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German Firms in International Trade: Evidence from Recent Microdata

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Abstract: In this paper, we zoom in on the firm level of German merchandise foreign trade, using a novel data base with information on the export and import value by firm, country, product and year for the period 2011–2019. Problems arising from the consolidated reporting of taxable entities and the reporting thresholds present in intra-EU trade have been largely eliminated through redistributions conducted by DESTATIS. Using the data, we examine how *global* German firms are by looking at the joint distribution of the number of products they trade and the number of countries they trade with. Moreover, we examine the importance of firms mainly engaged in trade intermediation, as opposed to production. Most importantly, we provide a rich description of heterogeneity among German firms by decomposing their trade relationships into intensive margins (value of trade) and extensive margins (number of firms, products and countries). We describe the distributions for each margin, distinguishing intra-EU and extra-EU trade as well as different firm types (producers, wholesalers, retailers). Finally, we reveal strong positive correlations between and

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within importing and exporting margins, supporting the presence of firm-level complementarities implied by recent theory.

Keywords: firm-level data; Germany; trade intermediation; trade statistics

JEL Classification: F14; F23

1 Introduction

Detailed customs-transaction data has been used to explore various aspects of firm heterogeneity in trade for a number of countries, most notably for the US in 1997 and 2007 by Bernard et al. (2007, 2018) and for France in 2003 by Mayer and Ottaviano (2008).¹ Wagner (2016a, 2019, 2021) has used earlier versions of German firm-level trade data to answer a whole array of specific questions related to firm heterogeneity.² He was also among the first to examine exporter premia among German firms, see Bernard and Wagner (1997) and Schank et al. (2007).

In this paper, we use a new transaction-level³ data set generated by the Federal Statistical Office of Germany (DESTATIS) in order to describe, in a consistent and theory-guided manner, what we believe are important characteristics of firm heterogeneity in German foreign trade. More specifically, we examine the distributions of exporting and importing activity of German firms along several intensive and extensive margins. A unit of observation in our data is a foreign trade transaction of a certain firm including information on the direction (export, import), the transaction value, the country of destination and origin, respectively, and the product involved according to eight-digit HS.⁴ This allows us to decompose German exports as well as imports into the intensive and extensive margins along three different dimensions: the firm dimension, the country dimension and the product dimension.

¹ The first studies exploring firm-level trade are Bernard and Jensen (1995, 1999). Békés et al. (2011) present evidence for Hungary. Manova and Zhang (2009) analyse similar data for China.

² Among other topics, Joachim Wagner has used earlier German transaction data to investigate the extensive margins of trade in manufacturing (Wagner 2018), the short run dynamics of trade (Wagner 2016b), firm productivity (Wagner 2012), firm age (Wagner 2015), innovation activity (Wagner 2017a), firm profits (Wagner 2014), the trade impact of the distance to destination countries (Wagner 2017b), and the lumpiness of trade (Wagner 2016c).

³ When using the term “transaction”, we refer to the sum of exports or imports of a certain product by a certain German firm to or from a certain country within a certain time frame. In other words, if a firm exports the same product to the same country within the same period more than once, we will observe only the sum of these transactions.

⁴ Technically, the Harmonized System (HS) product codes are only defined up to six digits. Eight-digit HS thus refers to the German “Warenverzeichnis für die Außenhandelsstatistik” based on the European Union’s Combined Nomenclature.

In focusing on these cross-sections we identify key features of firm heterogeneity in German foreign trade. We mainly focus on 2019, which is an obvious choice: It is the most recent year available in our data set as well as the most recent year not yet affected by the Covid-19 pandemic, by Brexit or by other current events. Nonetheless, we also identify salient differences between 2019 and the same cross sections for 2011. The full set of results for 2011 is provided in a separate Appendix.

A special purpose of our analysis is to examine differences between German firms' trade with the 27 European Union (EU) partner countries (as of 2019) and external trade with non-EU countries. Any such comparison is potentially hampered by different reporting procedures for intra- and extra-EU trade. Since all intra-EU trade is free of tariffs, intra-EU trade data cannot be collected relying on customs procedures but must be collected through a separate procedure. To avoid the bureaucratic burden for small firms, firm-level reporting of intra-EU trade is subject to a minimum threshold-level. Obviously, no such threshold is present for extra-EU trade which is collected on the basis of customs procedures. This causes a potential selection problem. Fortunately, recent work by DESTATIS (see Kruse et al. 2021) allows us to circumvent this problem for most of our analysis, as we detail in Section 2.

A further goal of our analysis is to shed light on the role of trade intermediation in German firms' foreign trade. Merging our trade data with company register data, we can identify each trading firm's main economic activity according to the Statistical Classification of Economic Activities in the European Community (NACE, Rev. 2).⁵ In particular, we distinguish manufacturing firms, wholesale firms and retail firms, and we single out wholesale, retail and maintenance of vehicles. A residual category, labeled as "other" has firms whose main activity is in agriculture, forestry, mining and quarrying, or other services. Our focus on this type of firm categorization is motivated by the theoretical expectation that the use of trade intermediation through wholesalers or retailers is differently important across both, countries and products, as emphasized by Bernard et al. (2010, 2015).

We want to examine whether the salient features of the country and product distribution of trade by these firm types in our new data set are in line with expectations from theory.

Finally, inspired by Bernard et al. (2018), we explore the prevalence of "global firms" in German foreign trade, meaning firms that are active traders along multiple margins. More specifically, being a more global firm involves exporting more products to more foreign markets and, perhaps more importantly, being an importer as well as an exporter.

5 The German version thereof is called "Klassifikation der Wirtschaftszweige 2008" (WZ 2008).

The literature on global firms (see Antràs et al. 2017; Bernard et al. 2018) suggests many interesting directions for empirical research. We take a first step in computing the numbers of German *pure* exporters, *pure* importers and *two-way* traders. We do so for total as well as extra-EU and intra-EU trade, and we also compute the number of firms active in both within-EU and extra-EU markets. To characterize the breadth of internationalization among German firms we calculate the joint distribution of both, the number of firms and trade values per firm along two dimensions, the number of partner countries and the number of products traded. The literature also suggests that if firms are operating on multiple margins of trade we should observe positive correlation among firms between different margins. In particular, positive correlation should obtain also between margins for exports and margins for imports. We therefore calculate a full set of correlation coefficients between all intensive and extensive margins.

Among the many findings of our calculations, the following are perhaps the most interesting. First, the number of firms active in importing is much larger than the number of exporting firms, by a factor of 2.6 for a simple count and by a factor of 7 if we identify pure importers and pure exporters. Of a total number of roughly 790,000 trading firms, a share of 25 % (or 201,000) is trading both ways, as importers and exporters. However, the number of firms trading both ways and active both within the EU and outside, “truly global” firms if you will, is relatively small: 30,302 (under 4 % of all trading firms). The share of two-way traders is generally larger for manufacturing and wholesale firms than for other firm types, and within these two firm types it is larger for extra-EU trade than for intra-EU trade.

A second interesting result relates to the joint distribution of firms over the number of countries that firms serve as exporters and the number of products they export. Looking at the number of firms, this distribution has a striking mass point at 1-product-1-country, equal to more than 50 % for both imports and exports. No such mass point, however, occurs if we look at the distribution of trade values. Indeed, here we find opposite mass points for more than 10 products and countries, and these are even larger (84 % for exports and 76.5 % for imports).

A third result relates to trade intermediation. The share of firms trading as intermediaries is larger for exports than for imports and larger for extra-EU trade than for intra-EU trade, which is consistent with the idea that intermediation serves a more useful purpose for high destination-specific fixed entry costs and a weaker contracting environment; see Bernard et al. (2015). Looking at trade volumes in addition to the number of firms, we find that the average trade value for manufacturing traders is much larger than the aggregate of all firms, by a factor of 3.0 for exports and a factor of 3.4 for imports. They also trade more per firm than do

wholesale traders, particularly for exports if less so for imports. A further interesting result is that German firms active in trade intermediation generate a trade deficit, which means that German intermediaries are engaged in helping foreign goods find (German) consumers, more than in helping German goods find foreign consumers. The aggregate German trade surplus is generated exclusively by manufacturing firms.

Fourth, regarding the products traded, we find that German exports as a whole to be quite broadly spread across products. We look at 22 different product categories and find that within these categories, Germany exports virtually all of the HS eight-digit products, the major exceptions being Animals and Food. And pretty much the same holds also for German imports. As expected, machinery is in the lead as regards the number of exporting firms, at least if we look at total exports. Within the dominating categories of German exports (machinery and vehicles) by far the largest share of exports is accounted for by exports through producers directly (79 and 88 %, respectively). This share is lowest (below 50 %) for minerals, textiles, leather and footwear. Thus, intermediaries seem to play a larger role in products involving a relatively low degree of customization where detailed knowledge about specific product characteristics (available only to the producer) is less important.

Our margin decomposition reveals that the distributions are heavily skewed towards the right for all margins, for exports and imports, and for intra-EU as well as extra-EU trade. But it holds true more for imports than for exports and more for the intensive margins (values per firm) than the extensive margins (number of products or countries per firm). For instance, for total export values per manufacturing firm, we find a mean 75 times the median for exports, whereas for imports the ratio is 221!⁶ For the extensive product margin, we find ratios of 7.7 (exports) and 11.5 (imports). By and large these ratios are also larger for extra-EU trade than for intra-EU trade. Comparing across firm types, it is not generally true, as perhaps expected, that the skewness is more pronounced for manufacturing traders, compared to wholesale and retail traders.

Finally, we find all correlation coefficients between different margins to be positive. But there is a distinct pattern. For extensive margins (number of countries and products), we find coefficients close to unity if we look at exports or imports. Values around 0.8 are found for correlations between these extensive and the corresponding (i.e. same direction of trade) intensive margins. Values around 0.6

⁶ See Tables A.20 and A.21 in Appendix. These ratios may seem somewhat excessive, which is likely due to a large presence of very small transaction values. This may be subject to change in the final version of the data.

are found for the correlation for extensive margins between exports and imports. And somewhat lower, but still significantly positive values emerge for correlations between extensive margins of one direction (imports or exports) and intensive margins of the opposite directions. Thus, our results are in line with the theory suggesting that higher productivity firms export more products to more destinations and use those additional profits to incur the fixed costs of adding new import suppliers. In other words, there is a complementary relationship between different margins: firms that export more tend to export more products to more countries, but also generally import more products from more countries. However, the intensive margin correlation between export and import values is rather weak, with a coefficient value of only 0.11.

The paper is structured as follows. We start out in Section 2 with a short, but comprehensive description of our data, and a discussion of data limitations. In Section 3, we ask just how global German trading firms are, judged by whether they are both importers and exporters as well as by the number of countries they export to, or import from. In Section 4, we zoom in on trade of different firm types, distinguishing between producers and wholesale or retail traders. This allows us to portray a picture on the role of intermediation in German foreign trade. Section 5 adds the product dimension to our analysis, ultimately answering the question “who trades what”. Section 6 presents a full decomposition of both German exports and imports into so-called intensive (regarding values) and extensive (regarding counts) margins along both the partner-country and the product dimensions. The main purpose of this section is a thorough analysis of the skewness of distributions at the various margins. Finally, in Section 7, we calculate correlation coefficients between different extensive and intensive margins at the firm level.

Throughout all of these sections we rely on diagrams, with the accompanying tables presented in Appendix. Moreover, for almost all results, we also discuss differences between intra-EU and extra-EU trade, details of which we again mostly relegate to Appendix.

2 German Firm-Level Trade Data

The data used in this paper were prepared by the Federal Statistical Office of Germany (DESTATIS) in a research project financed by the German Federal Ministry for Economic Affairs and Climate Action and will in due course be made accessible for the scientific community.

Our main data set contains detailed data on German export and import transactions and has been made available in the Research Data Center of the Federal Statistical Office as AFiD-Panel Außenhandelsstatistik (AFiD-Panel Foreign Trade Statistics, henceforth AHS-Panel).^{7,8} For each transaction, we can identify the year, the trading German firm, the trade direction (import, export), the country of origin or destination, the HS eight-digit product code and the transaction value.⁹ The data currently spans the time period 2011–2019, with more recent years planned to be added as they become available. A major purpose of the project is to merge AHS-Panel with other data sets containing a host of firm-level covariates, such as total sales, employment or sector of activity. For this paper, we merge statistical business register data (URS: “Unternehmensregister-System”) in order to identify each trading firm’s primary sector of activity, which allows us to address trade intermediation by separating producers from wholesalers and retailers.

When collecting and preparing the data, two fundamental issues arise, both having to do with reporting practices. In Germany, firms’ trade reporting is connected to their value-added-tax (VAT) reporting. If firms engage in consolidated reporting, then trading activities are similarly reported in a consolidated fashion. That is, the VAT-reporting company summarily reports trading activities for all firms participating in the consolidated tax reporting, even if the individual firm remains a legally independent unit with full autonomy regarding trade. However, for most purposes, what is of interest is the trading activity of each individual firm, regardless of whether it participates in consolidated tax filing.¹⁰ To achieve this higher level of detail, the Federal Statistical Office distributes the trade value collectively reported to each subsidiary involved, using a variety of additional data sources. This amounts to a significant quality improvement of the data used in this paper (see Kruse et al. 2021).

The second fundamental problem is the difference in data collection between extra-EU and intra-EU trade. Due to the presence of tariffs on external trade with non-EU countries, extra-EU transactions are fully recorded by the German customs

7 DOI: 10.21242/51911.2019.00.05.1.1.0.

8 The AHS-Panel contains reported transactions, i.e. extra-EU transactions and intra-EU transactions above the reporting threshold, and estimates of intra-EU transactions below the reporting threshold; see below.

9 We follow DESTATIS in applying the relaxed definition of the special trade system. Thus, our data set contains neither imports entering bonded warehouses from abroad nor exports leaving bonded warehouses, but instead contains imports entering Germany from bonded warehouses (“Zollager”).

10 In the remainder of the paper, a firm is thus defined as the smallest legal unit keeping accounts due to reasons related to commercial or fiscal law.

authorities, virtually starting from the first euro of trade conducted by a firm.¹¹ In contrast, as intra-EU trade is entirely tariff-free, data collection requires a separate reporting procedure which is subject to censoring from below. The thresholds in place are chosen to ensure that the largest part of the intra-EU export and import values are reported and DESTATIS estimates that as much as 97 % of intra-EU exports and 93 % of intra-EU imports are recorded.¹² Nonetheless, due to the well-known right-skewness of the export and import value distribution (see below), the censoring introduces a firm-level selection bias in that only a relatively small fraction of all firms makes it into the sample.

To avoid this selection bias when comparing intra-EU and extra-EU trade, we rely on an effort made by DESTATIS to estimate imports and exports of firms lying below the reporting threshold. This is done using other data not subject to a reporting threshold, in particular value-added-tax (VAT) reporting. If VAT reporting is in consolidated form involving several firms, trade values for individual firms are estimated following the procedure outlined above; see Kruse et al. (2021). However, this whole procedure is feasible only for aggregate bilateral trade and cannot be extended to trade on the HS eight-digit product level. Although we still report product-level results for intra-EU and total trade, care should be taken when interpreting these figures, since any firm below the reporting threshold will appear in the raw data as a single-product firm (with a generic eight-digit product ID). In the analysis below, we will alert the reader whenever this data limitation becomes relevant.¹³ This is mostly the case when we look at the number of goods traded. A detailed analysis of the limitations is therefore found in Section 3.2.

3 How Global are German Trading Firms

Firms face multiple decision margins: where to produce a certain product, where to sell it and where to source the required material inputs. In each case, “where” potentially involves multiple countries. Thus, how global a firm is may be measured

11 While very small commercial transactions below €1000 or 1000 kg are still exempt from the reporting duty, extra-EU reporting is nonetheless much more comprehensive than intra-EU reporting.

12 The thresholds are set at €500,000 and €800,000, respectively, for exports and imports.

13 In rare cases, the data for below-threshold firms do not include the country of destination or origin. This affects the extensive-margin results reported below but will not affect the distinction between intra-EU and extra-EU trade, since we know that all below-threshold transactions must involve an EU partner country. And the extensive margin results are affected only marginally as firms where the information on the partner country is missing lies well below 2 % of the total number of firms.

by the number of different countries it sells to, and obtains inputs from. This can be done for each of the goods a firm produces, for its entire range of products. Interest in this question has recently increased due to theoretical models that highlight interdependence of decisions across different margins. The interdependence is typically one of complementarity, driven by significant fixed costs of market access for both exports and imports (sourcing from foreign countries). For instance, if a firm incurs the fixed cost of sourcing inputs from a cheap foreign supplier, this will reduce its marginal cost and, thus, increase its profits from exporting to any foreign market. Consequently, it may pay off for this firm to incur the fixed cost of entering a certain export market that it did not hitherto sell to. Higher exports means operating on a higher scale and may, therefore, make it profitable for the firm to incur the fixed cost of adding a further source of input supply. A given productivity advantage that a firm has over its competitors will thus be magnified, in terms of profits, through multiple decision margins of globalization. Models highlighting this type of complementarity across multiple decision margins have been developed, among others, by Antràs et al. (2017) and Bernard et al. (2018). See also Dhyne et al. (2023), who examine these considerations in the presence of firm-level production networks.

We will provide a more thorough analysis of correlation across different margins further below. In this section, we want to portray a first and rough picture of just how global German trading firms are by applying two simple criteria: i) whether a firm is both an importer and an exporter and ii) the number of countries it trades with in either capacity. For a start, we distinguish between two blocks of partner countries, those belonging to the European Union and extra-EU trading partners. Subsequently, we turn to a finer measurement of the breadth of globalization in counting the number of countries a firm exports to, or imports from, alongside the number of products it trades.

3.1 Two-Way Traders and Intra-EU Versus Extra-EU Traders

In the tables and figures presented in this section, we further distinguish between five types of firms by their main economic activity: manufacturing firms, wholesale firms, retail firms, firms engaging in the wholesale, retail or maintenance of motor vehicles and parts thereof, simply labeled “motor vehicles”, and a residual category labeled “other”.¹⁴ The residual category has firms in agriculture and forestry as well as mining and quarrying, or other services. This breakdown also allows us to address the role that trade intermediation plays in various parts of German foreign trade,

¹⁴ For information on these firm types, we merge our trade data with statistical business register data (URS) allowing us to identify each trading firm's main economic activity; see Section 2.

but we shall not do so until the next section. In this section, our focus squarely lies on the breakdown of German firms by degree of internationalization in the sense just described.

In our analysis, we make a distinction between *pure* importers and *pure* exporters, and we also single out firms that are both, exporters and importers (henceforth called two-way traders). In a similar vein, we distinguish between firms trading with partner countries within the EU and partner countries outside the EU, and we single out firms engaged in trade both within the EU and outside the EU (henceforth called global traders). Let n_X and n_M be the number of exporting firms and importing firms, respectively, and n_T be the total number of trading firms. Moreover let n_x and n_m be the number of pure exporters and pure importers, respectively, and n_w be the number of two-way traders. Then, we have $n_T \equiv n_m + n_x + n_w$, while $n_M \equiv n_m + n_w$ and $n_X \equiv n_x + n_w$. Hence $n_X + n_M \equiv n_T + n_w$ or, equivalently, $n_w \equiv n_M + n_X - n_T$. The exact same logic may be applied with respect to the number of firms active in intra-EU and extra-EU trade, respectively, and the number of firms active in both.

Table A.1 in Appendix gives the number of exporting and importing firms for all trade as well as for intra-EU and extra-EU trade, respectively. Throughout the paper, all numbers relate to the year 2019, unless otherwise specified. A first striking finding is that the total number of firms engaged in foreign trade is much larger for imports than for exports: We have 716,574 importing firms versus 275,011 exporting firms. Looking at different firm types and regions, there is but a single exception to the rule of more importing firms than exporting firms, which is (wholesale, retail or maintenance of) vehicles in extra-EU trade.¹⁵ Looking at *pure* exporters and *pure* importers the discrepancy is even larger: there are 515,397 pure importers versus 73,834 pure exporters; see Table A.3 in Appendix. There are 201,177 two-way traders, which leads to a total number of trading firms equal to 790,408. The number of two-way traders is thus about 2.7 times the number of pure exporters, but only a bit less than two fifths of the number of pure importers. This asymmetry has important implications for trade transaction volumes per firm, to which we shall return below.

In order to assess the trade participation of German firms, we relate the numbers of exporting and importing firms to the total number of firms present in the statistical business register data (URS), which we assume to be a good approximation for the total number of firms active in Germany (DESTATIS 2022). From Table A.3, we can infer that about 22.2 % of the almost 3.6 million firms are actively trading in 2019; most of which, as pointed out above, as importers. The trade participation rates differ by firm type: Manufacturing firms are much more prone to trade, with every second

¹⁵ This is despite the fact that the transaction value for this firm type is larger for imports than for exports, with a larger share of extra-EU trade for imports, too; see Appendix Table A.2.

manufacturer (50.4 %) either exporting, importing or doing both. This rate is slightly lower for wholesale, retail and motor vehicle trading firms (which appear jointly as a single category in DESTATIS 2022), at 47.9 %. Consequently, trade participation in the residual firm category must be much lower, and indeed, agriculture, mining and other service firms, making up the bulk of Germany’s firm population (about three quarters of all firms are found here), engage in trade at a rate of only 14.1 %.

Figure 1 gives an impression of the prevalence of firms that simultaneously export and import (two-way traders) across trading regions as well as firm types; the absolute numbers are found in Table A.3 in Appendix. What strikes from this figure is that the share of two-way trading firms is generally larger for manufacturing and wholesale firms than for other firm types, and within these two firm types it is larger for extra-EU trade than for intra-EU trade. This latter finding emerges for most firm types (the exception being vehicle traders). This is consistent with the theoretical expectation that follows from Bernard et al. (2018), that sourcing from far-away markets is conducive to entering far-away markets too, and vice versa. This expectation follows from combining Propositions 3 and 4 in Bernard et al. (2018). A further salient feature is that the share of pure importers is larger than the share



Figure 1: Pure exporters, importers and two-way traders in 2019.
Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

of pure exporters for all firm types, not just in the aggregate (as pointed out above), the only exception being vehicles, which sticks out with by far the largest share of pure exporters. With a mere 25 %, the overall share of two-way traders seems relatively small.

Next up, Figure 2 highlights the prevalence of global firms, i.e. those active both within the EU and in extra-EU trade, among importers, exporters and among all trading firms. The corresponding absolute numbers are found in Table A.4. The striking finding here is that global firms are generally found more frequently among exporters than among importers, and particularly so for manufacturing, wholesale and vehicle traders. The smallest share is found among importers in the firm type “other” (mining, quarrying, agriculture, other services). The share of global firms among all trading firms (21 %) is the same as the share of firms trading both ways (see Figure 1). Unsurprisingly, the share of pure intra-EU traders is much larger for all firm types than the share of pure extra-EU traders. The share of pure extra-EU traders is smallest among manufacturing exporters, which is the only case where global firms are dominating, with a share of 50 %.

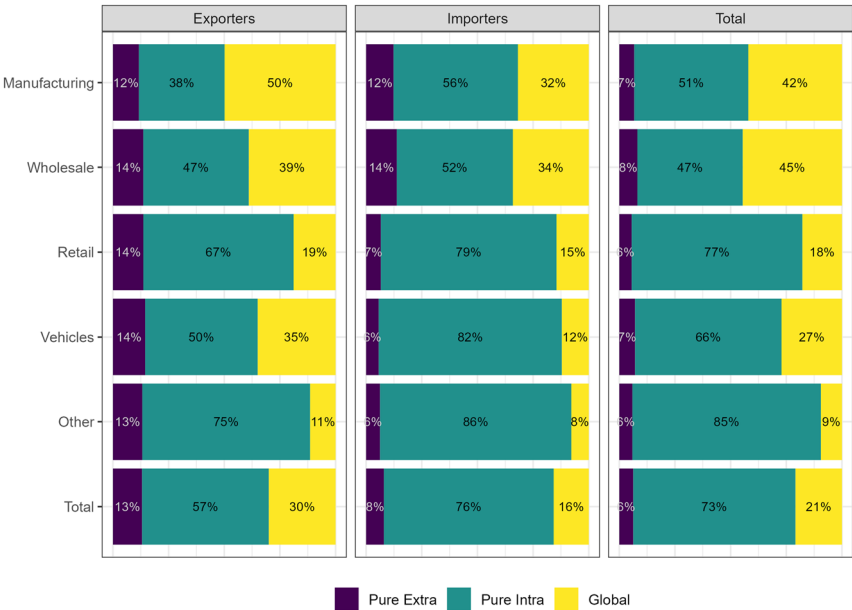


Figure 2: Pure extra, intra and global firms in 2019.
Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Combining the two-way criterion with the criterion of intra-EU plus extra-EU trade, we can identify the “truly global” firms. The numbers are found in the bottom panel of Table A.4. The total number of two-way traders active in both intra-EU and extra-EU trade is 30,302, which is somewhat less than 4 % of all trading firms (790,408). This share is largest for manufacturing traders where the total number is 115,212, of which 18,679 (or 16 %) are truly global. A relatively large share of just below 11 % is also found for wholesale traders, whereas for all other firm types the share is much smaller than 1 %.

How does the picture for 2019 portrayed above compare to that of 2011? A quick inspection of Figures 1 and B.1 as well as Figures 2 and B.2 might suggest there is no conspicuous change worth pointing out. However, upon closer inspection, particularly of the absolute numbers behind these figures, we do find a remarkable change. While the number of pure importers rose between 2011 and 2019, as perhaps expected, the same period has seen a substantial *reduction* in the number of pure exporters. Taking the aggregate over all firm types and looking at total trade, pure importers rose in number from 349,581 to 515,397 (by 47.7 %), while pure exporters fell from 90,536 to 73,834 (by 18.4 %). The reduction in pure exporters occurred mainly among those engaged in intra-EU trade, the number of firms engaged in extra-EU trade in fact rose, although by a modest 6.8 %. In intra-EU exports, the reduction occurs for all firm-types, and in extra-EU exports the increase similarly is observed for almost all firm types, the exception being motor vehicles (with an increase equal to 6.5 %).

A lower number of pure exporters by no means implies that the German economy has become less well integrated as an exporter to world markets, for two reasons. First, we must add an important further observation, which is that the number of two-way traders has increased for total trade as well as for both intra-EU and extra-EU trade, although more so for intra-EU trade. Indeed, the larger number of two-way traders more than compensates the drop in the number of pure exporters, so that the total number of firms engaged in exporting has, in fact, increased for all types of firms and for both, intra- and extra-EU trade. But still, the broader conclusion is that the period from 2011 through 2019 has seen a much stronger increase in the number of firms active as importers than the number of firms active as exporters. And the second observation is that while the number of pure exporters has fallen, their export volume has risen. This will be discussed in somewhat more detail further down below where we shall explore the intensive and extensive margin decomposition through time.

3.2 Joint Country-Product Distributions

We now proceed to a greater level of detail by counting the number of partner countries for exports and imports, rather than aggregating countries into the intra-EU block and the extra-EU block. Moreover, we add a further dimension by counting the number of products a firm is trading. Following Mayer and Ottaviano (2008) and Bernard et al. (2018), we merge the country and the product dimension by describing the joint distribution of German exporting and importing firms over these two dimensions. As in Bernard et al. (2018), we distinguish between seven numeric categories: one, two, three, four, five, six to ten, or more than ten HS eight-digit products, and the same for partner countries.¹⁶ In addition to the number of firms (extensive margin of trade), we also describe the joint distribution of trade values per firm, separately for exports and imports (intensive margin of trade).

These joint country-product distributions shed a first light on the interrelationship between the multiple decision margins firms are facing. The simple question we want to address here is whether firms exporting to many markets are also likely to export many goods and whether such firms command an overproportional share of the aggregate export value, as perhaps expected. Although the bulk of the literature focuses on exports, the question is no less interesting to address also for imports, as emphasized by Antràs et al. (2017) and Bernard et al. (2018). Table 1 presents the joint distribution of firm numbers (top panel) and transaction values (bottom panel) for Germany's total exports in 2019 as well as the two marginal distributions. We observe strong skewness. The firms exporting a single product to a single country account for 55 % of all exporting firms but are responsible for a mere 0.9 % of the total export value. Looking at the marginal country distribution, 59.4 % of all exporting firms sell to a single foreign country but their combined export value amounts to no more than 1.5 % of the total. On the product side, 59.7 % of all exporters report exporting a single product, with a combined export value equal to 2.7 % of the total. At the other end of the distribution, the number of exporters selling to 11 countries or more is relatively low, equal to 12.4 % of all exporting firms, but in value terms their exports amount to 91.1 % of the total. In a similar vein, exporters selling 11 products or more make up a mere 13.1 % of all exporting firms, but they contribute as much as 87.1 % to the total value. "Truly global" exporters, i.e. those exporting more than 10 products to more than 10

¹⁶ Once again, our results are biased downward by the presence of counterfactual single-product firms due to the lack of product-level information for firms below the exemption threshold in total and intra-EU trade. Especially for the trade-value distribution, however, this will barely affect the results.

destinations, make up a paltry share of 7.7 % of all exporting firms, but in value terms their contribution to total exports is 84 %.

In Table 2, we see that the corresponding distributions for total imports are similarly skewed. The share of importers importing a single product is equal to 74.4 %, but in value terms these firms contribute a mere 3.2 % to total imports. The percentages at the bottom end of the two marginal distributions of firm numbers are similarly larger for imports than for exports, equal to 76.9 and 77.4 %, with smaller corresponding shares also for the distribution of import values. The share of “truly global” importers (importing more than 10 products from more than 10 countries) in the total number of importing firms is equal to 3.2 % and thus only about half the corresponding share for truly global exporters, yet their combined share in the total import value is equal to 76.5 %.

This type of skewness is quite common in trade data, but comparing our results to those for other countries, we also find differences. For instance, Bernard et al. (2018) finds a significantly lower share of single-product-single-country exporters:

Table 1: Joint country-product distribution for total exports in 2019.

Firms		Number of countries							
	1	2	3	4	5	6-10	11+	Total	
Number of products	1	55.0	1.3	0.7	0.4	0.3	1.0	1.0	59.7
	2	1.4	5.6	0.9	0.4	0.2	0.5	0.5	9.6
	3	0.7	1.7	1.1	0.5	0.3	0.5	0.5	5.3
	4	0.4	0.8	0.6	0.4	0.2	0.5	0.5	3.4
	5	0.3	0.5	0.3	0.2	0.2	0.4	0.5	2.5
	6-10	0.7	1.0	0.7	0.5	0.4	1.2	1.8	6.4
	11+	0.9	1.0	0.7	0.5	0.5	1.8	7.7	13.1
Total	59.4	12.0	5.1	3.0	2.2	6.0	12.4	100.0	

Value		Number of countries							
	1	2	3	4	5	6-10	11+	Total	
Number of products	1	0.9	0.1	0.4	0.1	0.1	0.3	0.8	2.7
	2	0.1	0.2	0.1	0.1	0.1	0.2	0.7	1.5
	3	0.1	0.1	0.1	0.1	0.1	0.2	0.7	1.4
	4	0.0	0.1	0.1	0.1	0.1	0.2	0.7	1.2
	5	0.0	0.1	0.1	0.1	0.0	0.4	0.7	1.3
	6-10	0.1	0.1	0.1	0.1	0.1	0.7	3.5	4.8
	11+	0.2	0.2	0.2	0.2	0.4	1.8	84.0	87.1
Total	1.5	1.0	1.1	0.7	0.9	3.8	91.1	100.0	

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Table 2: Joint country-product distribution for total imports in 2019.

Firms		Number of countries						
Number of products		1	2	3	4	5	6-10	11+
	1	74.4	0.8	0.6	0.4	0.4	0.7	0.1
	2	0.9	3.5	0.2	0.1	0.0	0.1	0.0
	3	0.5	1.3	0.7	0.1	0.0	0.1	0.0
	4	0.3	0.6	0.5	0.2	0.1	0.1	0.0
	5	0.2	0.4	0.4	0.2	0.1	0.1	0.0
	6-10	0.4	0.8	0.9	0.7	0.4	0.6	0.1
	11+	0.3	0.6	0.7	0.6	0.6	2.1	3.2
	Total	76.9	8.0	3.9	2.3	1.6	3.7	3.5
Value		Number of countries						
Number of products		1	2	3	4	5	6-10	11+
	1	3.2	0.3	0.1	0.3	0.1	0.7	0.7
	2	0.2	0.5	0.2	0.1	0.1	0.1	0.0
	3	0.1	0.2	0.2	0.1	0.1	0.1	0.1
	4	0.1	0.2	0.1	0.1	0.1	0.1	0.1
	5	0.1	0.4	0.1	0.1	0.1	0.3	0.1
	6-10	0.2	0.3	0.4	0.4	0.3	1.2	0.9
	11+	0.4	0.5	0.7	1.0	0.9	6.7	76.5
	Total	4.3	2.3	1.8	2.1	1.7	9.3	78.4

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

34.9 % as opposed to our 55.0 %.¹⁷ They also find a lower share of “truly global” exporters: 5.5 % compared to our 7.7 %. Thus the skewness is somewhat less pronounced for the US in 2007 than for Germany in 2019. For imports, too, the share of single-product-single-country firms is much smaller for the US: 29.7 % compared to our 74.4 %. But in value terms we observe a remarkable similarity: while the value share of 0.6 % for the single-product-single-country firms lies well below the 3.2 % for Germany, the share of 76.4 % for “truly global” US importers compares well to a share of 76.5 % for Germany.

Summarizing their results, Bernard et al. (2018) also state a tendency of the diagonal elements in the joint distribution to be larger than the off-diagonal ones and interpret this as evidence of a positive correlation between the number of products

¹⁷ When comparing our results with those of Bernard et al. (2018), one needs to bear in mind that Bernard et al. (2018) use a 10-digit classification for the product count whereas we use eight-digits. Exporting a single eight-digit product may represent a lower level of specialization than exporting a single 10-digit product. Moving from eight-digit data to 10-digit data would likely make some single-product firms appearing as firms exporting more than a single product.

exported or imported and the number of destination or source countries, respectively. This would be in line with the theoretical expectation mentioned at the outset of this section above, but in our case this tendency is not very pronounced, mainly occurring for numbers up to 3 and 11+. In any case, we shall return to this issue in somewhat more detail in Section 7 below, where we also look at cross-correlations between different margins on the export and the import side. The results from the French 2003 data used by Mayer and Ottaviano (2008) are quite similar to our German figures for 2019 in value terms, but much less skewed towards single-country-single product firms, like the US data. The same can be observed for the Hungarian results for 1999 found in Békés et al. (2011).¹⁸

We have mentioned in Section 2 that firm-level reporting of intra-EU trade is subject to a threshold below which firms need not report their trade. The data used for Tables 1 and 2 above rely on a procedure used by DESTATIS to estimate trade flows for firms falling below the threshold. Unfortunately, however, this procedure could not be extended to the product level; see Kruse et al. (2021). In the firm-count data, as far as intra-EU trade is concerned, all below-threshold firms appear as single-product exporters and importers. Since they are small firms, many of them also *are* single product firms, but some are not. Hence, this data limitation introduces a bias into the joint distribution presented above. Here, the researcher faces two imperfect options. Option one, underlying Tables 1 and 2 above, is to go for a full coverage of all firms at the risk of wrongly classifying some below-threshold firms as single-product exporters or importers when looking at their intra-EU trade. Option two would be restricting the analysis to firms that surpass the reporting threshold, thus ensuring that all firms appearing as single product exporters or importers truly fall into this category—at the expense of small firms being left out of the picture when it comes to intra-EU trade. To move forward, we compare the results for both options, concentrating on intra-EU trade where the problem exists (it does not for extra-EU trade).

The results are found in Tables A.7 and A.9 for exports and in Tables A.8 and A.10 for imports. Based on this comparison, we make two claims: i) The number of small firms that option two would ignore is huge, and ii) these firms to a very large extent are, indeed, single-product exporters selling to a single foreign market and single-product importers buying from a single foreign country. More specifically, looking at exports, in the marginal product-number distribution (rightmost column) for intra-EU exports the share of single-product firms drops from 83.6 % in option one to

¹⁸ The results from Békés et al. (2011) for Hungarian imports are again similar to ours as far as the value dimension is concerned. However, there is a much stronger presence of multi-country multi-product firms in the Hungarian data. Unfortunately, Mayer and Ottaviano (2008) conduct their analysis only for French exports, which is why we cannot compare our results for imports with theirs.

18.9 % in option two. Similarly, in the marginal country-number distribution (bottom row) the share of “single-country” firms drops from 78.1 % in option one to 10.5 % in option 2. This is evidence for claim i). For claim ii), we observe two things. First, in these marginal distributions, all other shares, i.e. for more than one product and more than one country, respectively, are rising when we move from option one to option two. Secondly, and perhaps more importantly, when looking at the joint firm-number distribution, we find that the share of single-country-single product firms drops by somewhat more than the shares in the marginal distributions and, perhaps more importantly, there is not a single instance of other shares, i.e. those for more than one product and more than one country, falling when we move from option one to option two. The exact same picture arises, qualitatively, when we look at imports. Naturally, the discrepancy between options one and two are significantly less pronounced when we look at trade values; see again Tables A.7 and A.9 for exports and in Tables A.8 and A.10 for imports.

We conclude from this exercise that option one, underlying the above tables, is vastly superior to option two. To complete the picture, Tables A.5 through A.8 present these joint product- and country-number distributions separately for extra-EU and intra-EU trade. Remember that the problem underlying the awkward choice between options one and two is entirely absent in data for extra-EU trade. To broadly summarize this breakdown, the skewness described above for total trade is much less pronounced for extra-EU trade than for intra-EU trade and also, but less so, for total trade. Part of this difference is due to the bias in intra-EU trade that we have just discussed. But a large part of it is real, reflecting the fact that small traders are genuinely more likely to trade within the EU than being engaged in extra-EU trade.

We close this section with a brief comparison of the joint product-country distributions described above with those of the year 2011, found in Tables B.2 through B.7. The overall conclusion is that all distributions (firm counts and transaction values for total trade as well as intra-EU and extra-EU trade) have remained fairly stable over this time span. For instance, looking at the firm-count distribution for total exports, the biggest absolute changes are a 1.4 % point increase for the 11+ exporters in the marginal product-count distribution and a 1.3 % point decrease in the single-product exporters in that same marginal distribution. All other changes are smaller in magnitude, mostly below a percentage point. Thus, over the time span considered, exporters seem to have become slightly more diversified in their product ranges. For export values we see the biggest increase, equal to 2.9 % points, occurring for firms in the (11+, 11+) cell of the distribution, followed by an increase equal to 2.1 % points for the 11+ cell in the marginal product distribution. Interestingly, the biggest changes for the firm-count distribution on the import side are the same as those on the export side, but in opposite directions: a 1.6 % point increase for single-product importers in the marginal product distribution, with a 1.8 % point

increase in this same cell also in the import value distribution, and a 1.0 % point reduction in the share of 11+ importers. We abstain from describing changes in the distributions for intra-EU and extra-EU trade, as this would bring almost no additional insights. But for the interested reader, we still offer the pertinent tables in Appendix.

4 Trade Intermediation

When looking at trade at the firm-level, one recognizes that producers and exporters of any given good are not necessarily the same. In many cases firms are exporting products they have not produced themselves, and in some cases producers do not engage in exporting at all but use other firms through which to sell their products abroad. We speak of intermediated exports. An obvious explanation for this phenomenon is that domestic producers face high fixed costs of entering foreign markets, and—other things equal—these costs may be lower for firms specializing in the trading activity as such than for producers. In the extreme, the ability to access a certain foreign market may be like a technology that is not available to a producer at all. This creates the need for producers to find, or be matched with, traders (or trade intermediaries) who have access to (and are willing to sell) this technology; see Antràs and Costinot (2010, 2011). Perhaps more realistically, using a specialized trade intermediary may simply be a less costly alternative to selling directly to foreign buyers. An extension of the Melitz (2003) type logic then suggests that for a given product and market, the choice depends on the manufacturing firm's productivity. A plausible outcome is one where high-productivity firms choose exporting directly (internalizing the intermediation activity), while less productive firms rely on third-party intermediation; see Felbermayr and Jung (2011), Ahn et al. (2011), and Akerman (2018).¹⁹

The literature on trade intermediation mostly looks at exports, but in principle the same mechanisms should also apply on the import side. Indeed, in Felbermayr and Jung (2011), intermediaries are assumed to locate in the country of destination, although in standard Melitz (2003) fashion the decision about trade intermediation is being made by the exporter, or the seller. It would, however, seem natural to think about trade intermediation also as an integral part of firm-level decision making

¹⁹ An earlier paper by Rauch and Watson (2004) models the use of trade intermediation as the result, not of a producer's exogenous productivity, but of the size (drawn randomly) of the producer's own network designed to search successful matches with potential buyers being too small, while the supply of intermediaries comes forward from agents who draw a sufficiently large network size so that becoming an intermediary is more profitable than becoming a producer.

about the sourcing of inputs, i.e. a buyer-decision where access to, or matching with, potential (foreign) suppliers of inputs may, or may not, be outsourced to independent trade intermediaries.²⁰ Without going into details, this seems like a natural way to interpret the situation that we find in our data where trade intermediation takes place both on the export and the import side; see below.

Melitz-type models of intermediation conveniently explain why we find firms choosing intermediation as well as firms selling directly, even holding the product and market served constant, simply by invoking heterogeneity in firm productivity. Moreover, once we allow for multi-product firms the same mechanisms may lead them to serve some foreign markets directly for some of *their* products while relying on intermediaries for other products and/or markets. But manufacturing firms may even act as intermediaries for *other* firms' products. In a recent paper using Turkish data, Erbahar and Rebeyrol (2023) disentangle cases where a firm sells other firms' as well as its own products to a given market from cases where a firm serves a certain foreign market *exclusively* with products sourced from other firms.

The former phenomenon was first documented by Bernard et al. (2019), who call it “carry-along trade” (CAT). They explain the emergence of CAT by invoking multi-product firms who are endowed with a *sourcing technology* which allows them to increase the range of products they sell to a certain market without producing the added range or products themselves. Sourcing these products from other producers spares them having to move farther away from their core competency which would imply diseconomies of scope when increasing the scope of products sold. Under certain conditions, it pays for a firm to source some of the goods it sells to a foreign market from other producers, rather than relying on own production for the entire range of goods sold. This may be reinforced by a complementarity between the products “carried along” and the products from one's own work bench, say if producers have a preference for obtaining a given range of products from a single firm rather than many firms. Although available data do not allow us to identify CAT as such, it seems like a plausible theoretical rationale for the empirical patterns that we discuss in this section.²¹ But the second fact identified by Erbahar and Rebeyrol (2023), viz. exporters serving a certain destination entirely through products sourced from other producers, indicates that the rationale for producers engaging in trade intermediation goes beyond exploiting complementarities

²⁰ There is a literature dealing with the endogenous formation of global production networks, mostly modeled as the outcome of firm-to-firm matching. There is an obvious potential connection here to trade intermediation (see Bernard and Moxnes 2018), but so far trade intermediation as such has not been analyzed in this literature.

²¹ In Eckel and Riezman (2020), CAT is driven by strategic motives. More specifically, it is a possible outcome of an oligopoly game where delivery of one's own goods serves as an outside option.

between sourced products and one's own products, although what, exactly, underlies this rationale still remains open to research.

The literature on trade intermediation thus suggests that for any given product and market we must expect the simultaneous appearance in the data of producers and intermediaries (wholesalers or retailers), mainly driven by underlying heterogeneity in firm productivity. Moreover, we should expect to observe firms that are not *pure* producers or *pure* intermediaries but engage in both production and trading, even for relatively narrow product definitions and for a single destination market. But importantly, the literature also suggests that the share of intermediated trade should vary systematically across markets as well as products. Intuitively, from an exporter's perspective, the share of intermediated trade is larger for smaller and farer-away markets. The reason is that using firms specializing on trade intermediation offers a way to spread the fixed entry cost over many firms and products, without having to go all the way to a full merger. Obviously, this rationale is more compelling for small markets with a high fixed cost of entry, as documented for the US in Bernard et al. (2010).

In essence, using a trade intermediary means outsourcing key steps of market access. It is well known that the rationale for outsourcing also depends on the degree of contractual imperfections that firms are facing when exporting or importing. Contractibility varies both across countries and markets. As regards products, it is well known that relationship specificity coupled with lack of third-party verifiability of product characteristics may give rise to a hold-up problem. The property rights theory holds that efficiently dealing with such hold-up problems may imply outsourcing or integration, depending on the degree of contractual imperfection and on the importance of the service in question (trading activity or market access) for the production relationship, i.e. for exporting or importing.²² There is a certain presumption that, other things equal, the rationale for trade intermediation is stronger when trading with countries with weak contracting institutions and weaker for products with high degree of contractual imperfection. Evidence in this direction is presented in Bernard et al. (2015).²³

Against this backdrop, we now highlight salient features of trade intermediation for both exports and imports in intra-EU as well as extra-EU trade of German firms. More specifically, we want to explore the distributions of exports and imports over

²² A large part of the literature focuses on the role of “sourcing intensity”, i.e. the share of the relevant product or service in total cost; see Antràs and Helpman (2004) and Kohler and Smolka (2021). In the present context, this might be called the “trading intensity” of trade.

²³ However, one should be careful: The way in which the quality of contractual institutions prevailing in countries (of destination or origin) and the inherent contractual imperfections of the traded products affect the outsourcing-versus-integration decision (in our case the decision on whether or not to rely on trade intermediaries) hinges on whether one subscribes to the property rights theory or its rival, i.e. the transaction-cost approach; see Eppinger and Kukharskyy (2021).

all of the above mentioned types of firms, both for total trade as well as for intra-EU and extra-EU trade. Doing so for both the number of firms as well as the transaction values also allows us to explore the distribution of transaction values across our firm types. In the next subsection, we shall turn to the prevalence of trade intermediation across different categories of products.

A note on our definitions before turning to the numbers. As known from above, we define firm types based on main economic activity, and we distinguish between five types labeled as manufacturing, wholesale, retail, vehicles and others. Manufacturing firms include pure producers but they may also include firms with some (minor) wholesaling or retailing activity. Likewise, wholesale and retail firms are defined to include pure wholesalers and retailers, respectively, but they may also include firms with some (minor) production activity. Firms labeled “vehicles” are firms whose main economic activity is “wholesale, retail or maintenance of vehicles and parts thereof.” A residual category has firms whose main activity is agriculture, forestry, mining and quarrying, or other services not related to wholesale and retail. Note, importantly, that manufacturing firms include firms producing vehicles. This soft delineation between firm types notwithstanding, our data allows us to identify salient features of trade intermediation in German trade.²⁴

In the following, the term intermediary (or intermediation) refers to the sum of wholesalers and retailers plus “motor vehicles”. What, then, is the share of foreign trade conducted by producers, relative to trade conducted by intermediaries? Figure 3 gives the numbers of firms for each type engaged in imports and exports, each separately for intra-EU and extra-EU trade. The vertical axis has the absolute numbers while the percentage figures give the shares of firm-types in the total.²⁵ The absolute numbers are given in Table A.1 in Appendix. Figure 4 does the same for trade transaction values, with absolute numbers given in Table A.2.

A first striking finding is that the share of firms engaged in trade intermediation is generally larger for exports than for imports. In total trade this share is 42.9 % for exports and 37.0 for imports. This discrepancy is dominated by intra-EU trade where it is 42.6 versus 36.7 %, whereas for extra-EU trade the difference is much smaller (45.8 vs. 44.5 %).²⁶ Perhaps less surprisingly, the share of manufacturing traders is also generally larger for exports than for imports. For total trade we observe 25.2 % on the export side against 14.3 % on the import side. Again, this difference is mainly driven by intra-EU trade.

²⁴ Our categorization is similar to the one used in Blum et al. (2010) and Bernard et al. (2015).

²⁵ For instance, in Figure 3 there is a total of about 275,000 exporting firms, 25.2 % of which (around 70,000) are firms whose main activity is manufacturing.

²⁶ The share for the total need not lie between the shares for intra- and extra-EU trade, respectively, because the numbers for intra-EU and extra-EU trade include firms trading both intra- and extra-EU simultaneously.

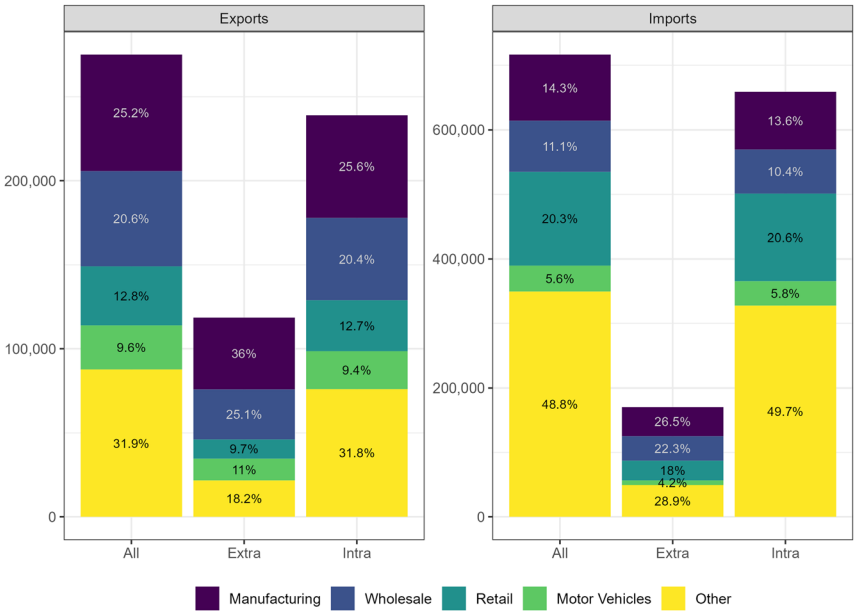


Figure 3: Number of trading firms by firm type in 2019.

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

In terms of transaction values (see Figure 4), the share of manufacturing firms is 75.7 % for exports, for imports it is 48.7 %. Looking at intermediaries, the opposite pattern is observed for exports, with a value share of 19.8 %. However, for imports the share of intermediaries in transaction values is even larger, at 40.6 %, than their share in the number of firms, equal to 37 %. Invoking the idea, proposed by Bernard et al. (2015), that intermediation is serving a more useful purpose in the presence of high destination-specific fixed entry costs and a weak contracting environment, one might expect that the share of intermediated trade is larger for extra-EU trade than for intra-EU trade. After all, the single market should induce low fixed entry costs and a good contracting environment. For exports, our data support this only with a small margin for the number of intermediating firms, with a share of 45.8 % for extra-EU exports compared to 42.6 %. For trade values, we even find an opposite pattern: 13.1 % for extra-EU exports compared to 24.7 % for intra-EU exports. For imports, our data provide stronger support for this idea with a firm-number share of 44.5 % for intermediaries and a value share of 43.6 % for extra-EU imports, compared to values of 36.7 and 38.4 % for intra-EU imports.

To further highlight the intensive margins, we compute the transaction volume per firm for each firm type relative to the total transaction volume per firm for all trade flows.

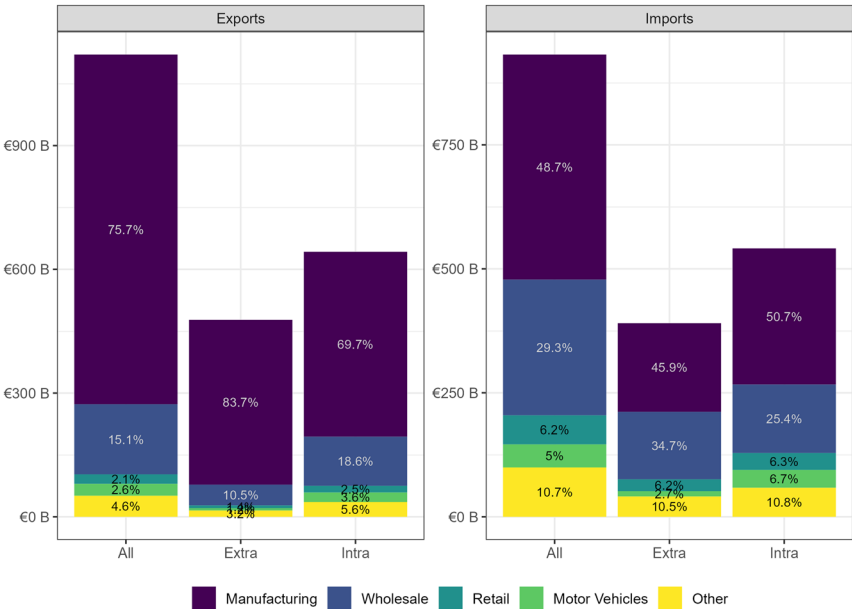


Figure 4: Traded value by firm type in 2019.
Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

The results are found in the bottom panel of Table A.1. Averaging over all firm types, the export value per firm for extra-EU exports is €4.03 mio., compared to €2.69 mio for intra-EU exports. For total exports, the corresponding value is €4.07 mio.²⁷ For imports, values per firm are much smaller, equal to €1.30 mio for total trade, compared to €2.29 mio. For extra-EU trade and €0.82 mio for intra-EU trade.

Comparing firm types, we identify a striking pattern: Across all types of trade considered, transaction values per manufacturing firm are much larger than the overall average, by a factor of 3.00 for total exports, 2.32 for intra-EU exports and 2.72 for extra-EU exports. The corresponding ratios for imports are 3.41 for total imports, 3.73 for intra-EU imports and 1.73 for extra-EU imports. Aggregating over all intermediaries (wholesaler, retailers and vehicle traders), we find corresponding ratios of 0.46 for total exports and 1.10 for total imports, compared to 0.29 and 0.89 for extra-EU exports and imports, respectively, and 0.58 and 1.05 for intra-EU exports and imports. The fact that these ratios are significantly smaller for intermediaries

²⁷ Note that the total number of firms is smaller than the number of intra-EU plus extra-EU exporters, since many firms appear as both importers and exporters. Hence, the transaction value per firm for total trade need not lie in-between the values for intra-EU and extra-EU trade.

than for manufacturing exporters is consistent with the notion that specialized intermediaries face lower destination-specific market entry costs. Applying the same logic to the comparison between wholesale and retail traders, however, the implication would be that retail traders face even lower market entry costs than wholesale traders, which seems questionable.

A further striking pattern is that for all firm types considered the transaction value per firm in intra-EU trade is larger for exports than for imports; while for extra-EU trade the opposite is true for all firm types except for manufacturing traders.²⁸ For total trade we observe the same discrepancy as for intra-EU trade, except for wholesale traders where the transaction value per firm is smaller for exports than for imports.

We close this section with a note on the German trade surplus. Germany is well known for its large and persistent export surplus in merchandise trade. Naturally, the explanation of this is beyond the scope of this paper. But what we can do is answer two very simple questions: First, to what extent is the trade surplus reflected in a lower number of importing firms than exporting firms and in lower imports per firm than exports per firm? And second, does this decomposition vary across our five firm types? We provide answers by looking at the ratio of export values (X) to import values (M), each expressed as a product of trade per firm, denoted by x and m , and the number of trading firms, denoted by n_x and n_m . In Table A.11, column one gives X/M while column two gives x/m and column three has n_x/n_m . Of course, we have $X/M = (x/m)(n_x/n_m)$. Table A.11 is visualized in Figure 5, where the left panel (total value) depicts X/M , while the other two panels depict the components x/m (per firm) and n_x/n_m (number of firms). For reasons of space, we restrict our analysis to total trade.

A first interesting result is that an export surplus, $X/M > 1$, emerges only for manufacturing traders, with a value of 1.87, while for all other firm types we observe $X/M < 1$, with the lowest value of 0.39 for vehicles (wholesale, retail and repairs). Moreover the surplus for manufacturing reflects higher export values than import values per firm, $x > m$, with a ratio equal to 2.76, combined with a lower number of exporting firms than importing firms, $n_x < n_m$, with a ratio equal to 0.68. This pattern is even more pronounced for the aggregate, with ratios of 3.13 and 0.384, although the overall export surplus is lower than the trade surplus among manufacturing traders. Given what we have learned above, this is no real surprise.

The fact that German firms active in trade intermediation generate a trade deficit, collectively as well as each of the types considered (wholesalers, retailers and vehicle traders), is consistent with the notion that German intermediaries are mostly

²⁸ Transaction values per firm are obtained by multiplying the ratios in the bottom panel of Table A.1.

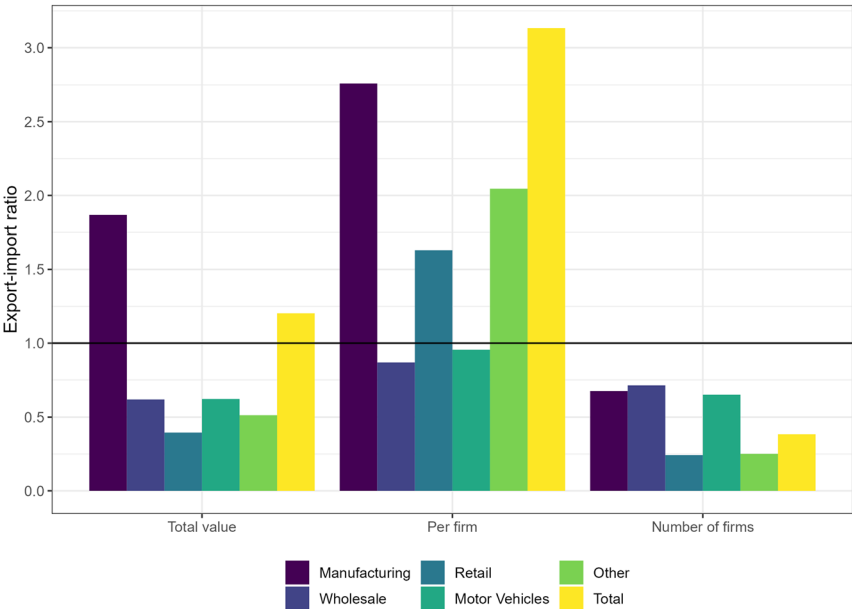


Figure 5: Decomposition of the German trade surplus in 2019.
Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

engaged in helping foreign goods find (German) consumers, more so than in helping German goods find foreign consumers.²⁹ For wholesalers this holds true both in terms of the transaction values per firm (if by a very small margin) and the numbers of firms active as importers and exporters, respectively. Somewhat surprisingly, retailers stick out among intermediaries with the largest aggregate trade deficit among all firm types, coupled with an above one export-to-import ratio of trade values per firm, $x/n = 1.63$ and a very low ratio for the number of firms, $n_x/n_m = 0.24$. Thus, trade by German retailing firms is characterized by the majority of firms engaged in intermediating imports, but with those engaged in exports being significantly larger than those engaged in imports.

Finally, as in the previous section, we want to explore salient changes over the period from 2011 through 2019. Comparing Figures 3 and B.3, the first impression is that there wasn't much change at all. Looking closer, however, we find a few

²⁹ It is perhaps important to point out here that our data do not include any information on German producers using intermediaries located in *foreign* countries to get their products to foreign consumers; see our theoretical discussion above.

noteworthy differences, especially regarding trade intermediation. Thus, while the share of firms engaged in intermediation of exports has remained roughly stable (falling from 43.4 % in 2011 to 42.9 %), the share has fallen significantly on the import side, from 44.6 % in 2011 to 37.0 % in 2019. Similarly, the share of manufacturing firms, while remaining roughly constant on the export side, has fallen somewhat (from 16.4 to 14.3 %). Correspondingly, the share of the residual category has increased over the time span considered. As in 2019, the share of trade intermediation in extra-EU exports is larger than for intra-EU exports only in terms of firm-numbers (and only by a small margin: 46.7 % compared to 43.0 %), thus confirming the theoretical expectation, but not in terms of transaction values (13.1 % compared to 21.0 %). On the import side, the 2019 data show larger shares of trade intermediation in terms of both, firm numbers and transaction values, thus negating theoretical expectations, whereas our 2011 data reveals this pattern only for transaction values (38.7 % for extra-EU compared to 35.4 % for intra-EU), but not for firm-numbers (around 45 % for both extra-EU and intra-EU).

How did trade values per firm, the extensive margin, change from 2011 to 2019? The answer, based on Tables A.1 and B.1 and looking only at salient changes, is as follows. First, averaging across all firm types, export values per firm have increased for total exports as well as intra- and extra-EU trade, while import values per firm have fallen. Secondly, relative to these total averages, the intensive margin has increased significantly for all intermediaries, and for exports and imports as well as for intra- and for extra-EU trade. For manufacturing firms, this holds true to a much lesser extent, and for other firms, we observe the opposite pattern. Decomposing the trade surplus for 2011 as we did for 2019 in Table 5, we do not find any change worth reporting.

In this section, we have focused on the prevalence of trade intermediation. The literature on trade intermediation also makes predictions on how the firm-product extensive and intensive margins differ across trade intermediaries and producers (Akerman 2018). We shall return to this question in Section 6. We also take potential differences between trade intermediaries and producers into account when we explore “who trades what” in the next section.

5 Who Trades What?

In the previous sections, the focus was on trading firms. We now turn to the question of what these firms are trading in. To conceptualize the “what”, we focus on the two-digit sections of the harmonized system, since more disaggregated levels (e.g. HS chapters) would be too difficult to display in an informative manner. In addition to these 22 broad product sections, we introduce a 23rd “product category” labelled

“Unknown” which collects firms below the reporting threshold, for which we do not have product information; see Section 2. Although the share of these firms is large in both intra-EU trade and total trade, their share in transaction values is small.

While the new focus thus lies on the product level, we will not give up completely on the firm type perspective in that we provide an answer to the question “who trades what”. By “who” we mean the firm type as defined in the previous sections, with a focus on trade intermediation. Theory as well as evidence from other countries leads us to expect that the significance of trade intermediation varies systematically across countries of origin and destination as well as across product categories. Above, we have distinguished between intra-EU and extra-EU trade. In this Section, we add the product-type dimension.

5.1 Trade by Product Categories

As a first step, we compute the shares of the product sections in the total value of trade. While the main export or import products can easily be identified from publicly available data sources, our data set allows us to contrast these shares to the corresponding shares in the number of trading firms.³⁰

Figure 6 reports the results for exports. As perhaps expected, export values are heavily concentrated on two product categories: machinery and electronics with 29.8 % and vehicles with 21.2 %. Together, they account for more than half of the entire export value. In terms of the number of exporters, however, the shares of these product categories are considerably smaller (21.8 and 9.6 %). Thus, less than a third of all exporting firms account for 51 % of exports. This is mirrored by an opposite pattern for most of the other product sections, i.e. larger shares for the number of exporting firms than for export values. This holds true especially for the small firms below the exemption threshold listed under “Unknown” which make up almost 70 % of all exporters, yet account for only 1.7 % of the total export value. Chemicals is the only further example of a major product section with a larger value share (10.5 %) than firm-number share (9.5 %). As can be seen from Table A.14, the shares sum up to 214.6 %, meaning that, on average, firms export products from 2.15 product categories. Compared to 2011 (see Figure B.6), the composition of exported product categories across both values and firms has remained virtually constant.

A similar picture arises on the import side; see Figure 7. Interestingly, the product categories dominating export values are also dominating import values, with a share of 25.0 % for machinery and electronics and a share of 13.8 % for

³⁰ Since firms can be actively trading in more than one product category, the shares do not sum up to 100 %. The sum of shares thus acts as a measure for the presence of multi-product-category firms.

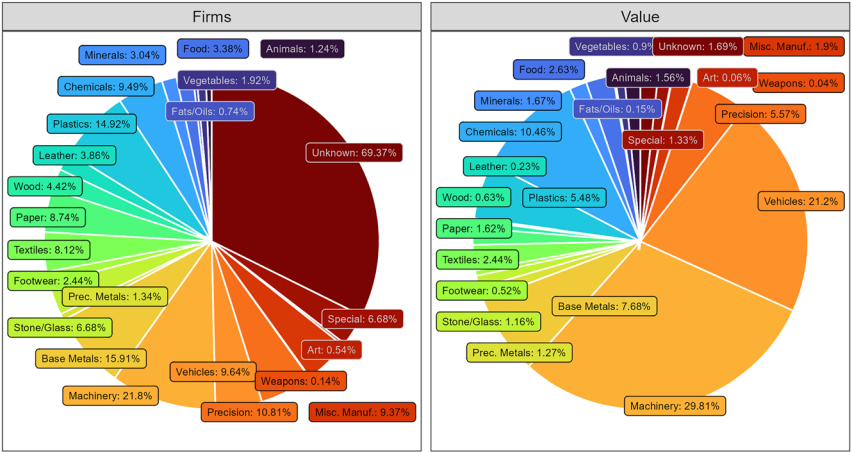


Figure 6: Product categories in total exports in 2019.
Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.
Notes: “Unknown” refers to observations from estimated data for firms below the exemption threshold for which product information is not available.

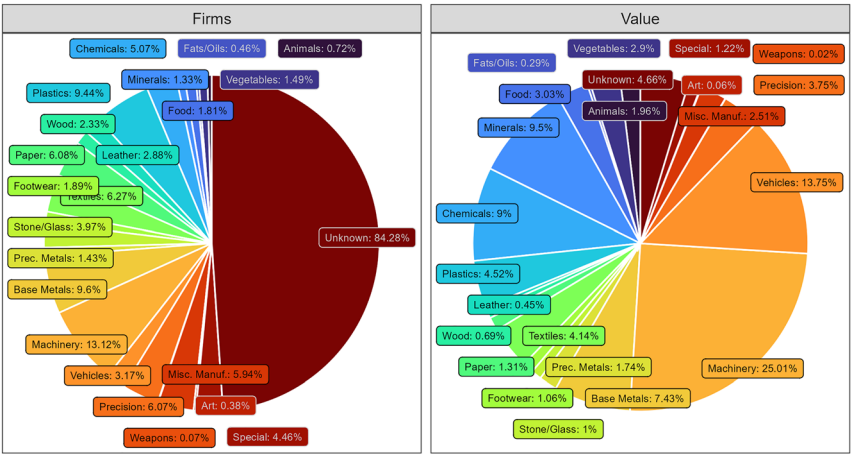


Figure 7: Product categories in total imports in 2019.
Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.
Notes: Missing values result from censoring. “Unknown” refers to observations from estimated data for firms below the exemption threshold for which product information is not available.

vehicles. This is consistent with the notion that modern trade is largely intra-industry in nature, although the present level of industry aggregation is, admittedly, rather high. Again, the corresponding shares in the firm-count are much lower: collectively, firms importing these two product categories account for less than 20 %. By and large, the pattern of differences between value shares and shares of trading firms that we have found for exports, we also find for imports: the dominating sectors exhibit significantly larger value shares than firm shares, with the difference being even more pronounced on the import side. Notice again, the large share of small firms listed under “Unknown”. These account for almost 85 % of importing firms, yet account for only 14.3 % of the import value. As can be seen from Table A.16, the shares sum up to 172.3 %, such that on average, firms import products from 1.72 product categories. Compared to 2011 (see Figure B.7), we observe a slight shift from mineral products towards vehicles and machinery, while most other categories barely move at all.

The intra-industry nature of German trade is also evident from the strong correlation across product categories between exports and imports. Interestingly, this holds for both, trade values (with a correlation coefficient of 0.94) and the number of trading firms (with a correlation coefficient of 0.98).³¹ The rank correlations are somewhat lower but still very high, with 0.91 for trade values and 0.95 for firm numbers. At the same time, our data does highlight some inter-industry structure of trade as well, with machinery and electronics as well as vehicles, the two leading product sections, exhibiting somewhat lower shares on the import side than on the export side. In a similar vein, minerals and mineral products are looming much larger on the import side (9.5 % in value terms) than on the export side (1.7 %).

We now turn to three extensive margins: (i) the number of firms that trade products within a given product section, (ii) the number of traded HS-8 products within this section, and (iii) the number of partner countries German firms are trading with in this section.³² Figure 8 (and Table A.12 in Appendix) report the results for exports. The darkest shade within each product category represents the counts for total trade, with the medium and lighter shades referring to extra-EU and intra-EU trade, respectively. The left panel shows that most exporters sell machinery and electronics, followed by firms engaging in exports of base metals or plastics and rubber. Chemicals, paper, textiles, vehicles, precision instruments and miscellaneous manufacturing are also strongly represented.

³¹ The numbers underlying these correlation coefficients can be found in the two leftmost columns of Tables A.14 and A.15.

³² Technically, the Harmonized System only covers product codes up to the six-digit level and our eight-digit products are specified according to the German version of the Combined Nomenclature system in use by EU countries (where the first six digits coincide with the HS).

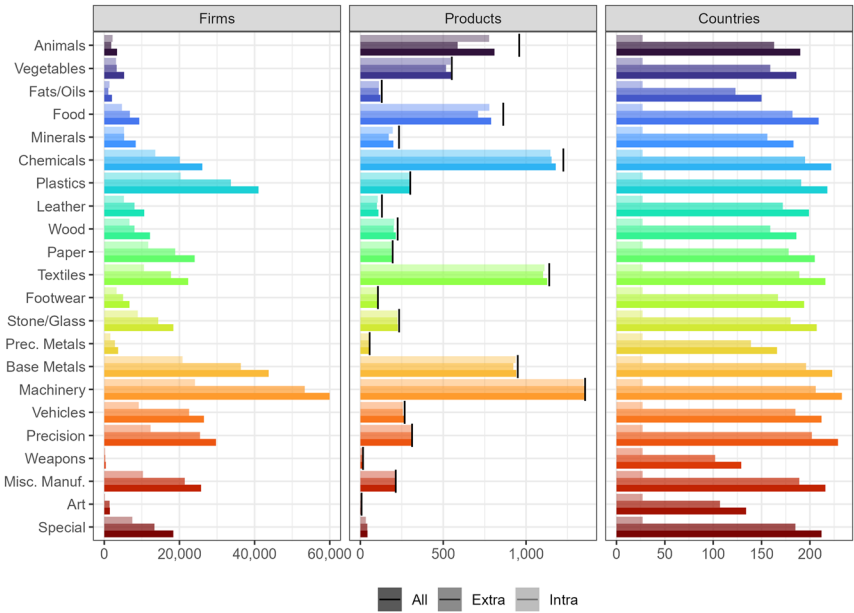


Figure 8: Exporting firms, exported products and destination countries by product categories in 2019.

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Notes: The vertical bar for the product panel indicates the maximum number of products existing in the respective category. Missing values result from censoring.

Comparing extra-EU and intra-EU exports, we observe that extra-EU firms tend to outnumber intra-EU firms in most product sections, but even without the firms below the exemption threshold, there are two exceptions: live animals and animal products, and fats and oils. The dominance of extra-EU firms is by far largest for art, but machinery and electronics as well as vehicles stick out, too.³³ Compared to 2011 (Figure B.8), there were no drastic changes.

The panel in the center shows the number of products traded, with the maximum (total) number of products that can be traded appearing as a vertical line. The short story here is that in most of the product sections, German firms *in their entirety* export almost all products. A visible gap only appears for animal products,

³³ Note that if we included the extra product category “Unknown”, most firms would fall into this category and thereby skew the entire plot, as can be read from Table A.12. But still, the remaining bars show the distribution across product categories of those firms responsible for most of the export volume.

food, minerals and chemicals.³⁴ The German economy as a whole thus appears highly diversified. As we shall document below, however, this does not hold true for each German firm individually. Note also, that this diversification has increased since 2011 (see Figure B.8), when the gap between the actual and maximum number of exported products used to be visible for the majority of product categories.

A similar story of diversification can be told for the number of destination countries for each product category; see the right panel. Unsurprisingly, within each section, Germany exports at least one product per category to all 27 EU partners and to the vast majority of non-EU countries, ranging from 102 countries (weapons) to 206 countries (machinery and electronics). Again, this masks much of the heterogeneity at the firm level, as will become evident below.

Figure 9 shows the results for imports. Again, the most frequently imported product category is machinery and electronics, but also chemicals, plastics and rubber, paper, textiles, base metals, precision instruments and miscellaneous manufacturing products are imported by a significant number of firms. While the numbers of eight-digit products within the categories are similar to those for the German exports, the number of origin countries tends to be somewhat lower across the board. Fats and oils as well as wood products are moreover imported from only 26 EU countries, respectively, instead of all 27. For extra-EU trade, the number of origin countries ranges from only 37 (weapons) to 181 (machinery and electronics).

5.2 Trade by Product Categories and Firm Types

We now combine information on “what” is traded with information on “who” is trading. More precisely, for each product category (HS section), we compute the shares of the five firm types defined above in the firm count and the transaction value. In doing so, we finally answer the question “who trades what”.

The share of manufacturing firms in the total export value of the product-section is by far largest for vehicles (88.5 %); see Figure 10 and Table A.14.³⁵ This is followed by a large group of products with shares around 70 %. We find only six product sections where this share is below 50 %, viz. minerals (45.3 %), textiles (39.0 %), leather (34.0 %), vegetable products (32.0 %), footwear and headgear (14.2 %), and art (4.5 %). Apart from minerals and art, these product sections exhibit a mirroring share of above 50 % for wholesale and retail firms. The value share of manufacturers is larger than the firm-number share of manufacturers for most products, the only

³⁴ Those also happen to be the product categories where we observe the strongest differences between extra-EU and intra-EU export participation.

³⁵ Even though almost 50 % of the firms engaged in vehicles exports are part of the motor vehicle traders, these only account for 7.7 % of the vehicles export value.

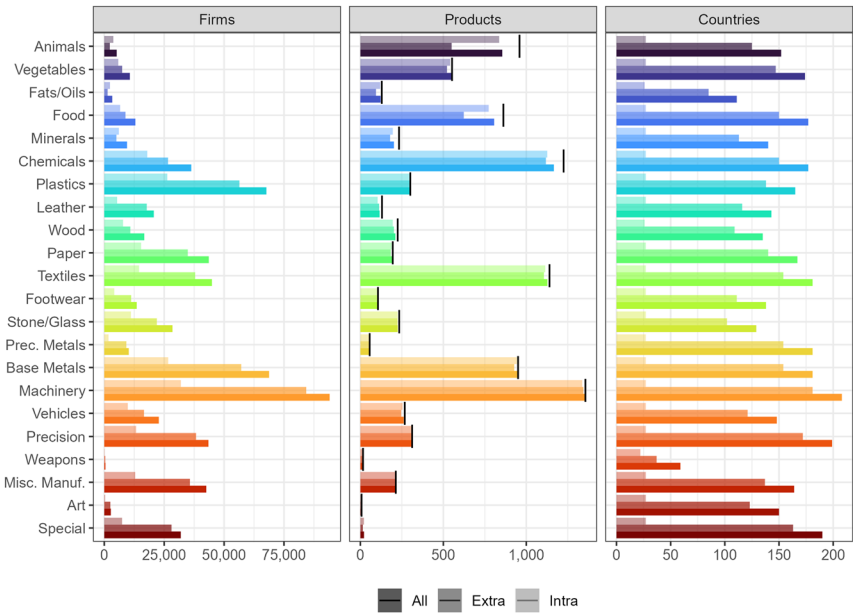


Figure 9: Importing firms, imported products and origin countries by product categories in 2019.
Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.
Notes: The vertical bar for the product panel indicates the maximum number of products existing in the respective category. Missing values result from censoring.

exception being footwear and headgear, and art. This indicates that manufacturing firms are generally more intensely involved in exporting than non-manufacturing firms.

On average, the exporting firms are split three-fold between manufacturing, wholesale and the remaining three types; whereas the export volume is largely concentrated on the manufacturing sector (59.3 %). Finally, the differences between total, extra-EU and intra-EU trade are relatively minor, which is why we relegate this information to Appendix (see Tables A.16 and A.17). Very similar results also hold for the year 2011 (see Figure B.10); with the only eye-catching change being a strong shift of export values from manufacturing towards retail in the leather, textiles and footwear categories.

Bernard et al. (2015) report that in Italian exports, intermediaries are focusing on products that are less differentiated, have lower contract intensity and require high sunk costs of trading.³⁶ It should be noted that we ask a different, though related,

³⁶ A similar finding is reported for US trade in Bernard et al. (2010).



Figure 10: Total exports by product category and firm type in 2019.

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Notes: Missing values result from censoring. “Unknown” refers to observations from estimated data for firms below the exemption threshold for which product information is not available.

question in that we look at the share of intermediaries active in trade within given product categories. Our results do not allow a conclusion as to whether this line of argument is also valid for German exports. Our reading of Figure 10 is that intermediaries play a more important role in products involving a relatively low degree of customization where detailed knowledge about specific product characteristics (available only to the producer) is less important.

For imports we observe a lower dominance of manufacturing within the different product sections than we do for exports; compare Figure 11 to Figure 10. This is consistent with our remarks on the role of intermediation in relation to the German aggregate export surplus at the end of Section 4 above. Moreover, the difference between the value share and the firm-number share of manufacturing firms, while still positive for almost all products, tends to be significantly smaller on the import side than on the export side. Nonetheless, in analogy to exports, manufacturing firms tend to be more engaged importers than non-manufacturing firms. For instance, within the machinery and electronics section, 52.3 % of the

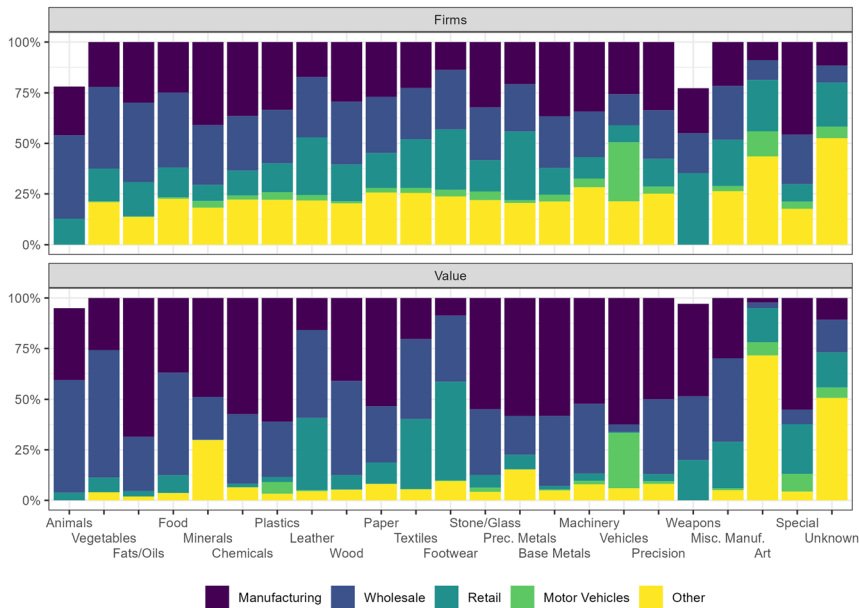


Figure 11: Total imports by product category and firm type in 2019.

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Notes: Missing values result from censoring. “Unknown” refers to observations from estimated data for firms below the exemption threshold for which product information is not available.

import value is handled by manufacturing firms, while the share of manufacturing importers accounts for only 34.3 % of all firms importing machinery and electronics. For vehicles, the value share of manufacturing importers is 62.5 % even though these account for no more than 25.7 % of all vehicles importers. However, compared to exporting, vehicle traders now play a much larger role, with a firm-count share (29.3 %) that is almost equal to the value share (27.5 %).

On average, comparing imports to exports, the composition of firms across all product categories shifts slightly from manufacturing and wholesale to retail and other firms, with the former two still being the most relevant firm types. Similarly, the value composition shifts from manufacturing to mostly wholesale, with manufacturing still being the most relevant firm type. Again, the differences between total, extra-EU and intra-EU trade, as well as the changes between 2011 and 2019 are more subtle and can be found in Tables A.18 and A.19, and Figure B.11, respectively.

6 Margin Decompositions

Since our firm-level trade data are broken down by products as well as partner countries, we may now generate further insights by investigating a whole cascade of decompositions into extensive and intensive margins as depicted in Figure 12, adapted from Mayer and Ottaviano (2008).³⁷ The figure uses export terminology but the idea may analogously be applied also to imports. To characterize the distribution for each of these margins, we compute means, standard deviations and five different percentiles (P1, P25, P50, P75, P99). Moreover, we again distinguish between the five firm types introduced above. Akerman (2018) assumes that the trade intermediation technology exhibits increasing returns to scale regarding the number of products

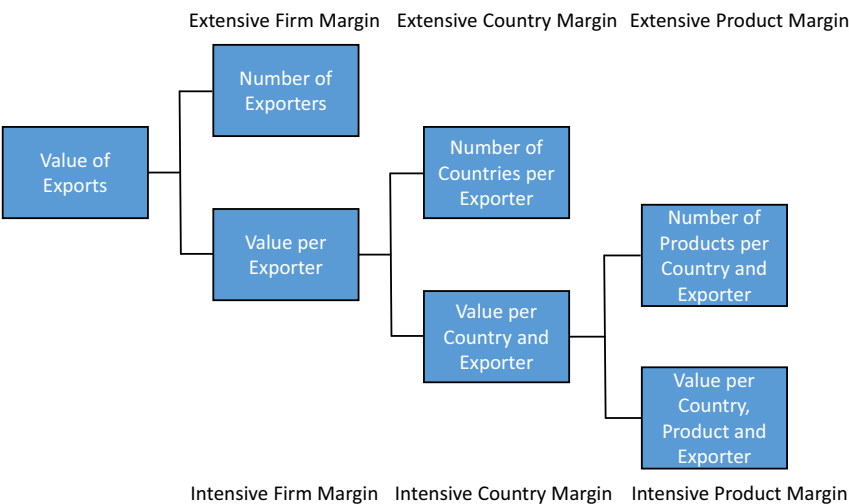


Figure 12: Decomposition of trade into intensive and extensive margins.

Source: Adapted from Mayer and Ottaviano (2008).

³⁷ Alternatively, the “value per exporter” can be first decomposed into product margins (“number of products per exporter”, “value per product and exporter”) and then into country margins (“number of countries per product and exporter”, “value per destination, product and exporter”). This decomposition order would reflect the idea that firms take their products as given, and then think about possible destinations (and not vice versa). However, due to the lack of detailed product information for firms below the exemption threshold (thus affecting total and intra-EU trade), we choose to prioritize the country margins. Nonetheless, we still present the results of the product decomposition below.

handed. His model predicts that trade intermediaries export more products than producers and that export sales per product are lower for trade intermediaries than for producers exporting on their own (Akerman 2018, p. 173). Using Swedish firm-level data for the year 2005, he finds evidence supporting these hypotheses.

Figure 13 and Table A.20 present the results for total German exports, while Figure 14 and Table A.21 look at total German imports. Two things are important when reading the subsequent figures. First, they have a log-scale on the horizontal axis. We do this in order to facilitate an easier visualization of the skewness of the distributions, since the discrepancy between the means and the medians is very large sometimes. A similar argument holds regarding the differences between different intensive margins, which are very large, too. The natural values are found in the corresponding Appendix tables. The second point relates to the fact, mentioned several times above, that the small firms below a certain threshold trade value

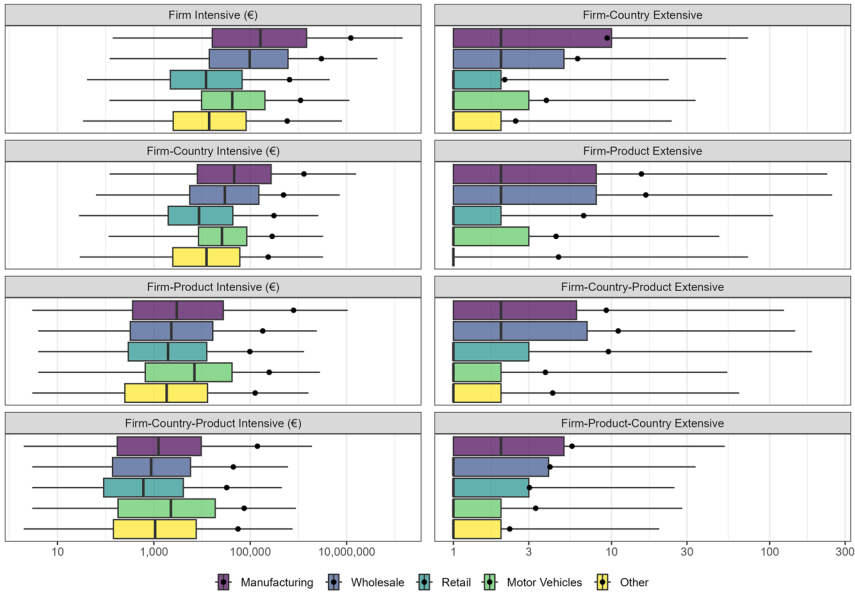


Figure 13: Margin decomposition for total exports in 2019.
Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.
Notes: The x-axis has a log-scale which allows for an easier visualization of the distributions despite their skewness. The left and right whiskers of the boxplots indicate the 1st and 99th percentiles, respectively. The box itself marks the 25th and 75th percentiles, with the vertical bar within the box representing the 50th percentile (median). The black circle marks the mean of the distribution. The standard deviation as well as the precise figures can be read from the accompanying table.

appear with a single (generic) product code in intra-EU trade. This means that the extensive product margins reported below must be read as lower bounds (except for extra-EU trade of course).

We infer from Figure 13, and in more detail from Table A.20, that on average, manufacturing firms are much larger exporters (in terms of export values) than non-manufacturing firms. However, the standard deviation of the export value distribution for manufacturing firms is also largest – about 27 times the mean, more than for non-manufacturing firms apart from vehicle traders and retailers. When it comes to the average number of export destinations, manufacturers are again in the lead, with an average of 9.4 countries per firm, although wholesale firms are not too far behind with around six destinations. On the other hand, all other firm types have much lower export sales per country than the manufacturers. For instance, on average retailers only sell €310,383 per foreign destination, compared to more than

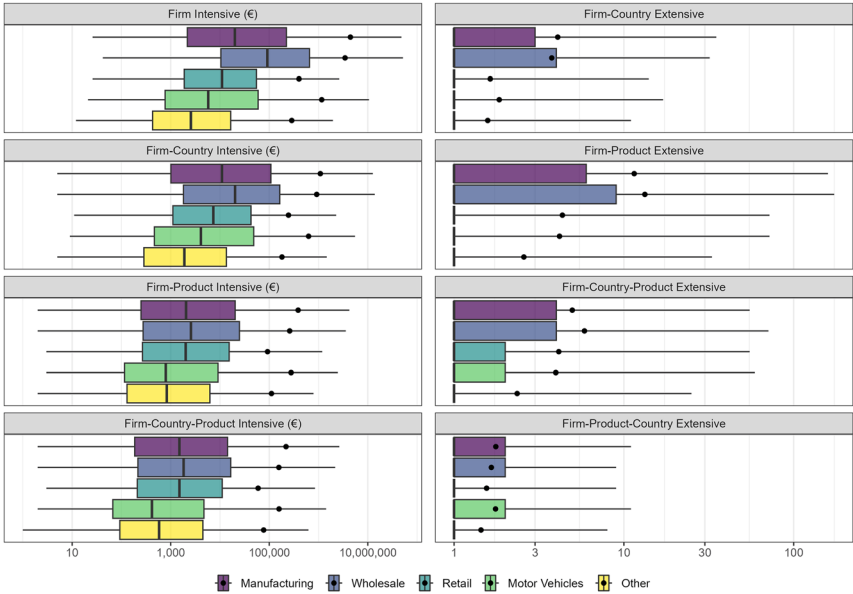


Figure 14: Margin decomposition for total imports in 2019.

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Notes: The x-axis has a log-scale which allows for an easier visualization of the distributions despite their skewness. The left and right whiskers of the boxplots indicate the 1st and 99th percentiles, respectively. The box itself marks the 25th and 75th percentiles, with the vertical bar within the box representing the 50th percentile (median). The black circle marks the mean of the distribution. The standard deviation as well as the precise figures can be read from the accompanying table.

€1.3 mio for manufacturing exporters.³⁸ As expected, and in line with observations for other countries, the intensive margin distribution is heavily right-skewed, with a median (P50) of a mere 1.3 % of the mean (3.6 % for the intensive country margin). The skewness of the intensive country margin distribution is even more pronounced for retail firms, with a median just below 3 % of the mean. The other non-manufacturing firms have a somewhat less pronounced right-skewness of their intensive export margins. The P99/P1 as well as the P75/P25 percentile ratios are by far largest for manufacturing firms. These observations tend to hold also for the year 2011 (see Figure B.12), especially for manufacturing, while the intensive margin skewness has increased somewhat notably for retailers and vehicle traders.

The extensive country margin distribution (number of destinations per firm) is right-skewed as well, but somewhat less so than the intensive firm or country margins, again measured by the ratio of the median to the mean. The numbers generally seem small compared to what one might have expected. For instance, 75 % of the manufacturing firms export to 10 or fewer destinations. For the remaining firm types, this number is even smaller.

All product margins in the bottom half of Figure 13 must be read with caution for reasons mentioned above (small firms appearing as single-product firms in intra-EU trade data). We nonetheless offer a few comments. Starting with the extensive firm-product margin, the average number of products exported is somewhat higher than the average number of destination countries. Remember that the reported number of products is a lower bound for the actual number. On average, manufacturing firms export 15.4 products and are surpassed only by wholesalers with 16.5 products. This result is in line with the prediction of the model proposed by Akerman (2018) and his empirical evidence (his Table 2). Unsurprisingly, the distribution is also more skewed than the extensive firm-country distribution, the median-to-mean ratio for manufacturing is about half of its country margin equivalent. Relative to the intensive firm-country margin, the intensive firm-product margin is much more dispersed, but tends to display smaller means and percentile values for almost all firm types. The average firm exports per product range from €98,284 (retail) to €791,601 (manufacturing), and the first three quartiles for vehicle traders lie above those of manufacturers. Again, this result is in line with the theoretical prediction and empirical evidence (Akerman 2018, Table 3).

Similar observations can be made for the third-level intensive and extensive margins. The extensive firm-country-product (products per firm and country) and firm-product-country (destination countries per firm and product) margins behave like their corresponding second-level margins, albeit at a smaller scale.

38 The results on the differences between trade intermediaries and producers in total exports and the number of destinations are in line with Akerman (2018); see his Table 1.

The associated intensive margin (value per firm, country and product)³⁹ strongly resembles the intensive firm-product margin.

To summarize this margin decomposition for German exports: The right-skewness is smaller for extensive margins than for intensive margins. Relative to the intensive firm margin, the skewness is larger for the firm-product and firm-country-product intensive margins, but smaller for the firm-country intensive margin. For the extensive margins, the skewness is largest at the firm-product level and smallest at the firm-country level, with the remaining margins found in-between. By and large, these tendencies hold for all firm types. Finally, the right-skewness at the intensive margins tends to be larger for manufacturing firms than for non-manufacturing ones, but the same is not true for the extensive margin.

Appendix contains two additional tables where we split exports into exports to other EU countries and exports to non-EU countries. In Table A.22, we decompose Germany's extra-EU exports. Note that unlike for total and intra-EU trade, these results are free of any product bias originating from small firms since for extra-EU trade there is virtually no reporting threshold. Perhaps the most striking difference between total and extra-EU trade is that manufacturing firms' sales to non-EU countries (€9.4 mio.) are on average about 5.5 times larger than those of wholesalers (€1.7 mio.), compared to a factor of 4.1 when considering total trade (€12.2 vs. €3.0 mio.). This difference also carries through to the intensive firm-product margin, but gets weaker for the other intensive margins. In contrast, for intra-EU trade (Table A.23), the difference in mean exports per firm only amounts to a factor of 3.0 (€7.3 vs. €2.4 mio.), indicating that wholesalers tend to export relatively more to EU partner countries. This is mainly driven by relative differences in the extensive firm-country and intensive firm-product margins.

The differences between 2011 and 2019, also to be found in Appendix (Table B.12), can be summarized swiftly. While the patterns regarding the skewness and the composition of heterogeneity across firm types remain largely unchanged, the observed levels used to be lower for some margins and firm types in 2011. This concerns especially the firm-intensive, firm-country-intensive, firm-product-extensive and firm-country-product extensive margins, and the firm types retailers and vehicle traders.

Switching to the import perspective, Figure 14 and Table A.21 replicate the margin decompositions for Germany's total imports in 2019. Throughout all four intensive margins, we observe very similar patterns. For instance, manufacturing firms boast the highest average import value per firm, per country and firm, per product and firm, and per country, product and firm. Somewhat lower values are

³⁹ For this margin, the calculation order does not matter, i.e. the value per firm, country and product is equal to the value per firm, product and country.

found for wholesalers and – in the latter two cases – by motor vehicle traders, with retailers and other firms trailing behind. The extensive margins, however, are much closer together. For instance, for the extensive firm-product-country margin there are almost no differences across firm categories. However, within these categories we nonetheless observe a pronounced right-skewness of the distributions.

Considering the mean-to-median ratio, the right-skewness of the intensive firm margin distribution for imports is much more pronounced than for exports if we consider manufacturing and most non-manufacturing firms, except for retailers. The extensive country margin distribution is less right-skewed for imports than for exports, except for the wholesalers. The general tendencies observed for exports when looking at ever narrower margins also appear for imports, albeit mostly at a smaller scale, although some exceptions exist for wholesalers and vehicle traders.

As with exports, we present separate decomposition tables for imports in Appendix. Thus, Table A.24 looks at extra-EU imports, again finding a stronger role of wholesalers in importing relative to exporting. The average import value per wholesaler (€3.6 mio.) is only about 10 % below its manufacturing counterpart (€4.0 mio.). Starting at the 25th percentile, wholesale imports even surpass manufacturing imports per firm. Throughout the remaining margins, there are only minor differences between manufacturing firms and wholesalers in the extra-EU part of German trade. Mirroring the differences between total and extra-EU trade, Table A.25 shows that for intra-EU imports, the average intensive margin values for manufacturers and wholesalers diverge again, while they stay close together throughout the extensive margins.

Regarding the changes between 2011 and 2019, we can infer from Figure B.13 that the intensive margin means of importing tend to have increased for retailers, wholesalers and vehicle traders, while having slightly decreased for manufacturers and other firms. The firm-product and firm-country-product extensive margin means have increased for all firm types except “others”. As for exports, the skewness and composition patterns largely hold throughout time.

7 Margin Correlations

The different margins considered up to this point are connected in at least three ways. Most obviously, if entering a certain export market is subject to a fixed cost, only firms above a certain productivity threshold will find entry to be profitable. Firms below this threshold level will abstain from entry (extensive margin). Moreover, across firms entering the market, those with a higher productivity will sell more than those with a lower productivity (intensive margin). But if productivity differences across firms are the same across products and destination markets, then

firms active on a certain product-country trade link are more likely to be active also in trade with other products and/or countries, and those selling more on one link will also sell more on other links. This argument is equally plausible on the import side where firms consider sourcing different types of inputs from different countries of origin.

Less obviously, there is a reinforcing element of *within-firm complementarity* across different product-country trade links. To see this, consider a certain set of firms sourcing certain inputs in some foreign country and assume that trade liberalization reduces the tariff and/or non-tariff barriers for these imports. This will prompt firms to *import more* (intensive margin) and in some cases to start sourcing inputs from this country where they did not do so before (extensive margin), due to a low productivity. In all cases, these firms will now benefit from lower input prices and, thus, from a lower marginal cost. But a lower marginal cost, in turn, magnifies the maximum profits that these firms will be able to reap from exporting to foreign markets. Consequently, they will *increase their export sales* to all markets (intensive margin), in some cases from a level of zero to start with (extensive margin). In other words, if a firm is more likely to be exporting a certain product to a certain market than some other firm because it is more productive, then this extensive margin advantage will increase if—for whatever reason—the firm's advantage from sourcing inputs from any foreign country increases. Complementarity also obtains in the other direction, from trade liberalization for a firm's exports to a certain country to the same firm's decision about sourcing inputs from cheap foreign sources. Remember the earlier argument that firms who benefit from lower barriers on their exports to certain countries will sell more to these countries, maybe even starting to export where they did not do so before. But higher revenues from exports allow these firms to spread the fixed cost of sourcing inputs from cheap foreign markets over larger volumes of sales, thus increasing the likelihood of entering those markets as buyers of inputs. A formal analysis of such complementarities is found in Bernard et al. (2018).

Clearly, the exact same logic of within-firm complementarity also applies across different export markets as well as across different import markets. For instance, if trade liberalization for a firm's exports on a certain product-country link enables the firm to better exploit cheap intermediates from foreign suppliers, then this will also benefit (through lower marginal cost) the firm's exports to other countries for that same product or for other products using those same intermediates.

Finally, the margins considered above are also related through general equilibrium interdependencies *between firms and sectors*. Different firms are connected to each other by using the same primary inputs that are in fixed supply, like labor. Firms react to trade liberalization for exports or imported intermediates by expanding production and sales. But with a given overall resource constraint on

national factor markets, they can only do so by bidding away primary inputs from other firms not benefiting (or less so) from trade liberalization. This implies higher prices of those inputs, which will negatively affect these other firms’ activities on all of their trading links. It is obvious that these general equilibrium connections are not complementary in nature since some firms expand at the expense of others. Notice, however, that there may also be cross-firm complementarity relationships running through cheaper inputs obtained from other (domestic) firms benefiting from cheaper imported intermediates do work in this direction.

Against this background—and following Bernard et al. (2018)—we calculate a set of correlation coefficients between different margins of trade for German firms. The within-firm complementarities described above work towards positive values for all possible coefficients. High coefficient values thus indicate a strong empirical importance of these complementarities, small (or negative) coefficients indicate that mechanisms other than the productivity-based determinations of the various margins lying behind the complementarities are important, too. Table 3 depicts a “heat-map” representation of cross-margin correlation coefficients for total trade in 2019. In this figure, the element 1,2 (first row, second column) tells us that the correlation

Table 3: Margin correlations for total trade in 2019.

	Trade Value	Export Value	Import Value	Imported Country-Products	Imported Products	Origin Countries	Exported Country-Products	Exported Products	Destination Countries
Trade Value		0.65	0.67	0.53	0.51	0.49	0.62	0.60	0.64
Export Value	0.65		0.11	0.34	0.32	0.28	0.80	0.82	0.87
Import Value	0.67	0.11		0.63	0.62	0.68	0.27	0.23	0.23
Imported Country-Products	0.53	0.34	0.63		0.98	0.93	0.57	0.53	0.51
Imported Products	0.51	0.32	0.62	0.98		0.87	0.54	0.52	0.47
Origin Countries	0.49	0.28	0.68	0.93	0.87		0.52	0.47	0.47
Exported Country-Products	0.62	0.80	0.27	0.57	0.54	0.52		0.97	0.95
Exported Products	0.60	0.82	0.23	0.53	0.52	0.47	0.97		0.88
Destination Countries	0.64	0.87	0.23	0.51	0.47	0.47	0.95	0.88	

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.
Notes: All coefficients are statistically significant (p -value < 0.01).

coefficient across all firms between their total trade (exports plus imports, taking all product and partner countries) and their export values is equal to 0.65. The corresponding coefficient for import values is equal to 0.67 (element 2,3). However, positive values of these coefficients are not surprising since gross trade and exports (or imports) are positively correlated by definition. More interestingly, the correlation between import values and export values is positive but relatively small, with a value of 0.11. Calculated separately for extra-EU and intra-EU trade, we even obtain negative values, equal to -0.04 in either case (see Tables A.26 and A.27). By comparison, Bernard et al. (2018) find a markedly larger coefficient of correlation between export and import values per firm for 2007 US data, equal to 0.34.

Moving further to the right (and down) of Table 3, we look at the number of countries and products, respectively, imported by each firm as well as the number of distinct country-product pairs for imports. When looking at the extensive product margin, however, we need to bear in mind that in our data for intra-EU trade small firms below the reporting threshold appear as trading a single product, even if in fact they trade more than one good. We argue that this should not be much of a concern at this stage, for the following reason. Whatever two margins we look at, below-threshold firms—almost by definition—are small on both margins. Hence, their contribution to the true covariance is positive. To the extent that the data wrongly classify such firms as trading but a single product, their calculated contribution to the covariance is larger than their true contribution, which generates an upward bias in the calculated correlation coefficient. At the same time, for the exact same reason, such firms also lead to an upward bias in the calculated standard deviation, which—in and of itself—introduces a downward bias in the calculated correlation coefficient. Given two opposing forces mechanically deriving from the same logic, we conclude that there is reason to expect that the bias in the calculated correlation coefficients caused by firms wrongly classified as single-product traders is small. This still leaves the question of whether the coefficient of correlation is the “correct” way to measure the degree of complementarity between different margins, but this question lies beyond the scope of the present paper.

The correlation coefficient between any two of the three extensive margins are very high, with values between 0.87 and 0.98. This is not too surprising. Firms importing many products tend to also import from many countries, as witnessed by a correlation coefficient equal to 0.87. Pretty much the same picture emerges if we look at the corresponding export margins in the far right columns (or bottom rows). Moreover, the corresponding values for extra-EU and intra-EU imports found in Tables A.26 and A.27 are quite similar. Interestingly, the corresponding values reported for the US by Bernard et al. (2018) are much lower, at 0.69 for imports and 0.74 for exports.

More interesting, against the above theoretical background, are the correlations between these extensive margins for imports and those for exports. For total trade, we observe correlation coefficients in the vicinity of (and mostly above) 0.5, while calculated separately for intra-EU as well as for extra-EU trade, the values are somewhat lower, particularly for extra-EU trade. How are the extensive margins for exports related to the intensive margin for imports? For total trade, Table 3 reports values between 0.23 and 0.27 while for the intensive margin for exports, i.e. the same trade direction; the values are between 0.80 and 0.87. For the extensive margins for imports the correlation with the intensive margin of the same direction (imports) are also higher, between 0.62 and 0.68, than with the intensive margin of the opposite direction (exports), which are between 0.28 and 0.34. A broadly similar pattern is observed for the US by Bernard et al. (2018). The positive correlation between extensive export margins and the intensive import margin (and vice versa) testifies to the empirical importance of the above-mentioned complementarities. Interestingly, this evidence is markedly lower if we look at intra-EU and extra-EU trade separately. The cross-correlation coefficients that we obtain are much lower than those for total trade.⁴⁰

Finally, we compare these correlations for 2019 with those for 2011 in Tables B.8 through B.10. Perhaps the most striking difference are the lower values for the cross-correlation coefficients between the extensive export margins and the intensive import margins, and vice versa. This is cursory evidence for German firms having become more global in terms of being active on multiple margins for both, exports and imports.

8 Summary and Outlook

In this paper, we have zoomed in on the firm level of German foreign trade, using a novel data base, “AHS-Panel”, furnished by the Federal Statistical Office of Germany (DESTATIS). As we have detailed in the paper, DESTATIS has made special efforts to purge this data set from inconsistencies due to peculiarities of reporting procedures, particularly regarding threshold levels for intra-EU trade and consolidated reporting of taxable entities.

Our analysis has focused on several questions. First, we have explored just how global German trading firms are. Following the recent literature, we have judged how global a firm is based on the number of countries it trades with and the number

⁴⁰ Note, again, that the values for total trade do not lie between those for intra-EU and extra-EU trade since the distinction is not mutually exclusive. Nonetheless, calculating extensive margins separately for intra- and extra-EU trade might be questioned, at least when looking at the extensive country margin.

of products it trades in as well as by whether it is both, an importer and an exporter, and whether it is active in intra-EU and extra-EU trade.

A second focus of our analysis, again prompted by recent literature, is the role of trade intermediation in German trade. More specifically, in all of the calculations, we have made a distinction between trade that is carried out directly by firms whose main activity is manufacturing production and non-manufacturing production, respectively, and firms mainly engaged in wholesale or retail trade. Although we did not formally test any of the hypotheses brought up in the literature about what drives trade intermediation, the differences that we find between these firm types are substantial and quite plausible against the backdrop of this literature.

Perhaps the richest set of results that we present in this paper relates to the distribution of German firms in their foreign trade along three different margins: transaction values (intensive margins), the number of products traded in, and countries traded with (extensive margins). We describe details of this heterogeneity through conventional statistics, such as different percentiles, the mean/median ratio and the standard deviations, and we do so separately for imports and exports as well as for intra-EU and extra-EU trade. In some sense, the main message from this part of our analysis is, admittedly, not too surprising, given the existing literature on Germany and other countries: There really is a lot of firm-level heterogeneity in German trade, and all distributions are heavily skewed to the right which means that a small number of firms account for a vast part of German trade. But we go much beyond this message, however, in decomposing firm-level trade along the above mentioned margins and describing the distributions at all possible margins. Furthermore, we do so not only for total trade (exports and imports), but also for intra-EU and extra-EU trade, and separately for all of the above mentioned firm types. It turns out that the distributions differ substantially across these different parts of German trade, and available space did not allow us to describe these differences in full detail.

Finally, we have used the new data set to shed light on complementarities between different margins, particularly between export and import margins. Recent literature argues for such complementarities based on productivity-based self-selection of firms into both export markets and into sourcing inputs from foreign countries. We measure such complementarities through the coefficient of correlation across individual firms, and the positive values we find indicate that complementarities do play a substantial role in German firms' foreign trade.

This paper has done little more than scratching the surface of what can be done using the data set "AHS-Panel". We hope it will serve as a starting point for the wider use of this data set by the scientific community. Indeed, "AHS-Panel" has been made accessible for the scientific community as AFiD-Panel Außenhandelsstatistik,⁴¹ and it

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is due to be merged with data on services trade as well as data on a host of firm-level co-variates (see Kruse et al. 2021). This should prompt researchers to extend the descriptive analysis of German firm-level trade beyond what we could do in this first attempt. But more importantly, this whole structure of firm-level data around “AHS-Panel” should form the basis of a whole strand of research aiming to establish causal relationships related to all sorts of firm-level performance and such phenomena as outsourcing or questions about the international decoupling of value chains. And finally, it should be a valuable data base to use for the calibration of computable general equilibrium models of the “new quantitative trade” variety.

Appendix A: Tables

A.1 How Global are German Trading Firms

Table A.1: Number of trading firms and relative values per firm by firm type in 2019.

Firm type	All trade		Extra-EU		Intra-EU	
	Number of					
	Exporters	Importers	Exporters	Importers	Exporters	Importers
Manufacturing	69,316	102,391	42,667	45,209	61,217	89,774
Wholesale	56,556	79,269	29,783	37,961	48,841	68,336
Retail	35,203	145,224	11,457	30,699	30,389	135,584
Motor vehicles	26,312	40,339	13,027	7177	22,498	38,054
Other	87,624	349,351	21,634	49,309	76,053	327,478
Total	275,011	716,574	118,568	170,355	238,998	659,226
Firm type	Value per					
	Exporter*	Importer*	Exporter*	Importer*	Exporter*	Importer*
Manufacturing	3.00	3.41	2.32	1.73	2.72	3.73
Wholesale	0.74	2.65	0.42	1.56	0.91	2.45
Retail	0.16	0.31	0.15	0.34	0.20	0.31
Motor vehicles	0.27	0.89	0.11	0.65	0.39	1.16
Other	0.14	0.22	0.18	0.36	0.18	0.22
Mean (mio. €)	4.07	1.30	4.03	2.29	2.69	0.82

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Notes: *: relative to the mean. Note that firm numbers for extra-EU plus intra-EU trade exceed the number of firms for total trade, due to firms that are both exporters and importers. Hence, the values for total trade are no convex combinations of the numbers for intra-EU and extra-EU trade.

Table A.2: Traded value by firm type in 2019.

Firm type	Exports (bn. €)	Extra-EU share	Imports (bn. €)	Extra-EU share
Manufacturing	847.7	47.2 %	453.8	39.5 %
Wholesale	169.5	29.6 %	273.4	49.6 %
Retail	23.0	29.6 %	58.2	41.4 %
Motor vehicles	29.1	19.9 %	46.7	22.9 %
Other	51.2	29.9 %	99.8	41.2 %
Total	1120.5	42.7 %	931.9	41.9 %

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Table A.3: Pure exporters, importers and two-way traders in 2019.

Firm type	Number of			
	Pure importers	Pure exporters	Two-way traders	Firms in URS
Total trade				
Manufacturing	45,896	12,821	56,495	228,723
Wholesale	32,060	9347	47,209	↓
Retail	117,430	7409	27,794	609,381
Motor vehicles	24,355	10,328	15,984	↑
Other	295,656	33,929	53,695	2,721,093
Total	515,397	73,834	201,177	3,559,197
Extra-EU trade				
Manufacturing	13,577	11,035	31,632	
Wholesale	16,945	8767	21,016	
Retail	24,213	4971	6486	
Motor vehicles	4,326	10,176	2851	
Other	37,320	9645	11,989	
Total	96,381	44,594	73,974	
Intra-EU trade				
Manufacturing	46,232	17,675	43,542	
Wholesale	32,561	13,066	35,775	
Retail	113,738	8543	21,846	
Motor vehicles	24,572	9016	13,482	
Other	284,618	33,193	42,860	
Total	501,721	81,493	157,505	

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations. See also DESTATIS (2022).

Notes: Quite surprisingly, there seem to be more pure exporters in intra-EU than in total trade. This is most likely due to some intra-EU pure importers turning into two-way traders once we change the perspective to total trade and the additional pure exporters from extra-EU trade not being sufficient to balance this outflow. The last column displays the number of firms appearing in the URS data and can be considered an approximation of the total number of firms (including non-trading firms). Wholesale, retail and vehicles are not separated.

Table A.4: Global firms in 2019.

Sector	Number of		
	Importers	Exporters	Total traders
Active in intra-EU or extra-EU trade			
Manufacturing	102,391	69,316	115,212
Wholesale	79,269	56,556	88,616
Retail	145,224	35,203	152,633
Motor vehicles	40,339	26,312	50,667
Other	349,351	87,624	383,280
Total	716,574	275,011	790,408
Active in both intra-EU and extra-EU trade			
Manufacturing	32,592	34,568	48,481
Wholesale	27,028	22,068	39,514
Retail	21,059	6643	27,164
Motor vehicles	4892	9213	13,756
Other	27,436	10,063	36,345
Total	113,007	82,555	165,260
Active in both intra-EU and extra-EU trade			
	Pure importers	Pure exporters	Two-way traders
Manufacturing	13,913	15,889	18,679
Wholesale	17,446	12,486	9582
Retail	20,521	6105	538
Motor vehicles	4543	8864	349
Other	26,282	8909	1154
Total	82,705	52,253	30,302

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Table A.5: Distribution of extra-EU exports by number of countries and products in 2019.

Firms		Number of countries						
Number of products		1	2	3	4	5	6-10	11+
	1	25.2	3.0	1.1	0.6	0.3	0.6	0.3
	2	7.1	4.2	1.5	0.8	0.4	0.8	0.4
	3	3.2	2.0	1.4	0.8	0.5	0.9	0.4
	4	2.0	1.2	0.8	0.6	0.4	0.8	0.4
	5	1.3	0.8	0.5	0.4	0.3	0.7	0.5
	6-10	3.1	1.9	1.3	1.0	0.8	2.2	1.8
	11+	3.0	2.1	1.6	1.3	1.1	4.1	8.6
	Total	44.8	15.2	8.2	5.4	3.8	10.2	12.4
Value		Number of countries						
Number of products		1	2	3	4	5	6-10	11+
	1	0.6	0.1	0.1	0.1	0.0	0.1	0.2
	2	0.4	0.2	0.3	0.1	0.1	0.3	0.4
	3	0.1	0.2	0.1	0.1	0.1	0.2	0.3
	4	0.1	0.1	0.1	0.1	0.1	0.2	0.5
	5	0.4	0.1	0.1	0.1	0.1	0.2	0.6
	6-10	0.2	0.2	0.3	0.2	0.2	1.1	2.3
	11+	0.5	0.5	0.5	0.5	0.5	3.9	82.2
	Total	2.3	1.5	1.4	1.1	1.2	6.0	86.5

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Table A.6: Distribution of extra-EU imports by number of countries and products in 2019.

Firms		Number of countries						
Number of products		1	2	3	4	5	6-10	11+
	1	26.6	0.9	0.1	0.0	0.0	0.0	0.0
	2	8.1	5.0	0.5	0.1	0.0	0.0	0.0
	3	3.8	3.2	1.3	0.2	0.1	0.1	0.0
	4	2.3	2.1	1.2	0.5	0.1	0.1	0.0
	5	1.5	1.5	1.0	0.5	0.2	0.1	0.0
	6-10	2.9	3.6	2.9	1.9	1.1	1.1	0.1
	11+	1.9	2.6	2.8	2.8	2.3	7.2	5.7
	Total	47.0	18.9	9.8	6.0	3.8	8.6	5.9
Value		Number of countries						
Number of products		1	2	3	4	5	6-10	11+
	1	1.7	0.1	0.0	0.0	0.0	0.2	0.0
	2	0.2	0.3	0.1	0.0	0.2	0.0	0.0
	3	0.2	0.4	0.3	0.0	0.0	0.0	0.0
	4	0.1	0.1	0.1	0.1	0.1	0.1	0.8
	5	0.1	0.1	0.1	0.1	0.1	0.1	0.0
	6-10	0.3	0.5	0.6	0.5	0.5	2.5	0.4
	11+	0.6	1.1	1.7	1.6	2.2	13.1	68.5
	Total	3.3	2.7	2.8	2.3	3.0	16.1	69.8

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Table A.7: Distribution of intra-EU exports by number of countries and products in 2019.

Firms		Number of countries						
Number of products		1	2	3	4	5	6-10	11+
	1	77.1	1.2	0.8	0.6	0.5	1.6	1.8
	2	0.3	0.3	0.2	0.1	0.1	0.5	0.6
	3	0.1	0.1	0.1	0.1	0.1	0.3	0.4
	4	0.1	0.1	0.1	0.1	0.1	0.3	0.4
	5	0.1	0.1	0.1	0.1	0.1	0.3	0.3
	6-10	0.2	0.1	0.1	0.1	0.2	0.7	1.4
	11+	0.3	0.2	0.2	0.2	0.3	1.3	5.7
	Total	78.1	2.1	1.6	1.3	1.2	5.0	10.6
Value		Number of countries						
Number of products		1	2	3	4	5	6-10	11+
	1	2.6	0.3	0.6	0.2	0.3	1.0	2.8
	2	0.1	0.1	0.1	0.1	0.1	0.7	1.5
	3	0.1	0.1	0.1	0.1	0.1	0.5	1.1
	4	0.1	0.0	0.1	0.1	0.1	0.4	1.1
	5	0.0	0.0	0.0	0.1	0.1	0.3	0.9
	6-10	0.1	0.1	0.1	0.2	0.2	1.8	4.5
	11+	0.3	0.3	0.2	0.4	0.6	3.7	71.7
	Total	3.3	1.0	1.3	1.1	1.4	8.4	83.6

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Table A.8: Distribution of intra-EU imports by number of countries and products in 2019.

Firms		Number of countries						
Number of products		1	2	3	4	5	6-10	11+
	1	88.7	0.9	0.7	0.5	0.4	0.9	0.1
	2	0.2	0.5	0.1	0.1	0.0	0.1	0.0
	3	0.1	0.2	0.2	0.1	0.0	0.1	0.0
	4	0.1	0.1	0.1	0.1	0.0	0.1	0.0
	5	0.0	0.1	0.1	0.1	0.1	0.1	0.0
	6-10	0.1	0.2	0.2	0.2	0.2	0.4	0.1
	11+	0.2	0.2	0.2	0.2	0.3	1.7	1.3
	Total	89.5	2.0	1.4	1.2	1.0	3.2	1.6

Value		Number of countries						
Number of products		1	2	3	4	5	6-10	11+
	1	6.4	0.5	0.3	0.6	0.3	1.5	1.5
	2	0.4	0.4	0.3	0.2	0.1	0.3	0.2
	3	0.4	0.3	0.2	0.4	0.1	0.2	0.2
	4	0.2	0.2	0.2	0.2	0.1	0.3	0.2
	5	0.2	0.6	0.2	0.1	0.2	0.4	0.1
	6-10	0.3	0.5	0.5	0.7	0.4	1.9	0.8
	11+	1.0	0.6	0.9	1.7	1.2	15.3	56.6
	Total	8.9	3.0	2.6	3.8	2.4	19.9	59.5

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Table A.9: Distribution of intra-EU exports (without estimations for firms below the exemption threshold) by number of countries and products in 2019.

Firms		Number of countries						
Number of products		1	2	3	4	5	6-10	11+
	1	5.4	1.8	1.3	1.0	0.9	3.5	5.0
	2	1.3	1.3	0.8	0.7	0.6	2.3	2.9
	3	0.7	0.7	0.6	0.5	0.4	1.7	2.1
	4	0.4	0.3	0.4	0.4	0.3	1.4	1.8
	5	0.3	0.3	0.3	0.3	0.3	1.3	1.6
	6-10	0.9	0.7	0.7	0.7	0.8	3.5	6.7
	11+	1.5	1.1	1.1	1.1	1.2	6.6	28.3
	Total	10.5	6.2	5.2	4.8	4.6	20.3	48.4
Value		Number of countries						
Number of products		1	2	3	4	5	6-10	11+
	1	0.6	0.3	0.6	0.1	0.3	0.8	2.2
	2	0.2	0.1	0.1	0.1	0.1	0.7	1.5
	3	0.1	0.1	0.1	0.1	0.1	0.5	1.2
	4	0.1	0.1	0.1	0.1	0.1	0.5	1.1
	5	0.0	0.0	0.0	0.1	0.1	0.3	1.0
	6-10	0.1	0.1	0.1	0.2	0.2	1.9	4.6
	11+	0.3	0.3	0.2	0.4	0.7	3.8	73.9
	Total	1.3	1.0	1.3	1.1	1.4	8.5	85.5

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, survey years 2011–2019, own calculations.

Table A.10: Distribution of intra-EU imports (without estimations for firms below the exemption threshold) by number of countries and products in 2019.

Firms		Number of countries						
		1	2	3	4	5	6-10	11+
Number of products	1	13.4	1.8	0.8	0.6	0.4	1.2	0.4
	2	3.1	3.0	0.9	0.6	0.3	0.7	0.2
	3	1.5	1.5	1.4	0.6	0.3	0.6	0.2
	4	0.9	0.9	1.0	0.8	0.4	0.6	0.1
	5	0.6	0.6	0.7	0.7	0.5	0.7	0.2
	6-10	1.7	1.4	1.9	2.1	1.8	4.1	0.6
	11+	2.0	1.5	1.8	2.5	2.9	18.5	14.7
	Total	23.3	10.7	8.6	7.8	6.8	26.5	16.3
Value		Number of countries						
		1	2	3	4	5	6-10	11+
Number of products	1	1.4	0.5	0.2	0.5	0.1	0.5	0.3
	2	0.5	0.4	0.3	0.2	0.1	0.3	0.2
	3	0.4	0.3	0.2	0.4	0.1	0.3	0.2
	4	0.2	0.2	0.2	0.2	0.1	0.3	0.2
	5	0.2	0.6	0.2	0.1	0.2	0.4	0.1
	6-10	0.4	0.5	0.5	0.7	0.4	2.1	0.9
	11+	1.1	0.6	1.0	1.8	1.3	16.6	61.5
	Total	4.1	3.1	2.7	4.0	2.4	20.4	63.4

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, survey years 2011–2019, own calculations.

A.2 Trade Intermediation

Table A.11: Decomposition of the German trade surplus in 2019.

Firm type	Export-import ratio		
	Total values	Per firm	No. of firms
Manufacturing	1.868	2.759	0.677
Wholesale	0.620	0.869	0.713
Retail	0.395	1.630	0.242
Motor vehicles	0.623	0.955	0.652
Other	0.513	2.045	0.652
Total	1.202	3.133	0.384

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

A.3 Who Trades What?

Table A.12: Exporting firms, exported products and destination countries by product categories in 2019.

HS section	Description	Number of firms			Number of products			Number of countries			
		Total	Extra-EU	Intra-EU	Maximum	Total	Extra-EU	Intra-EU	Total	Extra-EU	Intra-EU
1	Live animals; animal products	3399	1860	2211	959	809	587	777	190	163	27
2	Vegetable products	5281	3302	3117	552	547	517	545	186	159	27
3	Animal or vegetable fats and oils	2046	1085	1385	129	121	111	112	150	123	27
4	Food, beverages, tobacco	9303	6803	4699	862	789	710	778	209	182	27
5	Mineral products	8361	5288	5254	233	199	171	195	183	156	27
6	Chemical products	26,095	20,105	13,566	1225	1179	1154	1147	222	195	27
7	Plastics and rubber	41,041	33,692	20,311	301	300	300	300	218	191	27
8	Leather	10,618	8035	5222	130	109	100	105	199	172	27
9	Wood	12,148	8028	6690	225	214	201	204	186	159	27
10	Paper	24,048	18,874	11,684	195	190	188	189	205	178	27
11	Textiles	22,327	17,747	10,575	1140	1127	1103	1111	216	189	27
12	Footwear and headgear	6698	5002	3276	106	106	106	106	194	167	27
13	Stone products	18,380	14,351	8906	234	226	224	225	207	180	27
14	Precious metals	3678	2829	1619	56	53	52	53	166	139	27
15	Base metals	43,747	36,328	20,828	950	941	923	937	223	196	27
16	Machinery and electronics	59,965	53,338	24,139	1360	1360	1352	1348	233	206	27
17	Vehicles	26,521	22,574	9161	267	267	256	257	212	185	27
18	Precision instruments	29,733	25,471	12,303	313	313	313	309	229	202	27
19	Weapons	389	268	208	16	16	16	16	129	102	27
20	Miscellaneous manufacturing	25,759	21,422	10,281	214	214	214	213	216	189	27
21	Art	1482	1409	144	7	7	7	7	134	107	27
22	National categories	18,372	13,346	7454	-	43	42	33	212	185	27
23	Unknown	190,764	0	190,764	1	1	0	1	27	0	27
	Total	275,011	118,568	238,998	9475	9131	8647	8968	244	217	27

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations. **Notes:** The column 'Maximum' contains the potential number of products per HS section. The column totals refer to the total number of firms, the total number of products, and the total number of destination countries. Missing values result from censoring. "Unknown" refers to observations from estimated data for firms below the exemption threshold for which product information is not available.

Table A.13: Importing firms, imported products and origin countries by product categories in 2019.

HS section	Description	Number of firms			Number of products			Number of countries			
		Total	Extra-EU	Intra-EU	Maximum	Total	Extra-EU	Intra-EU	Total	Extra-EU	Intra-EU
1	Live animals; animal products	5176	2320	3778	959	855	550	836	152	125	27
2	Vegetable products	10,668	7466	5827	552	549	522	541	174	147	27
3	Animal or vegetable fats and oils	3332	1391	2376	129	122	94	120	111	85	26
4	Food, beverages, tobacco	12,979	8834	6616	862	806	623	773	177	150	27
5	Mineral products	9496	5053	6075	233	202	179	195	140	113	27
6	Chemical products	36,309	26,602	17,941	1225	1166	1118	1126	177	150	27
7	Plastics and rubber	67,655	56,377	26,308	301	301	300	298	165	138	27
8	Leather	20,656	17,711	5377	130	116	113	104	143	116	27
9	Wood	16,676	10,871	7821	225	211	202	195	135	109	26
10	Paper	43,599	34,848	15,343	195	191	183	189	167	140	27
11	Textiles	44,918	37,939	14,490	1140	1127	1106	1114	181	154	27
12	Footwear and headgear	13,537	11,224	4157	106	106	106	106	138	111	27
13	Stone products	28,467	21,919	11,130	234	225	224	225	129	102	27
14	Precious metals	10,215	9220	1778	56	55	55	54	181	154	27
15	Base metals	68,776	57,152	26,669	950	948	927	944	181	154	27
16	Machinery and electronics	94,043	84,292	31,979	1358	1358	1344	1337	208	181	27
17	Vehicles	22,751	16,565	9812	267	261	246	254	148	121	27
18	Precision instruments	43,475	38,301	13,274	313	313	313	308	199	172	27
19	Weapons	485	415	130	16	16	16	16	59	37	22
20	Miscellaneous manufacturing	42,582	35,753	12,901	214	214	214	213	164	137	27
21	Art	2730	2549	324	7	7	7	7	150	123	27
22	National categories	31,934	28,053	7427	-	22	15	21	190	163	27
23	Unknown	603,948	0	603,948	1	1	0	1	27	0	27
	Total	716,574	170,355	659,226	9473	9172	8457	8977	244	217	27

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Notes: The column 'Maximum' contains the potential number of products per HS section. The column totals refer to the total number of firms, the total number of products, and the total number of destination countries. Missing values result from censoring. "Unknown" refers to observations from estimated data for firms below the exemption threshold for which product information is not available.

Table A.14: Total exports by firm type and commodity type in 2019.

HS section	Description	Total		Manufacturing		Wholesale		Retail		Motor vehicles		Other	
		Exporters	Exports	Exporters	Exports	Exporters	Exports	Exporters	Exports	Exporters	Exports	Exporters	Exports
1	Live animals; animal products	1.24	1.56	22.42	68.88	44.16	24.56	8.38	0.36	–	–	–	–
2	Vegetable products	1.92	0.90	20.20	32.02	49.31	57.43	10.30	3.16	0.74	0.00	19.45	7.39
3	Animal or vegetable fats and oils	0.74	0.15	30.94	75.38	46.68	22.12	10.17	0.81	1.91	0.00	10.31	1.69
4	Food, beverages, tobacco	3.38	2.63	31.41	66.38	39.42	28.38	11.77	2.02	1.24	0.04	16.17	3.17
5	Mineral products	3.04	1.67	41.10	45.33	36.45	20.21	4.88	0.14	3.41	0.46	14.16	33.86
6	Chemical products	9.49	10.46	39.84	76.07	35.65	20.94	7.86	0.51	1.94	0.08	14.72	2.39
7	Plastics and rubber	14.92	5.48	44.44	78.93	31.21	14.66	6.26	0.58	3.40	2.51	14.69	3.32
8	Leather	3.86	0.23	30.66	33.95	37.54	38.32	14.30	21.88	2.31	0.80	15.20	5.04
9	Wood	4.42	0.63	41.67	61.22	33.12	30.29	8.68	2.03	1.10	0.02	15.43	6.43
10	Paper	8.74	1.62	44.76	77.55	30.04	11.63	6.42	2.48	1.48	0.07	17.29	8.28
11	Textiles	8.12	2.44	36.85	38.97	34.04	30.86	11.67	26.83	2.28	0.20	15.17	3.15
12	Footwear and headgear	2.44	0.52	25.71	14.24	39.12	37.97	16.53	41.22	2.61	0.59	16.03	5.97
13	Stone products	6.68	1.16	42.74	79.14	31.45	15.95	8.39	1.38	2.69	1.26	14.73	2.28
14	Precious metals	1.34	1.27	30.18	70.41	34.37	15.37	19.28	5.01	0.82	0.01	15.36	9.19
15	Base metals	15.91	7.68	46.88	72.98	29.58	21.42	6.29	0.60	2.23	0.31	15.01	4.69
16	Machinery and electronics	21.80	29.81	41.42	78.78	28.35	15.40	6.99	1.11	4.03	1.28	19.22	3.43
17	Vehicles	9.64	21.20	20.32	88.48	12.74	1.84	4.07	0.12	47.89	7.72	14.98	1.85
18	Precision instruments	10.81	5.57	43.04	82.43	28.81	12.07	8.16	1.34	2.12	0.80	17.87	3.36
19	Weapons	0.14	0.04	32.90	73.24	31.62	19.66	22.62	5.67	–	–	–	–
20	Miscellaneous manufacturing	9.37	1.90	36.08	60.30	30.64	26.54	13.79	8.32	2.49	1.05	17.01	3.79
21	Art	0.54	0.06	5.13	4.50	8.23	1.73	39.41	40.30	2.77	2.80	44.47	50.67
22	Special categories	6.68	1.33	45.17	62.56	25.89	15.53	5.77	3.44	5.85	12.82	17.32	5.65
23	Unknown	69.37	1.69	20.27	22.75	17.76	17.68	14.84	7.15	10.01	8.13	37.12	44.29
	Total/mean	214.59	100.00	33.66	59.33	32.01	21.76	11.60	7.67	4.92	1.95	18.18	9.99

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Notes: The first two columns give the shares of product sections in the total number of trading firms and the total value of trade, respectively, while the remaining columns give shares of the different firm types in trade within each product section, with the column-totals interpreted as the unweighted averages. Note that the first column sums up to more than 100 % to reflect the fact that firms can be active in more than one product category. “Unknown” refers to observations from estimated data for firms below the exemption threshold for which product information is not available. Missing values result from censoring.

Table A.15: Total imports by firm type and commodity type in 2019.

HS section	Description	Total		Manufacturing		Wholesale		Retail		Motor vehicles		Other	
		Importers	Imports	Importers	Imports	Importers	Imports	Importers	Imports	Importers	Imports	Importers	Imports
1	Live animals; animal products	0.72	1.96	24.19	35.65	41.23	55.51	12.73	3.79	–	–	–	–
2	Vegetable products	1.49	2.90	22.04	25.77	40.42	62.98	16.24	7.23	0.46	0.00	20.85	4.01
3	Animal or vegetable fats and oils	0.46	0.29	29.86	68.59	39.32	26.81	16.96	2.68	0.30	0.00	13.57	1.92
4	Food, beverages, tobacco	1.81	3.03	24.86	37.01	37.05	50.53	14.79	8.80	0.76	0.05	22.53	3.61
5	Mineral products	1.33	9.50	40.96	48.82	29.58	21.19	7.94	0.14	3.39	0.03	18.12	29.82
6	Chemical products	5.07	9.00	36.50	57.41	26.96	34.34	12.34	1.75	2.06	0.12	22.15	6.39
7	Plastics and rubber	9.44	4.52	33.46	61.12	26.40	27.37	14.32	2.48	3.80	5.80	22.02	3.23
8	Leather	2.88	0.45	17.31	15.86	29.72	43.32	28.53	35.75	2.76	0.60	21.67	4.47
9	Wood	2.33	0.69	29.41	41.07	31.00	46.42	18.24	7.12	1.10	0.18	20.25	5.21
10	Paper	6.08	1.31	26.99	53.49	27.76	27.76	17.29	10.58	2.35	0.10	25.61	8.07
11	Textiles	6.27	4.14	22.56	20.35	25.42	39.39	24.07	34.63	2.47	0.24	25.48	5.39
12	Footwear and headgear	1.89	1.06	13.82	8.71	29.28	32.75	29.90	48.68	3.28	0.41	23.73	9.44
13	Stone products	3.97	1.00	32.24	54.95	26.08	32.48	15.48	6.27	4.31	2.17	21.88	4.14
14	Precious metals	1.43	1.74	20.71	58.20	23.36	19.25	34.07	7.22	1.40	0.05	20.46	15.28
15	Base metals	9.60	7.43	36.60	58.27	25.54	34.64	13.31	1.72	3.36	0.48	21.20	4.88
16	Machinery and electronics	13.12	25.01	34.25	52.26	22.55	34.46	10.64	3.61	4.31	1.80	28.25	7.87
17	Vehicles	3.17	13.75	25.65	62.52	15.36	3.62	8.44	0.45	29.27	27.48	21.28	5.93
18	Precision instruments	6.07	3.75	33.64	50.00	23.97	37.03	13.77	3.51	3.50	1.31	25.12	8.14
19	Weapons	0.07	0.02	22.27	45.70	19.79	31.50	35.26	19.93	–	–	–	–
20	Miscellaneous manufacturing	5.94	2.51	21.58	29.85	26.64	41.21	22.89	22.95	2.53	0.99	26.36	4.99
21	Art	0.38	0.06	8.94	2.25	9.82	2.76	25.27	16.89	12.42	6.57	43.55	71.53
22	Special categories	4.46	1.22	45.72	55.16	24.47	7.13	8.62	24.62	3.62	8.80	17.57	4.29
23	Unknown	84.28	4.66	11.62	10.82	8.43	16.07	21.66	17.26	5.71	5.17	52.58	50.69
	Total/mean	172.27	100.00	26.75	41.47	26.53	31.67	18.38	12.52	4.44	2.97	24.49	12.35

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Notes: The first two columns give the shares of product sections in the total number of trading firms and the total value of trade, respectively, while the remaining columns give shares of the different firm types in trade within each product section, with the column-totals interpreted as the unweighted averages. Note that the first column sums up to more than 100 % to reflect the fact that firms can be active in more than one product category. “Unknown” refers to observations from estimated data for firms below the exemption threshold for which product information is not available. Missing values result from censoring.

Table A.16: Extra-EU exports by firm type and commodity type in 2019.

HS section	Description	Total		Manufacturing		Wholesale		Retail		Motor vehicles		Other	
		Exporters	Exports	Exporters	Exports	Exporters	Exports	Exporters	Exports	Exporters	Exports	Exporters	Exports
1	Live animals; animal products	1.57	0.75	19.09	69.91	37.90	21.04	10.05	0.42	–	–	–	–
2	Vegetable products	2.78	0.57	19.02	44.49	44.43	47.27	11.42	1.55	1.00	0.00	24.14	6.69
3	Animal or vegetable fats and oils	0.92	0.05	28.29	69.09	44.33	28.29	13.09	1.67	2.95	0.01	11.34	0.93
4	Food, beverages, tobacco	5.74	1.50	31.21	62.56	36.23	30.82	13.35	3.17	1.26	0.07	17.95	3.39
5	Mineral products	4.46	0.88	42.59	53.63	34.30	23.42	5.39	0.16	3.31	1.08	14.41	21.70
6	Chemical products	16.96	12.40	39.71	77.06	34.58	20.38	8.34	0.32	1.84	0.07	15.52	2.17
7	Plastics and rubber	28.42	4.39	45.75	85.26	30.24	11.08	6.32	0.39	3.29	1.23	14.40	2.04
8	Leather	6.78	0.18	31.21	35.70	35.61	30.49	14.96	29.84	2.33	0.71	15.89	3.25
9	Wood	6.77	0.52	40.20	58.60	31.23	34.86	10.48	1.50	0.96	0.05	17.14	5.00
10	Paper	15.92	1.01	46.02	78.46	28.52	11.91	6.64	1.99	1.32	0.07	17.49	7.57
11	Textiles	14.97	1.78	36.70	45.58	33.12	19.14	12.37	31.90	2.16	0.20	15.64	3.18
12	Footwear and headgear	4.22	0.37	26.57	11.72	36.99	30.63	16.99	52.80	2.52	0.15	16.93	4.70
13	Stone products	12.10	1.02	43.24	84.16	29.91	11.54	9.00	1.08	2.70	0.82	15.13	2.40
14	Precious metals	2.39	1.62	29.94	63.97	33.47	21.98	20.15	3.18	0.74	0.00	15.69	10.87
15	Base metals	30.64	5.69	48.38	78.08	28.28	17.08	6.58	0.43	2.14	0.19	14.62	4.21
16	Machinery and electronics	44.99	34.18	42.17	88.11	27.71	7.85	6.93	0.31	3.99	0.61	19.20	3.12
17	Vehicles	19.04	22.01	17.79	94.00	10.96	1.23	4.19	0.12	52.53	3.24	14.53	1.42
18	Precision instruments	21.48	7.85	44.20	87.99	27.55	7.66	8.05	0.96	1.96	0.29	18.23	3.10
19	Weapons	0.23	0.04	36.57	58.02	25.75	22.98	25.37	7.89	–	–	–	–
20	Miscellaneous manufacturing	18.07	1.33	36.54	70.12	29.20	17.45	14.48	7.43	2.40	0.53	17.37	4.46
21	Art	1.19	0.13	4.90	4.62	6.74	1.56	40.24	40.97	2.84	3.40	45.28	49.45
22	Special categories	11.26	1.73	48.71	63.65	23.14	18.72	4.00	0.61	4.26	9.57	19.89	7.45
23	Unknown	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total/mean		270.86	100.00	34.49	63.40	30.46	19.88	12.20	8.58	4.83	1.12	18.04	7.36

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Notes: The first two columns give the shares of product sections in the total number of trading firms and the total value of trade, respectively, while the remaining columns give shares of the different firm types in trade within each product section, with the column-totals interpreted as the unweighted averages. Note that the first column sums up to more than 100 % to reflect the fact that firms can be active in more than one product category. “Unknown” refers to observations from estimated data for firms below the exemption threshold for which product information is not available. Missing values result from censoring.

Table A.17: Intra-EU exports by firm type and commodity type in 2019.

HS section	Description	Total		Manufacturing		Wholesale		Retail		Motor vehicles		Other	
		Exporters	Exports	Exporters	Exports	Exporters	Exports	Exporters	Exports	Exporters	Exports	Exporters	Exports
1	Live animals; animal products	0.93	2.16	28.86	68.61	51.97	25.47	5.70	0.35	–	–	–	–
2	Vegetable products	1.30	1.14	24.35	27.37	58.58	61.21	7.28	3.76	0.22	0.00	9.56	7.66
3	Animal or vegetable fats and oils	0.58	0.22	35.45	76.39	49.75	21.13	7.15	0.67	0.65	0.00	7.00	1.81
4	Food, beverages, tobacco	1.97	3.48	39.65	67.61	45.22	27.60	6.21	1.66	0.79	0.03	8.13	3.10
5	Mineral products	2.20	2.26	46.04	42.93	37.36	19.28	3.33	0.13	2.72	0.28	10.54	37.38
6	Chemical products	5.68	9.01	49.14	75.07	36.97	21.52	4.21	0.71	1.52	0.09	8.16	2.61
7	Plastics and rubber	8.50	6.30	53.65	75.65	31.70	16.52	3.47	0.68	2.45	3.17	8.74	3.99
8	Leather	2.18	0.27	34.93	33.07	43.78	42.26	9.86	17.88	1.86	0.85	9.57	5.94
9	Wood	2.80	0.72	46.29	62.63	38.15	27.85	5.10	2.31	1.09	0.01	9.37	7.20
10	Paper	4.89	2.08	50.14	77.22	33.22	11.52	4.01	2.65	1.49	0.07	11.14	8.54
11	Textiles	4.42	2.93	45.93	35.97	37.42	36.18	6.56	24.53	1.75	0.20	8.34	3.13
12	Footwear and headgear	1.37	0.63	28.51	15.34	47.10	41.17	12.73	36.18	2.35	0.78	9.31	6.53
13	Stone products	3.73	1.27	51.28	76.13	33.89	18.59	4.55	1.56	1.83	1.52	8.45	2.20
14	Precious metals	0.68	1.01	35.21	78.09	38.73	7.49	14.64	7.21	0.86	0.02	10.56	7.19
15	Base metals	8.71	9.16	54.83	70.62	31.50	23.43	2.93	0.68	1.63	0.36	9.11	4.90
16	Machinery and electronics	10.10	26.56	53.25	69.85	30.15	22.63	3.57	1.88	2.54	1.93	10.49	3.72
17	Vehicles	3.83	20.59	36.48	84.09	17.65	2.32	2.49	0.12	32.75	11.28	10.63	2.19
18	Precision instruments	5.15	3.87	52.74	74.02	31.34	18.74	4.79	1.91	1.79	1.58	9.35	3.75
19	Weapons	0.09	0.03	34.62	78.15	43.27	16.53	11.54	3.60	–	–	–	–
20	Miscellaneous manufacturing	4.30	2.31	44.45	56.09	37.17	30.43	7.18	8.70	1.78	1.28	9.43	3.50
21	Art	0.06	0.02	9.03	3.95	29.17	2.51	34.03	37.16	–	–	–	–
22	Special categories	3.12	1.02	45.36	61.19	29.57	11.51	7.77	7.00	8.64	16.92	8.67	3.38
23	Unknown	79.82	2.95	20.27	22.75	17.76	17.68	14.84	7.15	10.01	8.13	37.12	44.29
	Total/mean	156.40	100.00	40.02	57.95	37.02	22.76	8.00	7.32	3.94	2.42	10.68	8.15

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Notes: The first two columns give the shares of product sections in the total number of trading firms and the total value of trade, respectively, while the remaining columns give shares of the different firm types in trade within each product section, with the column-totals interpreted as the unweighted averages. Note that the first column sums up to more than 100 % to reflect the fact that firms can be active in more than one product category. “Unknown” refers to observations from estimated data for firms below the exemption threshold for which product information is not available. Missing values result from censoring.

Table A.18: Extra-EU imports by firm type and commodity type in 2019.

HS section	Description	Total		Manufacturing		Wholesale		Retail		Motor vehicles		Other	
		Importers	Imports	Importers	Imports	Importers	Imports	Importers	Imports	Importers	Imports	Importers	Imports
1	Live animals; animal products	1.36	0.81	16.98	25.89	41.08	67.87	13.02	2.57	–	–	–	–
2	Vegetable products	4.38	2.75	20.33	31.19	40.99	60.34	16.97	4.88	0.47	0.01	21.24	3.58
3	Animal or vegetable fats and oils	0.82	0.23	28.76	81.84	36.02	16.80	14.38	0.22	0.43	0.00	20.42	1.14
4	Food, beverages, tobacco	5.19	1.53	24.42	41.90	34.73	47.49	15.40	3.90	0.59	0.03	24.87	6.68
5	Mineral products	2.97	13.35	44.86	54.80	25.03	24.47	6.79	0.01	3.52	0.00	19.79	20.71
6	Chemical products	15.62	9.66	35.90	62.95	25.73	27.07	13.00	0.76	1.90	0.05	23.46	9.16
7	Plastics and rubber	33.09	3.21	32.95	47.52	25.99	35.89	15.44	3.95	3.89	7.98	21.73	4.66
8	Leather	10.40	0.63	16.14	11.23	30.26	58.19	29.37	23.74	2.61	0.58	21.61	6.26
9	Wood	6.38	0.44	23.29	22.45	31.59	61.30	21.96	10.49	1.14	0.09	22.02	5.67
10	Paper	20.46	0.66	24.16	62.84	28.17	22.04	18.67	5.39	2.31	0.10	26.69	9.64
11	Textiles	22.27	6.93	19.76	13.74	25.20	44.88	26.22	34.92	2.41	0.22	26.41	6.24
12	Footwear and headgear	6.59	1.42	13.20	6.56	29.43	40.97	29.91	36.91	3.05	0.35	24.41	15.21
13	Stone products	12.87	0.91	30.03	52.90	25.73	33.05	16.73	7.38	4.77	2.97	22.74	3.69
14	Precious metals	5.41	2.19	19.56	41.70	23.52	30.19	34.89	9.48	1.26	0.00	20.77	18.62
15	Base metals	33.55	5.44	36.42	55.83	25.01	36.48	14.31	2.57	3.49	0.70	20.76	4.42
16	Machinery and electronics	49.48	31.29	34.67	43.67	21.92	41.85	10.80	2.55	4.36	1.40	28.26	10.53
17	Vehicles	9.72	8.59	27.39	63.11	15.09	5.79	9.34	0.55	27.49	20.75	20.69	9.79
18	Precision instruments	22.48	5.78	33.73	46.57	23.88	39.04	14.04	2.88	3.45	1.66	24.89	9.85
19	Weapons	0.24	0.03	20.24	39.05	17.83	37.15	38.80	19.45	–	–	–	–
20	Miscellaneous manufacturing	20.99	2.57	19.87	16.49	26.11	53.62	24.65	22.78	2.41	1.29	26.96	5.83
21	Art	1.50	0.13	9.14	2.22	9.53	1.49	24.05	11.82	13.06	7.16	44.21	77.31
22	Special categories	16.47	1.45	48.34	51.67	23.25	4.86	8.65	36.79	2.36	0.96	17.40	5.72
23	Unknown	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total/mean	302.22	100.00	26.37	39.82	26.64	35.95	18.97	11.09	4.25	2.32	23.97	11.74

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Notes: The first two columns give the shares of product sections in the total number of trading firms and the total value of trade, respectively, while the remaining columns give shares of the different firm types in trade within each product section, with the column-totals interpreted as the unweighted averages. Note that the first column sums up to more than 100 % to reflect the fact that firms can be active in more than one product category. “Unknown” refers to observations from estimated data for firms below the exemption threshold for which product information is not available. Missing values result from censoring.

Table A.19: Intra-EU imports by firm type and commodity type in 2019.

HS section	Description	Total		Manufacturing		Wholesale		Retail		Motor vehicles		Other	
		Importers	Imports	Importers	Imports	Importers	Imports	Importers	Imports	Importers	Imports	Importers	Imports
1	Live animals; animal products	0.57	2.79	27.47	37.69	44.79	52.92	11.51	4.05	–	–	–	–
2	Vegetable products	0.88	3.01	25.24	22.21	45.82	64.72	13.15	8.78	0.24	0.00	15.55	4.29
3	Animal or vegetable fats and oils	0.36	0.33	32.49	62.11	42.09	31.70	17.00	3.88	–	–	–	–
4	Food, beverages, tobacco	1.00	4.11	27.61	35.70	42.79	51.34	13.35	10.12	0.77	0.05	15.48	2.78
5	Mineral products	0.92	6.71	40.10	40.23	32.69	16.47	7.93	0.32	3.75	0.07	15.52	42.90
6	Chemical products	2.72	8.52	43.54	52.87	29.25	40.28	8.93	2.56	2.19	0.17	16.09	4.12
7	Plastics and rubber	3.99	5.47	45.89	66.88	27.65	23.76	6.50	1.86	3.33	4.88	16.63	2.62
8	Leather	0.82	0.32	23.21	22.44	29.96	22.19	23.73	52.81	5.00	0.64	18.10	1.92
9	Wood	1.19	0.88	39.01	47.80	32.72	41.04	12.66	5.90	0.91	0.21	14.70	5.05
10	Paper	2.33	1.78	41.35	50.97	27.67	29.30	10.19	11.98	2.48	0.10	18.29	7.64
11	Textiles	2.20	2.13	35.20	35.90	27.90	26.47	17.92	33.95	2.92	0.30	16.07	3.39
12	Footwear and headgear	0.63	0.80	14.70	11.47	31.01	22.20	32.11	63.79	5.32	0.49	16.86	2.04
13	Stone products	1.69	1.06	41.87	56.23	28.07	32.12	10.39	5.57	3.75	1.67	15.93	4.42
14	Precious metals	0.27	1.42	28.68	76.55	25.31	7.09	27.84	4.71	1.80	0.09	16.37	11.56
15	Base metals	4.05	8.86	47.14	59.36	27.61	33.82	6.53	1.35	2.57	0.39	16.15	5.09
16	Machinery and electronics	4.85	20.48	44.09	61.74	25.50	26.30	6.77	4.78	3.36	2.25	20.29	4.94
17	Vehicles	1.49	17.47	27.28	62.31	15.30	2.85	5.50	0.41	31.86	29.87	20.06	4.56
18	Precision instruments	2.01	2.29	40.38	56.27	24.75	33.36	10.59	4.67	3.86	0.68	20.42	5.02
19	Weapons	0.02	0.02	31.54	52.50	33.85	25.71	21.54	20.42	–	–	13.08	1.37
20	Miscellaneous manufacturing	1.96	2.47	29.73	39.90	30.81	31.89	18.05	23.08	3.13	0.77	18.28	4.36
21	Art	0.05	0.01	4.32	2.56	10.49	15.39	42.28	67.12	3.09	0.73	39.81	14.21
22	Special categories	1.13	1.05	41.46	58.63	29.42	9.39	6.49	12.51	8.43	16.60	14.20	2.88
23	Unknown	91.61	8.03	11.62	10.82	8.43	16.07	21.66	17.26	5.71	5.17	52.58	50.69
	Total/mean	126.74	100.00	32.35	44.48	29.30	28.54	15.33	15.73	4.72	3.26	19.55	8.85

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Notes: The first two columns give the shares of product sections in the total number of trading firms and the total value of trade, respectively, while the remaining columns give shares of the different firm types in trade within each product section, with the column-totals interpreted as the unweighted averages. Note that the first column sums up to more than 100 % to reflect the fact that firms can be active in more than one product category. “Unknown” refers to observations from estimated data for firms below the exemption threshold for which product information is not available. Missing values result from censoring.

A.4 Margin Decompositions

Table A.20: Margin decomposition for total exports in 2019.

Margin	Firm type	Mean	Std. dev.	P1	P25	P50	P75	P99
Firm intensive	Manufacturing	12,229,849	332,798,209	140	16,304	162,591	1,475,561	143,921,047
	Motor vehicles	1,105,423	54,473,167	120	9768	42,350	202,025	11,378,380
	Other	584,825	10,311,415	34	2519	14,068	81,987	7,992,849
	Retail	654,633	29,961,834	41	2200	12,106	67,750	4,444,824
	Wholesale	2,996,842	39,062,867	121	14,153	97,480	608,371	43,520,635
Firm-country extensive	Manufacturing	9.4	15.8	1	1	2	10	73
	Motor vehicles	3.9	6.9	1	1	1	3	34
	Other	2.5	4.9	1	1	1	2	24
	Retail	2.1	4.0	1	1	1	2	23
	Wholesale	6.1	11.0	1	1	2	5	53
Firm-country intensive	Manufacturing	1,303,107	34,062,947	121	8008	46,354	270,935	15,729,337
	Motor vehicles	285,441	8,722,600	116	8450	25,900	84,730	3,244,555
	Other	236,363	4,728,088	29	2473	12,378	60,860	3,237,440
	Retail	310,383	11,710,882	28	1986	8655	43,511	2,594,875
	Wholesale	491,181	6,335,631	63	5566	29,718	150,570	7,177,858
Firm-product extensive	Manufacturing	15.4	49.6	1	1	2	8	231
	Motor vehicles	4.5	23.4	1	1	1	3	48
	Other	4.6	28.3	1	1	1	1	73
	Retail	6.7	45.6	1	1	1	2	105
	Wholesale	16.5	59.9	1	1	2	8	248
Firm-product intensive	Manufacturing	791,601	30,018,245	3	363	2984	27,563	10,518,282
	Motor vehicles	247,845	7,424,872	4	664	6961	41,827	2,788,145
	Other	126,460	4,207,238	3	250	1842	13,000	1,612,029
	Retail	98,284	1,741,986	4	294	1970	12,525	1,303,603
	Wholesale	181,916	5,577,555	4	324	2303	16,705	2,391,430
Firm-country-product extensive	Manufacturing	9.3	28.0	1	1	2	6	123
	Motor vehicles	3.8	20.9	1	1	1	2	54
	Other	4.2	20.2	1	1	1	2	64
	Retail	9.6	58.4	1	1	1	3	185
	Wholesale	11.0	36.9	1	1	2	7	145
Firm-product-country extensive	Manufacturing	5.6	10.1	1	1	2	5	52
	Motor vehicles	3.3	6.1	1	1	1	2	28
	Other	2.3	4.0	1	1	1	2	20
	Retail	3.0	4.8	1	1	1	3	25
	Wholesale	4.1	6.9	1	1	1	4	34
Firm-country-product intensive	Manufacturing	140,691	5,863,275	2	174	1245	9606	1,907,729
	Motor vehicles	74,719	1,679,828	3	181	2257	18,765	886,295
	Other	55,683	2,172,693	2	145	1062	7552	757,115
	Retail	32,482	621,421	3	91	605	4082	452,223
	Wholesale	44,571	1,447,148	3	139	879	5766	605,940

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations. **Notes:** This table reports summary statistics of the margin decomposition for German total exports, by margin and firm type. The intensive margins are in €. Note that in column one (Mean), the extensive margins multiplied by the corresponding intensive margins yield the associated upper-level intensive margins, except for rounding errors.

Table A.21: Margin decomposition for total imports in 2019.

Margin	Firm type	Mean	Std. dev.	P1	P25	P50	P75	P99
Firm intensive	Manufacturing	4,432,226	141,992,385	26	2179	20,013	222,787	47,962,952
	Motor vehicles	1,157,762	32,171,937	21	770	5780	59,379	10,544,090
	Other	285,752	21,814,160	12	429	2570	16,471	1,953,555
	Retail	400,968	25,510,334	26	1882	11,000	54,952	2,628,778
	Wholesale	3,449,249	45,017,930	42	10,439	91,421	654,197	51,515,831
Firm-country extensive	Manufacturing	4.1	7.0	1	1	1	3	35
	Motor vehicles	1.8	3.5	1	1	1	1	17
	Other	1.6	2.4	1	1	1	1	11
	Retail	1.6	2.8	1	1	1	1	14
	Wholesale	3.8	6.1	1	1	1	4	32
Firm-country intensive	Manufacturing	1,086,749	28,383,757	5	1010	10,975	107,869	12,623,495
	Motor vehicles	627,610	20,421,079	9	466	4101	48,382	5,501,150
	Other	181,072	16,354,391	5	286	1895	13,490	1,467,514
	Retail	245,584	10,656,950	11	1108	7325	42,565	2,273,094
	Wholesale	917,342	15,475,939	5	1818	20,212	163,252	13,799,587
Firm-product extensive	Manufacturing	11.5	37.1	1	1	1	6	159
	Motor vehicles	4.2	21.3	1	1	1	1	72
	Other	2.6	19.7	1	1	1	1	33
	Retail	4.3	25.0	1	1	1	1	72
	Wholesale	13.3	40.7	1	1	1	9	173
Firm-product intensive	Manufacturing	385,369	14,780,381	2	250	2051	20,310	4,214,735
	Motor vehicles	277,134	9,195,624	3	116	794	9117	2,459,188
	Other	110,899	13,122,237	2	130	832	6243	787,672
	Retail	92,308	2,789,988	3	268	2016	15,320	1,183,804
	Wholesale	259,569	7,421,556	2	275	2578	24,765	3,570,368
Firm-country-product extensive	Manufacturing	5.0	14.7	1	1	1	4	55
	Motor vehicles	4.0	14.8	1	1	1	2	59
	Other	2.4	15.9	1	1	1	1	25
	Retail	4.1	21.9	1	1	1	2	55
	Wholesale	5.9	18.1	1	1	1	4	71
Firm-product-country extensive	Manufacturing	1.8	2.2	1	1	1	2	11
	Motor vehicles	1.8	2.1	1	1	1	2	11
	Other	1.4	1.7	1	1	1	1	8
	Retail	1.6	1.8	1	1	1	1	9
	Wholesale	1.7	1.8	1	1	1	2	9
Firm-country-product intensive	Manufacturing	218,848	7,364,901	2	186	1502	14,220	2,634,688
	Motor vehicles	157,977	6,168,662	2	67	416	4727	1,422,869
	Other	76,964	10,484,183	1	93	581	4502	622,800
	Retail	59,390	1,817,086	3	210	1504	11,093	845,684
	Wholesale	156,610	4,822,565	2	216	1831	16,488	2,175,681

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations. **Notes:** This table reports summary statistics of the margin decomposition for German total imports, by margin and firm type. The intensive margins are in €. Note that in column one (Mean), the extensive margins multiplied by the corresponding intensive margins yield the associated upper-level intensive margins, except for rounding errors.

Table A.22: Margin decomposition for extra-EU exports in 2019.

Margin	Firm type	Mean	Std. dev.	P1	P25	P50	P75	P99
Firm intensive	Manufacturing	9,373,726	262,304,020	1129	25,010	177,995	1,345,488	100,348,474
	Motor vehicles	447,288	4,457,620	1250	12,750	39,381	143,339	7,400,812
	Other	706,845	7,353,131	420	6759	28,576	147,457	10,449,569
	Retail	593,158	24,932,695	897	5548	21,700	94,770	5,606,589
	Wholesale	1,685,931	26,653,455	1020	15,469	77,109	424,128	23,098,583
Firm-country extensive	Manufacturing	7.6	11.9	1	1	3	8	58
	Motor vehicles	3.6	5.0	1	1	2	4	24
	Other	3.0	5.5	1	1	1	3	27
	Retail	2.4	3.6	1	1	1	2	18
	Wholesale	4.8	8.1	1	1	2	5	41
Firm-product intensive	Manufacturing	1,238,258	40,778,110	154	7196	35,800	202,704	13,667,340
	Motor vehicles	123,806	1,014,890	216	6750	16,400	43,050	1,919,271
	Other	235,448	3,469,805	20	3370	13,386	59,762	3,324,092
	Retail	250,472	14,795,828	35	2708	8600	34,884	2,170,563
	Wholesale	350,225	6,204,331	52	4612	19,526	89,525	4,649,986
Firm-product extensive	Manufacturing	17.3	50.5	1	1	3	11	238
	Motor vehicles	5.0	20.3	1	1	2	4	53
	Other	10.7	38.8	1	1	2	6	153
	Retail	11.6	50.3	1	1	2	6	173
	Wholesale	17.7	53.9	1	2	4	13	230
Firm-country-product intensive	Manufacturing	542,149	25,226,387	3	345	2550	19,798	6,497,477
	Motor vehicles	89,077	1,139,754	5	540	4900	24,485	1,237,000
	Other	66,183	1,843,542	3	205	1276	6845	813,629
	Retail	51,041	1,096,583	5	256	1444	7071	583,272
	Wholesale	95,138	4,126,927	4	329	1944	10,640	1,072,823
Firm-country-product extensive	Manufacturing	9.1	27.1	1	1	2	6	122
	Motor vehicles	3.0	11.8	1	1	1	2	37
	Other	6.3	21.3	1	1	2	4	80
	Retail	7.3	34.8	1	1	1	4	103
	Wholesale	8.8	28.8	1	1	2	6	112
Firm-product-country intensive	Manufacturing	4.0	7.3	1	1	1	3	38
	Motor vehicles	2.1	3.9	1	1	1	2	17
	Other	1.8	2.9	1	1	1	1	13
	Retail	1.5	2.3	1	1	1	1	9
	Wholesale	2.4	4.2	1	1	1	2	22
Firm-country-product intensive	Manufacturing	136,618	6,562,317	2	202	1389	9325	1,702,241
	Motor vehicles	41,907	407,447	3	310	3400	15,577	611,071
	Other	37,594	1,278,804	3	176	1040	5335	484,250
	Retail	34,407	817,390	5	214	1192	5384	393,124
	Wholesale	39,645	1,707,282	3	200	1144	5948	485,797

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations. **Notes:** This table reports summary statistics of the margin decomposition for German extra-EU exports, by margin and firm type. The intensive margins are in €. Note that in column one (Mean), the extensive margins multiplied by the corresponding intensive margins yield the associated trade values, except for rounding errors.

Table A.23: Margin decomposition for intra-EU exports in 2019.

Margin	Firm type	Mean	Std. dev.	P1	P25	P50	P75	P99
Firm intensive	Manufacturing	7,314,561	154,925,928	116	12,981	138,701	1,106,356	96,611,404
	Motor vehicles	1,033,828	58,574,885	94	8251	36,901	170,523	9,807,409
	Other	472,734	9,696,385	31	1970	11,329	65,046	6,230,460
	Retail	534,708	23,032,581	36	1548	8795	48,547	3,463,451
	Wholesale	2,442,156	28,435,789	101	11,016	80,146	497,196	36,418,641
Firm-country extensive	Manufacturing	5.4	7.2	1	1	1	8	26
	Motor vehicles	2.4	4.3	1	1	1	1	22
	Other	2.0	3.4	1	1	1	1	20
	Retail	1.6	2.9	1	1	1	1	19
	Wholesale	4.1	6.4	1	1	1	3	26
Firm-country intensive	Manufacturing	1,367,053	25,781,752	107	9257	61,483	345,206	17,539,348
	Motor vehicles	424,172	11,851,661	95	12,178	41,694	133,114	4,387,627
	Other	236,754	5,173,652	32	2057	11,874	61,361	3,198,811
	Retail	344,884	9,489,755	26	1475	8703	50,119	2,957,930
	Wholesale	591,378	6,425,468	70	6798	41,585	208,125	8,774,889
Firm-product extensive	Manufacturing	10.9	39.6	1	1	1	3	181
	Motor vehicles	2.9	21.5	1	1	1	1	23
	Other	2.6	22.3	1	1	1	1	32
	Retail	4.4	43.0	1	1	1	1	65
	Wholesale	12.3	53.9	1	1	1	2	210
Firm-product intensive	Manufacturing	670,466	19,727,747	3	329	2902	32,105	10,037,256
	Motor vehicles	361,474	9,862,700	4	752	10,952	74,535	4,042,215
	Other	182,063	5,402,203	2	321	3154	26,101	2,482,989
	Retail	121,961	1,631,287	4	289	2521	19,365	1,786,235
	Wholesale	199,276	4,741,678	4	283	2375	21,538	2,844,639
Firm-country-product extensive	Manufacturing	9.5	28.9	1	1	2	6	123
	Motor vehicles	4.6	26.3	1	1	1	2	80
	Other	3.4	19.7	1	1	1	1	53
	Retail	10.9	68.3	1	1	1	1	221
	Wholesale	12.6	41.7	1	1	2	8	167
Firm-product-country extensive	Manufacturing	4.6	5.5	1	1	2	6	24
	Motor vehicles	3.9	5.4	1	1	1	4	25
	Other	2.6	3.7	1	1	1	2	20
	Retail	3.8	5.1	1	1	1	4	25
	Wholesale	4.2	5.1	1	1	2	5	23
Firm-country-product intensive	Manufacturing	144,539	5,115,649	2	151	1106	9915	2,100,415
	Motor vehicles	92,952	2,072,830	3	141	1650	21,678	1,044,995
	Other	70,010	2,676,547	2	122	1088	10,465	955,055
	Retail	31,739	526,671	2	68	440	3497	471,173
	Wholesale	47,031	1,297,856	3	116	753	5658	663,767

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations. **Notes:** This table reports summary statistics of the margin decomposition for German intra-EU exports, by margin and firm type. The intensive margins are in €. Note that in column one (Mean), the extensive margins multiplied by the corresponding intensive margins yield the associated trade values, except for rounding errors.

Table A.24: Margin decomposition for extra-EU imports in 2019.

Margin	Firm type	Mean	Std. dev.	P1	P25	P50	P75	P99
Firm intensive	Manufacturing	3,962,786	81,938,728	24	3218	31,648	307,566	40,611,815
	Motor vehicles	1,484,118	26,135,360	26	860	7483	67,921	16,934,926
	Other	834,311	30,483,762	9	574	3514	23,118	4,770,965
	Retail	783,996	20,332,169	21	1517	8,893	51,621	6,022,418
	Wholesale	3,575,997	49,115,450	18	6440	67,666	607,828	48,266,491
Firm-country extensive	Manufacturing	4.4	5.6	1	1	2	5	27
	Motor vehicles	2.9	3.9	1	1	1	3	20
	Other	2.5	3.8	1	1	1	2	19
	Retail	2.4	3.3	1	1	1	3	17
	Wholesale	3.7	4.8	1	1	2	4	25
Firm-country intensive	Manufacturing	906,822	24,725,137	2	483	4765	48,774	10,257,216
	Motor vehicles	513,697	12,865,692	5	200	1321	15,010	4,623,197
	Other	331,614	18,192,534	1	166	1069	8405	2,074,201
	Retail	328,738	8,835,214	4	450	3272	22,793	3,536,846
	Wholesale	961,194	19,364,364	2	760	9416	95,532	13,780,051
Firm-product extensive	Manufacturing	15.8	37.2	1	2	5	15	163
	Motor vehicles	12.1	30.4	1	1	3	8	151
	Other	8.6	45.9	1	1	2	6	99
	Retail	10.7	32.5	1	1	3	9	115
	Wholesale	16.9	37.6	1	2	5	16	172
Firm-product intensive	Manufacturing	251,431	11,838,588	1	160	1057	8879	2,352,639
	Motor vehicles	122,268	4,859,528	2	74	350	2680	829,593
	Other	97,169	9,550,282	1	80	404	2625	486,756
	Retail	73,253	3,008,823	2	139	872	6479	1,038,141
	Wholesale	211,352	8,557,991	1	179	1476	13,861	2,640,030
Firm-country-product extensive	Manufacturing	5.4	14.8	1	1	2	4	57
	Motor vehicles	6.3	16.0	1	1	2	5	71
	Other	4.9	31.6	1	1	1	3	49
	Retail	6.2	20.0	1	1	2	5	67
	Wholesale	6.4	18.1	1	1	2	5	75
Firm-product-country extensive	Manufacturing	1.5	1.5	1	1	1	1	8
	Motor vehicles	1.5	1.2	1	1	1	2	7
	Other	1.4	1.7	1	1	1	1	8
	Retail	1.4	1.3	1	1	1	1	7
	Wholesale	1.4	1.1	1	1	1	1	6
Firm-country-product intensive	Manufacturing	168,433	6,706,667	1	129	847	6868	1,710,979
	Motor vehicles	81,199	3,649,324	2	54	239	1791	544,206
	Other	67,389	7,769,305	1	63	305	1906	363,856
	Retail	53,062	2,392,346	2	135	833	6099	816,760
	Wholesale	149,855	6,140,985	1	157	1225	11,170	1,945,729

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations. **Notes:** This table reports summary statistics of the margin decomposition for German extra-EU imports, by margin and firm type. The intensive margins are in €. Note that in column one (Mean), the extensive margins multiplied by the corresponding intensive margins yield the associated trade values, except for rounding errors.

Table A.25: Margin decomposition for intra-EU imports in 2019.

Margin	Firm type	Mean	Std. dev.	P1	P25	P50	P75	P99
Firm intensive	Manufacturing	3,059,532	104,506,581	24	1759	15,366	171,331	36,131,383
	Motor vehicles	947,376	29,886,361	19	713	5077	53,070	8,780,836
	Other	179,214	18,983,004	12	404	2385	15,092	1,509,378
	Retail	251,964	21,764,197	25	1691	9699	48,253	1,835,787
	Wholesale	2,014,605	22,332,473	40	7510	64,772	428,593	32,431,682
Firm-country extensive	Manufacturing	2.5	3.5	1	1	1	1	17
	Motor vehicles	1.4	1.9	1	1	1	1	11
	Other	1.3	1.4	1	1	1	1	8
	Retail	1.2	1.4	1	1	1	1	8
	Wholesale	2.3	3.2	1	1	1	1	16
Firm-country intensive	Manufacturing	1,248,302	31,305,728	15	2312	22,503	185,354	14,363,068
	Motor vehicles	671,612	22,675,209	12	705	6409	69,252	5,956,104
	Other	137,361	15,780,371	8	341	2214	15,177	1,333,981
	Retail	208,439	11,376,685	20	1687	10,077	52,214	1,875,330
	Wholesale	877,852	10,839,858	19	4268	36,713	229,362	13,823,022
Firm-product extensive	Manufacturing	6.8	26.7	1	1	1	1	106
	Motor vehicles	2.6	16.8	1	1	1	1	32
	Other	1.6	8.7	1	1	1	1	13
	Retail	2.6	19.9	1	1	1	1	46
	Wholesale	7.7	31.9	1	1	1	1	122
Firm-product intensive	Manufacturing	447,486	12,241,050	4	462	4336	41,385	5,535,065
	Motor vehicles	361,053	10,630,956	2	162	1403	19,350	3,409,170
	Other	113,354	14,955,038	4	212	1466	10,697	928,833
	Retail	95,152	2,184,298	6	495	3816	24,403	1,150,063
	Wholesale	261,935	3,974,673	5	491	4508	39,102	3,942,438
Firm-country-product extensive	Manufacturing	4.6	14.5	1	1	1	3	53
	Motor vehicles	3.1	14.2	1	1	1	1	50
	Other	1.6	6.0	1	1	1	1	15
	Retail	3.2	22.6	1	1	1	1	48
	Wholesale	5.4	18.2	1	1	1	3	67
Firm-product-country extensive	Manufacturing	1.6	1.7	1	1	1	2	9
	Motor vehicles	1.6	1.7	1	1	1	1	10
	Other	1.3	1.2	1	1	1	1	7
	Retail	1.5	1.4	1	1	1	1	8
	Wholesale	1.6	1.5	1	1	1	2	8
Firm-country-product intensive	Manufacturing	271,941	7,999,406	3	316	2935	27,530	3,566,567
	Motor vehicles	219,220	7,600,934	2	87	722	10,947	2,019,095
	Other	85,478	12,408,857	3	154	1124	8751	798,690
	Retail	64,838	1,103,240	5	345	2529	16,787	865,629
	Wholesale	163,895	2,769,281	4	324	2804	23,877	2,414,792

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations. **Notes:** This table reports summary statistics of the margin decomposition for German intra-EU imports, by margin and firm type. The intensive margins are in €. Note that in column one (Mean), the extensive margins multiplied by the corresponding intensive margins yield the associated trade values, except for rounding errors.

A.5 Margin Correlations

Table A.26: Margin correlations for extra-EU trade in 2019.

	Trade Value	Export Value	Import Value	Imported Country-Products	Imported Products	Origin Countries	Exported Country-Products	Exported Products	Destination Countries
Trade Value		0.67	0.52	0.51	0.50	0.45	0.68	0.64	0.67
Export Value	0.67		-0.04	0.09	0.08	0.09	0.83	0.82	0.85
Import Value	0.52	-0.04		0.80	0.81	0.79	0.18	0.14	0.13
Imported Country-Products	0.51	0.09	0.80		0.99	0.91	0.32	0.29	0.27
Imported Products	0.50	0.08	0.81	0.99		0.88	0.31	0.28	0.25
Origin Countries	0.45	0.09	0.79	0.91	0.88		0.33	0.28	0.30
Exported Country-Products	0.68	0.83	0.18	0.32	0.31	0.33		0.97	0.92
Exported Products	0.64	0.82	0.14	0.29	0.28	0.28	0.97		0.83
Destination Countries	0.67	0.85	0.13	0.27	0.25	0.30	0.92	0.83	

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations. **Notes:** All coefficients are statistically significant (p -value < 0.01).

Table A.27: Margin correlations for intra-EU trade in 2019.

	Trade Value	Export Value	Import Value	Imported Country-Products	Imported Products	Origin Countries	Exported Country-Products	Exported Products	Destination Countries
Trade Value		0.60	0.58	0.41	0.37	0.34	0.56	0.53	0.58
Export Value	0.60		-0.04	0.16	0.10	0.06	0.76	0.78	0.86
Import Value	0.58	-0.04		0.59	0.58	0.68	0.10	0.07	0.04
Imported Country-Products	0.41	0.16	0.59		0.96	0.92	0.46	0.43	0.35
Imported Products	0.37	0.10	0.58	0.96		0.82	0.42	0.41	0.28
Origin Countries	0.34	0.06	0.68	0.92	0.82		0.35	0.29	0.26
Exported Country-Products	0.56	0.76	0.10	0.46	0.42	0.35		0.96	0.94
Exported Products	0.53	0.78	0.07	0.43	0.41	0.29	0.96		0.86
Destination Countries	0.58	0.86	0.04	0.35	0.28	0.26	0.94	0.86	

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations. **Notes:** All coefficients are statistically significant (p -value < 0.01).

Appendix B: Results for 2011

B.1 How Global are German Trading Firms

Table B.1: Number of trading firms and relative values per firm by firm type in 2011.

Firm type	All trade		Extra-EU		Intra-EU	
			Number of			
	Exporters	Importers	Exporters	Importers	Exporters	Importers
Manufacturing	69,268	86,903	40,161	40,076	60,544	72,993
Wholesale	58,047	77,374	28,615	31,860	50,380	65,905
Retail	33,210	129,998	9841	30,699	29,259	122,414
Motor vehicles	26,202	28,695	13,417	4656	21,871	26,930
Other	84,082	206,884	19,029	31,860	74,043	189,959
Total	270,809	529,584	111,063	132,265	236,097	478,201
Firm type	Value per					
	Exporter*	Importer*	Exporter*	Importer*	Exporter*	Importer*
Manufacturing	2.97	3.19	2.26	1.60	2.79	3.62
Wholesale	0.68	2.02	0.41	1.23	0.83	1.96
Retail	0.10	0.16	0.11	0.26	0.11	0.15
Motor vehicles	0.19	0.62	0.13	0.52	0.21	0.80
Other	0.21	0.28	0.30	0.53	0.24	0.23
Mean (mio. €)	3.39	1.40	3.53	2.44	2.23	0.88

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations. **Notes:** *: relative to the mean. Note that firm numbers for extra-EU plus intra-EU trade exceed the number of firms for total trade, due to firms that are both exporters and importers. Hence, the values for total trade are no convex combinations of the numbers for intra-EU and extra-EU trade.



Figure B.1: Pure exporters, importers and two-way traders in 2011.
Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

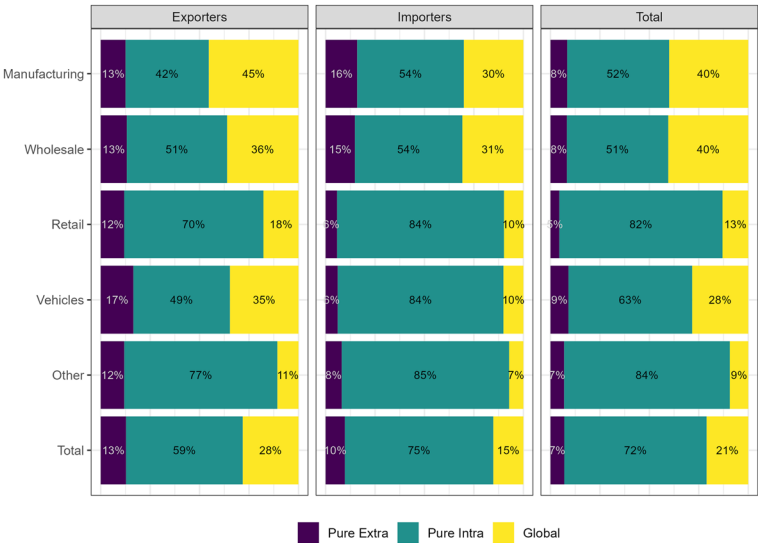


Figure B.2: Pure extra, intra and global firms in 2011.
Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

B.2 Joint Country-Product Distributions

Table B.2: Joint country-product distribution for total exports in 2011.

Firms		Number of countries							
		1	2	3	4	5	6-10	11+	Total
Number of products	1	55.7	1.5	0.8	0.5	0.4	1.1	1.0	61.0
	2	1.3	5.1	1.0	0.4	0.2	0.5	0.5	9.1
	3	0.7	1.6	1.2	0.5	0.3	0.5	0.5	5.3
	4	0.4	0.8	0.6	0.4	0.3	0.6	0.5	3.6
	5	0.3	0.5	0.4	0.3	0.2	0.5	0.5	2.6
	6-10	0.7	0.9	0.7	0.5	0.4	1.4	2.0	6.6
	11+	0.8	0.8	0.6	0.5	0.4	1.7	6.9	11.7
	Total	59.9	11.1	5.1	3.2	2.3	6.4	12.0	100.0
Value		Number of countries							
		1	2	3	4	5	6-10	11+	Total
Number of products	1	1.1	0.1	0.1	0.1	0.1	0.3	0.5	2.3
	2	0.1	0.2	0.1	0.1	0.1	0.3	0.6	1.5
	3	0.1	0.2	0.4	0.1	0.1	0.4	0.8	2.0
	4	0.1	0.2	0.1	0.1	0.1	0.4	1.0	1.8
	5	0.0	0.1	0.1	0.1	0.0	0.3	0.9	1.5
	6-10	0.1	0.1	0.1	0.2	0.2	0.8	4.2	5.8
	11+	0.2	0.4	0.3	0.4	0.3	2.3	81.1	85.0
	Total	1.7	1.3	1.3	1.0	0.8	4.8	89.2	100.0

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Table B.3: Joint country-product distribution for total imports in 2011.

Firms		Number of countries							
		1	2	3	4	5	6-10	11+	Total
Number of products	1	72.9	1.0	0.6	0.4	0.3	0.5	0.1	75.8
	2	1.1	3.1	0.3	0.1	0.0	0.1	0.0	4.6
	3	0.5	1.2	0.7	0.1	0.1	0.1	0.0	2.8
	4	0.3	0.6	0.5	0.2	0.1	0.1	0.0	1.9
	5	0.2	0.4	0.4	0.2	0.1	0.1	0.0	1.5
	6-10	0.4	0.9	0.9	0.7	0.5	0.8	0.1	4.3
	11+	0.3	0.6	0.7	0.7	0.7	2.6	3.5	9.1
	Total	75.8	7.9	4.0	2.5	1.7	4.3	3.7	100.0

Value		Number of countries							
		1	2	3	4	5	6-10	11+	Total
Number of products	1	2.4	0.3	0.2	0.1	0.1	0.4	0.1	3.6
	2	0.4	0.4	0.1	0.1	0.1	0.2	0.1	1.3
	3	0.2	0.4	0.2	0.6	0.1	0.3	0.3	1.9
	4	0.1	0.2	0.2	0.1	0.2	0.2	0.1	1.1
	5	0.1	0.1	0.1	0.1	0.2	0.3	0.2	1.1
	6-10	0.3	0.4	0.4	0.4	0.4	1.3	0.8	4.0
	11+	0.4	0.6	0.7	0.8	1.1	8.0	75.7	87.1
	Total	3.8	2.3	1.9	2.1	2.1	10.6	77.2	100.0

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Table B.4: Joint country-product distribution for extra-EU exports in 2011.

Firms		Number of countries						
		1	2	3	4	5	6-10	11+
Number of products	1	23.4	3.1	1.2	0.6	0.4	0.7	0.3
	2	6.7	4.7	1.7	0.8	0.5	0.9	0.4
	3	3.1	2.2	1.6	0.9	0.6	1.1	0.5
	4	1.9	1.3	1.0	0.8	0.5	1.1	0.5
	5	1.2	0.8	0.6	0.5	0.4	1.0	0.5
	6-10	2.7	1.7	1.4	1.1	0.9	2.7	2.2
	11+	2.5	1.7	1.4	1.1	1.1	3.8	8.4
Total		41.4	15.5	8.8	5.8	4.4	11.2	12.9
Value		Number of countries						
		1	2	3	4	5	6-10	11+
Number of products	1	0.8	0.2	0.2	0.1	0.1	0.2	0.2
	2	0.3	0.2	0.1	0.1	0.1	0.3	0.3
	3	0.7	0.2	0.2	0.1	0.1	0.3	0.6
	4	0.1	0.1	0.1	0.1	0.1	0.5	0.7
	5	0.1	0.1	0.1	0.1	0.1	0.3	0.7
	6-10	0.3	0.4	0.2	0.3	0.3	1.2	4.2
	11+	0.5	0.4	0.6	0.6	0.5	3.2	78.8
Total		2.8	1.6	1.6	1.4	1.2	6.0	85.5

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Table B.5: Joint country-product distribution for extra-EU imports in 2011.

Firms		Number of countries						
		1	2	3	4	5	6-10	11+
Number of products	1	24.3	1.1	0.2	0.1	0.0	0.0	0.0
	2	7.8	5.0	0.6	0.1	0.1	0.0	0.0
	3	3.6	3.3	1.5	0.3	0.1	0.1	0.0
	4	2.1	2.1	1.4	0.5	0.2	0.1	0.0
	5	1.4	1.5	1.1	0.6	0.2	0.1	0.0
	6-10	2.7	3.4	3.1	2.2	1.3	1.5	0.1
	11+	1.6	2.6	2.7	2.8	2.5	8.2	5.8
Total		43.6	19.0	10.4	6.5	4.4	10.1	6.0
Value		Number of countries						
		1	2	3	4	5	6-10	11+
Number of products	1	0.8	0.2	0.1	0.0	0.0	0.3	0.1
	2	0.6	0.5	1.2	0.1	0.1	0.5	0.0
	3	0.2	0.2	0.2	0.1	0.1	0.4	0.2
	4	0.1	0.3	0.2	0.1	0.2	0.2	0.0
	5	0.1	0.1	0.2	0.1	0.1	0.3	0.1
	6-10	0.4	0.5	0.9	1.1	0.4	0.9	2.5
	11+	0.5	1.0	1.2	2.3	1.9	12.2	66.5
Total		2.8	2.8	4.0	3.6	2.8	14.7	69.3

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Table B.6: Joint country-product distribution for intra-EU exports in 2011.

Firms		Number of countries							
		1	2	3	4	5	6-10	11+	Total
Number of products	1	76.9	1.4	0.9	0.7	0.5	1.7	1.7	83.9
	2	0.3	0.3	0.2	0.2	0.1	0.5	0.6	2.2
	3	0.2	0.2	0.1	0.1	0.1	0.4	0.5	1.5
	4	0.1	0.1	0.1	0.1	0.1	0.3	0.4	1.2
	5	0.1	0.1	0.1	0.1	0.1	0.3	0.4	1.0
	6-10	0.2	0.2	0.1	0.2	0.2	0.8	1.3	3.0
	11+	0.3	0.2	0.2	0.2	0.2	1.3	4.7	7.2
	Total	78.0	2.4	1.8	1.5	1.3	5.2	9.7	100.0
Value		Number of countries							
		1	2	3	4	5	6-10	11+	Total
Number of products	1	2.5	0.3	0.2	0.3	0.3	1.0	2.1	6.6
	2	0.2	0.2	0.2	0.1	0.2	0.6	1.6	3.0
	3	0.2	0.2	0.4	0.1	0.1	0.5	1.3	2.7
	4	0.1	0.1	0.1	0.1	0.3	0.4	1.1	2.1
	5	0.1	0.1	0.1	0.1	0.1	0.5	1.1	1.9
	6-10	0.1	0.1	0.1	0.2	0.2	1.3	4.6	6.8
	11+	0.2	0.5	0.4	0.5	0.5	4.7	70.0	76.9
	Total	3.3	1.4	1.4	1.4	1.7	9.1	81.8	100.0

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

Table B.7: Joint country-product distribution for intra-EU imports in 2011.

Firms		Number of countries							
		1	2	3	4	5	6-10	11+	Total
Number of products	1	87.3	1.1	0.7	0.5	0.4	0.7	0.1	90.9
	2	0.3	0.4	0.1	0.1	0.0	0.1	0.0	1.1
	3	0.2	0.2	0.2	0.1	0.1	0.1	0.0	0.8
	4	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.6
	5	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.5
	6-10	0.2	0.2	0.2	0.3	0.3	0.6	0.0	1.7
	11+	0.2	0.2	0.2	0.3	0.4	2.0	1.1	4.4
	Total	88.4	2.3	1.7	1.4	1.2	3.6	1.3	100.0
Value		Number of countries							
		1	2	3	4	5	6-10	11+	Total
Number of products	1	5.3	0.6	0.4	0.2	0.3	0.8	0.5	8.2
	2	0.7	0.5	0.3	0.2	0.1	0.3	0.2	2.2
	3	0.3	0.4	0.3	0.4	0.1	0.4	0.2	2.0
	4	0.2	0.3	0.2	0.3	0.2	0.4	0.2	1.8
	5	0.1	0.3	0.2	0.2	0.1	0.5	0.2	1.6
	6-10	0.6	0.4	0.5	0.7	0.7	2.5	1.0	6.5
	11+	0.8	1.3	1.3	1.3	2.5	16.5	53.9	77.6
	Total	8.0	3.8	3.1	3.4	4.1	21.4	56.1	100.0

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

B.3 Trade Intermediation

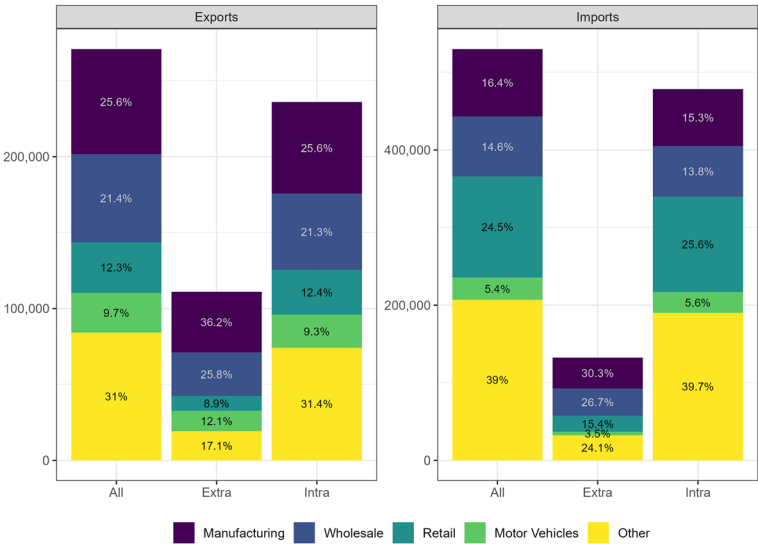


Figure B.3: Number of trading firms by firm type in 2011.

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

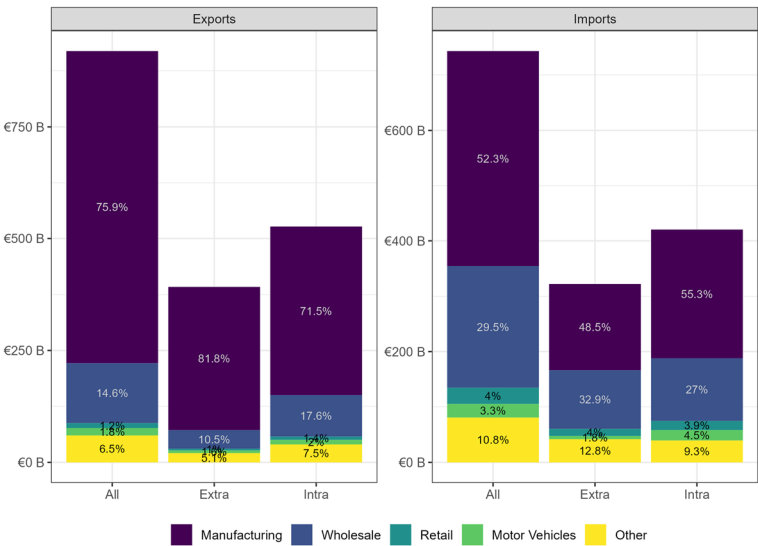


Figure B.4: Traded value by firm type in 2011.

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

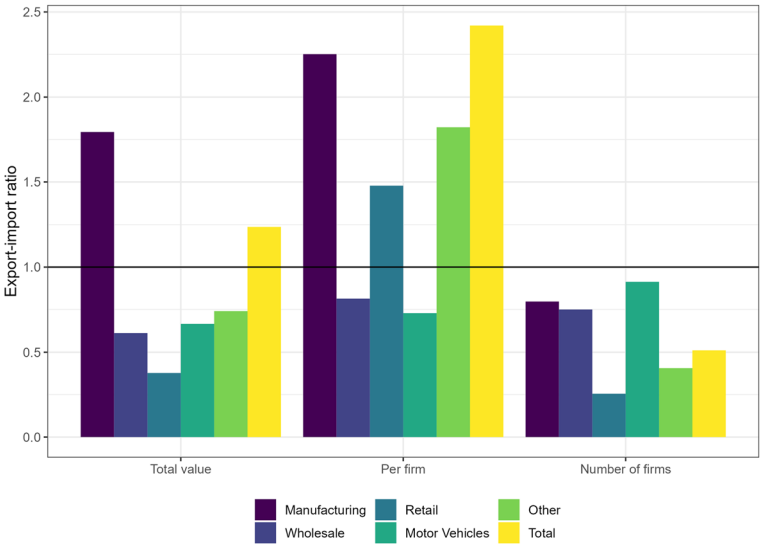


Figure B.5: Decomposition of the German trade surplus in 2011.
Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations.

B.4 Who Trades What?

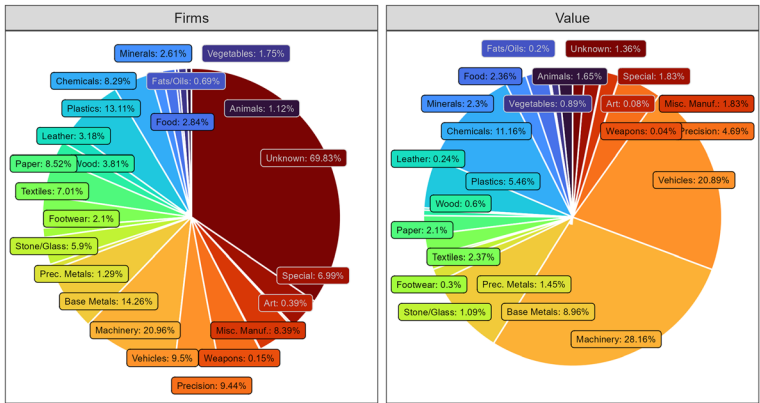


Figure B.6: Product categories in total exports in 2011.
Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations. **Notes:** “Unknown” refers to observations from estimated data for firms below the exemption threshold for which product information is not available.

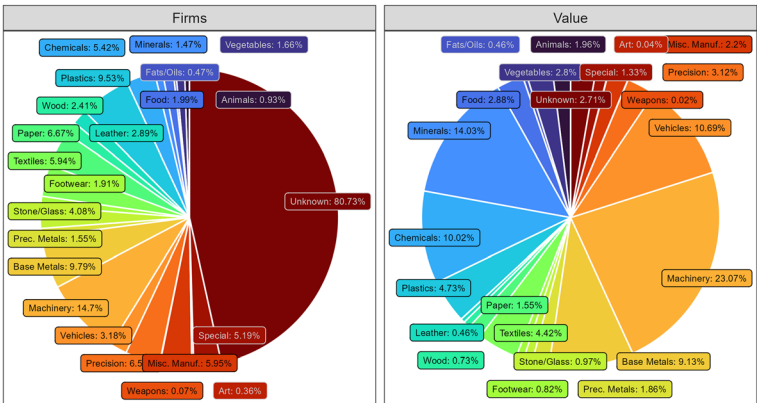


Figure B.7: Product categories in total imports in 2011.
Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations. **Notes:** Missing values result from censoring. “Unknown” refers to observations from estimated data for firms below the exemption threshold for which product information is not available.

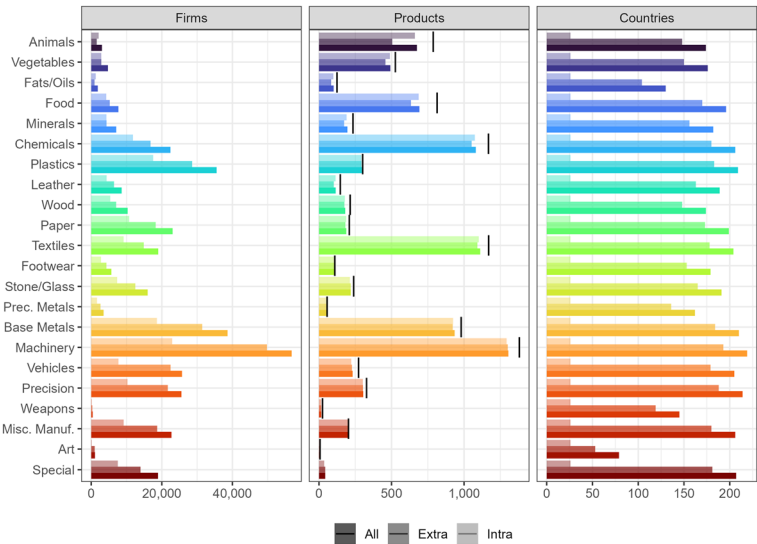


Figure B.8: Exporting firms, exported products and destination countries by product categories in 2011.
Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations. **Note:** The vertical bar for the product panel indicates the maximum number of products existing in the respective category. Missing values result from censoring.

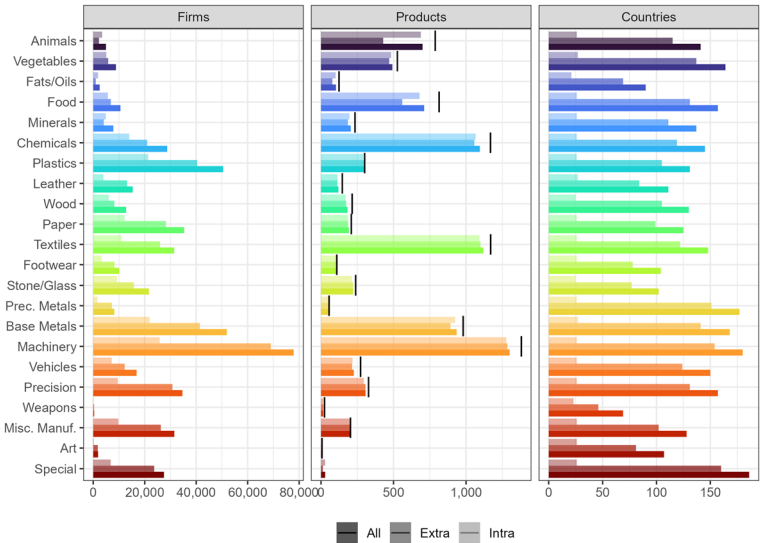


Figure B.9: Importing firms, imported products and origin countries by product categories in 2011.
Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations. **Note:** The vertical bar for the product panel indicates the maximum number of products existing in the respective category. Missing values result from censoring.



Figure B.10: Total exports by product category and firm type in 2011.
Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations. **Notes:** Missing values result from censoring. “Unknown” refers to observations from estimated data for firms below the exemption threshold for which product information is not available.

B.5 Margin Decompositions

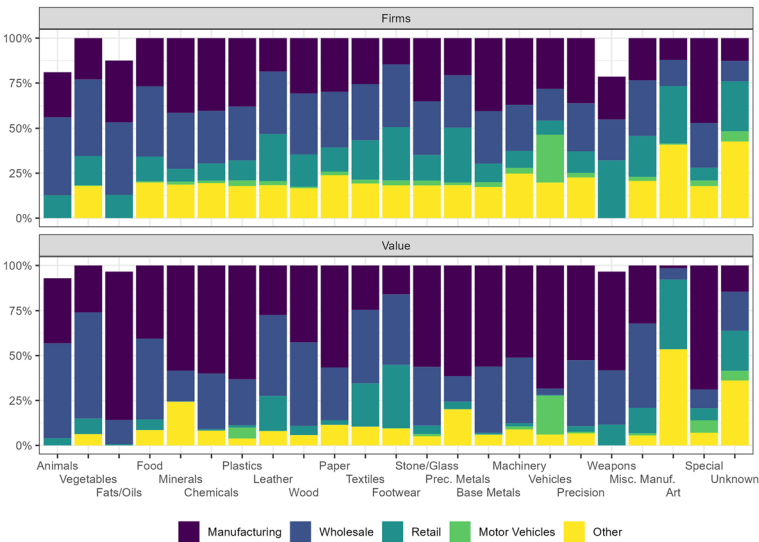


Figure B.11: Total imports by product category and firm type in 2011.

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations. **Notes:** Missing values result from censoring. “Unknown” refers to observations from estimated data for firms below the exemption threshold for which product information is not available.

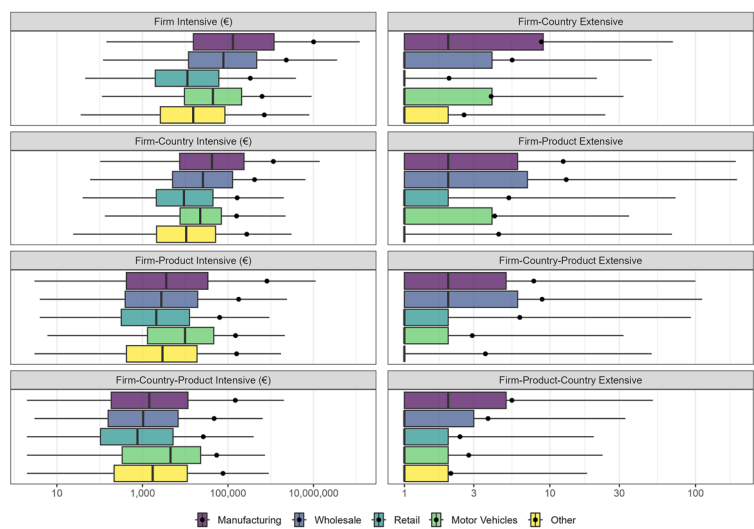


Figure B.12: Margin decomposition for total exports in 2011.

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations. **Notes:** The *x*-axis has a log-scale which allows for an easier visualization of the distributions despite their skewness. The left and right whiskers of the boxplots indicate the 1st and 99th percentiles, respectively. The box itself marks the 25th and 75th percentiles, with the vertical bar within the box representing the 50th percentile (median). The black circle marks the mean of the distribution. The standard deviation as well as the precise figures can be read from the accompanying table.

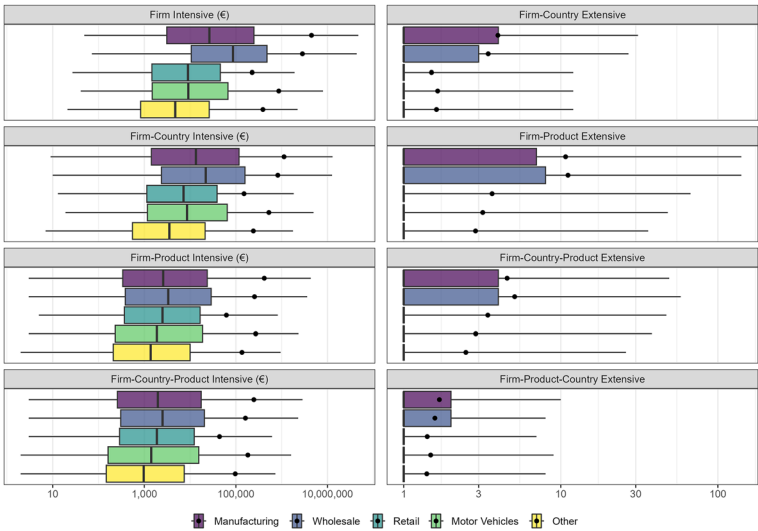


Figure B.13: Margin decomposition for total imports in 2011.

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations. **Notes:** The x-axis has a log-scale which allows for an easier visualization visualization of the distributions despite their skewness. The left and right whiskers of the boxplots indicate the 1st and 99th percentiles, respectively. The box itself marks the 25th and 75th percentiles, with the vertical bar within the box representing the 50th percentile (median). The black circle marks the mean of the distribution. The standard deviation as well as the precise figures can be read from the accompanying table.

B.6 Margin Correlations

Table B.8: Margin correlations for total trade in 2011.

	Trade Value	Export Value	Import Value	Imported Country-Products	Imported Products	Origin Countries	Exported Country-Products	Exported Products	Destination Countries
Trade Value		0.65	0.58	0.55	0.53	0.51	0.64	0.61	0.64
Export Value	0.65		0.01	0.30	0.27	0.23	0.80	0.81	0.85
Import Value	0.58	0.01		0.66	0.66	0.74	0.22	0.17	0.16
Imported Country-Products	0.55	0.30	0.66		0.98	0.93	0.56	0.51	0.48
Imported Products	0.53	0.27	0.66	0.98		0.89	0.53	0.50	0.45
Origin Countries	0.51	0.23	0.74	0.93	0.89		0.50	0.44	0.44
Exported Country-Products	0.64	0.80	0.22	0.56	0.53	0.50		0.96	0.95
Exported Products	0.61	0.81	0.17	0.51	0.50	0.44	0.96		0.87
Destination Countries	0.64	0.85	0.16	0.48	0.45	0.44	0.95	0.87	

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations. **Notes:** All coefficients are statistically significant (p -value < 0.01).

Table B.9: Margin correlations for extra-EU trade in 2011.

	Trade Value	Export Value	Import Value	Imported Country-Products	Imported Products	Origin Countries	Exported Country-Products	Exported Products	Destination Countries
Trade Value		0.65	0.49	0.51	0.50	0.46	0.68	0.63	0.66
Export Value	0.65		-0.08	0.07	0.06	0.07	0.82	0.80	0.84
Import Value	0.49	-0.08		0.81	0.81	0.81	0.15	0.11	0.10
Imported Country-Products	0.51	0.07	0.81		0.99	0.91	0.31	0.27	0.26
Imported Products	0.50	0.06	0.81	0.99		0.89	0.30	0.27	0.25
Origin Countries	0.46	0.07	0.81	0.91	0.89		0.32	0.26	0.28
Exported Country-Products	0.68	0.82	0.15	0.31	0.30	0.32		0.96	0.91
Exported Products	0.63	0.80	0.11	0.27	0.27	0.26	0.96		0.81
Destination Countries	0.66	0.84	0.10	0.26	0.25	0.28	0.91	0.81	

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations. **Notes:** All coefficients are statistically significant (p -value < 0.01).

Table B.10: Margin correlations for intra-EU trade in 2011.

	Trade Value	Export Value	Import Value	Imported Country-Products	Imported Products	Origin Countries	Exported Country-Products	Exported Products	Destination Countries
Trade Value		0.59	0.50	0.44	0.39	0.36	0.57	0.53	0.57
Export Value	0.59		-0.15	0.10	0.04	-0.02	0.75	0.77	0.85
Import Value	0.50	-0.15		0.65	0.65	0.76	0.05	0.01	-0.03
Imported Country-Products	0.44	0.10	0.65		0.97	0.91	0.44	0.40	0.31
Imported Products	0.39	0.04	0.65	0.97		0.85	0.39	0.37	0.23
Origin Countries	0.36	-0.02	0.76	0.91	0.85		0.32	0.25	0.21
Exported Country-Products	0.57	0.75	0.05	0.44	0.39	0.32		0.95	0.94
Exported Products	0.53	0.77	0.01	0.40	0.37	0.25	0.95		0.85
Destination Countries	0.57	0.85	-0.03	0.31	0.23	0.21	0.94	0.85	

Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, Foreign Trade Statistics, Statistical Business Register, survey years 2011–2019, own calculations. **Notes:** All coefficients are statistically significant (p -value < 0.01).

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