GUO 2. $Only\ in\ Old\ MNC\ Network_{ic}$ is dummy variable equal to 1 if country c belongs to the network of GUO 1, but does not belong to the network of GUO 2. The sample includes all countries that belong to GUO 1's network (i.e., $In\ Old\ MNC\ Network_{ic} = 1$). Heteroscedasticity robust standard errors in parenthesis. Significance levels: *** 0.01, ** 0.05, * 0.1.

We next compare the probability that after changing GUO, affiliates enter countries dropped from their network versus never in their network. If network effects take time to manifest, we would expect affiliates to be more likely to start exporting to and importing from countries that are no longer in their network relative to countries never in their network. To this purpose, we exclude from the sample countries added to the network

from the sample (i.e. $In\ New\ MNC\ Network_{ic} = 1$) and estimate

$$Entry_{ict} = \alpha_1(New\ MNC_{i,t} \times Only\ in\ Old\ MNC\ Network_{ic}) + \delta_{it} + \delta_{ic} + \delta_{ct} + \varepsilon_{ict}. \quad (28)$$

The results reported in Table 7 show that even after changing GUO, affiliates are more likely to start trading with countries that used to be in their multinational network relative to countries never in the their network. These results confirm that MNC network effects are persistent and are not confined to intra-firm trade.

Table 7
Persistence of Network Effects of MNC Ownership
(Countries Dropped vs Never in the Network)

	Export Entry	Import Entry
	(1)	(2)
$New\ MNC_{it} \times Only\ In\ Old\ MNC\ Network_{ic}$	0.039**	0.036**
	(0.019)	(0.006)
Firm-Country FE	Yes	Yes
Firm-Year FE	Yes	Yes
Country-Year FE	Yes	Yes
Observations	14,383	14,383
Estimator	OLS	OLS

The table reports the results of estimating equation (28). In column 1, the dependent variable is $Export\ Entry_{ict}$, a dummy variable equal to 1 if firm from the first year t in which firm i exports to country c. In column 2, the dependent variable is $Import\ Entry_{ict}$, a dummy variable equal to 1 from the first year t in which firm i imports from country c. $New\ MNC_{it}$ is a dummy variable equal to 1 in the years in which firm i has GUO 2. $Only\ in\ Old\ MNC\ Network_{ic}$ is dummy variable equal to 1 if country c belongs to the network of GUO 1, but does not belong to the network of GUO 2. The sample excludes countries added to i's network after the change in GUO (i.e. $Only\ in\ New\ MNC\ Network_{ic} = 1$). Heteroscedasticity robust standard errors in parenthesis. Significance levels: *** 0.01, ** 0.05, * 0.1.

5.4.4 Distance from Other Affiliates Along Value Chains

If the network effects were driven by supply chain linkages within MNCs, we would expect them to be stronger when the activities of affiliates are vertically-related. To investigate this, we use the methodology of Alfaro *et al.* (2019) and construct the variable $Upstreamness_{ij}$, which measures the distance along supply chains between Belgian affiliate i's and affiliate j of parent p located in country c.

Since the upstreamness measure can only be defined for countries in the parental net-

work, we restrict the analysis to these countries (i.e. $In\ MNC\ Network_{cp} = 1$) and estimate

$$Entry_{i(p)c(j)t} = \beta_1(MNC_{i(p)t} \times Upstreamness_{ij}) + \delta_{it} + \delta_{ic} + \delta_{ct} + \varepsilon_{i(p)c(j)t}. \quad (29)$$

Depending on the specification, the dependent variable is a dummy variable equal to 1 from the first year t in which Belgian affiliate i (with multinational parent p) exports to or imports from c, the country in which affiliate j (of parent p) is located. When looking at export (import) entry, the variable $Upstreamness_{ij}$ is constructed using the Belgian affiliate as the supplier (user) and affiliate j in country c as the user (supplier). Given that parent p can have multiple affiliates in country c, we cluster standard errors at the country level.

Table 8
Network Effects of MNC Ownership, The Role of Distance Along Supply Chains

	Export Entry	Import Entry
	(1)	(2)
$MNC_{i(p)t} \times Upstreamness_{ij}$	0.004	0.001
	(0.007)	(0.003)
Firm-Country FE	Yes	Yes
Firm-Year FE	Yes	Yes
Country-Year FE	Yes	Yes
Observations	14,295	14,054
Estimator	OLS	OLS

The table reports the results of estimating equation (29). In column 1, the dependent variable is $Export\ Entry_{i(p)c(j)t}$, a dummy variable equal to 1 from the first year t in which Belgian affiliate i (with parent p) exports to c (the country in which affiliate j is located). In column 2, the dependent variable is $Import\ Entry_{i(p)c(j)t}$, a dummy variable equal to 1 from the first year t in which Belgian affiliate i (with parent p) imports from c (the country in which affiliate j is located). In column 2, the dependent variable is $Import\ Entry_{ict}$, a dummy variable equal to 1 from the first year t in which firm i imports from country c. $MNC_{i(p)t}$ is a dummy variable equal to 1 after firm i is acquired by p. $Upstreamness_{ij}$ measures the distance along supply chains between Belgian affiliate i's and affiliate j. In column 1 (column 2) it is constructed using the Belgian affiliate as the supplier (user) and affiliate j in country c as the user (supplier). The sample is restricted to countries belonging to the parental network (i.e. $In\ MNC\ Network_{cp} = 1$). Standard errors clustered by country in parenthesis. Significance levels: *** 0.01, ** 0.05, * 0.1.

Table 8 reports the results of estimating equation (29). The β_1 coefficient is not significant, indicating that whether the acquired Belgian affiliate i starts trading with countries in the network of its parent does not depend on its position along supply chains relative to other affiliates of the same parent. That is, whether or not the network presence

is upstream or downstream of the Belgian affiliate does not affect the magnitude of the network effect, counter to the idea that the network effects are due to direct sales and purchases by commonly-owned affiliates within a global supply chain.

6 Conclusions

Firms affiliated with multinationals account for a disproportionately large share of international trade. Previous studies explain this dominance as the result of mechanisms that affect the affiliate at the time of acquisition: for examples, MNCs boost their affiliates' trade participation by increasing their productivity through transfers of technology or managerial know-how (e.g., Bloom *et al.*, 2012; Bircan, 2019) or by alleviating credit frictions (e.g., Harrison *et al.*, 2004; Manova *et al.*, 2015). In this paper, we identify a novel affiliate-country-specific mechanism: firms acquired by multinationals face lower trade frictions in and around the network of countries in which their parent has other affiliates.

We first provide some stylized facts on the overall effects of multinational ownership. Using rich administrative data from the National Bank of Belgium, we show that after being acquired by an MNC, firms are more likely to export and import, export to and import from more countries, and have higher total values of exports and imports. As the literature would suggest, non-trade outcomes are also affected, with acquired firms becoming larger and more productive. These results are robust to accounting for selection effects through re-weighting methods that allow us to create a group of untreated firms that is indistinguishable—in terms of the different moments (mean, variance, and skewness) of the distribution of a large set of observables—from the group of treated firms.

We next develop a model in which a firm exports to a country if doing so generates positive profits, and imports from a country if doing so minimizes their overall production costs. On the export side, we allow multinational ownership to increase export revenues and/or reduce the fixed entry costs in countries in which the parent has a presence. On the import side, multinational ownership can reduce the variable and fixed cost of importing from countries that belong to the multinational network. In the model, firm-specific effects of multinational acquisition, such as affiliate productivity increases or access to capital, are captured by firm-year fixed effects.

Combining the administrative NBB data with data on multinational networks constructed from various Bureau van Dijk datasets, we find evidence of network effects from MNC ownership at the extensive margin: new affiliates are more likely to start exporting to, and importing from, countries in which their parent has a presence. These effects explain a substantial share of the total variation in affiliates' trade participation in the

data, larger than the share explained by firm-specific effects (e.g., productivity increases due to transfers of R&D or managerial know-how). The results are robust to a broad set of alternative specifications and estimation approaches. Crucially, they also continue to hold when we exploit exogenous changes in multinational networks arising from M&A activities that change the organizational structure of the multinational group. We instead find no significant network effects on the intensive margin: new affiliates do increase the value of their exports to (and imports from) countries they were already trading with prior to the acquisition. These findings suggest that multinational ownership alleviates country-specific trade frictions that operate at the extensive margin of trade (e.g., entry costs associated with learning regulations in foreign markets).

We provide several additional results, which indicate that the effects are not confined to the boundaries of the multinational. First, we show that the network effects increase with the geographical or cultural distance between the foreign country and the country of the acquired firms (Belgium), suggesting that MNC ownership alleviates trade frictions that are related to gravity. If the effects were solely driven by global supply chains within the multinational, we would expect them to *decrease* with distance: new Belgian affiliates should be *less* likely to start exporting to and importing from other affiliates of their parent when these are further away from Belgium. Second, acquired firms are more likely to start trading not only with countries in which other affiliates are located, but also with countries that are close—but do not belong—to their parents' network. By definition, these effects cannot be driven by intra-MNC trade, since they involve countries in which the multinational parent has no subsidiaries. Further evidence that the effects are not confined to the boundaries of the multinational comes from looking at divestitures that result in some countries endogenously being dropped from the affiliates' network. We find that MNC network effects are persistent, i.e. affiliates continue trading with countries that used to belong to their MNC network. Finally, we find that the network effects do not depend on the relative position of affiliates along supply chains: the probability that an acquired firm starts exporting to (importing from) a country that belongs to its parental network does not depend on how upstream (downstream) its activities are relative to those of its parent's affiliates in that country.

Overall, our analysis shows that multinational ownership reduces entry frictions in and around the network of countries in which the parent has a presence, making it easier for affiliates to expand both their set of customers and suppliers. In ongoing work, we use our theoretical model and gravity estimates to quantify the importance of these network effects in explaining affiliates' output and employment growth.

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Appendices

A-1 Descriptive Statistics

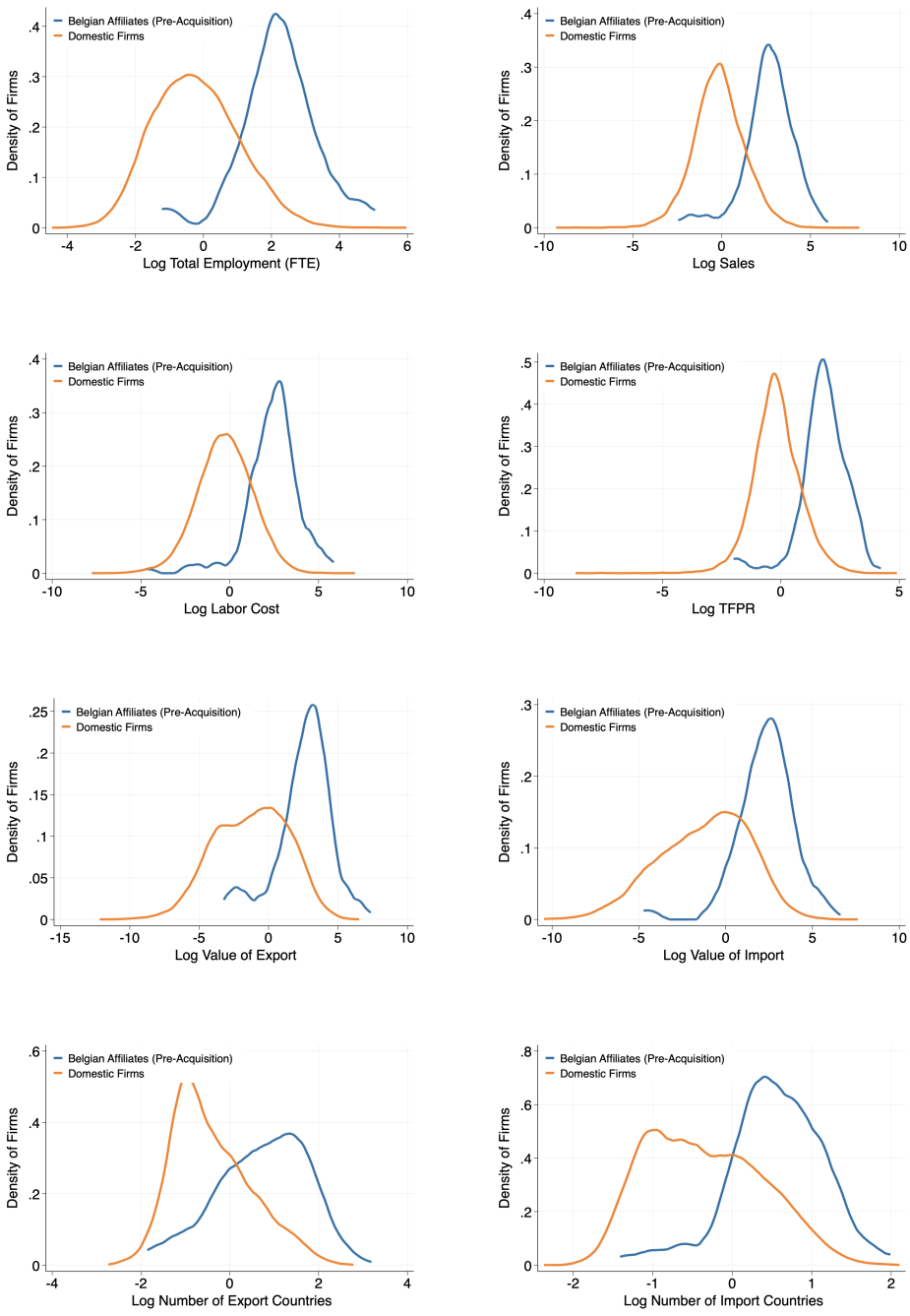
A-1.1 Acquired and Non-Acquired Firms

Table A-1
Distributions of Covariates of Treated (Acquired) and Untreated (Non-Acquired) Firms

Covariates	Mean Treat	Mean Control	Var. Treat	Var. Control	Skew. Treat	Skew. Control
Lag Log Fixed Assets	16.20	13.65	1.60	2.56	–0.03	–0.38
Lag Log Employees	4.93	3.19	1.08	1.37	–0.23	–0.38
Lag Log Sales	17.44	15.51	1.32	1.45	–0.09	0.11
Lag Log No. Export Countries	2.64	1.88	0.95	1.12	–0.35	–0.06
Lag Log No. Import Countries	2.32	1.69	0.30	0.58	–0.36	–0.64
Lag Log Exports	13.85	12.00	2.19	3.86	–0.88	–1.11
Lag Log Imports	13.46	11.56	1.75	3.64	0.08	–1.10
Growth Rate Sales	0.08	0.00	0.15	0.10	0.68	–3.11
Growth Rate Exports	–0.09	–0.03	1.45	1.15	–3.25	–0.09
Growth Rate Imports	0.02	–0.04	0.49	1.09	–1.02	–0.30
Growth Rate No. Export Countries	0.01	0.00	0.15	0.19	0.82	–0.13
Growth Rate No. Import Countries	0.03	–0.00	0.07	0.18	0.41	–0.17
Log Distance	7.78	7.41	0.55	0.85	–1.16	–0.55
Lag Log GDP Per Capita (PPP)	20.84	21.05	0.19	0.36	–0.13	–0.02
Longitude	15.22	13.69	160.77	306.94	–0.22	0.14
Latitude	39.90	42.56	72.95	65.63	–0.86	–1.35

The table reports the mean, variance, and skewness of firms' characteristics for the treated and control groups, after applying the entropy balance re-weighting algorithm of Hainmueller (2012). The weights assigned to treated and non-treated firms are constructed to equate the mean, variance, and skewness of all covariates. All the lagged variables refer to the year before the acquisition for firms in the treatment group and the year before the one in which they are controls for those in the control group. The same applies to variables in growth rates. Log Distance, Lag Log GDP per capita (PPP), Longitude, and Latitude refer to the characteristics of the countries with whom firms trade (export or import) in the year before the acquisition (if they are acquired) or in the year before the one in which they are controls (if they are not acquired).

Figure A-1
Acquired and Non-Acquired Firms



The figure shows empirical probability density functions of various outcomes (in logarithms and after de-meaning by industry-time). The orange lines refer to domestic-owned firms, whereas the blue lines to foreign-owned firms before the acquisition.

A-1.2 New Foreign Affiliates and their Multinational Network

Table A-2
Number of New Foreign Affiliates by Sector

Sector	
Agriculture, Mining and Quarrying (A1 - B9)	2
Automobile, Transport (C29 - C30)	8
Coke, Chemicals, Pharmaceuticals, Rubbers (C19 - C22)	40
Computer, Machinery, Equipment (C26 - C28)	13
Food, Beverages, Tobacco (C10 - C12)	20
Furniture and Other (C31- C33)	5
Mineral, Metal, Steel (C23 - C25)	19
Wood, Paper, Media (C16 - C18)	8

The table shows the number of new foreign affiliates by sector (1998-2014). Incumbent foreign-owned surviving firms are excluded.

Table A-3
Distribution of Foreign Equity

Mean	1st Pctile	25th Pctile	Median	75th Pctile	99th Pctile
89.118%	23.000%	88.294%	99.975%	100.000%	100.000%

Distribution of average equity of new foreign affiliates (across the years in which they are foreign owned). For affiliates with more than one DP, we average across years and parents.

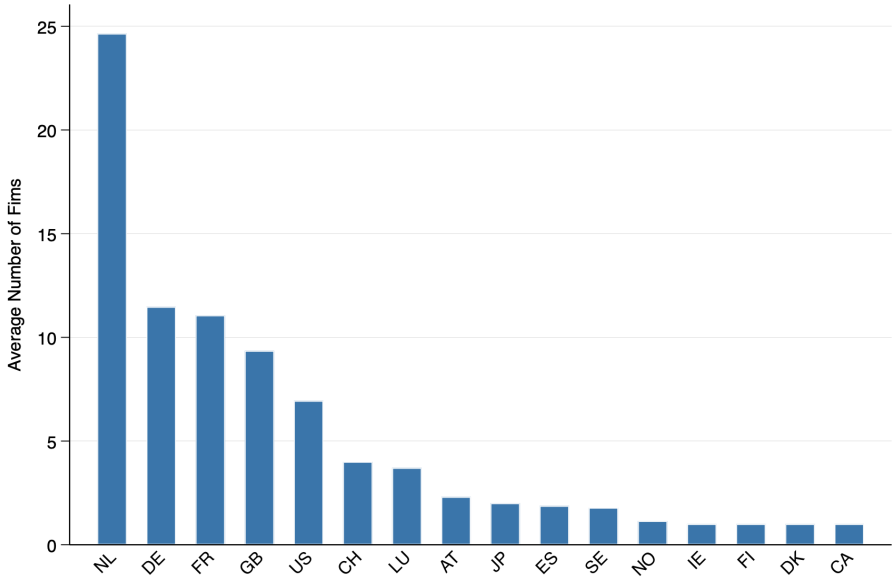
Table A-4
Parental Network of New Affiliates, Summary Statistics

Network of Direct Parents				
Mean	Median	Min	Max	Std. Dev.
9.44	3.00	1.00	75.00	14.33
Network of GUOs				
Mean	Median	Min	Max	Std. Dev.
24.65	18.00	1.00	103.00	23.41

The table reports summary statistics of the variable $Network\ Size_p$, for global and direct parents.

Figure A-2

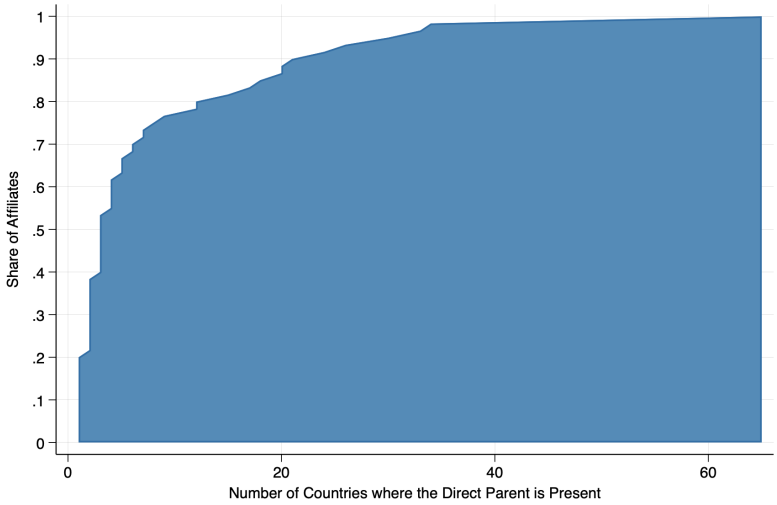
Number of Belgian Affiliates by Country of the DP



The figure shows the average number of Belgian affiliates by country of origin of the direct parent during 1998-2014.

Figure A-3

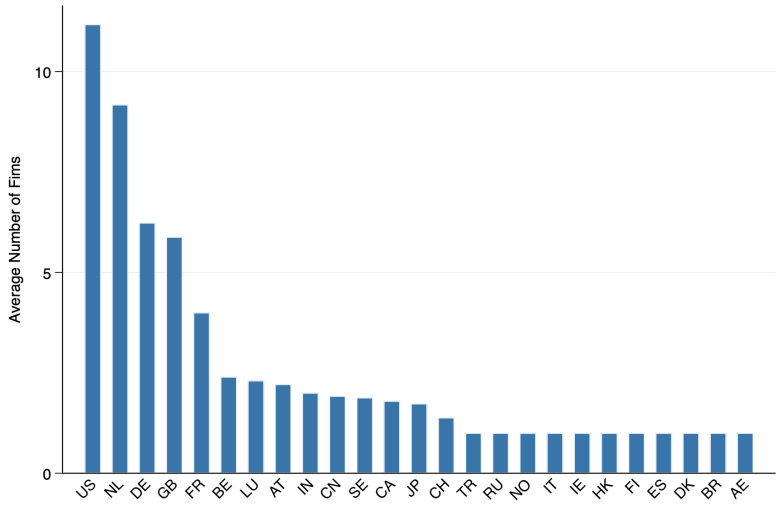
Share of Affiliates, by Number of Countries in the DP's Network



The figure plots the c.d.f. of the variable $Network\ Size_p$ for the direct parents of Belgian affiliates.

Figure A-4

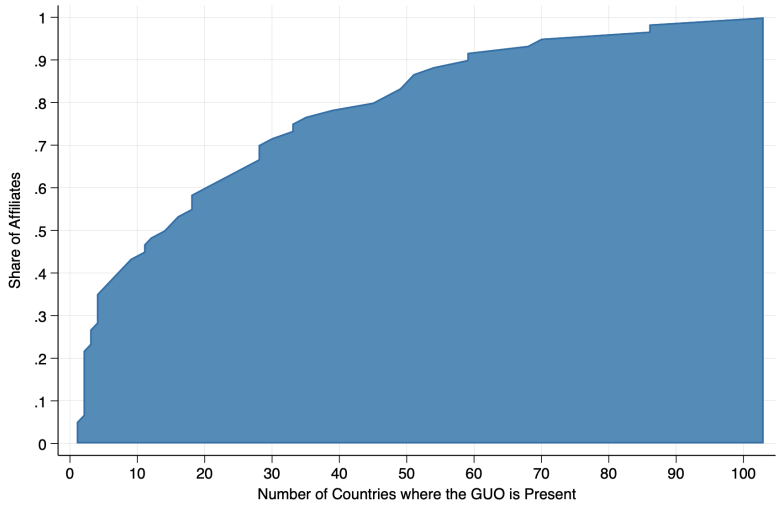
Average Number of Belgian Affiliates by Country of the GUO



The figure shows the number of Belgian affiliates by country of origin of the global ultimate owner.

Figure A-5

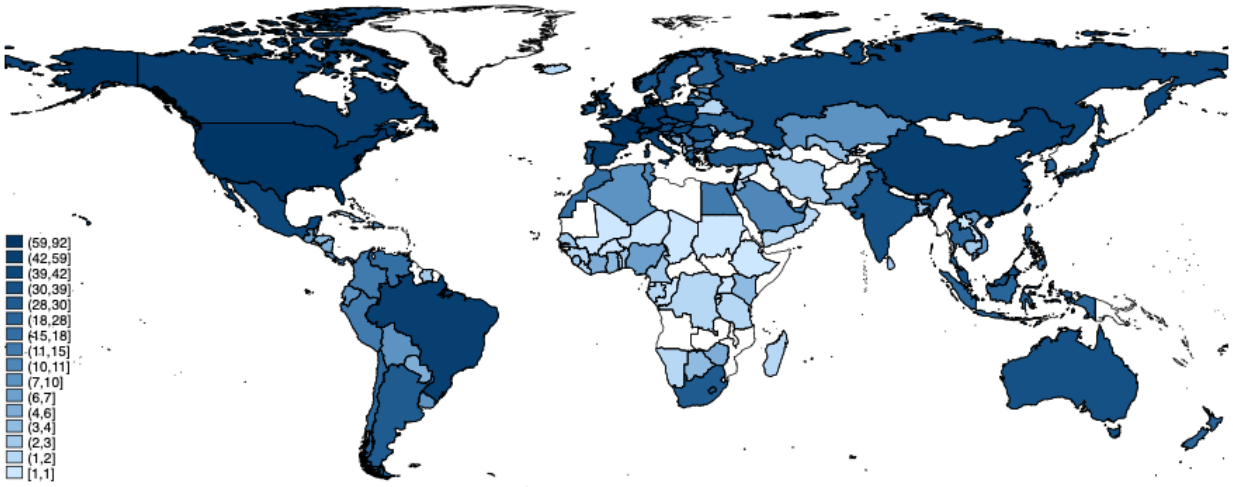
Share of Affiliates, by Number of Countries in the GUO's Network



The figure plots the c.d.f. of the variable *Network Size*$_p$ for the global ultimate owners of Belgian affiliates.

Figure A-6

Global Presence of GUOs of Belgian Affiliates



The figure shows the countries in which the global ultimate owners of Belgian affiliates have a presence.

A-2 MNC Ownership and Overall Trade Participation

A-2.1 Event Study

We estimate the following equation:

$$y_{it} = \sum_{s=-k_l}^{k_u} \theta_s MNC_{it}^s + \delta_i + \delta_t + \varepsilon_{it}. \tag{30}$$

y_{it} is the trade outcome variable of interest of firm i at time t, i.e., its export/import status, the number of countries to which the firm exports, of from which it imports, and the total value of its exports/imports.[38] MNC_{it}^s is a dummy variable identifying periods before and after the acquisition of firm i by a foreign multinational. k_l and k_u denote the first and last period for which MNC_{it}^s can be defined. δ_i and δ_t are respectively firm and year fixed effects. The coefficients θ_s measure the dynamic treatment effect, and we normalize $\theta_{-1} = 0$. Therefore, the estimated coefficients are relative to the year before the acquisition.[39]

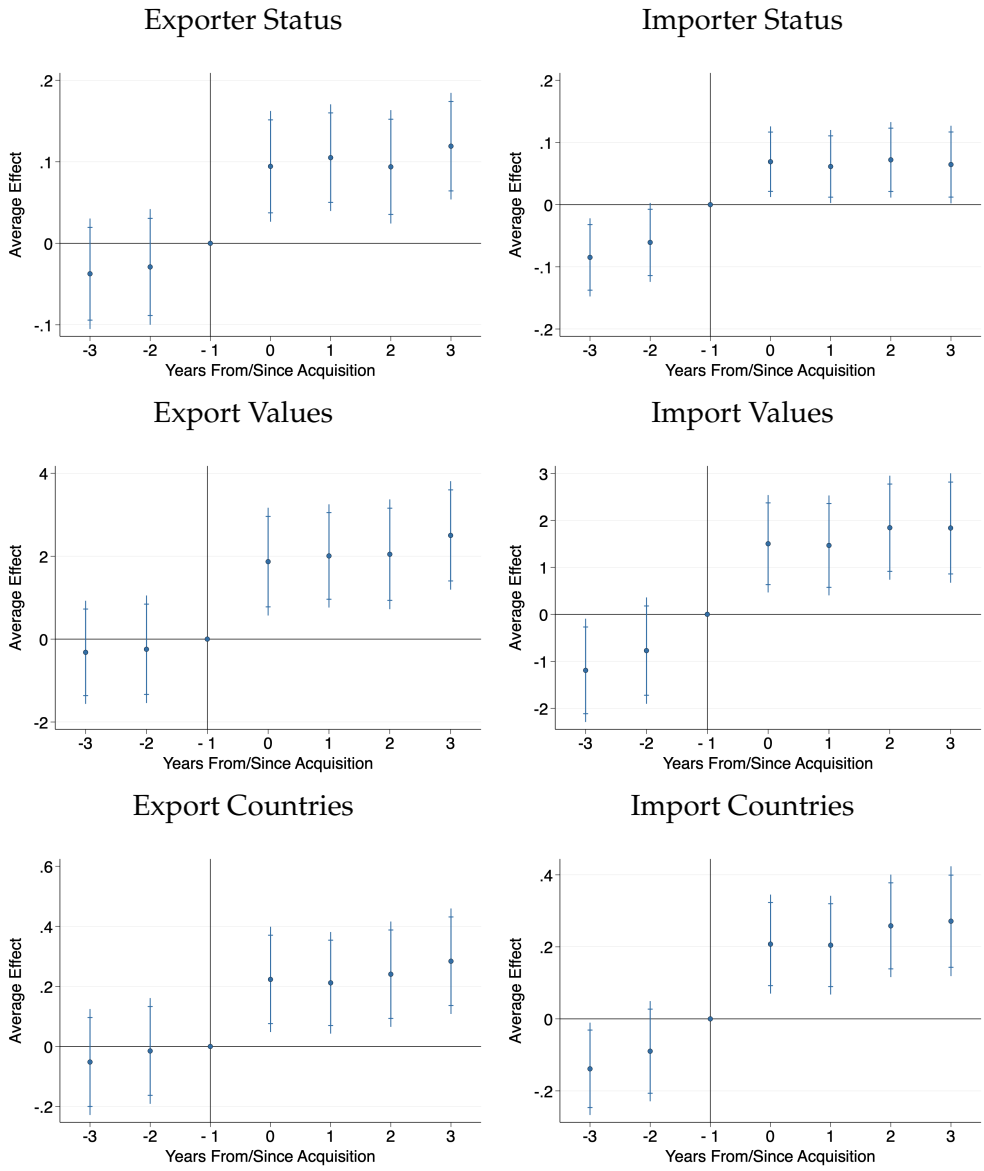
The recent literature surveyed by de Chaisemartin and D'Haultfœuille (2023) emphasizes that estimating event studies with a two-way fixed-effects (TWFE) estimator may fail to recover the treatment effect when the roll-out is staggered and treatment effects are time-varying. We deal with this concern by using the method proposed by Sun and Abraham (2021), which entails estimating cohort-specific dynamic treatment effects and aggregating them using the size of each cohort as a weight. We estimate equation (30) using all firms in the sample. The θ_s coefficients are identified under the assumption that never acquired and not-yet-acquired firms are a credible counterfactual for acquired ones, conditional on the fixed effects.

The results are reported in Figure A-7. Compared to never- and not-yet-treated firms, acquired firms increase the probability of any exporting (importing) by around 10 percentage points (7 percentage points). Additionally, they increase average export (import) values by approximately 6 (3.5) times and the number of export (import) markets by around 22% (25%).

[38] When looking at the number of countries a firm trades with or the total of its exports and imports, the dependent variable is $\log(1 + y_{it})$. This allows us to include observations in which $y_{it} = 0$, accounting for the fact that acquired and non-acquired firms do not always trade. The results are robust to using the inverse hyperbolic sine transformation of these variables. Unlike the log transformation, the inverse hyperbolic sine is defined at zero (Burbidge *et al.*, 1988; MacKinnon and Magee, 1990). The PPML estimator often used in the gravity literature to account for zeros (e.g., Santos Silva and Tenreyro, 2006) cannot be used to consistently estimate event-study specifications with staggered treatment roll-out and potentially time-varying treatment effects.

[39] In line with Alfaro-Ureña *et al.* (2022), in our baseline specifications, we use heteroskedasticity-robust standard errors. The results continue to hold if we cluster standard errors by firm.

Figure A-7
Event Studies



The figure reports the results of estimating (30) using different outcome variables. There are 280,101 observations. 90% and 95% confidence intervals are based on heteroskedasticity-robust standard errors.

A key concern with the event studies is that selection effects—observed or unobserved time-varying firm-level shocks that are correlated with the acquisition and the trade variables—are biasing the results. This concern is particularly relevant for the import variables, for which Figure A-7 shows significant pre-trends. In Section 3, we show that the results are robust to using reweighting methods to account for selection effects.

A-2.2 Re-weighting

Table A-5

Distributions of Covariates of Treated and Untreated Firms, After Re-Weighting (Entropy Balancing)

Covariates	Mean Treat	Mean Control	Var. Treat	Var. Control	Skew. Treat	Skew. Control
Lag Log Fixed Assets	16.20	16.20	1.60	1.60	–0.03	–0.03
Lag Log Employees	4.93	4.93	1.08	1.08	–0.23	–0.23
Lag Log Sales	17.44	17.44	1.32	1.32	–0.09	–0.09
Lag Log No. Export Countries	2.64	2.64	0.95	0.95	–0.35	–0.35
Lag Log No. Import Countries	2.32	2.32	0.30	0.30	–0.36	–0.36
Lag Log Exports	13.85	13.85	2.19	2.19	–0.88	–0.88
Lag Log Imports	13.46	13.46	1.75	1.75	0.08	0.08
Growth Rate Sales	0.08	0.08	0.15	0.15	0.68	0.68
Growth Rate Exports	–0.09	–0.09	1.45	1.45	–3.25	–3.25
Growth Rate Imports	0.02	0.02	0.49	0.49	–1.02	–1.02
Growth Rate No. Export Countries	0.01	0.01	0.15	0.15	0.82	0.82
Growth Rate No. Import Countries	0.03	0.03	0.07	0.07	0.41	0.41
Log Distance	7.78	7.78	0.55	0.55	–1.16	–1.16
Lag Log GDP Per Capita (PPP)	20.84	20.84	0.19	0.19	–0.13	–0.13
Longitude	15.22	15.22	160.77	160.77	–0.22	–0.22
Latitude	39.90	39.90	72.95	72.95	–0.86	–0.86

The table reports the mean, variance, and skewness of firms' characteristics for the treated and control groups, after applying the entropy balance re-weighting algorithm of Hainmueller (2012). The weights assigned to treated and non-treated firms are constructed to equate the mean, variance, and skewness of all covariates. All the lagged variables refer to the year before the acquisition for firms in the treatment group and the year before the one in which they are controls for those in the control group. The same applies to variables in growth rates. Log Distance, Lag Log GDP per capita (PPP), Longitude, and Latitude refer to the characteristics of the countries with whom firms trade (export or import) in the year before the acquisition (if they are acquired) or in the year before the one in which they are controls (if they are not acquired).

Table A-6

Distributions of Non-Targeted Covariates of Treated and Untreated Firms, After Re-Weighting (Entropy Balancing)

Covariates	Mean Treat	Mean Control	Var Treat	Var. Control	Skew. Treat	Skew. Control
Lag Log No. Import Products	1.48	1.36	0.81	0.72	–0.17	–0.16
Lag Log No. Export Products	0.76	0.77	0.68	0.83	–0.25	0.14
Lag Log No. Import Products (DE)	2.79	2.76	1.20	1.22	–0.00	–0.26
Lag Log No. Import Products (FR)	2.12	2.32	1.32	1.16	–0.06	–0.21
Lag Log No. Import Products (GB)	1.74	1.46	1.11	1.05	0.02	0.44
Lag Log No. Import Products (NL)	2.95	3.00	1.46	1.31	–0.56	–0.22
Lag Log No. Import Products (US)	1.75	1.48	1.47	1.72	0.21	0.52
Lag Log No. Import Products (JP)	0.82	1.20	0.92	2.07	1.24	1.30
Lag Log No. Export Products (DE)	1.38	1.46	1.22	1.35	0.54	0.59
Lag Log No. Export Products (FR)	1.46	1.65	1.49	1.46	0.34	0.44
Lag Log No. Export Products (GB)	1.21	1.24	1.12	1.17	0.57	0.70
Lag Log No. Export Products (NL)	1.70	1.70	1.67	1.44	0.43	0.53
Lag Log No. Export Products (US)	1.18	1.22	0.83	1.26	0.38	0.95
Lag Log No. Export Products (JP)	0.71	0.95	0.48	1.10	0.51	1.00
Lag Log Imports (DE)	14.44	14.35	3.88	4.14	–0.38	–0.60
Lag Log Imports (FR)	13.42	13.87	6.13	4.68	–0.88	–0.75
Lag Log Imports (GB)	12.67	12.30	4.20	6.68	–0.27	–0.32
Lag Log Imports (NL)	14.05	14.31	5.14	4.75	–0.23	–0.59
Lag Log Imports (US)	12.21	11.93	7.19	10.13	–0.09	–0.12
Lag Log Imports (JP)	11.50	11.79	8.09	12.67	–0.39	0.16
Lag Log Exports (DE)	14.04	14.33	8.90	6.15	–1.13	–0.91
Lag Log Exports (FR)	14.42	14.96	7.59	4.66	–1.83	–1.02
Lag Log Exports (GB)	13.43	13.92	8.07	6.45	–1.16	–0.95
Lag Log Exports (NL)	14.65	14.67	6.39	5.09	–0.95	–1.03
Lag Log Exports (US)	12.41	13.05	8.88	8.52	–0.43	–0.06
Lag Log Exports (JP)	11.78	12.15	4.10	7.77	–0.23	–0.02

The table shows the mean, variance, and skewness of non-targeted firms' characteristics for the treated and control group after using the entropy balance re-weighting algorithm of Hainmueller (2012).

Table A-7

Distributions of Covariates of Treated and Untreated Firms, After Re-Weighting (Inverse Probability Re-Weighting)

Covariates	Mean Treat	Mean Control	Var. Treat	Var. Control	Skew. Treat	Skew. Control
Lag Log Fixed Assets	16.20	16.26	1.60	2.32	–0.03	0.56
Lag Log Employees	4.93	4.95	1.08	1.27	–0.23	0.29
Lag Log Sales	17.44	17.45	1.32	2.08	–0.09	–1.01
Lag Log No. Export Countries	2.64	2.67	0.95	1.10	–0.35	–0.37
Lag Log No. Import Countries	2.32	2.34	0.30	0.37	–0.36	–0.56
Lag Log Exports	13.85	13.83	2.19	2.08	–0.88	–0.89
Lag Log Imports	13.46	13.45	1.75	1.80	0.08	–0.04
Growth Rate Sales	0.08	0.10	0.15	0.29	0.68	7.75
Growth Rate Exports	–0.09	–0.08	1.45	0.82	–3.25	–3.17
Growth Rate Imports	0.02	0.01	0.49	0.45	–1.02	–1.24
Growth Rate No. Export Countries	0.01	0.02	0.15	0.15	0.82	0.64
Growth Rate No. Import Countries	0.03	0.03	0.07	0.07	0.41	0.41
Log Distance	7.78	7.78	0.55	0.46	–1.16	–0.98
Lag Log GDP Per Capita (PPP)	20.84	20.85	0.19	0.26	–0.13	–0.78
Longitude	15.22	15.26	160.77	164.61	–0.22	0.05
Latitude	39.90	39.85	72.95	69.86	–0.86	–0.54

The table reports the mean, variance, and skewness of firms' characteristics for the treated and control groups, after applying the inverse probability re-weighting algorithm of Guadalupe *et al.* (2012). The weights assigned to treated and non-treated firms are constructed to equate the mean, variance, and skewness of all covariates. All the lagged variables refer to the year before the acquisition for firms in the treatment group and the year before the one in which they are controls for those in the control group. The same applies to variables in growth rates. Log Distance, Lag Log GDP per capita (PPP), Longitude, and Latitude refer to the characteristics of the countries with whom firms trade (export or import) in the year before the acquisition (if they are acquired) or in the year before the one in which they are controls (if they are not acquired).

Table A-8

MNC Ownership and Trade Participation (No Re-Weighting)

	(1)	(2)	(3)
	Exporter Dummy	Export Values	Export Countries
MNC_{it}	0.127***	2.259***	0.263***
	(0.010)	(0.206)	(0.034)
	(4)	(5)	(6)
	Importer Dummy	Import Values	Import Countries
MNC_{it}	0.095***	1.904***	0.319***
	(0.009)	(0.190)	(0.026)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Estimator	OLS	OLS	OLS
Re-weighting	No	No	No
Observations	93,171	93,171	93,171

The table reports the results of estimating equation (1) without re-weighting the observations for treated and non-treated firms. Heteroscedasticity robust standard errors in parenthesis. Significance levels: *** 0.01, ** 0.05, * 0.1.

Table A-9

MNC Ownership and Trade Participation (Inverse Probability Re-Weighting)

	(1)	(2)	(3)
	Exporter Dummy	Export Values	Export Countries
MNC_{it}	0.043***	0.722***	0.099**
	(0.013)	(0.268)	(0.046)
	(4)	(5)	(6)
	Importer Dummy	Import Values	Import Countries
MNC_{it}	0.034***	0.743***	0.112***
	(0.010)	(0.229)	(0.034)
Firm FE	Yes	Yes	Yes
Year FME	Yes	Yes	Yes
Estimator	OLS	OLS	OLS
Re-weighting	Yes	Yes	Yes
Observations	93,171	93,171	93,171

The table reports the results of estimating equation (1). We compute the weights as a function of all the observables in Table A-5 using the Inverse Probability Re-Weighting (IPW) estimator. Heteroscedasticity robust standard errors in parenthesis. Significance levels: *** 0.01, ** 0.05, * 0.1.

Table A-10

MNC Ownership and Other Firm-Level Outcomes
(Entropy Balance Re-Weighting)

	(1)	(2)	(3)	(4)
	Employment	Sales	Value Added	Productivity
MNC_{it}	0.198***	0.323***	0.199***	0.168***
	(0.037)	(0.059)	(0.041)	(0.047)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Estimator	OLS	OLS	OLS	OLS
Re-weighting	Yes	Yes	Yes	Yes
Observations	71,979	75,645	73,964	71,347

The table reports the results of estimating (1). The dependent variable is the log of $Employment_{f,t}$, $Sales_{f,t}$, $Value\ Added_{f,t}$, and $TFRP_{f,t}$. We compute the entropy balance weights as a function of all the observables in Table A-5. Heteroscedasticity robust standard errors in parenthesis. Significance levels: *** 0.01, ** 0.05, * 0.1.

Table A-11

MNC Ownership and Other Firm-Level Outcomes (No Re-Weighting)

	(1)	(2)	(3)	(4)
	Employment	Sales	Value Added	Productivity
MNC_{it}	0.244***	0.473***	0.354***	0.198***
	(0.037)	(0.059)	(0.041)	(0.047)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Estimator	OLS	OLS	OLS	OLS
Re-weighting	Yes	Yes	Yes	Yes
Observations	71,979	75,645	73,964	71,347

The table reports the results of estimating equation (1) without re-weighting the observations for treated and non-treated firms. The dependent variable is the log of $Employment_{f,t}$, $Sales_{f,t}$, $Value\ Added_{f,t}$, and $TFRP_{f,t}$. Heteroscedasticity robust standard errors in parenthesis. Significance levels: *** 0.01, ** 0.05, * 0.1.

A-3 Network Effects of MNC Ownership

A-3.1 Decomposing Variation in Export and Import Entry

We employ the Shapley decomposition to decompose the variance of $Entry_{ict}$ in equation (23) into its components, identifying the contribution of MNC network effects and each fixed effect. Intuitively, this method allows us to identify the contribution of each covariate in explaining the variance of a regression outcome of interest in two steps. In the first, it iteratively calculates all the possible ways of decomposing the outcome of interest by eliminating each covariate at once. In the second, it takes the average of the contributions of the covariate.

Because the original method does not accommodate high-dimensional fixed effects as in equation (23), we modify it and proceed in two steps:

1. We regress $Entry_{ict}$ on FE_{ic}, FE_{ct}, and FE_{it} and store the predicted fixed effects (denoted by $\widehat{FE}_{ic}$, $\widehat{FE}_{ct}$, and $\widehat{FE}_{it}$);

2. We regress $Entry_{ict}$ on $MNC_{i(p)t} \times In\ MNC\ Network_{cp}$, $\widehat{FE}_{ic}$, $\widehat{FE}_{ct}$, and $\widehat{FE}_{it}$ and apply the Shapley decomposition treating each estimated set of fixed effects as a distinct variable.

We employ this procedure to decompose the probability of export and import entry. The results reported in Table A-12 show that gravity, captured by firm-country fixed effects, explains the largest share of the variance (around 90%). MNC network effects explain a larger share of the remaining variation than firm-year and country-year fixed effects.

Table A-12
Shapley Decomposition of the Probability of Trade Entry

Firm-Country FE	Country-Year FE	Firm-Year FE	MNC x in MNC
	Export Entry		
90.71%	2.16%	3.22%	3.91%
	Import Entry		
89.08%	3.66%	1.50%	5.76%

Each column shows the percentage contribution of a factor to explaining the variance of the outcome variable (the probability of export or import entry).

A-3.2 Additional Results and Robustness Checks

Table A-13
Network Effects of MNC Ownership (Network of the GUO)

	(1)	(2)
	Export Entry	Import Entry
$MNC_{i(p)t} \times In\ MNC\ Network_{cp}$	0.033***	0.027***
	(0.004)	(0.004)
Firm-Country FE	Yes	Yes
Firm-Year FE	Yes	Yes
Country-Year FE	Yes	Yes
Observations	202,924	202,924
Estimator	OLS	OLS

The table reports the results of estimating equation (23). In column 1, the dependent variable is $Export\ Entry_{i(p)ct}$, a dummy variable equal to 1 from the first year t in which firm i (with GUO p) exports to country c. In column 2, the dependent variable is $Import\ Entry_{i(p)ct}$, a dummy variable equal to 1 from the first year t in which firm i (with GUO p) imports from country c. Heteroscedasticity robust standard errors in parenthesis. Significance levels: *** 0.01, ** 0.05, * 0.1.

Table A-14
Network Effects of MNC Ownership (Logit Model)

	(1)	(2)
	Export Entry	Import Entry
$MNC_{i(p)t} \times In\ MNC\ Network_{cp}$	0.066***	0.058**
	(0.022)	(0.023)
Firm-Country FE	Yes	Yes
Firm-Year FE	Yes	Yes
Country-Year FE	Yes	Yes
Observations	236,256	236,256
Estimator	Logit	Logit

The table reports the results of estimating equation (23). In column 1, the dependent variable is $Export\ Entry_{i(p)ct}$, a dummy variable equal to 1 from the first year t in which firm i (owned by parent p) exports to country c. In column 2, the dependent variable is $Import\ Entry_{i(p)ct}$, a dummy variable equal to 1 from the first year t in which firm i (owned by parent p) imports from country c. Heteroscedasticity robust standard errors in parenthesis. Significance levels: *** 0.01, ** 0.05, * 0.1.

Table A-15
Network Effects of MNC Ownership (Excluding Tax Havens)

	(1)	(2)
	Export Entry	Import Entry
$MNC_{i(p)t} \times In\ MNC\ Network_{cp}$	0.027***	0.013**
	(0.007)	(0.007)
Firm-Country FE	Yes	Yes
Firm-Year FE	Yes	Yes
Country-Year FE	Yes	Yes
Observations	194,304	194,304
Estimator	OLS	OLS

The table reports the results of estimating equation (23). In column 1, the dependent variable is $Export\ Entry_{i(p)ct}$, a dummy variable equal to 1 from the first year t in which firm i (owned by parent p) exports to country c. In column 2, the dependent variable is $Import\ Entry_{i(p)ct}$, a dummy variable equal to 1 from the first year t in which firm i (owned by parent p) imports from country c. The sample excludes countries classified as tax haven countries by Dharmapala and Hines (2009). Heteroscedasticity robust standard errors in parenthesis. Significance levels: *** 0.01, ** 0.05, * 0.1.

Table A-16
Network Effects of MNC Ownership: Intensive Margin

	(1)	(2)
	Export Entry	Import Entry
$MNC_{i(p)t} \times In\ MNC\ Network_{cp}$	0.040	-0.157
	(0.090)	(0.098)
Firm-Country FE	Yes	Yes
Firm-Year FE	Yes	Yes
Country-Year FE	Yes	Yes
Observations	15,942	10,448
Estimator	OLS	OLS

The table reports the results of estimating equation (23). In column 1, the dependent variable is $\log Exports_{i(p)ct}$, the value of exports of firm i (owned by parent p) to country c in year t. In column 2, the dependent variable is $\log Imports_{i(p)ct}$, the value of imports of firm i (owned by parent p) from country c in year t. The sample is restricted to countries firm i was already trading with before being acquired. Heteroscedasticity robust standard errors in parenthesis. Significance levels: *** 0.01, ** 0.05, * 0.1.