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# 1 Introduction

In most countries, international trade is dominated by a small number of exceptionally performing firms (Bernard et al., 2007; Bernard et al., 2018; Greenaway and Kneller, 2007). Moreover, while most exporters export only one product to one country, a tiny fraction of firms export many products to many countries (Bernard et al., 2009a; Bernard et al., 2009b). The patterns are similar for importers. Mounting theoretical and empirical research has found that these empirical observations are consistent with the seminal model by Melitz (2003).[1]

The goal of this study is to confirm these empirical regularities in the Japanese context and provide additional insights in terms of a wide range of dimensions, including the destination and origin of exports and imports, the products involved, and the characteristics of firms engaged in international trade. To this end, we utilize newly available Japanese transaction-level customs data for the 2014-2020 period.[2] Our dataset has two major advantages over datasets previously used in research in this context. First, unlike censored datasets, it includes all trading firms.[3] Second, the accuracy of trade values in customs data are much higher than in self-reported survey data.[4]

In the trade literature, the first studies using countries' customs data emerged in the 2000s. It has now been almost two decades since academic research began to utilize customs data to investigate the detailed behavior of individual firms in exporting and importing. Issues such studies have focused on include the extensive and intensive margin of international trade (Bernard et al., 2009a, Bernard et al., 2009b, for the United States), product quality (Crozet et al., 2012, for French wine; Bastos and Silva, 2010, for Portuguese trade), and destinations (Eaton et al., 2004, Eaton et al., 2011, for France; Lawless, 2009, for Ireland). Countries that have made their customs data available to researchers since a relatively early date include Belgium, Brazil, China, France, Hungary, Ireland, Norway, Portugal, Thailand, and the United States, facilitating academic research on international trade.[5] More recently, detailed empirical studies have been conducted by connecting customs data with firm-level data (e.g., Aghion et al. (2024), Albornoz et al. (2023), and Koenig and Poncet (2022) for France, Adão et al. (2022) for Ecuador, Fan et al. (2023) for China, and Gimenez-Perales (2024) for Colombia).

This study contributes to this literature using countries' customs data by making use of newly available transaction-level customs data for a major trading nation, Japan. While this is not the first study to examine trade at the firm-level in the Japanese context, most existing studies on this matter use a dataset provided by the Ministry of Economy, Trade and Industry (METI) called the Basic Survey of Japanese Business Structure and Activity (e.g., Kimura and Kiyota, 2006; Wakasugi et al., 2014).[6] However, as mentioned,

[1] Moreover, several recent studies (e.g., Costinot et al., 2020; Bergstrand et al., 2023) have demonstrated the importance of firm heterogeneity in designing trade policy.

[2] Japanese customs data are collected by Japan Customs under the jurisdiction of the Ministry of Finance (MOF). The data became available to researchers starting in 2022 through a new scheme under which researcher can propose a collaborative project with the Policy Research Institute (PRI) of the MOF and, if accepted, gain access to the data. The authors of this study form one of the first groups working on a collaborative project with the PRI.

[3] For example, the Ministry of Economy, Trade and Industry (METI)'s data only provide aggregate export and import information, missing details on destinations and products. As a result, numerous aspects of Japanese firms' trading activities remain unexplored.

[4] For example, METI's firm-level data only include firms with more than 50 employees and capital assets exceeding 30 million yen, which means that smaller firms are excluded. Furthermore, METI's aggregate export and import data are based on firms' self-reporting, potentially including large measurement errors. Therefore, previous estimates based on the METI data may be biased.

[5] See, for example, Muûls and Pisu (2009) for Belgium, Békés and Muraközy (2012) for Hungary, and Manova and Zhang (2012) for China.

[6] A few studies use other data. For example, Tomiura (2005) uses the Survey of Commercial and Manufacturing Structure and Activities, which provides information on exports and foreign outsourcing, while Okubo and Tomiura (2019) use plant-level data

this dataset has limitations in terms of coverage and accuracy of the information, which has been an obstacle to further advancement of Japanese firm-level studies on international trade.

This study overcomes such issues by employing Japanese customs data. The customs data comprise exhaustive export and import declaration information, i.e., transaction-level information, covering all exports and imports by Japanese firms in all industries. The advantage of this comprehensive dataset is that all transactions are included, without any thresholds, and port, destination or origin, and product details are included for each transaction. In addition, as the customs data are administrative data, measurement errors can be assumed to be smaller than in previously used datasets.

Our analysis consists of three parts. First, we decompose trade into the intensive and the extensive margin. Second, we examine the degree of concentration of trading firms. And third, matching the customs data with METI's firm-level data, we estimate the performance premia of exporting firms. The first analysis reveals that, during 2014-2020, the intensive margin accounts for around 30% of the variation in Japan's partner country-specific export amounts, while the remainder is explained by the extensive margin. Similarly, around 40% of the variation in Japan's partner country-specific import amounts is explained by the intensive margin, and about 60% by the extensive margin.

Second, regarding the degree of concentration of trading firms, in 2017, the top 10% of exporters accounted for 96.6% of all exports and the top 10% of importers for 94.6% of all imports. Moreover, the top 1% of firms that engage in both exports and imports accounted for 76.7% of the total trade, whereas the top 1% of exporters were responsible for 75.9% of exports and the top 1% of importers for 73.9% of imports. Focusing on manufacturing industries, 21.1% of exporting firms exported only one HS9-digit level product to only one destination country. On the other hand, 11.3% of exporting firms exported more than 10 products to more than 10 destination countries. On the import side, the share of the firms that imported one HS9-digit level product from a single country is slightly higher (24.0%) and that of those importing more than 10 products from more than 10 countries is much lower (4.7%) than on the export side.

Third, we find exporters outperform non-exporters in all aspects we consider: sales, value added, the number of employees, the capital-labor ratio, labor productivity, total factor productivity (TFP), and wages, echoing previous studies (e.g., Wakasugi et al., 2014). Our new findings include that the exporter premia with respect to value added, labor productivity, and TFP decreased from 2014, the start of our observation period, until 2016 and then increased until 2019, whereas the exporter premium with respect to the average wage steadily increased. The export participation ratio steadily increased from 47.1% in 2014 to 49.9% in 2018 but slightly decreased thereafter.

Our observation period, 2014-2020, overlaps with the period of the 'Abenomics' policies initiated by Former Prime Minister Shinzo Abe, which included three "arrows": aggressive monetary policy, a flexible fiscal policy, and a growth strategy.[7] To facilitate international trade, several important regional trade agreements, such as the Japan-Australia Economic Partnership Agreement, the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), and the Japan-EU Economic Partnership Agreement, were signed and entered into force during the Abenomics period.[8] Our study helps to examine the impact of these policies on firms engaged in international trade.

This study contributes to the literature examining the characteristics of exporters using firm- or plant-level data. Early studies by Bernard and Jensen (1995), Aw et al. (2000), and Bernard and Wagner (2001) show that only a small number of firms engage in exporting, and that they tend to be more productive

from the Census of Manufacture, which provides export shares of total output.

[7] See Ito (2021) for monetary and fiscal policies and Solís and Urata (2018) for trade policies as part of the growth strategy.

[8] Felbermayr et al. (2019) provide a quantitative analysis on the Japan-EU EPA.

and larger firms.[9] Melitz (2003) constructs a model to describe these findings and demonstrates that the benefits of trade liberalization have primarily accrued to these exporting firms.[10] Subsequent studies have investigated firm behavior with regard to exports and imports (e.g., Bernard et al., 2007; Greenaway and Kneller, 2007), learning by exporting (or importing) (De Loecker, 2007; De Loecker, 2013; Vogel and Wagner, 2010), the choice between export and foreign direct investment (FDI) (e.g., Helpman et al., 2004), and outsourcing (e.g., Girma and Görg, 2004; Görg et al., 2008; Tomiura, 2005; Tomiura, 2007). Meanwhile, ISGEP (2008) has estimated export premia for 14 countries. More recently, the availability of micro-level customs data for individual trade transactions has spurred research into various facets of trade behavior, as explained above.

Existing studies in the Japanese context have focused on the characteristics of exporters and firms conducting FDI.[11] For instance, using METI's firm-level data, Wakasugi et al. (2014) and Kimura and Kiyota (2006) find that the most productive firms tend to engage in both exporting and FDI, while moderately productive firms tend to engage in either exporting or FDI.[12] Kimura and Kiyota (2006) and Hayakawa and Matsuura (2015) investigate FDI decisions and firm productivity. Likewise, Tanaka (2012) discusses the relationship between firm productivity and the number of FDI destinations rather than export destinations. Bellone et al. (2014) conduct a cross-country comparison of exporters' productivity premia using Japanese and French data. As Japanese transaction-level customs data were unavailable in the past, these existing studies exclusively focus on the performance of international firms rather than export destinations or products. Our study differs from these prior studies in that we analyze firm behavior more comprehensively, including in terms of these two dimensions.

The remainder of this study is organized as follows. Section 2 explains the data used in this study and provides stylized facts gleaned from the customs data. Section 3 decomposes Japan's trade into the intensive and extensive margin of trade. Section 4 investigates the degree of concentration of Japan's trade in a small number of large firms. Section 5 matches the customs data with Japanese firm-level data and estimates the performance premia of exporting firms. Finally, Section 6 concludes.

# 2 Data and Stylized Facts

## 2.1 *Transaction-level data from Japan Customs*

Our study employs transaction-level customs data from Japan Customs, Ministry of Finance, covering the period 2014-2020. This dataset contains a comprehensive record of both exports and imports at the transaction level. It includes transaction details such as the names and addresses of exporters and importers, the registration codes of these entities, HS9-digit product codes, shipping ports, destination/source countries, declaration dates, declared export (FOB) and import (CIF) values and quantities, invoice currencies, and so on. The dataset encompasses all seaports and airports in Japan and the declaration-level data include

[9] See Wagner (2012) for a survey of studies until 2012.

[10] As is well known, Melitz (2003) is the first study to construct a heterogeneous-firm trade model. Since then, a number of similar types of models have been constructed by, for example, Helpman et al. (2004), Melitz and Ottaviano (2008), and Chaney (2008).

[11] Some studies focus on the dynamics of export decisions (Inui et al., 2015), survival in export markets (Inui et al., 2017), and foreign outsourcing and intra-firm trade (Tomiura, 2005; Tomiura, 2007). Tomiura (2007) found that the most productive firms engage FDI, whereas less productive firms tend toward exporting and/or outsourcing. Apart from studies focusing on export participation and export behavior, there are studies investigating the impact of firms' trade on firm organization, employment (Tanaka, 2013), and research and development (R&D) investment (Ito and Tanaka, 2016). Okubo and Tomiura (2019) decompose export premia by region (prefecture).

[12] Another study in this vein is Todo (2011), which obtains similar findings.

various types of transactions: (1) regular transactions exceeding 200,000 yen in value, and (2) miscellaneous transactions including special trade activities like gold transactions and small-scale transactions valued at 200,000 yen or less. We exclusively use the data for regular transactions exceeding 200,000 yen in value, which fall under the general trade classification), since our study focuses on the exports and imports of firms.

## 2.2 *Overview of the data*

This sub-section provides an overview of our transaction-level customs data. Table 1 presents an overview of the number of transactions (Panel A) and the total value (Panel B) for exports and imports spanning the period from 2014 to 2020. Regular transactions, which we focus on in this paper, are listed in the column labelled "General Trade." These transaction counts (number of declaration columns) and trade values are stable over this period, although there was a discernible decline in the value of trade in 2020 due to the COVID-19 pandemic. Both exports and imports amount to approximately 70 to 80 trillion yen, with imports exceeding exports in all years except 2016.

TABLE 1: Overview of Export-Import Declaration Data

Panel A: Number of declaration columns

| | Total | General trade | | Other | |
|---|---|---|---|---|---|
| *Part A1: Exports* | | | | | |
| 2014 | 18,678,628 | 12,283,614 | (65.8%) | 6,395,014 | (34.2%) |
| 2015 | 18,813,924 | 12,348,526 | (65.6%) | 6,465,397 | (34.4%) |
| 2016 | 18,779,405 | 12,167,046 | (64.8%) | 6,612,359 | (35.2%) |
| 2017 | 20,182,821 | 12,926,968 | (64.0%) | 7,255,853 | (36.0%) |
| 2018 | 20,859,383 | 13,111,466 | (62.9%) | 7,747,917 | (37.1%) |
| 2019 | 19,258,079 | 12,235,596 | (63.5%) | 7,022,483 | (36.5%) |
| 2020 | 18,241,865 | 10,871,711 | (59.6%) | 7,370,154 | (40.4%) |
| *Part A2: Imports* | | | | | |
| 2014 | 20,948,209 | 10,407,848 | (49.7%) | 10,540,361 | (50.3%) |
| 2015 | 20,931,258 | 10,306,199 | (49.2%) | 10,625,059 | (50.8%) |
| 2016 | 21,794,316 | 10,217,918 | (46.9%) | 11,576,398 | (53.1%) |
| 2017 | 23,517,002 | 10,764,750 | (45.8%) | 12,752,252 | (54.2%) |
| 2018 | 25,179,862 | 10,951,621 | (43.5%) | 14,228,241 | (56.5%) |
| 2019 | 26,569,348 | 10,751,986 | (40.5%) | 15,817,362 | (59.5%) |
| 2020 | 27,724,720 | 10,013,860 | (36.1%) | 17,710,860 | (63.9%) |

Panel B: Export/Import amount (Unit: billion yen)

| | Total | General trade | | Other | |
|---|---|---|---|---|---|
| *Part B1: Exports* | | | | | |
| 2014 | 78,801 | 73,741 | (93.6%) | 5,060 | (6.4%) |
| 2015 | 79,411 | 75,266 | (94.8%) | 4,145 | (5.2%) |
| 2016 | 73,862 | 70,195 | (95.0%) | 3,667 | (5.0%) |
| 2017 | 82,012 | 78,233 | (95.4%) | 3,779 | (4.6%) |
| 2018 | 85,584 | 81,219 | (94.9%) | 4,364 | (5.1%) |
| 2019 | 80,963 | 76,688 | (94.7%) | 4,275 | (5.3%) |
| 2020 | 71,161 | 68,342 | (96.0%) | 2,819 | (4.0%) |
| *Part B2: Imports* | | | | | |
| 2014 | 89,057 | 84,810 | (95.2%) | 4,248 | (4.8%) |
| 2015 | 81,428 | 77,350 | (95.0%) | 4,078 | (5.0%) |
| 2016 | 69,911 | 65,483 | (93.7%) | 4,428 | (6.3%) |
| 2017 | 79,721 | 75,051 | (94.1%) | 4,670 | (5.9%) |
| 2018 | 87,685 | 82,729 | (94.3%) | 4,956 | (5.7%) |
| 2019 | 83,538 | 78,749 | (94.3%) | 4,789 | (5.7%) |
| 2020 | 71,922 | 68,455 | (95.2%) | 3,467 | (4.8%) |

Next, Table 2 presents basic statistics for the number of destination countries or countries of origin, the number of products traded, and the amount of trade per firm, by firms' industry at the NACE 1-digit level.[13] Note that to determine exporters' and importers' main industry, we use information from the Orbis database

[13]"NACE" stands for "Nomenclature of Economic Activities" and is the classification of economic activities used in the European Union. Figures for the manufacturing sector at the 2-digit level are presented in Appendix Table A3.

provide by Bureau van Dijk.[14] Starting with exports, the average number of products exported per firm in 2017 stood at 10.3, while the average number of destinations per firm was 3.7, and the average export value was 1,192 million yen. In the case of imports, the average number of products imported per firm was 8.2, the average number of countries of origin per firm stood at 2.7, and the average import value at 804 million yen. In sum, exporters tended to deal with a larger number of products and a larger number of partner countries than importers. However, there is substantial variation across industries. Specifically, the number of products and partner countries is particularly large for firms in the manufacturing and wholesale and retail sectors. The manufacturing sector, in particular, stands out with the highest number of products exported per firm (14.1), the largest number of export destinations (5.3), and the largest export value per firm (3,093 million yen).

TABLE 2: Exports and Imports by Industry, 2017

| | | Exports | | | Imports | | |
|---|---|---|---|---|---|---|---|
| NACE 1-digit classification | | No. of products (HS 6-digit) per firm | No. of countries per firm | Export value per firm (million yen) | No. of products (HS 6-digit) per firm | No. of countries per firm | Import value per firm (million yen) |
| A | Agriculture, forestry and fishing | 4.2 | 2.7 | 123 | 3.5 | 2.3 | X |
| B | Mining and quarrying | 7.4 | 3.8 | 1,449 | 6.6 | 3.3 | X |
| C | Manufacturing | 14.1 | 5.3 | 3,093 | 8.9 | 3.1 | 1,535 |
| D | Electricity, gas, and other utilities | 5.6 | 2.0 | 70 | 5.2 | 2.6 | 13,480 |
| E | Water supply; sewerage; etc. | 4.6 | 2.4 | 88 | 5.7 | 1.9 | 333 |
| F | Construction | 10.6 | 2.4 | 228 | 4.4 | 1.8 | 87 |
| G | Wholesale and retail trade, etc. | 11.6 | 3.7 | 820 | 11.0 | 3.2 | 874 |
| H | Transportation and storage | 12.2 | 3.5 | 707 | 9.7 | 2.9 | 1,361 |
| I | Accomodation and food service activities | 5.1 | 1.9 | 37 | 4.4 | 2.0 | 158 |
| J | Information and communication | 3.3 | 2.3 | 264 | 4.1 | 2.2 | 283 |
| K | Financial and insurance activities | 9.8 | 3.1 | 558 | 6.1 | 2.3 | X |
| L | Real estate activities | 4.4 | 1.8 | 41 | 4.5 | 1.9 | 82 |
| M | Professional services | 5.1 | 2.2 | 92 | 4.2 | 1.9 | 120 |
| N | Administrative and support services | 6.1 | 2.3 | 276 | 4.9 | 2.1 | 241 |
| O | Public administration and defence, etc. | 1.9 | 1.3 | 5 | 1.4 | 1.5 | 9 |
| P | Education | 4.1 | 2.2 | 17 | 3.7 | 2.0 | 20 |
| Q-T | Other services | 3.5 | 2.4 | 58 | 4.6 | 2.0 | 259 |
| n.a. | Unclassified | 6.0 | 2.3 | 156 | 5.1 | 1.9 | 278 |
| All industries | | 10.3 | 3.7 | 1,192 | 8.2 | 2.7 | 804 |

Note: For sectors A (Agriculture, forestry and fishing), B (Mining and quarrying), and K (Financial and insurance activities), the import values per firm are withheld.

[14] In this section and Section 3, we conduct analyses by connecting the customs data, i.e., export and import declaration data, with corporate information from the Orbis database provided by Bureau van Dijk, which comprehensively covers companies worldwide, including those in Japan. The customs data include the corporate number designated by the National Tax Agency for each exporter and importer, and we link this data with the Orbis database at the firm level using the corporate number. See Appendix A for the overview of our matched dataset. As shown in Appendix Table A1, we were able to successfully link approximately 97% of the export/import declarations observed in the regular transaction data in the customs data with Orbis corporate information. It should be noted, however, that even for firms recorded in the Orbis database, there is a significant amount of missing information such as with regard to revenue, the number of employees, and the industry classification. Moreover, the industry classification of firms used in Sections 2 and 3 is based on the most recent information available from Orbis as of June 2022, and data for the years 2014 to 2020 for the industry classification were not available to us. This means that our analysis is based on the assumption that the industry classification of firms in our sample did not change between 2014 and June 2022.

# 3 Trade Decomposition: Extensive and Intensive Margins

## 3.1 *Decomposition of factors contributing to cross-section variation in Japan's trade*

Trade amounts with each partner country are likely to be linked to the number of firms trading with that country and the number of products traded. The impact of the number of firms and products on the amount of trade is referred to as the extensive margin, while the impact of the average trade amount per firm-product pair on the total amount of trade is referred to as the intensive margin. In this subsection, following Bernard et al. (2009a) and Bernard et al. (2009b), we analyze to what extent the extensive or the intensive margin explains the variation in Japan's trade across partner country.

The trade amount $x_c$ with partner country $c$ can be expressed using the following equation:

$$x_c = f_c p_c d_c \bar{x}_c, \tag{1}$$

where $f_c$ represents the number of firms trading with country $c$, $p_c$ represents the number of products traded with country $c$, $d_c$ represents the trade density, and $\bar{x}_c$ represents the average trade amount per firm-product pair. Trade density is defined as $o_c/(f_c p_c)$, where $o_c$ denotes the number of firm-product pairs in trade with country $c$, while $f_c p_c$ denotes the number of all potential firm-product combinations that could potentially be involved in trade with country $c$. Trade density takes into account the fact that only a small fraction of all possible firm-product combinations is actually involved in trade with each country. The average trade amount $\bar{x}_c$ is calculated as $x_c/o_c$, representing the intensive margin.

Taking the logarithm of equation (1) above, we get:

$$\ln x_c = \ln f_c + \ln p_c + \ln d_c + \ln \bar{x}_c, \tag{2}$$

In equation (2), the logarithm of the export or import amounts in each year and for each partner country is used as the dependent variable. To decompose Japan's exports to or imports from each partner country into the extensive and the intensive margin, we regress the dependent variable on each term on the right-hand side of equation (2). Table 3 shows the results for 2014, 2017, and 2020.

TABLE 3: Decomposition of Japan's Exports and Imports Across Partner Countries for the Years 2014, 2017, and 2020

| | Exports | | | Imports | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | 2014 | 2017 | 2020 | 2014 | 2017 | 2020 |
| Number of firms | 0.588 | 0.619 | 0.622 | 0.495 | 0.522 | 0.526 |
| | (0.013) | (0.013) | (0.013) | (0.019) | (0.018) | (0.018) |
| Number of products | 0.531 | 0.541 | 0.554 | 0.462 | 0.480 | 0.478 |
| | (0.011) | (0.011) | (0.011) | (0.019) | (0.017) | (0.017) |
| Density | -0.431 | -0.450 | -0.457 | -0.385 | -0.403 | -0.405 |
| | (0.011) | (0.011) | (0.012) | (0.015) | (0.015) | (0.014) |
| Intensive margin | 0.312 | 0.289 | 0.281 | 0.428 | 0.401 | 0.401 |
| | (0.013) | (0.014) | (0.014) | (0.023) | (0.021) | (0.021) |
| No. of partner countries | 234 | 231 | 233 | 228 | 229 | 228 |

Note: For each year, the estimated coefficients of each explanatory variable and their standard errors (in parentheses) are presented. The number of observations in each year corresponds to the number of countries with which Japanese firms engaged in exports or imports.

The coefficients shown in Table 3 indicate how much each factor on the right-hand side of equation

(2) contributes to the variation in the dependent variable on the left-hand side. Columns (1) to (3) indicate that the intensive margin ($\ln \bar{x}_c$) explains around 30% of the variation in Japan's partner country-specific export amounts. On the other hand, the variation in the number of export firms ($\ln f_c$) and number of exported products ($\ln p_c$) account for approximately 60% and 55%, respectively, of the partner country-specific export amounts. Meanwhile, trade density is negatively related to export amounts, so that the sum of these three coefficients is around 70%, indicating that the majority (about 70%) of the variation in partner country-specific export amounts is explained by the extensive margin. Thus, although the intensive margin, at around 30%, is quite large, the extensive margin, at around 70%, is larger, indicating that larger overall exports are primarily due a larger number of exporting firms and exported products. In other words, the decomposition implies that in the case of countries that account for a large amount of Japan's exports, a large number of firms export a large number of products, while in the case of countries that account for a small amount of exports, a small number of firms export a smaller number of products.

A similar pattern is observed for the variation in Japan's imports across countries. Specifically, columns (4) to (6) show that around 60% of the variation can be explained by the extensive margin, while around 40% is explained by the intensive margin. These figures indicate that imports are more concentrated than exports in that fewer firms account for a larger amount of imports from each partner country, so that the extensive margin makes a smaller contribution than in the case of exports.

While the decomposition results in Table 3 generally align with the findings of Bernard et al. (2009a) and Bernard et al. (2009b) for the United States, in the case of Japan, the share explained by the intensive margin in both exports and imports is about 10 percentage points larger than in the United States. This suggests that in Japan, trade is more concentrated among a smaller number of firms than in the United States.

### 3.2 *Decomposition of factors contributing to time-series variation in Japan's trade*

Next, we examine the determinants of changes in Japan's trade over time. The change in Japan's total exports and imports compared to the previous year can be decomposed into three components: (1) the increase due to firms newly engaging in exports or imports, (2) the decrease due to firms stopping to export or import, and (3) the increase or decrease resulting from changes in the amount traded by continuing exporters or importers. Therefore, the change in aggregate exports or imports from $t-1$ to year $t$, $\Delta x_t$, can be decomposed using the following equation:

$$\Delta x_t = \sum_{f \in N_t} x_{ft} - \sum_{f \in E_t} x_{ft-1} + \sum_{f \in C_t} \Delta x_{ft}, \tag{3}$$

where $f$ refers to a firm, $N_t$ is the set of firms that newly started exporting or importing in year $t$, $E_t$ is the set of firms that stopped exporting or importing in year $t$, and $C_t$ is the set of firms that continued exporting or importing from year $t-1$ to year $t$.

The change in exports or imports of firms continuing to engage in export or import activities $\sum_{f \in N_t} x_{ft}$, can be further decomposed into (i) the changes due to the adding or dropping of new partner country-product pairs, and (ii) the changes due to an increase or decrease in the trade amount for continuing partner country-product pairs. Therefore, for continuous exporter or importer $f$, the change in exports or imports from year $t-1$ to year $t$, $\Delta x_{ft}$, can be decomposed using the following equation:

$$\Delta x_{ft} = \sum_{j \in A_{ft}} x_{fjt} - \sum_{j \in D_{ft}} x_{fjt-1} + \sum_{j \in G_{ft}} \Delta x_{fjt} + \sum_{j \in S_{ft}} \Delta x_{ft}, \tag{4}$$

where $j$ refers to a partner country-product pair, $A_{ft}$ is the set of partner country-product pairs where firm $f$ started trading in year $t$, $D_{ft}$ is the set of partner country-product pairs where firm $f$ stopped trading in year $t$, $G_{ft}$ is the set of partner country-product pairs where firm $f$'s trade amount increased from year $t-1$ to year $t$, and $S_{ft}$ is the set of partner country-product pairs where firm $f$'s trade amount decreased from year $t-1$ to year $t$.

The first two terms on the right-hand side of equation (3) represent the entry into exporting or importing and thus represent the extensive margin. The first two terms on the right-hand side of equation (4) represent another extensive margin, namely, the switching of country-products by exporters or importers. The third and fourth terms on the right-hand side of equation (4) represent the intensive margin, reflecting the change in trade for continuing exporters or importers.

The results of decomposing changes in Japan's exports are presented in Table 4, while the corresponding results for imports are shown in Table 5. Specifically, Table 4 presents the decomposition of year-on-year changes in Japan's nominal exports, followed by the decomposition of changes over two years (2014-2016, 2017-2019) and three years (2017-2020). Rows 1 to 9 show the results of the decomposition into the extensive and intensive margins, while row 10 presents the overall change in exports. Rows 11 through 13 report the net contribution of each margin as a percentage of the overall change in exports.

TABLE 4: Decomposition of Changes in Japan's Exports over Time (Unit: Billion Yen)

| | Year-on-year changes | | | | | 2-year | | 3-year |
|---|---|---|---|---|---|---|---|---|
| | 2014-2015 | 2015-2016 | 2017-2018 | 2018-2019 | 2019-2020 | 2014-2016 | 2017-2019 | 2017-2020 |
| *Panel A: Export entry and exit* | | | | | | | | |
| (1) Exporter entry | 287 | 414 | 1,111 | 279 | 266 | 878 | 2,101 | 2,232 |
| (2) Exporter exit | -68 | -106 | -228 | -706 | -334 | -184 | -1,160 | -1,538 |
| (3) Net entry | 219 | 308 | 882 | -428 | -68 | 694 | 941 | 694 |
| *Panel B: Product-country switching by continuing exporters* | | | | | | | | |
| (4) New product-country | 3,959 | 3,745 | 4,024 | 3,821 | 3,365 | 5,916 | 5,994 | 6,786 |
| (5) Discontinued product-country | -3,800 | -3,879 | -4,076 | -4,599 | -4,160 | -6,159 | -7,093 | -8,951 |
| (6) Net product-country | 159 | -133 | -52 | -779 | -794 | -243 | -1,099 | -2,166 |
| *Panel C: Intensive margin for continuing exporters* | | | | | | | | |
| (7) Product-country growth | 14,598 | 11,385 | 15,575 | 13,194 | 11,057 | 16,013 | 16,837 | 15,658 |
| (8) Product-country decline | -13,255 | -15,936 | -12,940 | -16,488 | -18,559 | -19,120 | -17,715 | -23,587 |
| (9) Net intensive margin | 1,343 | -4,552 | 2,634 | -3,294 | -7,502 | -3,108 | -878 | -7,928 |
| (10) Total change in exports | 1,721 | -4,377 | 3,464 | -4,500 | -8,364 | -2,657 | -1,036 | -9,400 |
| *Panel D: Percent of annual growth due to:* | | | | | | | | |
| (11) % Net entry and exit | 13 | -7 | 25 | 10 | 1 | -26 | -91 | -7 |
| (12) % Net product-country addition | 9 | 3 | -2 | 17 | 9 | 9 | 106 | 23 |
| (13) % Net intensive margin | 78 | 104 | 76 | 73 | 90 | 117 | 85 | 84 |

Note: Row (11) is computed as ((1)+(2))/(10). Row (12) is computed as ((4)+(5))/(10). Row (13) is computed as ((7)+(8))/(10).

Row 10 indicates that Japan's total exports exhibited a decreasing trend from 2014 to 2020. Furthermore, row 13 shows that a significant share of the year-on-year – i.e., short-run – changes in total exports is explained by the intensive margin, which is consistent with the findings by Bernard et al. (2009a) and Bernard et al. (2009b) for the United States. In the case of Japan, the intensive margin accounted for an average 84% of the year-on-year changes in exports, ranging from a low of 73% for 2018 to 2019 to a high of 104% for 2015 to 2016.[15] As Japan's total exports followed a downward trend tend during the period from

[15]This finding regarding the share of the intensive margin is comparable to Bernard et al. (2009a) results for the United States: they find that over the period from 1993 to 2003, but excluding 2000 to 2002, when the U.S. economy was in recession, on average 76% of annual export growth was due to the intensive margin.

2014 to 2020, this means that continuing exporters' exports of incumbent products to incumbent destinations (row 8) made the largest contribution to the overall decline in Japan's exports during this period. In addition, the intensive margin accounts for over 80% of the changes over the two- and three-year intervals.

Turning to the extensive margin and looking at product-country switching by continuing exporters shows that except in 2014-2015, the contribution of the discontinuation of exports of incumbent products to incumbent destinations (row 5) always exceeded the contribution of the addition of new product-country combinations (row 4). Next, looking at export entry and exit shows that the contribution of export market entry followed an increasing trend until 2018 but then declined (row 1). As a result, from 2018 onwards, the negative contribution of export market exit exceeded the positive contribution of export market entry, so that the net contribution of entry and exit turned negative (rows 2 and 3). While possible reasons for these developments include external factors such as the U.S.-China trade tensions and the COVID-19 pandemic, more detailed analysis is required to understand the factors contributing to the recent decrease in new entries into export markets.

TABLE 5: Decomposition of Changes in Japan's Imports over Time (Unit: Billion Yen)

| | Year-on-year changes | | | | | 2-year | | 3-year |
|---|---|---|---|---|---|---|---|---|
| | 2014-2015 | 2015-2016 | 2017-2018 | 2018-2019 | 2019-2020 | 2014-2016 | 2017-2019 | 2017-2020 |
| *Panel A: Export entry and exit* | | | | | | | | |
| (1) Importer entry | 291 | 269 | 490 | 1,532 | 388 | 667 | 2,273 | 2,816 |
| (2) Importer exit | -114 | -108 | -557 | -380 | -902 | -214 | -1,142 | -2,769 |
| (3) Net entry | 177 | 161 | -67 | 1,152 | -515 | 452 | 1,130 | 47 |
| *Panel B: Product-country switching by continuing importers* | | | | | | | | |
| (4) New product-country | 3,635 | 2,885 | 4,008 | 3,080 | 2,792 | 5,283 | 5,992 | 7,130 |
| (5) Discontinued product-country | -3,028 | -2,919 | -2,656 | -3,236 | -3,144 | -5,447 | -4,791 | -7,061 |
| (6) Net product-country | 607 | -35 | 1,351 | -156 | -352 | -164 | 1,200 | 70 |
| *Panel C: Intensive margin for continuing importers* | | | | | | | | |
| (7) Product-country growth | 11,612 | 7,963 | 16,458 | 11,383 | 9,362 | 10,876 | 16,831 | 14,435 |
| (8) Product-country decline | -18,850 | -19,039 | -9,610 | -16,299 | -18,666 | -28,569 | -14,950 | -20,511 |
| (9) Net intensive margin | -7,239 | -11,077 | 6,848 | -4,917 | -9,303 | -17,693 | 1,881 | -6,075 |
| (10) Total change in exports | -6,455 | -10,950 | 8,132 | -3,920 | -10,170 | -17,405 | 4,211 | -5,959 |
| *Panel D: Percent of annual growth due to:* | | | | | | | | |
| (11) % Net entry and exit | -3 | -1 | -1 | -29 | 5 | -3 | 27 | -1 |
| (12) % Net product-country addition | -9 | 0 | 17 | 4 | 3 | 1 | 29 | -1 |
| (13) % Net intensive margin | 112 | 101 | 84 | 125 | 91 | 102 | 45 | 102 |

Note: Row (11) is computed as ((1)+(2))/(10). Row (12) is computed as ((4)+(5))/(10). Row (13) is computed as ((7)+(8))/(10).

Next, Table 5 presents the decomposition of changes in Japan's nominal imports. Similar to exports, Japan's imports followed a decreasing trend from 2014 to 2020 (row 10). Furthermore, as with exports, a substantial share of year-on-year changes in total imports is explained by the intensive margin. In other words, the overall decline in Japan's imports is primarily due to the decrease in continuing importers' imports of incumbent products from incumbent countries of origin (row 8). However, the contribution of the intensive margin (row 13) varies over time. Moreover, comparing the contribution of the intensive margin for imports and exports shows that, generally, it makes a larger contribution in the case of imports than exports.

Tables 4 and 5 show that a large part of the overall change in both exports and imports is explained by the intensive margin. The similarity in the patterns of the decomposition results for exports and imports can be explained by the fact that large firms engaged in both exports and imports account for a substantial share of a country's total trade. We show that Japan's trade is concentrated among a small number of large

firms engaged in both exporting and importing in Table 9 of Section 4. For firms that are engaged in both exports and imports, it is likely that if there is a decrease in the export of final goods for some reason, their intermediate goods imports also decrease. As a result, the contribution of the intensive margin to changes in exports and imports is likely to follow similar patterns.

As discussed in previous studies such as Mayer and Ottaviano (2008), Wakasugi et al. (2014), and Bernard et al. (2018), the majority of a country's total exports or imports tends to be carried by a very small number of large firms, and these large firms are continuing exporters and/or importers. It is for this reason that the contribution of the intensive margin to changes in aggregate trade is much larger than that of the extensive margin. Against this background, the next section examines the extent to which Japan's trade is concentrated among a small number of firms.

# 4 Concentration of Japan's International Trade

We next examine the concentration of Japan's international trade in a small number of large firms. Using data for 2017, we start by aggregating the exports and imports of each firm by product (HS9-digit level) and partner country. The number of products and countries each firm exports to or imports from is then counted. For exporters, Panel A of Table 6 shows the share of the total number of firms in each category based on the number of exported products and destination countries. Panel B of Table 6 presents the share of export values for each category of firm.

Panel A of Table 6 shows that firms exporting one product to one destination country make up the largest share, accounting for 21.1% of all exporting firms classified under manufacturing in the industry classification of the Orbis database. In terms of the number of destination countries, firms exporting to one or two countries account for 55.6% of all manufacturing exporting firms (39.5% + 16.1%). Moreover, firms exporting only one or two products account for 37.6% of all manufacturing exporting firms (24.4% + 13.2%). On the other hand, firms exporting to more than 10 countries and exporting more than 10 products make up 11.3% of all manufacturing firms. Thus, firms exporting only one product to one country and firms exporting more than 10 products to more than 10 countries make up the largest shares in the panel, indicating that a large number of exporting firms broadly fall into one of two categories.

Next, looking at the distribution of the share of export value (Panel B of Table 6), it becomes clear that firms exporting more than 10 products and to more than 10 countries account for 90.3% of the total value of exports. In other words, approximately 11% of all manufacturing exporters make up over 90% of the total value of exports. Such concentration of exports in large firms exporting many products to many countries is observed not only in Japan but also in other countries (e.g., Mayer and Ottaviano, 2008; Bernard et al., 2018).

Next, Table 7 shows the corresponding results for imports. Similar to exports, only importing firms classified under manufacturing in the Orbis database are considered.

As in the case of exports, firms importing only one product from a single country constitute the largest share, accounting for 24.0% of all manufacturing importing firms. In terms of the number of source countries, firms importing from one or two countries make up a substantial share, totaling 68.0% (47.9% + 20.1%). Meanwhile, firms importing one or two products account for 40.7% (25.7% + 15.0%) of all manufacturing importers. On the other hand, firms importing more than 10 products and from more than 10 countries constitute 4.7% of all manufacturing importers.

Comparing this figure with the corresponding figure for exports (Panel A of Table 6) shows that the

TABLE 6: Distribution (%) of Manufacturing Exporting Firms by Number of Products and Destination Countries, 2017

| No. of products | Number of countries | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6-10 | 11+ | All |
| *Panel A: Percentage of exporting firms* | | | | | | | | |
| 1 | 21.1 | 2.1 | 0.6 | 0.3 | 0.1 | 0.2 | 0.1 | 24.4 |
| 2 | 7.1 | 3.9 | 1.0 | 0.5 | 0.3 | 0.3 | 0.1 | 13.2 |
| 3 | 3.2 | 2.5 | 1.2 | 0.6 | 0.2 | 0.5 | 0.1 | 8.4 |
| 4 | 1.8 | 1.5 | 1.2 | 0.6 | 0.3 | 0.5 | 0.2 | 6.2 |
| 5 | 1.2 | 1.2 | 0.8 | 0.5 | 0.4 | 0.5 | 0.2 | 4.8 |
| 6-10 | 2.7 | 2.4 | 2.3 | 1.6 | 1.0 | 2.6 | 1.2 | 13.9 |
| 11+ | 2.5 | 2.4 | 2.2 | 2.0 | 1.8 | 6.9 | 11.3 | 29.1 |
| All | 39.5 | 16.1 | 9.3 | 6.0 | 4.1 | 11.6 | 13.3 | 100 |
| *Panel B: Percentage of export value* | | | | | | | | |
| 1 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 |
| 2 | 0.1 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.4 |
| 3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.3 |
| 4 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.2 | 0.1 | 0.4 |
| 5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 |
| 6-10 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.6 | 0.8 | 1.7 |
| 11+ | 0.7 | 0.3 | 0.4 | 0.5 | 0.6 | 3.8 | 90.3 | 96.7 |
| All | 1.0 | 0.5 | 0.7 | 0.9 | 0.8 | 4.7 | 91.3 | 100 |

TABLE 7: Distribution (%) of Manufacturing Importing Firms by Number of Products and Source Countries, 2017

| No. of products | Number of countries | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6-10 | 11+ | All |
| *Panel A: Percentage of importing firms* | | | | | | | | |
| 1 | 24.0 | 1.4 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 25.7 |
| 2 | 9.3 | 5.0 | 0.6 | 0.1 | 0.0 | 0.0 | 0.0 | 15.0 |
| 3 | 4.4 | 3.4 | 1.3 | 0.3 | 0.1 | 0.0 | 0.0 | 9.5 |
| 4 | 2.7 | 2.3 | 1.3 | 0.5 | 0.2 | 0.1 | 0.0 | 7.0 |
| 5 | 2.0 | 1.7 | 1.0 | 0.5 | 0.2 | 0.1 | 0.0 | 5.5 |
| 6-10 | 3.6 | 4.0 | 3.1 | 2.1 | 1.2 | 1.5 | 0.1 | 15.5 |
| 11+ | 2.0 | 2.3 | 2.3 | 2.1 | 2.1 | 6.2 | 4.7 | 21.7 |
| All | 47.9 | 20.1 | 9.7 | 5.7 | 3.8 | 8.0 | 4.8 | 100 |
| *Panel B: Percentage of import value* | | | | | | | | |
| 1 | 0.5 | 0.1 | 0.1 | 0.0 | 0.1 | 1.0 | 0.0 | 1.8 |
| 2 | 0.3 | 0.2 | 0.1 | 0.1 | 0.0 | 0.8 | 0.3 | 1.9 |
| 3 | 0.2 | 0.2 | 0.2 | 0.0 | 0.1 | 0.0 | 0.0 | 0.7 |
| 4 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.7 |
| 5 | 0.1 | 0.2 | 0.1 | 0.2 | 0.0 | 0.1 | 0.0 | 0.8 |
| 6-10 | 0.4 | 0.6 | 0.4 | 0.5 | 0.3 | 0.7 | 4.1 | 7.0 |
| 11+ | 0.5 | 0.8 | 1.1 | 1.3 | 1.7 | 7.1 | 74.8 | 87.2 |
| All | 2.2 | 2.4 | 2.0 | 2.2 | 2.3 | 9.8 | 79.1 | 100 |

percentage of firms importing many products from many countries is lower. However, looking at the distribution of the value of imports (Panel B of Table 7), we find that firms importing more than 10 products and from more than 10 countries are responsible for 74.8% of total imports. In other words, in terms of the number of firms, approximately 5% of all manufacturing importers account for three-quarters of total imports. This pattern is similar to that observed in the United States, suggesting that, also in the case of imports, large firms importing many products from many countries dominate.

Table 8 provides a more detailed breakdown of trade concentration. It shows the import shares of firms when these are sorted in ascending order in terms of their amount of trade and split into deciles or percentiles. The column labeled "Exports + Imports" indicates that the top 10% of firms (the 10th decile) account for 96.2% of the total trade amount. Looking at exports only, the top 10% of firms are responsible for 96.6% of total exports, while for imports only, the top 10% of firms account for 94.6% of total imports.

We further divide the distribution into percentiles within the top 10% and show the 91st to 100th percentiles in the table. It can be seen that the top 1% of firms (the 100th percentile) account for 76.7% of total trade. The figures are similar when looking at exports or imports only, indicating that the concentration of trade among the top 1% of firms is very high.

TABLE 8: Distribution of Trade Shares, 2017

| | Exports + Imports | Exports | Imports |
|---|---|---|---|
| *Panel A: Deciles* | | | |
| 1 | 0.000 | 0.000 | 0.000 |
| 2 | 0.000 | 0.000 | 0.000 |
| 3 | 0.000 | 0.000 | 0.000 |
| 4 | 0.000 | 0.000 | 0.001 |
| 5 | 0.001 | 0.001 | 0.001 |
| 6 | 0.002 | 0.001 | 0.003 |
| 7 | 0.003 | 0.003 | 0.005 |
| 8 | 0.008 | 0.007 | 0.012 |
| 9 | 0.024 | 0.022 | 0.032 |
| 10 | 0.962 | 0.966 | 0.946 |
| *Panel B: Percentiles* | | | |
| 91 | 0.005 | 0.005 | 0.006 |
| 92 | 0.006 | 0.006 | 0.007 |
| 93 | 0.007 | 0.007 | 0.009 |
| 94 | 0.009 | 0.009 | 0.011 |
| 95 | 0.012 | 0.012 | 0.014 |
| 96 | 0.016 | 0.017 | 0.019 |
| 97 | 0.023 | 0.024 | 0.025 |
| 98 | 0.038 | 0.040 | 0.040 |
| 99 | 0.080 | 0.088 | 0.075 |
| 100 | 0.767 | 0.759 | 0.739 |

Note: The table shows the share of trade accounted for by each decile or percentile of firms. The figures are based on data for 2017 and for firms classified under manufacturing based on the industry classification in the Orbis company database.

For comparison, in the United States, the top 10% of firms account for 96.3% of total trade, with the top 1% of firms responsible for 81.8% of the total trade (Bernard et al., 2018). Both Japan and the United States exhibit a high concentration of trade, with the top 1% of firms making up around 70-80% of trade in terms of the total as well as exports or imports only. Mayer and Ottaviano (2008) report lower concentration levels for European countries, such as Belgium (48%), France (44%), Germany (59%), Hungary (77%), Italy (32%), Norway (53%), and the United Kingdom (42%). Although European countries also show a high concentration among the top 1% of firms, the concentration in Japan and the United States is substantially higher. This difference is likely due to the close proximity between European countries, with shared borders, the establishment of a single market within the European Union (EU), and the overall ease of trade within the EU. In addition, the smaller market size of individual European countries may encourage businesses to export to other countries within the region.

Next, in Table 9 we examine the distribution of exports and imports across firms by again grouping firms into deciles and percentiles based on the amount of trade they are engaged in.[16] Starting with column (1), this shows the share of firms in each decile or percentile that are engaged in both exporting and importing (each decile comprises 2,557 or 2,558 firms, while each percentile comprises 256 or 257 firms). The share of firms engaged in both exporting and importing rises for each decile (and broadly increases over the percentiles). For instance, among firms belonging to the bottom 10% in terms of their total value of trade (1st decile), only 2.9% are involved in both exporting and importing, whereas among firms in the top 10%

[16] We further examine the diversity of exports and imports at the firm-level. The statistics are reported in Appendix B.2.

(10th decile) the corresponding share is 96.4%.

Column (2) shows the average value of the total amount of trade (exports and/or imports) per firm, while column (3) shows the average value of the intra-industry trade (IIT) index for each firm within each decile or percentile, where IIT is defined as the export and import of products in the same HS6-digit level category. The IIT index is calculated for each firm and then averaged within each decile or percentile. The IIT index, known as the Grubel-Lloyd index, is calculated as follows:

$$IIT_{fpt} = 1 - \frac{|X_{fpt} - M_{fpt}|}{X_{fpt} + M_{fpt}},$$

where $X_{fpt}$ stands for firm $f$'s value of exports of product $p$ in year $t$, and $M_{fpt}$ and $IIT_{fpt}$ stand for the corresponding value of imports and IIT (where exports and imports are aggregated at the product level and no distinction of trading partners is made). This index approaches 1 when the difference between the export and import amounts is small, indicating a significant level of IIT. Furthermore, the firm-level IIT index is defined as the weighted average of the IIT indices for each product $p$, where the weights are given by the share of product $p$ in the total trade amount of firm $f$:

$$IIT_{ft} = \sum_{p} \left( \frac{X_{fpt} + M_{fpt}}{X_{ft} + M_{ft}} \right) IIT_{fpt},$$

Column (2) of Table 9 shows that the average trade amounts of the top 10%, and especially the top 1%, of firms are much larger than those of other firms. Moreover, column (3) shows that the top 10% of firms to some extent both export and import products in the same category, even at the relatively detailed HS6-digit product category. Columns (4) to (6) and columns (8) to (10) present the average number of product-country pairs for exports and import, the average number of products, and the average number of partner countries, respectively. Here again, we find that the top 10%, and particularly the top 1%, of firms trade significantly more products with more partner countries than other firms. Comparing the figures in columns (4) to (6) and columns (8) to (10) shows that large exporters tend to trade a much larger number of products with a much larger number of countries than importers.

Next, column (7) shows the average export market share of firms' top export product. Specifically, we first identify the top-ranking product (at the HS9-digit level) in a firm's exports to a specific country in terms of the export value and then calculate the share of this in Japan's total exports of that product to that country, which we call the market share. Next, we calculate for each firm the average of the market shares across all product-country pairs. Finally, for column (7), the firm-level average top product market shares are further averaged for each decile or percentile. Column (11) show the corresponding values for imports.

For example, column (7) indicates that the top-ranking product of the top 1% of firms in terms of trade volume, on average, accounts for a 48% share of exports to each export market. In contrast, the top-ranking product of medium-sized exporters falling into the 5th decile has an average market share of only 13%. This suggests that among firms exporting the same product to the same country, large firms dominate the market, holding substantial power in the export market from Japan to that specific destination country. Similar patterns can be observed for imports, as shown in column (11).

TABLE 9: Distribution of Trade by Decile/Percentile of the Value of Total Trade, 2017

| | Exports + Imports | | | Exports | | | | Imports | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| | Share of firms engaged in both export and import | Average value of trade (million yen) | Average IIT index (HS6-digit level) | Average no. of product-country pairs (HS9-digit level) | Average no. of products (HS9-digit level) | Average no. of partner countries | Average market share of the top export product for each firm | Average no. of product-country pairs (HS9-digit level) | Average no. of products (HS9-digit level) | Average no. of partner countries | Average market share of the top import product for each firm |
| *Panel A: Deciles* | | | | | | | | | | | |
| 1 | 0.029 | 1 | 0.003 | 1.2 | 1.2 | 1.1 | 0.10 | 1.2 | 1.2 | 1.1 | 0.09 |
| 2 | 0.124 | 2 | 0.013 | 1.9 | 1.7 | 1.3 | 0.10 | 1.8 | 1.7 | 1.2 | 0.10 |
| 3 | 0.206 | 5 | 0.021 | 2.8 | 2.4 | 1.6 | 0.11 | 2.4 | 2.3 | 1.4 | 0.12 |
| 4 | 0.294 | 12 | 0.026 | 3.9 | 3.1 | 2.0 | 0.13 | 3.1 | 2.9 | 1.5 | 0.14 |
| 5 | 0.400 | 27 | 0.035 | 5.0 | 3.9 | 2.3 | 0.13 | 4.3 | 4.0 | 1.7 | 0.15 |
| 6 | 0.513 | 56 | 0.040 | 6.8 | 4.9 | 2.8 | 0.14 | 5.7 | 5.1 | 2.0 | 0.16 |
| 7 | 0.644 | 117 | 0.054 | 10.4 | 7.3 | 3.6 | 0.16 | 7.2 | 6.3 | 2.3 | 0.19 |
| 8 | 0.774 | 265 | 0.073 | 16.7 | 10.9 | 4.7 | 0.17 | 9.8 | 8.3 | 2.7 | 0.20 |
| 9 | 0.886 | 793 | 0.099 | 32.6 | 19.0 | 7.2 | 0.21 | 16.2 | 13.0 | 3.9 | 0.24 |
| 10 | 0.964 | 32,226 | 0.145 | 176.5 | 65.8 | 17.2 | 0.31 | 65.9 | 38.8 | 9.8 | 0.32 |
| *Panel B: Percentiles* | | | | | | | | | | | |
| 91 | 0.949 | 1,651 | 0.122 | 55.6 | 30.3 | 9.4 | 0.24 | 23.3 | 17.5 | 4.8 | 0.26 |
| 92 | 0.934 | 1,977 | 0.118 | 57.9 | 29.9 | 10.9 | 0.25 | 22.7 | 17.2 | 5.5 | 0.27 |
| 93 | 0.945 | 2,413 | 0.143 | 61.6 | 31.6 | 10.9 | 0.26 | 29.4 | 21.8 | 6.3 | 0.30 |
| 94 | 0.969 | 3,013 | 0.133 | 76.3 | 37.9 | 12.7 | 0.28 | 31.1 | 22.5 | 6.5 | 0.29 |
| 95 | 0.957 | 3,863 | 0.140 | 84.3 | 42.9 | 12.5 | 0.26 | 38.2 | 26.7 | 7.7 | 0.31 |
| 96 | 0.961 | 5,357 | 0.153 | 107.3 | 53.8 | 14.6 | 0.29 | 41.5 | 29.1 | 8.0 | 0.30 |
| 97 | 0.973 | 7,734 | 0.149 | 132.4 | 59.2 | 17.3 | 0.33 | 47.6 | 32.1 | 8.8 | 0.32 |
| 98 | 0.977 | 12,567 | 0.156 | 162.5 | 70.8 | 18.1 | 0.33 | 62.6 | 40.1 | 10.9 | 0.35 |
| 99 | 0.988 | 26,739 | 0.180 | 274.7 | 102.4 | 25.9 | 0.39 | 95.5 | 56.6 | 14.4 | 0.38 |
| 100 | 0.984 | 257,616 | 0.156 | 740.0 | 195.4 | 38.9 | 0.48 | 265.5 | 123.1 | 24.4 | 0.45 |

Note: The figures are for firms classified under manufacturing based on the Orbis industry classification.

# 5 Performance Premia of Firms Engaged in International Trade

In this section, we analyze the performance premia of exporting firms by matching the customs data with firm-level questionnaire information from the Basic Survey of Japanese Business Structure and Activities (BSJBSA). Details of the BSJBSA and the characteristics of the matched data are provided in Appendix C.

## 5.1 *Performance premia of exporting firms*

We compare the firm characteristics of exporting firms and non-exporting firms. In this section, we restrict our analysis to manufacturing firms in the matched data and use regression analysis to examine how firm performance differs between exporting and non-exporting firms. The specific estimation equation is as follows:

$$y_{ft} = \alpha + \beta D_{ft} + \gamma X_{ft} + \epsilon_{ft}, \tag{5}$$

where $y_{ft}$ represents the performance indicator of firm $f$ in year $t$, $D_{ft}$ is a dummy for exporters, and $X_{ft}$ represents other control variables. The performance indicators include sales, value added, labor productivity (value added per employee), the number of employees, the capital-labor ratio, TFP, and the average wage.[17]

[17] TFP is calculated from the residuals of the estimated production function for each industry. The production function is estimated using the method of Wooldridge (2009).

All these variables are in logs.

Taking the exponent of the estimated coefficient $\hat{\beta}$ of the exporter dummy, $\exp(\beta)$, allows us to calculate the factor by which the performance indicators of exporting firms exceed those of non-exporting firms. As a control variable, we use the log of the number of employees as a proxy for firm size. We also include two-digit-level industry fixed effects and year fixed effects. The basic statistics of the variables used in the analysis are presented in Table C4.

The estimation results of equation (5) are presented in Table 10, where columns (1), (2), and (3) show the estimation results with different combinations of fixed effects and control variables. The values in the table represent the coefficients on the exporter dummy, with standard errors in parentheses. For example, column (1) shows that the exporter premium with respect to sales is 0.761, implying that the sales of exporters are approximately twice those of non-exporters ($\exp(0.761) = 2.14$).

The following three observations can be made from Table 10. First, the coefficients on the exporter dummy are positive and statistically significant in all cases, indicating that firms engaged in exporting perform better than non-exporting firms. Second, the difference between exporting and non-exporting firms tends to decrease when industry fixed effects and firm size are controlled for (most of the coefficients in column (3) are smaller than those in columns (1) and (2)). Still, the coefficient on the export dummy remains statistically significant even after these factors are controlled for.[18]

TABLE 10: Estimation Results for Exporter Premia

| | (1) | (2) | (3) | *N* |
|---|---|---|---|---|
| Sales | 0.761* | 0.819* | 0.193* | 78,768 |
| | (0.019) | (0.020) | (0.011) | |
| Value added | 0.745* | 0.727* | 0.120* | 78,575 |
| | (0.017) | (0.017) | (0.007) | |
| Labor productivity | 0.230* | 0.173* | 0.119* | 78,575 |
| | (0.007) | (0.007) | (0.007) | |
| No. of employees | 0.519* | 0.557* | | 78,768 |
| | (0.014) | (0.015) | | |
| Capital-labor ratio | 0.262* | 0.281* | 0.185* | 78,370 |
| | (0.014) | (0.014) | (0.015) | |
| TFP | 0.313* | 0.188* | 0.072* | 78,180 |
| | (0.010) | (0.006) | (0.006) | |
| Average wage | 0.165* | 0.116* | 0.083* | 78,768 |
| | (0.005) | (0.004) | (0.005) | |
| Year FE | Yes | Yes | Yes | |
| Industry (2-digit) FE | No | Yes | Yes | |
| Size control | No | No | Yes | |

Note: The table shows the coefficient of the exporter dummy when each variable in the left column is used as the dependent variable. Numbers in parentheses are robust standard errors clustered by firm. Firms in the top and bottom 1% in terms of their log value added, capital per worker, and TFP are dropped as outliers in the estimations where these variables are used as the dependent variables. "n.a." stands for "not applicable." We do not estimate the exporter premia in the case where the number of employees is used as the dependent variable in column (3) because the variable to control for firms' size is based on the number of employees. * denotes statistical significance at the 1% level.

Table 11 presents estimates of export premia by year using the exporter dummy.[19] The exporter premia with respect to sales and the capital-labor ratio are stable over time, but those with respect to the other indicators show an increasing trend. For example, for the average wage, the coefficient on the exporter dummy

[18] In Appendix D, instead of the exporter dummy, we use an importer dummy and a dummy for two-way traders, i.e., firms that are engaged in both exporting and importing. The importer and two-way trader dummies based on the custom data tend to have slightly larger coefficients than those based on the BSJBSA. However, overall, the results are qualitatively similar to those obtained from the BSJBSA.

[19] See Appendix D for import premia and two-way trader premia.

increases from 0.07 to 0.09. Theoretically, an increase in export premia can be observed in the following cases: assuming the performance of domestic firms remains constant, either (1) exporters' performance improves, or (2) poorly performing exporters withdraw from foreign markets and export participation declines. The export participation rate shown in the bottom row of Table 11 remains almost unchanged, suggesting that the rise in export premia is driven by the improved performance of exporting firms. A possible interpretation of this result is that domestic firms' performance has been sluggish due to slow growth in the domestic market while exporting firms have improved their performance by capturing growth in foreign markets.

TABLE 11: Exporter Premia over Time

| | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|
| Exporter premia | | | | | | | |
| Sales | 0.192* | 0.185* | 0.185* | 0.208* | 0.198* | 0.195* | 0.189* |
| Value added | 0.114* | 0.105* | 0.106* | 0.127* | 0.134* | 0.134* | 0.126* |
| Labor productivity | 0.110* | 0.104* | 0.102* | 0.127* | 0.135* | 0.134* | 0.124* |
| Capital-labor ratio | 0.181* | 0.190* | 0.182* | 0.199* | 0.179* | 0.188* | 0.174* |
| TFP | 0.065* | 0.057* | 0.058* | 0.077* | 0.089* | 0.085* | 0.079* |
| Average wage | 0.072* | 0.074* | 0.079* | 0.091* | 0.083* | 0.090* | 0.093* |
| Number of employees | 0.544* | 0.535* | 0.548* | 0.559* | 0.561* | 0.569* | 0.582* |
| Number of firms | 11,262 | 11,328 | 11,255 | 11,324 | 11,136 | 11,168 | 11,295 |
| Export participation ratio | 47.1% | 48.0% | 48.1% | 49.4% | 49.9% | 49.1% | 47.1% |

Note: Two-digit industry fixed effects are included. Firm size, measured by the number of employees, is controlled for in all cases except where the number of employees is used as the dependent variable for firm performance. * denotes statistical significance at the 1% level.

## 5.2 *Link between firm size and the extensive margins of trade*

To explore the link between firm size and the number of countries and products traded, we estimate the following simple regression model:

$$y_{fst} = \exp(\alpha + \beta \ln(Emp_{fst}) + \lambda_s + \eta_t + \epsilon_{fst}), \tag{6}$$

where $y_{fst}$ is the number of destination or source countries or the number of exported or imported products for firm $f$ in industry $s$ and year $t$. $\ln(Emp_{fst})$ is the number of employees, a proxy for firm size. We also include industry and year fixed effects. The estimation results of equation (6) are presented in Table 12.

Since our sample covers non-exporting and non-importing firms, there are many zero values in the dependent variables, so that we use a negative binomial model. The coefficients on firm size are all positive and significant for the number of countries and products traded for both exports and imports, indicating that the larger a firm, the more countries it trades with and the larger the number of products it trades. Looking at the magnitude of the coefficients on firm size, those for exports are larger than those for imports, suggesting that larger exporters tend to trade more goods with a larger number of countries than importers.

Finally, Table 13 presents estimates of the same model for three industry categories: manufacturing, wholesale and retail trade, and other. The coefficients on firm size are positive and significant for all industry categories. Comparing the magnitude of the coefficients between the manufacturing and wholesale/retail industries, the coefficient for the wholesale/retail industry is about half that of the manufacturing industry. A possible explanation is that wholesale/retails firms trade many products with many different countries even though they tend to be relatively small compared to manufacturers.

TABLE 12: Link between Firm Size and Extensive Margins of Trade, All Industries

| | (1) No. of destination countries | (2) No. of source countries | (3) No. of exported products | (4) No. of imported products |
|---|---|---|---|---|
| ln(*Emp*) | 0.604* | 0.574* | 0.768* | 0.667* |
| | (0.098) | (0.087) | (0.098) | (0.077) |
| *N* | 208,741 | 208,741 | 208,741 | 208,741 |
| log-likelihood | -314961 | -312919 | -390534 | -402255 |

Note: Two-digit industry and country fixed effects are included. Figures in parentheses are robust standard errors clustered at the two-digit industry level. * denotes statistical significance at the 1% level.

TABLE 13: Link between Firm Size and Extensive Margins of Trade by Industry

| | (1) No. of destination countries | (2) No. of source countries | (3) No. of exported products | (4) No. of imported products |
|---|---|---|---|---|
| *Panel A: Manufacturing* | | | | |
| ln(*Emp*) | 0.773* | 0.724* | 0.949* | 0.822* |
| | (0.046) | (0.025) | (0.048) | (0.029) |
| *N* | 89,706 | 89,706 | 89,706 | 89,706 |
| log-likelihood | -179,088 | -158,286 | -221,959 | -210,074 |
| *Panel B: Wholesale and retail* | | | | |
| ln(*Emp*) | 0.304* | 0.316* | 0.463* | 0.432* |
| | (0.011) | (0.008) | (0.013) | (0.010) |
| *N* | 64,137 | 64,137 | 64,137 | 64,137 |
| log-likelihood | -99,153 | -108,299 | -123,742 | -138,778 |
| *Panel C: Other industries* | | | | |
| ln(*Emp*) | 0.666* | 0.638* | 0.809* | 0.678* |
| | (0.094) | (0.086) | (0.103) | (0.081) |
| *N* | 54,898 | 54,898 | 54,898 | 54,898 |
| log-likelihood | -29,092 | -35,583 | -34,368 | -42,441 |

Note: Two-digit industry and year fixed effects are included. Figures in parentheses are robust standard errors clustered at the two-digit industry level. * denotes statistical significance at the 1% level.

# 6 Conclusion

This study provides first insights into Japanese firms' export and import behavior using transaction-level customs data. While previous studies working with METI's firm-level survey data (e.g., Wakasugi et al., 2014) examine the performance of exporters, our study investigates firm behavior in terms of a greater number of dimensions, including various margins and the level of concentration in terms of products and partner countries. We found that during 2014-2020 approximately 70% of the variation in Japan's export values across partner countries was due to the number of exporting firms and the number of exported products (i.e., the extensive margin). Similarly, the extensive margin can explain about 60% of the variation on the import side. We also found that a limited number of firms accounts for a large share of both exports and imports, and they trade many products with many partner countries, whereas a large share of firms that engage in international trade export only one product to one destination country or import only one product from one source country. Notably, the distributions of the value of trade per firm, the number of products per firm, and the number of destinations per firm exhibit a high degree of skewness.

Furthermore, we found interesting trends in the performance premia of Japanese exporting firms in the period 2014-2020. Specifically, exporter premia with respect to value added and productivity (both labor productivity and TFP) decreased until 2016 and then increased until 2019, whereas the exporter premium

with respect to the average wage steadily increased in this period. On the other hand, the export participation ratio steadily increased until 2018 and slightly decreased thereafter. A possible explanation for these changes in exporter premia is the introduction of Abenomics in 2013, consisting of policies by the Abe administration to boost growth and overcome deflation. While it is beyond the scope of this study to investigate how economic policy in this period affected Japanese firms' engagement in international trade, doing so might be feasible by combining Japanese customs data with firm-level data and hence is an important topic for future research.

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# Appendix for "Margins, concentration, and the performance of firms in international trade: Evidence from Japanese customs data"

## A Overview of the Matched Customs/Orbis Data

In Sections 3 and 4, we conducted our analysis by connecting the customs data with corporate information from the Orbis database. In this appendix, we provide an overview of our matched dataset, in which we linked the customs data with the Orbis database. The original customs data are based on export and import declarations that contain detailed information such as the exporting/importing firm, the HS9-digit product code, the trading partner country, etc. The customs data include a huge number of observations for exports and imports (approximately 20 million declarations for exports and over 20 million declarations for imports each year), as shown in Table 1. For the analysis in Sections 3 and 4, we used the export and import declarations that fall under the general trade classification and are aggregated by year, exporting/importing firm, HS6-digit product, and trading partner country. The total annual number of observations in the aggregated data for exports and imports still each exceeds on million, as shown in Appendix Table A1. We then linked the aggregated customs data with the Orbis database using firms' corporate number. As shown in Table A1, we were able to link about 97% of all year-firm-product-country-level observations with the Orbis corporate information during the period 2014–2020.

TABLE A1: Number of Observations Aggregated by Year, Firm, HS6-digit Product, and Partner Country

| | Exports | | | Imports | | |
|---|---|---|---|---|---|---|
| | Total obs. | No. of obs. linked with the Orbis data | (%) | Total obs. | No. of obs. linked with the Orbis data | (%) |
| 2014 | 1,219,386 | 1,147,786 | (94.1%) | 1,038,975 | 955,111 | (91.9%) |
| 2015 | 1,258,900 | 1,195,177 | (94.9%) | 1,040,014 | 973,103 | (93.6%) |
| 2016 | 1,238,000 | 1,186,252 | (95.8%) | 1,007,615 | 956,759 | (95.0%) |
| 2017 | 1,274,327 | 1,233,216 | (96.8%) | 1,050,017 | 1,008,905 | (96.1%) |
| 2018 | 1,289,765 | 1,276,616 | (99.0%) | 1,067,551 | 1,055,288 | (98.9%) |
| 2019 | 1,253,764 | 1,243,034 | (99.1%) | 1,071,846 | 1,061,266 | (99.0%) |
| 2020 | 1,162,458 | 1,153,620 | (99.2%) | 1,038,981 | 1,030,113 | (99.1%) |
| All years | 8,696,600 | 8,435,701 | (97.0%) | 7,314,999 | 7,040,545 | (96.2%) |

Appendix Table A2 provides a more detailed overview for the year 2017, showing a breakdown of the number of firms, export and import values, etc., based on the industry to which exporting or importing firms belong. The Orbis database primarily uses the European Union's Nomenclature of Economic Activities (NACE Rev. 2) industry classification, and we follow this example. NACE is closely related to the International Standard Industrial Classification (ISIC). It should be noted that (as mentioned in footnote 13 of the main text), information regarding the industry classification of firms for the years 2014 to 2020 was not available, so that we classified firms based on their industry classification in June 2022. This means that in our regression analyses we assume that firms' industry classification in 2014 to 2020 was the same as in June 2022. Moreover, there are some firms that we managed to link with the Orbis database using the corporate number but for which no industry classification is provided. Exports and imports by firms for which the industry classification is unavailable account for approximately 4% of the total export value and 10% of the import value (Appendix Table A2). Possible reasons why the Orbis database does not provide information on the industry classification is that such information was not available because the firms in question were small or did not disclose such information because they are the subsidiaries of foreign companies.

Looking at firms for which the industry classification is available, Appendix Table A2 shows that the majority of international trade is conducted by firms in the manufacturing or wholesale and retail industries. Manufacturing firms account for 70% of the total export value, while wholesale and retail firms account for 25%. Meanwhile, both manufacturing and wholesale and retail firms each account for 42% of the total import value. The higher share of wholesale and retail firms in imports than exports may be due to the fact that Japan imports a substantial amount of undifferentiated goods, such as natural resources and grains/agricultural products. These goods are often mass imported by large trading companies (*sogo*

*shosha*).

TABLE A2: Number of Exporting and Importing Firms and Export and Import Values by Industry, 2017

| | | No. of firms in the Orbis database | Exports | | | | Imports | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | No. of firms | Share of exporting firms (%) | Total amount (billion yen) | Share of exports (%) | No. of firms | Share of importing firms (%) | Total amount (billion yen) | Share of imports (%) |
| NACE 1-digit Classification | | (A) | (B) | (B/A) | | | (C) | (C/A) | | |
| A | Agriculture, forestry and fishing | 16,058 | 112 | 0.7 | 14 | 0.02 | 300 | 1.9 | X | X |
| B | Mining and quarrying | 1,329 | 40 | 3.0 | 58 | 0.07 | 40 | 3.0 | X | X |
| C | Manufacturing | 198,194 | 17,621 | 8.9 | 54,500 | 69.80 | 20,312 | 10.2 | 31,170 | 41.63 |
| D | Electricity, gas, and other utilities | 2,909 | 23 | 0.8 | 2 | 0.00 | 95 | 3.3 | 1,281 | 1.71 |
| E | Water supply; sewerage; etc. | 11,214 | 100 | 0.9 | 9 | 0.01 | 90 | 0.8 | 30 | 0.04 |
| F | Construction | 270,145 | 728 | 0.3 | 166 | 0.21 | 1,885 | 0.7 | 164 | 0.22 |
| G | Wholesale and retail trade, etc. | 307,979 | 23,488 | 7.6 | 19,250 | 24.65 | 35,709 | 11.6 | 31,200 | 41.67 |
| H | Transportation and storage | 44,873 | 631 | 1.4 | 446 | 0.57 | 708 | 1.6 | 964 | 1.29 |
| I | Accomodation and food service activities | 30,806 | 164 | 0.5 | 6 | 0.01 | 354 | 1.1 | 56 | 0.07 |
| J | Information and communication | 36,404 | 627 | 1.7 | 166 | 0.21 | 1,055 | 2.9 | 299 | 0.40 |
| K | Financial and insurance activities | 12,405 | 119 | 1.0 | 66 | 0.09 | 209 | 1.7 | X | X |
| L | Real estate activities | 93,032 | 161 | 0.2 | 7 | 0.01 | 349 | 0.4 | 29 | 0.04 |
| M | Professional services | 99,434 | 650 | 0.7 | 60 | 0.08 | 1,092 | 1.1 | 132 | 0.18 |
| N | Administrative and support services | 62,265 | 895 | 1.4 | 247 | 0.32 | 1,694 | 2.7 | 408 | 0.55 |
| O | Public administration and defence, etc. | 2,285 | 17 | 0.7 | 0 | 0.00 | 15 | 0.7 | 0 | 0.00 |
| P | Education | 12,531 | 92 | 0.7 | 2 | 0.00 | 247 | 2.0 | 5 | 0.01 |
| Q-T | Other services | 156,530 | 378 | 0.2 | 22 | 0.03 | 881 | 0.6 | 228 | 0.30 |
| n.a. | Unclassified | 2,066,740 | 19,666 | 1.0 | 3,064 | 3.92 | 28139 | 1.4 | 7,808 | 10.43 |
| | All industries | 3,425,133 | 65,512 | 1.9 | 78,083 | 100 | 93,174 | 2.7 | 74,880 | 100 |

Note: For sectors A (Agriculture, forestry and fishing), B (Mining and quarrying), and K (Financial and insurance activities), the total import amount and the share of importers are withheld.

TABLE A3: Exports and Imports by 2-digit Manufacturing Industry, 2017

| | | Exports | | | | Imports | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | No. of firms | No. of products per firm (HS 6-digit level) | No. of countries per firm | Export value per firm (million yen) | No. of firms | No. of products per firm (HS 6-digit level) | No. of countries per firm | Import value per firm (million yen) |
| NACE 2-digit classification | | | | | | | | | |
| 10 | Food products | 913 | 4.7 | 2.8 | 177 | 1,183 | 4.3 | 2.5 | 945 |
| 11, 12 | Beverages and tobacco | 363 | 2.4 | 2.8 | 163 | 210 | 4.7 | 3.0 | 1,071 |
| 13 | Textiles | 410 | 8.9 | 4.2 | 331 | 604 | 7.5 | 2.1 | 227 |
| 14 | Wearing apparel | 378 | 15.0 | 2.6 | 191 | 537 | 13.3 | 2.1 | 453 |
| 15 | Leather and related products | 161 | 6.4 | 2.4 | 69 | 322 | 4.9 | 2.1 | 174 |
| 16 | Wooden products | 161 | 5.1 | 2.4 | 128 | 481 | 4.1 | 2.2 | 393 |
| 17 | Paper and paper products | 337 | 8.1 | 4.2 | 698 | 389 | 6.8 | 2.6 | 715 |
| 18 | Printing, recorded media | 210 | 8.2 | 3.5 | 1,127 | 278 | 6.9 | 2.1 | 261 |
| 19 | Coke and refined petroleum products | 71 | 11.5 | 7.4 | 20,120 | 65 | 6.8 | 4.8 | 121,900 |
| 20 | Chemicals and chemical products | 1,114 | 15.9 | 7.4 | 3,710 | 1,099 | 10.8 | 4.0 | 1,716 |
| 21 | Pharmaceutical products | 277 | 9.7 | 7.2 | 2,443 | 319 | 11.1 | 5.6 | 7,959 |
| 22 | Rubber and plastic products | 1,274 | 10.9 | 3.8 | 727 | 1,481 | 6.3 | 2.3 | 517 |
| 23 | Other non-metallic mineral products | 421 | 11.8 | 5.1 | 1,561 | 491 | 7.8 | 2.9 | 620 |
| 24 | Basic metals | 463 | 14.9 | 4.8 | 2,920 | 481 | 9.3 | 3.4 | 7,256 |
| 25 | Fabricated metal products | 1,976 | 9.1 | 3.5 | 461 | 2,257 | 5.9 | 2.1 | 302 |
| 26 | Computer, electronic and optical products | 1,994 | 19.6 | 7.2 | 5,027 | 2,261 | 11.9 | 4.0 | 1,877 |
| 27 | Electrical equipment | 1,068 | 18.2 | 5.6 | 2,799 | 1,216 | 10.5 | 3.1 | 1,286 |
| 28 | Machinery and equipment n.e.c. | 3,533 | 18.2 | 6.4 | 2,628 | 3,364 | 10.8 | 3.5 | 656 |
| 29 | Motor vehicles, trailers and semi-trailers | 763 | 28.2 | 6.6 | 22,310 | 816 | 14.7 | 4.3 | 2,808 |
| 30 | Other transport equipment | 104 | 32.6 | 9.0 | 21,730 | 126 | 22.7 | 4.5 | 2,706 |
| 31 | Furniture | 150 | 6.0 | 3.0 | 106 | 364 | 7.0 | 2.3 | 160 |
| 32 | Other manufacturing | 1,008 | 10.3 | 6.9 | 959 | 1,359 | 7.8 | 3.0 | 330 |
| 33 | Repair of machinery and equipment | 472 | 9.2 | 3.3 | 1,952 | 609 | 7.6 | 2.6 | 176 |
| | All manufacturing industries | 17,621 | 14.1 | 5.3 | 3,093 | 20,312 | 8.9 | 3.1 | 1,535 |

Note: The figures are for firms classified under manufacturing based on the Orbis industry classification.

In Table 2, we presented basic statistics for the year-firm-product-country-level data by firms' industry at the 1-digit industry level. Table A3 presents the same basic statistics for firms in the manufacturing sector, broken down by 2-digit manufacturing industry using the NACE classification. We see substantial heterogeneity across industries within the manufacturing sector. Some industries, such as the chemical, metal products, and machinery industries, have a large number of exporters and importers, whereas light industries such as the leather, wood, and furniture industries only have a small number of exporters and importers. Another notable fact is that the number of exporters in the petroleum products, motor vehicles, and other transport machinery industries is relatively small (71, 763, and 104, respectively) but the export value per firm is much higher than in the other industries, exceeding 20 billion yen. This pattern suggests that these industries are characterized by economies of scale and oligopolistic markets. In addition, the motor vehicles and other transport machinery industries are characterized by a substantial number of products per firm (28.2 and 32.6, respectively), reflecting the fact that these industries are parts and components intensive.

# B Concentration/Diversity of Traded Products and Partner Countries at the Firm Level

Next, this appendix examines the concentration or diversity of exports and imports at the firm level. Specifically, similar to Table 9 in Section 4, firms are grouped into deciles or percentiles based on their total amount of trade (i.e., exports and imports). Next, various indicators of the concentration/diversity of products traded and partner countries are calculated, and the averages of these indicators are then calculated for each decile or percentile. We calculate four types of indicators to examine the degree of concentration/diversification of traded products and partner countries. The first is the Herfindahl-Hirschman Index (HHI), which measures the concentration of partner countries and products based on the share of each partner country-product pair in the total export or import value of each firm. A smaller HHI value indicates a larger diversity. The second indicator we use is the standard deviation of the share of partner country-product pairs, with a smaller value indicating a lower bias toward specific products or partner countries and hence greater diversity.

The third and fourth indicators are entropy indexes. Specifically, we calculate the diversity of partner countries for each of firm f's export or import products in a given year:

$$E_f^P = \sum_p \left( \frac{\text{Number of partner countries for product } p \text{ of firm } f}{\text{Total number of product} - \text{country pairs for firm } f} \right) \times \ln \left( \frac{1}{\frac{\text{Number of partner countries for product } p \text{ for firm } f}{\text{Total number of product} - \text{country pairs for firm } f}} \right).$$

Similarly, we calculate the diversity of products for each of firm $f$'s partner countries in a given year:

$$E_f^C = \sum_c \left( \frac{\text{Number of products for partner country } c \text{ of firm } f}{\text{Total number of product} - \text{country pairs for firm } f} \right) \times \ln \left( \frac{1}{\frac{\text{Number of products for partner country } c \text{ of firm } f}{\text{Total number of product} - \text{country pairs for firm } f}} \right).$$

In these entropy indexes, a larger value suggests greater diversity.

The results are shown in Appendix B1. They show that firms that trade more (i.e., firms with a larger amount of exports and/or imports) tend to have more diverse trading patterns; that is, there is a positive correlation between the amount of trade and the diversity of trade. For instance, among the top 10% of exporting firms (10th decile), the average HHI is 0.23, while for the bottom 10% of exporting firms (1st decile), the average is 0.95, indicating that the trade of firms that trade less tends to be concentrated in fewer products and fewer trading partners. Turning to the average of the standard deviation of the share of partner country-product pairs, we find that although it does not monotonically fall with the amount of trade, the standard deviation for the top 1% of exporters and importers (100th percentile) is smaller than that of all other firms. This implies that the trade of firms that trade a lot is more evenly distributed across products and countries than the trade of firms that trade less.

Turning to the two entropy indexes, these also show that the trade of firms that trade more is more diverse. On implication of the results is the following: if greater diversification in trade in terms of the product variety and partner countries mitigates the impact of economic shocks overseas, firms that trade

more are likely to be more resilient to shocks. That said, how resilient firms are in practice likely will also depend on the relative shares accounted for by domestic and overseas procurement and the number of partner firms in a particular country with which a particular firm in Japan trades the same product.

TABLE B1: Diversity of Trade by Decile/Percentile of the Value of Total Trade, 2017

| | Exports | | | | | Imports | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| | Average concentration of dest. countries and products (HHI) | Average standard deviation of share for each destination country and product | Average dest.-country diversity index for each product (A) | Average product diversity index for each destination country (B) | Average diversity index (A+B) | Average concentration of source countries and products (HHI) | Average standard deviation of share for each source country and product | Average source-country diversity index for each product (C) | Average product diversity index for each source country (D) | Average diversity index (C+D) |
| *Panel A: Deciles* | | | | | | | | | | |
| 1 | 0.95 | 0.13 | 0.07 | 0.03 | 0.09 | 0.95 | 0.14 | 0.07 | 0.03 | 0.10 |
| 2 | 0.83 | 0.23 | 0.26 | 0.11 | 0.37 | 0.84 | 0.23 | 0.26 | 0.08 | 0.35 |
| 3 | 0.76 | 0.27 | 0.42 | 0.20 | 0.62 | 0.78 | 0.27 | 0.43 | 0.13 | 0.56 |
| 4 | 0.69 | 0.27 | 0.59 | 0.33 | 0.92 | 0.74 | 0.30 | 0.58 | 0.18 | 0.76 |
| 5 | 0.66 | 0.27 | 0.72 | 0.40 | 1.12 | 0.67 | 0.29 | 0.80 | 0.26 | 1.06 |
| 6 | 0.61 | 0.25 | 0.90 | 0.52 | 1.42 | 0.63 | 0.28 | 0.99 | 0.34 | 1.33 |
| 7 | 0.52 | 0.23 | 1.22 | 0.69 | 1.90 | 0.59 | 0.27 | 1.18 | 0.43 | 1.61 |
| 8 | 0.46 | 0.19 | 1.53 | 0.86 | 2.39 | 0.55 | 0.25 | 1.40 | 0.53 | 1.93 |
| 9 | 0.36 | 0.14 | 2.01 | 1.18 | 3.19 | 0.48 | 0.21 | 1.79 | 0.78 | 2.57 |
| 10 | 0.23 | 0.08 | 2.98 | 1.86 | 4.84 | 0.35 | 0.14 | 2.67 | 1.44 | 4.11 |
| *Panel B: Percentiles* | | | | | | | | | | |
| 91 | 0.31 | 0.12 | 2.42 | 1.38 | 3.79 | 0.45 | 0.19 | 2.10 | 0.96 | 3.06 |
| 92 | 0.29 | 0.10 | 2.47 | 1.55 | 4.02 | 0.42 | 0.19 | 2.11 | 1.10 | 3.21 |
| 93 | 0.29 | 0.11 | 2.48 | 1.52 | 4.00 | 0.41 | 0.17 | 2.30 | 1.14 | 3.44 |
| 94 | 0.26 | 0.09 | 2.64 | 1.69 | 4.33 | 0.40 | 0.17 | 2.33 | 1.22 | 3.55 |
| 95 | 0.23 | 0.08 | 2.80 | 1.69 | 4.49 | 0.37 | 0.14 | 2.50 | 1.35 | 3.85 |
| 96 | 0.22 | 0.08 | 2.98 | 1.78 | 4.76 | 0.36 | 0.14 | 2.59 | 1.33 | 3.93 |
| 97 | 0.21 | 0.07 | 3.07 | 1.98 | 5.05 | 0.35 | 0.13 | 2.66 | 1.45 | 4.11 |
| 98 | 0.20 | 0.07 | 3.11 | 2.06 | 5.16 | 0.32 | 0.12 | 2.86 | 1.66 | 4.52 |
| 99 | 0.16 | 0.04 | 3.61 | 2.34 | 5.95 | 0.25 | 0.08 | 3.28 | 1.90 | 5.19 |
| 100 | 0.14 | 0.04 | 4.14 | 2.60 | 6.74 | 0.19 | 0.05 | 3.90 | 2.31 | 6.21 |

Note: The figures are for firms classified under manufacturing based on the Orbis industry classification.

# C Overview of the Matched Customs/BSJBSA Data

For the analysis in Section 5, we matched the customs data with firm-level information from the Basic Survey of Japanese Business Structure and Activities (BSJBSA). The BSJBSA is collected and compiled by the Ministry of Economy, Trade and Industry (METI), Japan, and covers all firms with over 50 employees and capital exceeding 30 million yen in mining, manufacturing, wholesale, retail, and some service sectors. The BSJBSA contains variables such as sales, costs, debt, assets, profits, employment, exports, and imports. Many previous studies, such as Wakasugi et al. (2014), use the BSJBSA to examine the characteristics of exporting or importing firms in Japan. The matching of both datasets is primarily based on the corporate number provided by the National Tax Agency. Firms we could not match based on the corporate number were identified and matched, where possible, by referring to the company name, location, or phone number.

Firms surveyed by the BSJBSA report financial data on a fiscal year basis, and the majority of them use April to March as their fiscal year. On the other hand, the customs data we used are on a calendar year basis, starting from the beginning of January 2014 to the end of December 2020. We matched the customs data with firm-level information from the BSJBSA on a fiscal year basis. Appendix Table C1 shows the coverage ratio of the matched data. In Appendix Table C1, the number of exporting or importing firms for 2013 and 2020 is smaller than that for the other years. This is because the data for 2013 here covers the period from

January to March 2013 and the data for 2020 covers the period from April to December 2020. For other years, the annual data covers the period from April to March.

Regarding the number of importing and exporting firms, the coverage rate of the matched data is about 16% on the export side and 12% on the import side. For reference, we checked the number of firms that report export or import values in the BSJBSA, which is smaller than the corresponding numbers in the matched data.

TABLE C1: Number of Firms in the Customs Data and the Matched Data

| | (1) Customs data | (2) Matched data | (2)/(1) | BSJBSA |
|---|---|---|---|---|
| *Panel A: Number of exporters* | | | | |
| 2013 | 40,835 | 8,021 | 19.6% | |
| 2014 | 59,620 | 9,582 | 16.1% | 7,220 |
| 2015 | 61,841 | 9,823 | 15.9% | 7,019 |
| 2016 | 62,660 | 9,913 | 15.8% | 6,988 |
| 2017 | 66,618 | 10,151 | 15.2% | 6,955 |
| 2018 | 67,250 | 10,220 | 15.2% | 6,955 |
| 2019 | 66,350 | 9,985 | 15.0% | 6,890 |
| 2020 | 58,596 | 9,592 | 16.4% | |
| Total | 483,770 | 77,287 | 16.0% | |
| *Panel B: Number of importers* | | | | |
| 2013 | 65,440 | 8,986 | 13.7% | |
| 2014 | 86,667 | 10,550 | 12.2% | 7,244 |
| 2015 | 87,372 | 10,709 | 12.3% | 7,086 |
| 2016 | 88,157 | 10,770 | 12.2% | 7,097 |
| 2017 | 94,722 | 11,071 | 11.7% | 7,022 |
| 2018 | 96,416 | 11,218 | 11.6% | 7,022 |
| 2019 | 96,978 | 11,102 | 11.4% | 6,952 |
| 2020 | 92,355 | 10,734 | 11.6% | |
| Total | 708,107 | 85,140 | 12.0% | |

Next, Appendix Table C2 compares the total import and export values of the customs data and the matched data. Similar to Appendix Table C1, the values for 2013 and 2020 are smaller than those for other years because of the difference in the period covered. The coverage rate of the matched data ("(2)/(1)") is generally over 80% for the value of exports and close to 70% for the value of imports and is relatively stable over our observation period. As mentioned, since the BSJBSA only covers firms with 50 or more employees and in a limited number of industries, it is not surprising that the coverage rate in terms of the number of firms is low but in terms of the value of exports or imports is relatively high at around 70-80%. This likely reflects that a small number of large firms account for most exports and imports.

Turning to the industry-specific characteristics of the matched data, Appendix Table C3 compares the number of importing and exporting firms, the average number of export and import partner countries, and the average number of exported or imported goods in the manufacturing, wholesale, retail, and other industries in 2018.

In manufacturing, the average number of countries to which firms exported was nine, while the average number of countries from which firms imported was five. The average number of products exported was 26, while the corresponding number for products imported was 16. Manufacturing firms export to more destinations than they import from, and they export more items than they import. On the other hand, for the number of trading partner countries and products traded for firms in the wholesale and retail industry, the figures for exports and imports are very similar. Table C4 shows summary statistics of the matched data.

TABLE C2: Export and Import Values in the Customs Data and the Matched Data

| | (1) Customs data | (2) Matched data | (2)/(1) | BSJBSA |
|---|---|---|---|---|
| *Panel A: Export value* | | | | |
| 2013 | 17,351 | 14,669 | 84.5% | |
| 2014 | 75,025 | 63,257 | 84.3% | 77,726 |
| 2015 | 73,779 | 62,015 | 84.1% | 77,553 |
| 2016 | 71,591 | 59,819 | 83.6% | 73,062 |
| 2017 | 78,854 | 66,208 | 84.0% | 80,621 |
| 2018 | 80,260 | 66,778 | 83.2% | 82,954 |
| 2019 | 75,698 | 62,035 | 82.0% | 75,465 |
| 2020 | 50,019 | 41,530 | 83.0% | |
| Total | 522,579 | 436,311 | 83.5% | |
| *Panel B: Import value* | | | | |
| 2013 | 21,541 | 14,885 | 69.1% | |
| 2014 | 82,404 | 55,756 | 67.7% | 40,869 |
| 2015 | 74,356 | 49,938 | 67.2% | 41,614 |
| 2016 | 67,148 | 43,323 | 64.5% | 35,659 |
| 2017 | 76,157 | 51,269 | 67.3% | 40,379 |
| 2018 | 82,237 | 57,404 | 69.8% | 47,723 |
| 2019 | 77,263 | 52,615 | 68.1% | 43,832 |
| 2020 | 50,268 | 33,810 | 67.3% | |
| Total | 531,374 | 359,000 | 67.6% | |

Note: Figures are in billion yen.

TABLE C3: Industry-specific Characteristics of the Matched Data, 2018

| | Number of exporters | Average number of export partner countries | Average number of exported goods (HS 6-digit level) | Average export value per firm (million yen) |
|---|---|---|---|---|
| *Panel A: Exports* | | | | |
| Manufacturing | 6,324 | 8.8 | 26.2 | 7,446 |
| Wholesale and retail | 2,958 | 8.3 | 34.7 | 6,289 |
| Other | 846 | 4.3 | 14.0 | 639 |
| Total | 10,128 | 8.3 | 27.7 | 6,540 |
| *Panel B: Imports* | | | | |
| Manufacturing | 6,665 | 4.9 | 15.5 | 3,445 |
| Wholesale and retail | 3,328 | 7.7 | 33.1 | 7,601 |
| Other | 1,078 | 3.8 | 10.3 | 2,794 |
| Total | 11,071 | 5.7 | 20.3 | 4,631 |

TABLE C4: Summary Statistics of the Matched Data

| | *N* | No. of firms | Mean | Std. Dev. |
|---|---|---|---|---|
| Sales (log) | 78,768 | 14,186 | 8.417 | 1.229 |
| Value added (log) | 78,575 | 14,162 | 7.026 | 1.103 |
| Labor productivity (log) | 78,575 | 14,162 | 1.868 | 0.463 |
| Number of employees (log) | 78,768 | 14,186 | 5.161 | 0.904 |
| Capital-labor ratio (log) | 78,370 | 14,104 | 2.402 | 0.891 |
| TFP (log) | 78,180 | 14,080 | 2.125 | 0.637 |
| Average wage (log) | 78,768 | 14,186 | 1.466 | 0.316 |
| Exporter dummy (BSJBSA) | 78,768 | 14,186 | 0.368 | 0.482 |
| Exporter dummy (Customs data) | 78,768 | 14,186 | 0.484 | 0.500 |
| Importer dummy (BSJBSA) | 78,768 | 14,186 | 0.329 | 0.470 |
| Importer dummy (Customs data) | 78,768 | 14,186 | 0.511 | 0.500 |
| Two-way trader dummy (BSJBSA) | 78,768 | 14,186 | 0.250 | 0.433 |
| Two-way trader dummy (Customs data) | 78,768 | 14,186 | 0.412 | 0.492 |

# D Estimation Results for the Performance Premium of Firms Engaged in Trade

This appendix provides additional estimates of the performance premium of firms engaged in international trade. Table 10 in Section 5 provides the performance premium of exporters based on exporting information obtained from the customs data. Table D1 provides the same premia estimated using the export dummy based on the BSJBSA's export information. They show that the performance premia of exporters are qualitatively similar. However, the performance premia of exporters are slightly greater when the exporter dummy is based on the customs data as shown in columns (1) and (2). Nevertheless, as shown in column (3), when controlling for both industry fixed effects and firm size measured by the number of employees, the difference between the two estimates becomes smaller. The performance premium of exporters based on the BSJBSA even becomes greater for some variables such as value-added and the capital labor-ratio when controlling for industry fixed effects and firm size.

While Tables 10 and D1 show the performance premia of exporters, Table D2 reports the performance premia of importers. In Panel A, the importer dummy is based on import information based on the customs data, while in Panel B it is based on the BSJBSA. These panels show that importers outperform non-importers: the sales, value added, labor productivity, capital-labor ratio, TFP, and average wage of importers is higher than that of non-importers, and they employ a greater number of employees. While the differences in the importer premia estimated using the importer dummy based on the customs data (Panel A) and that based on the BSJBSA (Panel B) are not large, they are slightly larger when using the importer dummy constructed based on the customs data.

TABLE D1: Estimation Results for Exporter Premia based on BSJBSA

| | (1) | (2) | (3) | *N* |
|---|---|---|---|---|
| Sales | 0.709* | 0.744* | 0.158* | 78,768 |
| | (0.021) | (0.022) | (0.011) | |
| Value added | 0.718* | 0.687* | 0.123* | 78,575 |
| | (0.019) | (0.020) | (0.007) | |
| Labor productivity | 0.233* | 0.172* | 0.121* | 78,575 |
| | (0.007) | (0.007) | (0.007) | |
| No. of employees | 0.488* | 0.517* | | 78,768 |
| | (0.016) | (0.017) | | |
| Capital-labor ratio | 0.294* | 0.302* | 0.213* | 78,370 |
| | (0.014) | (0.014) | (0.015) | |
| TFP | 0.322* | 0.181* | 0.073* | 78,180 |
| | (0.011) | (0.007) | (0.006) | |
| Average wage | 0.169* | 0.118* | 0.088* | 78,768 |
| | (0.005) | (0.005) | (0.005) | |
| Year FE | Yes | Yes | Yes | |
| Industry (2-digit) FE | No | Yes | Yes | |
| Size control | No | No | Yes | |

Note: The table shows the coefficient of the exporter dummy when each variable in the left column is used as the dependent variable. Numbers in parentheses are robust standard errors clustered by firm. Firms in the top and bottom 1% in terms of their log value added, capital per worker, and TFP are dropped as outliers in the estimations where these variables are used as the dependent variables. "n.a." stands for "not applicable." We do not estimate the exporter premia in the case where the number of employees is used as the dependent variable in column (3) because the variable to control for firms' size is based on the number of employees. * denotes statistical significance at the 1% level.

Lastly, we estimate the performance premia of firms engaged in both exports and imports relative to all other firms. Table D3 presents the two-way trader premia, the premia of firms engaged in both exports and imports. In Panel A, the two-way trader dummy is constructed based on trade information obtained from the customs data, while in Panel B it is based on the BSJBSA. These panels show that two-way traders outperform firms engaged in export only, in import only, or not engaged in international trade at all. Table D4 presents developments in the importer premia and two-way trader premia over time during the 2014-

2020 period. The performance premium of importers in terms of sales followed an increasing trend between 2014 and 2017, decreased between 2017 and 2019, and then increased again from 2019 to 2020. The other variables follow similar patterns. Nevertheless, overall, the fluctuations in these variables are not substantial.

TABLE D2: Estimation Results for Importer Premia

| Panel A: Customs data | | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | *N* |
| Sales | 0.796* | 0.853* | 0.229* | 78,768 |
| | (0.019) | (0.019) | (0.011) | |
| Value added | 0.737* | 0.718* | 0.109* | 78,575 |
| | (0.017) | (0.017) | (0.007) | |
| Labor productivity | 0.214* | 0.164* | 0.109* | 78,575 |
| | (0.007) | (0.007) | (0.007) | |
| No. of employees | 0.528* | 0.557* | | 78,768 |
| | (0.014) | (0.014) | | |
| Capital-labor ratio | 0.240* | 0.266* | 0.169* | 78,370 |
| | (0.014) | (0.014) | (0.015) | |
| TFP | 0.288* | 0.182* | 0.066* | 78,180 |
| | (0.010) | (0.006) | (0.006) | |
| Average wage | 0.149* | 0.105* | 0.071* | 78,768 |
| | (0.005) | (0.004) | (0.005) | |
| Year FE | Yes | Yes | Yes | |
| Industry (2-digit) FE | No | Yes | Yes | |
| Size control | No | No | Yes | |
| Panel B: BSJBSA | | | | |
| | (1) | (2) | (3) | *N* |
| Sales | 0.654* | 0.682* | 0.191* | 78,768 |
| | (0.022) | (0.022) | (0.011) | |
| Value added | 0.592* | 0.557* | 0.082* | 78,575 |
| | (0.020) | (0.020) | (0.007) | |
| Labor productivity | 0.173* | 0.126* | 0.080* | 78,575 |
| | (0.007) | (0.007) | (0.007) | |
| No. of employees | 0.421* | 0.433* | | 78,768 |
| | (0.017) | (0.017) | | |
| Capital-labor ratio | 0.171* | 0.189* | 0.106* | 78,370 |
| | (0.015) | (0.014) | (0.014) | |
| TFP | 0.258* | 0.149* | 0.057* | 78,180 |
| | (0.011) | (0.007) | (0.006) | |
| Average wage | 0.126* | 0.0868* | 0.059* | 78,768 |
| | (0.005) | (0.005) | (0.005) | |
| Year FE | Yes | Yes | Yes | |
| Industry (2-digit) FE | No | Yes | Yes | |
| Size control | No | No | Yes | |

Note: The table shows the coefficient of the importer dummy when each variable in the left column is used as the dependent variable. Numbers in parentheses are robust standard errors clustered by firm. Firms in the top and bottom 1% in terms of their log value added, capital per worker, and TFP are dropped as outliers in the estimations where these variables are used as the dependent variables. "n.a." stands for "not applicable." We do not estimate the importer premia in the case where the number of employees is used as the dependent variable in column (3) because the variable to control for firms' size is based on the number of employees. * denotes statistical significance at the 1% level.

TABLE D3: Estimation Results for Two-way Trader Premia

Panel A: Customs data

| | (1) | (2) | (3) | *N* |
|---|---|---|---|---|
| Sales | 0.849* | 0.932* | 0.222* | 78,768 |
| | (0.020) | (0.020) | (0.011) | |
| Value added | 0.815* | 0.811* | 0.120* | 78,575 |
| | (0.018) | (0.018) | (0.007) | |
| Labor productivity | 0.235* | 0.179* | 0.119* | 78,575 |
| | (0.007) | (0.007) | (0.007) | |
| No. of employees | 0.585* | 0.635* | | 78,768 |
| | (0.015) | (0.015) | | |
| Capital-labor ratio | 0.242* | 0.271* | 0.161* | 78,370 |
| | (0.014) | (0.014) | (0.015) | |
| TFP | 0.339* | 0.210* | 0.080* | 78,180 |
| | (0.010) | (0.006) | (0.006) | |
| Average wage | 0.169* | 0.119* | 0.082* | 78,768 |
| | (0.005) | (0.004) | (0.005) | |
| Year FE | Yes | Yes | Yes | |
| Industry (2-digit) FE | No | Yes | Yes | |
| Size control | No | No | Yes | |

Panel B: BSJBSA

| | (1) | (2) | (3) | *N* |
|---|---|---|---|---|
| Sales | 0.761* | 0.795* | 0.182* | 78,768 |
| | (0.024) | (0.024) | (0.011) | |
| Value added | 0.729* | 0.690* | 0.097* | 78,575 |
| | (0.022) | (0.022) | (0.008) | |
| Labor productivity | 0.213* | 0.151* | 0.095* | 78,575 |
| | (0.008) | (0.008) | (0.008) | |
| No. of employees | 0.520* | 0.541* | | 78,768 |
| | (0.019) | (0.019) | | |
| Capital-labor ratio | 0.220* | 0.229* | 0.128* | 78,370 |
| | (0.015) | (0.015) | (0.015) | |
| TFP | 0.322* | 0.181* | 0.068* | 78,180 |
| | (0.012) | (0.008) | (0.007) | |
| Average wage | 0.157* | 0.107* | 0.073* | 78,768 |
| | (0.005) | (0.005) | (0.005) | |
| Year FE | Yes | Yes | Yes | |
| Industry (2-digit) FE | No | Yes | Yes | |
| Size control | No | No | Yes | |

Note: The table shows the coefficient of the importer-and-exporter dummy when each variable in the left column is used as the dependent variable. Numbers in parentheses are robust standard errors clustered by firm. Firms in the top and bottom 1% in terms of their log value added, capital per worker, and TFP are dropped as outliers in the estimations where these variables are used as the dependent variables. "n.a." stands for "not applicable." We do not estimate the importer-and-exporter premia in the case where the number of employees is used as the dependent variable in column (3) because the variable to control for firms' size is based on the number of employees. * denotes statistical significance at the 1% level.

TABLE D4: Importer and Two-way Trader Premia over Time

Panel A: Importer premia

| | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|
| Premia | | | | | | | |
| Sales | 0.215* | 0.224* | 0.234* | 0.245* | 0.239* | 0.219* | 0.229* |
| Value added | 0.106* | 0.103* | 0.100* | 0.120* | 0.117* | 0.114* | 0.106* |
| Labor productivity | 0.102* | 0.103* | 0.098* | 0.120* | 0.119* | 0.117* | 0.103* |
| Capital-labor ratio | 0.174* | 0.176* | 0.164* | 0.182* | 0.173* | 0.164* | 0.150* |
| TFP | 0.059* | 0.057* | 0.057* | 0.075* | 0.076* | 0.075* | 0.065* |
| Average wage | 0.061* | 0.069* | 0.071* | 0.076* | 0.074* | 0.078* | 0.070* |
| Number of employees | 0.537* | 0.547* | 0.552* | 0.563* | 0.556* | 0.571* | 0.576* |
| Number of firms | 11,262 | 11,328 | 11,255 | 11,324 | 11,136 | 11,168 | 11,295 |
| Export participation rate | 49.5% | 50.3% | 50.2% | 52.0% | 52.9% | 52.5% | 50.1% |

Panel B: Two-way trader premia

| | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|
| Premia | | | | | | | |
| Sales | 0.205* | 0.220* | 0.223* | 0.236* | 0.234* | 0.221* | 0.216* |
| Value added | 0.108* | 0.108* | 0.109* | 0.130* | 0.134* | 0.134* | 0.119* |
| Labor productivity | 0.103* | 0.108* | 0.104* | 0.131* | 0.136* | 0.135* | 0.117* |
| Capital-labor ratio | 0.160* | 0.170* | 0.161* | 0.172* | 0.159* | 0.157* | 0.148* |
| TFP | 0.065* | 0.066* | 0.066* | 0.089* | 0.097* | 0.096* | 0.080* |
| Average wage | 0.069* | 0.078* | 0.081* | 0.089* | 0.087* | 0.091* | 0.084* |
| Number of employees | 0.613* | 0.620* | 0.627* | 0.635* | 0.637* | 0.649* | 0.669* |
| Number of firms | 11,262 | 11,328 | 11,255 | 11,324 | 11,136 | 11,168 | 11,295 |
| Export participation rate | 40.6% | 41.0% | 40.9% | 41.9% | 42.5% | 41.9% | 39.4% |

Note: Two-digit industry fixed effects are included. Firm size, measured by the number of employees, is controlled for in all cases except where the number of employees is used as the dependent variable for firm performance. * denotes statistical significance at the 1% level.