

Myth of U.S. Dollar Dominance in Japanese Exports New Evidence from Japanese Customs Level Data*

(Preliminary. Please do not quote.)

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Abstract

While Japanese exports are believed to be invoiced mainly in USD, this study presents contrary evidence that most Japanese firms choose yen-invoiced exports, based on the Japan Customs export declaration data. Only the top one percent of firms in size tend to choose USD-invoiced exports. By conducting fixed-effect panel estimation using the Japan Customs transaction data and the most comprehensive firm-level data compiled by the Ministry of Economy, Trade and Industry (METI), we demonstrate that not only the intra-firm export share but also proxy variables for firm size negatively and significantly affect yen-invoiced exports. Since large-size firms tend to build overseas subsidiaries and to establish global production/sales network, Japanese parent firms will likely manage foreign exchange risk efficiently by choosing the USD. In contrast, smaller-size firms with fewer overseas subsidiaries have incentives to pass on exchange rate risk to importers by invoicing their exports in yen. It is more important for smaller-size firms to improve non-price export competitiveness by R&D expenditures, which helps them increase yen-invoiced exports to avoid foreign exchange risks.

Keywords: Invoice currency choice, intra-firm export, firm size, Japan Customs micro data

JEL classification: F14; F30; F31

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1. Introduction

The choice of invoice currency is a crucial issue when considering the effect of exchange rate changes on international trade and the impact of the international transmission mechanism of macroeconomic policy. Recent empirical studies such as Boz et al. (2022) demonstrate that exporters are more likely to choose a vehicle currency for export invoicing (i.e., vehicle currency pricing: VCP) than their own currencies (i.e., producer’s currency pricing: PCP). The U.S. dollar (USD) tends to play a vehicle role in global trade, which is called the “dominant currency paradigm” (Gopinath et al., 2020).

Japan is a well-known example of USD dominance for trade invoicing. As shown in Figure 1, around 50 percent of Japanese exports are invoiced in USD, while yen-invoiced exports account for 34–37 percent from 2014 to 2023.¹ In the 1980s and 1990s, the Japanese government initiated numerous policies to promote the “internationalization of the yen” for trade invoicing (Kawai, 1996; Sato, 1999). However, Japan’s own currency invoicing (PCP) share has long been smaller than the corresponding share of USD invoicing (Figure 1). Thus, the aggregated data of invoice currency choice in Japanese exports indicates that even though the government made efforts to liberalize financial transactions for further use of the yen, Japanese export firms have rationally chosen not the yen but the USD for their trade invoicing (Ito et al. 2018).

This paper presents contrary evidence to the USD dominance in Japanese exports, making three novel contributions. First, we present new evidence that most Japanese export firms choose yen-invoiced exports. Accessing the unpublished export declaration data compiled by Japan Customs, we reveal that most Japanese export firms choose not the USD but the yen for their export invoicing. Such invoicing choice is more evidently observed for smaller-size firms. Specifically, as shown in Section 2, we measure the firm size in percentile rank of firms’ export amounts. If Japanese export firms fall into the lowest quartile, their yen-invoiced export share is 74.7 percent, and the USD-invoiced share is just 20.6 percent which is much smaller than what Figure 1 suggests. Even if sample firms fall into the highest quartile, their yen-invoiced export share is 52.3 percent, much larger than the USD-invoiced share (39.3 percent). More intriguingly, only the top one percent of Japanese export firms tend to choose more USD-invoiced exports (55.8 percent) than yen-invoiced exports (29.6 percent), which conforms to the aggregated share of invoice currency choice in Figure 1.

The second novel contribution is to merge the Japan Customs’ export declaration data into the most comprehensive survey data of Japanese firms, the “Basic Survey of Japanese Business Structure and Activities” (BSJBSA) compiled by the Ministry of Economy, Trade and Industry (METI), Japan. The BSJBSA is an annual survey of all firms with establishments in the mining, industrial, commercial,

¹ Figure 1 has been often presented in previous studies to show the progress of yen-invoiced exports from Japan. See, for instance, Ito et al. (2018, 2021).

and other service industries with at least 50 employees and capital or investments of at least 30 million Japanese yen. In the 2020 survey, 36,294 firms were surveyed with a response rate of 81.5%. We collect information on 8,644 firms from the BSJBSA that export goods to foreign countries during the sample period from 2014 to 2019. Using the Japan Customs export declaration data, we calculate the share of invoice currency for exports of 8,644 firms by product and destination. We then conduct panel estimation to examine which firm characteristic variables affect the surprisingly large share of yen-invoiced exports.

Third, in addition to the firm size, we demonstrate that intra-firm exports significantly decrease the share of yen-invoiced exports. Previous studies such as Chung (2016) and Amiti et al. (2022) examined the exporters' invoice currency choice when they imported intermediate inputs from abroad.² However, these studies did not directly investigate how intra-firm trade affected the choice of invoice currency. Ito et al. (2012, 2018) collected firm-level information on invoice currency choice in intra-firm trade and revealed that intra-firm exports significantly reduced (raised) yen-invoiced (USD-invoiced) transactions. Although pioneering works, Ito et al. (2012, 2018) used a limited number of observations obtained through interviews and questionnaire surveys of Japanese firms. Yoshimi et al. (2024) used the transaction level data obtained from Japan Customs export and import declaration statistics and distinguished intra-firm trade from arm's-length trade of Japanese automobile exports to France. While Yoshimi et al. presented interesting findings that intra-firm exports significantly reduced yen-invoiced exports to France, their conclusions are limited to one industry's exports to one destination country with only 17 Japanese export firms.

Our research is far more comprehensive than previous studies since we calculated the share of intra-firm exports of 8,644 sample firms obtained from the BSJBSA data and empirically examined how the intra-firm export share affects their exports of all products to all destination countries during the period from 2014 to 2019.³ Our panel estimation demonstrates that the larger the intra-firm export share, the smaller the Japanese firms' yen-invoiced exports are. Our conclusion is robust even if we control for various fixed effects and firm characteristic variables such as firm size variables measured by total sales, export amounts, and the number of export transactions.⁴

The rest of the paper is organized as follows. Section 2 describes the two micro databases and presents notable evidence that the yen-invoiced share is larger in Japanese exports than the USD-invoiced share. Section 3 elaborates on the empirical model, and Section 4 shows empirical results.

² Ylonen and Teivainen (2018) argued that firms' pricing behavior depends on whether their trade is intra-firm or arm's-length one. Kato (2019) empirically examined the effect of exchange rate changes on intra-firm trade and arm's-length trade.

³ We follow Matsuura et al. (2023) to calculate the intra-firm export share of sample firms using the Basic Survey of Japanese Business Structure and Activities (BSJBSA) compiled by the Ministry of Economy, Trade and Industry (METI).

⁴ Matsuura et al. (2023) empirically showed that firm size significantly affects the Japanese intra-firm trade share. Lyonnet et al. (2022) showed that firm size positively affects currency hedging and negatively affects own currency invoicing (i.e., producer's currency pricing: PCP).

Finally, Section 5 concludes this study.

2. Data

2.1 Micro Databases

This paper uses two micro databases to investigate how the invoice currency choice is affected by intra-firm trade and firm size. The first database is the export declaration data at a transaction level compiled by Japan Customs, the Ministry of Finance. We can access the transaction-level information on export amounts and quantities, destination countries, the type of export goods, the export firm's identification code, the choice of invoice currency, etc.

The second database is the Basic Survey of Japanese Business Structure and Activities (BSJBSA),⁵ compiled by Japan's Ministry of Economy, Trade and Industry (METI). We can access firm-level information on intra-firm exports and other firm characteristics, including research and development (R&D) expenditures. This study uses 1,087,957 export transactions by 8,644 firms from 2014 to 2019,⁶ and the number of export destinations is 233 countries.⁷ This transaction data is merged into the firm characteristic data obtained from the BSJBSA.⁸

The intra-firm trade share is obtained not from the transaction-level information but from the firm-level information obtained from the BSJBSA.⁹ The export declaration data provides us with the names of importers for Japanese exports, but it is difficult to identify whether those importers are export firms' overseas subsidiaries. Yoshimi et al. (2024) thoroughly checked importer's names against the list of overseas subsidiaries of Japanese export firms and identified intra-firm trade at a transaction level. However, Yoshimi et al. (2024) focused only on 17 Japanese automobile firms and their exports to a single destination country, France. It is extremely difficult to conduct similar matching for 8,644 Japanese export firms and their exports to 233 destination countries. We finally decided to rely on the BSJBSA survey data to obtain firm-level information on the intra-firm export share. Although destination-specific intra-firm export share cannot be obtained from the BSJBSA data, our research is far more comprehensive than Yoshimi et al. (2024) and other previous studies.

2.2 Descriptive Analysis

⁵ The BSJBSA is an annual survey of all firms with establishments in the mining, industrial, commercial, and other service industries with at least 50 employees and capital or investments of at least 30 million Japanese yen. In the 2020 survey, 36,294 companies were surveyed with a response rate of 81.5%.

⁶ The BSJBSA survey reports the fiscal year data: for example, the 2014 fiscal year represents the period from April 1, 2014 to March 31, 2015.

⁷ We include Hong Kong and Taiwan in the 233 destination countries.

⁸ The Japan Customs export declaration data and the BSJBSA data were merged by connecting the corporate identification numbers assigned by Japan's National Tax Agency, referring to Ito et al. (2023).

⁹ The intra-firm export share for individual sample firm is calculated by dividing the sample firm's export amounts to its overseas subsidiaries by its total export amounts.

Table 1 presents the intra-firm export share and the invoice currency choice by export destination (region). The intra-firm export share for each destination is obtained by a simple annual average of individual firms' intra-firm export shares for the sample period from 2014 to 2019 if their exports are destined for the region concerned. Table 1 reports two invoice currency shares: one based on export amounts and the other based on the number of transactions.

First, Asia and the Americas (i.e., both North and South America) are the two largest export destinations. The second and the third columns in Table 1, respectively, present the average export amounts and the average number of export transactions for sample firms, which clearly shows that these two regions are the most important destinations for Japanese export firms. Second, the average share of intra-firm exports is around 26–35 percent and does not differ much across destination regions. Third, USD-invoiced exports account for around 50 percent of Japanese exports to the Americas on both amount and transaction bases. More interestingly, the share of yen-invoiced exports is the largest in all other destinations: 45–70 percent on the amount basis and 48–72 percent on the transaction basis.

Overall, the invoice currency share we have presented differs markedly from the findings of previous studies. As shown in Figure 1, the USD-invoiced exports accounted for around 50 percent of Japan's exports to the World in 2014–2019, while the corresponding yen-invoiced share was 36–37 percent during the same period. Why have we found such a striking difference between our results and previous studies?

Table 2 presents the industry breakdown of intra-firm export share and invoice currency share.¹⁰ First, the intra-firm export share varies across industries. The “Motor Vehicles, Parts and Accessories” industry has the highest intra-firm export share, 47.6 percent, among 17 industries. For instance, Yoshimi et al. (2024) found that more than 70 percent of Japanese automobile exports to France are intra-firm trade. However, Yoshimi et al. (2024) focus on only 17 automobile firms, while our study is much more comprehensive because we investigate 627 firms in the corresponding industry.

Second, the share of yen-invoiced exports is much higher than the USD-invoiced exports across all industries except the “Communication Equipment and Related Products” industry: only for the invoice currency share on an export amount basis, this industry's USD share (46.7 percent) is somewhat higher than the corresponding yen share (45.0 percent).

Why is the yen-invoiced export share much higher in Tables 1 and 2 than in previous studies? The most likely reason is that we have observed a simple average share for sample firms. Table 3 shows an intriguing relationship between firm size, intra-firm export, and invoice currency share. Specifically, the smaller the firm size in export amounts, the lower the intra-firm export share, leading to a larger share of yen-invoiced exports. For instance, in the lowest quartile in export amounts, the intra-firm export share is just 14.6 percent, and the yen-invoiced export share is 74.7 percent. In the second

¹⁰ Table 2 follows the industry classification of the BSJBSA.

largest quartile, the intra-firm export share is 29.3 percent, and the yen-invoiced export share is 64.9 percent. Even in the largest quartile, the yen-invoiced export share is 52.3 percent, still higher than the USD-invoiced share (39.3 percent), while the intra-firm export share increases to 39.0 percent. Another notable finding is that the top one percent of firms have far larger export amounts and number of export transactions, with higher intra-firm export share (47.8 percent). The USD-invoiced export share is 55.8 percent, much higher than the yen-invoiced export share (29.6 percent). In the lower panel of Table 3, we present the result obtained by measuring firm size by the number of export transactions. The result is almost similar to what we discussed above by measuring firm size by export amounts.

Thus, the choice of invoice currency is closely related to the size of export firms and the intra-firm export share. This is the first study to reveal that most Japanese export firms are more likely to use the yen in their exports. Only the top one percent of firms invoice their exports more in USD than in the yen.

3. Empirical Framework

The main purpose of this study is to test whether intra-firm trade and firm size affect the choice of invoice currency. We set up the following fixed-effect model for firm i 's export transaction of product p in year t to destination country c . As a product category, p , we use the H.S. 6-digit classification, a highly disaggregated product category. The whole sample includes 4,408,033 observations for a six-year period from 2014 to 2019, 8,644 firms, and 233 destinations.

$$y_{i,p,t,c} = a + bX_{i,t} + e_i + e_p + e_t + e_c + \varepsilon_{i,p,t,c} \quad (1)$$

where $y_{i,p,t,c}$ is the invoice currency share aggregated in the four dimensions of firm-product-year-country. The share of USD-invoiced exports and yen-invoiced exports, both on an export amount basis and on the number of transaction basis, are calculated. $X_{i,t}$ includes firm-specific explanatory variables described below. e_i , e_p , e_t , and e_c represent firm, product, year, and destination country fixed effects, respectively.

$X_{i,t}$ includes the following explanatory variables. First, we use the intra-firm export share, $Intra_{i,t}$, for each firm and each year. Since this variable is calculated from the firm-level survey data, the BSJBSA data, we cannot obtain the information on destination-specific intra-firm export share. This variable takes one when all firm i 's exports are intra-firm transactions, while the variable takes zero when all are arm's-length exports.

Second, we use four proxy variables for the firm size: (i) Firm's total sales ($Sales_{i,t}$) which is

obtained from the BSJBSA data; (ii) firm's export amounts ($Export_{i,t}$) calculated from the Japan Customs data; (iii) the number of export declarations ($N_transact_{i,t}$) by each firm computed from the Japan Customs data; and (iv) the number of products ($N_product_{i,p,t,c}$) exported by firm i to destination country c , obtained from the Japan Customs data. These four variables are converted into natural logarithms to estimate equation (1).

Third, we also use the natural log of research and development (R&D) expenditures in level ($R\&D_{i,t}$) as a firm characteristic variable. The larger the firms' R&D expenditure, the more likely they are to increase their non-price export competitiveness.

4. Empirical Results

This paper sets up a panel dataset and conducts ordinary least squares (OLS) estimation to investigate how intra-firm exports and firm size affect the choice of invoice currency in Japanese exports. Table 4 presents the results of OLS estimation for equation (1) with several combinations of fixed effects, where the dependent variable is either yen-invoiced export share (in terms of export amounts or the number of transactions) or USD-invoiced export share (in terms of export amounts or the number of transactions). In columns (I), (III), (V), and (VII), we include firm fixed-effect (FE) and present the estimated results with robust standard errors, while in the rest of columns, we exclude firm FE but use robust standard errors clustered at the industry classification.¹¹ For both cases, we have found statistically significant coefficients of the intra-firm export variable: it takes negative and significant coefficient when the dependent variable is the yen-invoiced export share, while it becomes significantly positive when the dependent variable is the USD invoiced export share.

The magnitude of estimated “*Intra-firm*” coefficients is much larger when excluding firm FE. To understand this difference in magnitude, let us look at the estimated results in columns (I) and (II) of Table 4. The estimated coefficient of the intra-firm export share is larger when excluding firm FE with cluster standard errors (-0.168) than when including firm FE with robust standard errors (-0.004). This difference in magnitude can be observed in other pairs of columns such as between (III) and (IV).

Tables 5-A and 5-B present the estimated results when including the intra-firm export share and each proxy variable for firm size. We have four proxy variables for firm size: the natural log of the firm's total sales, $\ln(Sales)$; the natural log of the firm's export amounts, $\ln(Export)$; the natural log of the number of transactions, $\ln(N_transact)$; and the natural log of the number of products, $\ln(N_product)$. In Table 5-A, each firm size variable negatively and significantly affects the yen-invoiced share, while the intra-firm export share keeps its significantly negative effect on the yen-invoice exports. In contrast, Table 5-B shows that both the intra-firm export share and the firm size

¹¹ We use the industry classification defined by the BSJBSA data. See Table 2, which presents 17 industries.

variables positively and significantly impact USD-invoiced exports. These results strongly suggest that the larger the firm size, the larger (smaller) the USD-invoiced (yen-invoiced) export share is. As observed in Table 4, the magnitude of the estimated coefficients for the firm size is smaller when including firm FE.

Next, we include a firm-characteristic variable, the natural log of the firm's R&D expenditures, in equation (1), and the estimated results are presented in Tables 6-A and 6-B. The sign of the estimated R&D coefficient when including firm FE differs from the corresponding sign when excluding firm FE with cluster standard errors. In Table 6-A, the estimated R&D coefficient is significantly positive when including firm FE, while the coefficient becomes significantly negative when excluding firm FE with cluster standard errors. We have the opposite result in Table 6-B where the sign of the estimated R&D coefficient on the USD-invoiced export share is negative (positive) when including (excluding) firm FE.

What caused such different results of estimated R&D coefficients? On one hand, R&D expenditures can be considered a source of non-price competitiveness for export firms. On the other hand, larger firms are likely to spend more on R&D expenditures. For example, in column (I) of Table 6-A, the estimated R&D coefficient is significantly positive, suggesting that R&D expenditures will likely improve the firm's non-price export competitiveness after controlling for firm-specific differences. In contrast, the estimated R&D coefficient becomes negative in column (II) of Table 6-A, since firm-specific differences are not considered without firm FE. Whereas we present the estimated results of both robust standard errors and cluster standard errors, our empirical analysis suggests that including firm FE helps us assess likely effect of R&D expenditures on firm's non-price export competitiveness.

Thus, the Japanese firm's decision to invoice is significantly affected by intra-firm trade and firm size. The share of intra-firm exports significantly reduces the yen-invoiced exports while increasing the USD-invoiced exports. The effect of intra-firm exports remains significant when including each of the four proxy variables for firm size. As a potential source of the firm's non-price competitiveness, we included the firm's R&D expenditures, and the effect of intra-firm exports and firm size continues to be significant. The estimated coefficient of R&D expenditures takes positive and negative signs depending on whether to include firm FE. When including firm FE, R&D expenditures significantly increase yen-invoiced exports, while decreasing USD-invoiced exports. This implies that small-size firms with fewer intra-firm exports will likely increase yen-invoiced exports if they strengthen their non-price export competitiveness through R&D expenditures.

5. Conclusion

It has long been believed that Japanese exports are mainly invoiced in USD. Due to its vehicle role

in foreign exchange transactions and well-developed financial markets, the USD is typically considered the most extensively used currency in Japanese exports, supported by the aggregated invoice currency share of Japanese exports presented in Figure 1. However, this study has presented contrary evidence that most Japanese firms choose yen-invoiced exports, based on the Japan Customs export declaration data. Only the top one percent of firms in size tend to choose USD-invoiced exports.

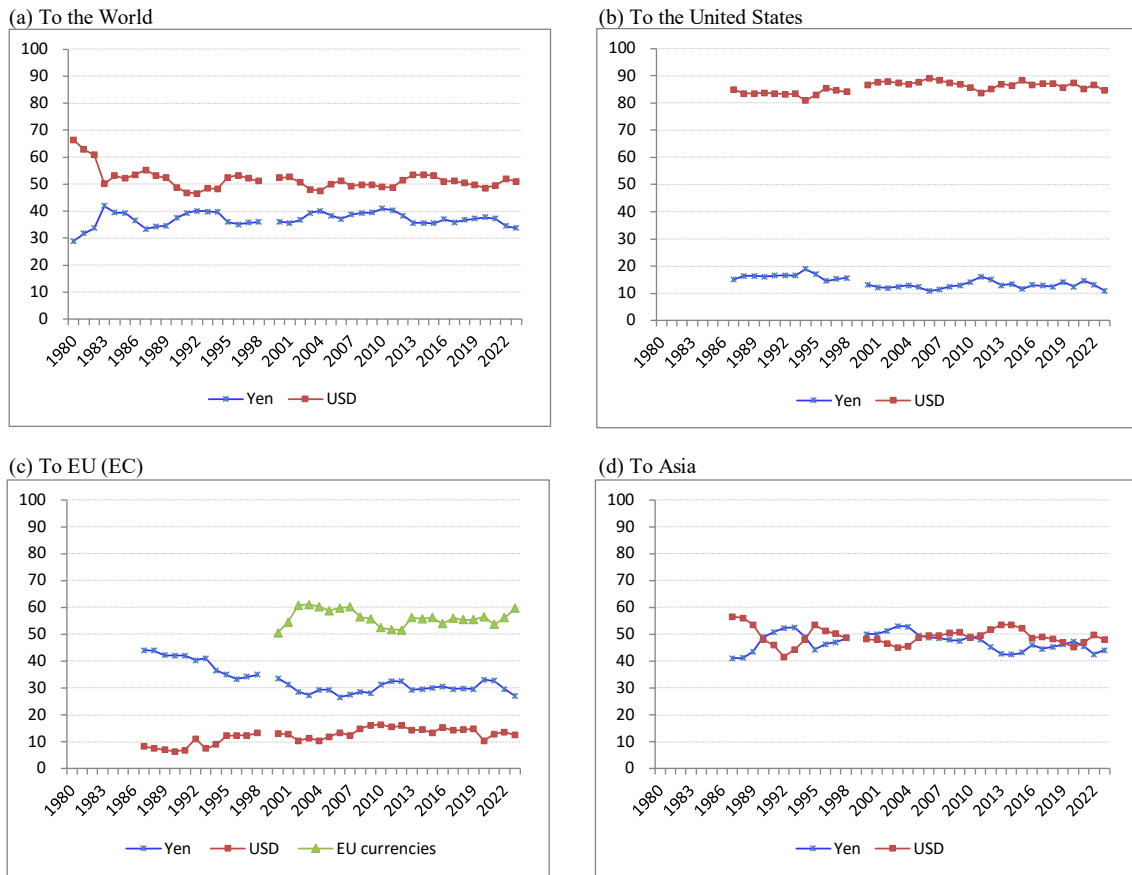
To explain why most Japanese firms choose yen-invoiced exports, we have conducted panel estimation with fixed effects and demonstrated that intra-firm exports likely facilitate USD-invoiced exports. As shown by Ito et al. (2018), Japanese parent firms manage foreign exchange risk by choosing a single currency, the USD, given their global production and sales network. In contrast, smaller firms are unlikely to establish global production/sales network with many overseas subsidiaries. In this case, smaller firms have strong incentive to pass on exchange rate risk to importers by choosing yen-invoiced exports. The estimated R&D coefficients with firm FE show significantly positive effect on yen-invoiced exports, which implies that to improve non-price export competitiveness by R&D expenditures will likely help Japanese firms increase yen-invoiced exports. Our findings can be supported by additional empirical analysis. We may split the whole sample firms into large firms and small/medium-sized firms and conduct panel estimation for two sub-sample groups of firms to compare estimated results. We can also attempt to employ additional firm-characteristic variables such as financial and operational hedges and other macroeconomic variables including exchange rate volatility to support our baseline results. These are left for our future research.

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Figure 1. Invoice Currency Choice in Japanese Exports (Percent): 1980–2023



Note: The share for 2023 in exports to the United States is computed based on Japanese exports to North America. “EU currencies” include the euro and other European currencies.

Source: The website of Japan Customs, Ministry of Finance.

Table 1. Averaged Intra-firm Export Share and Invoice Currency Share by Export Destination

Export Destination:	Averaged Export Amount (in Yen)	Averaged Number of Export Transactions	Averaged Intra-firm Export Share	Averaged Invoice Currency Share					
				Japanese Yen		U.S. Dollar		Euro	
				Amount-basis	Transaction-basis	Amount-basis	Transaction-basis	Amount-basis	Transaction-basis
Africa	1,958,886,567	373,056	0.303	0.550	0.556	0.347	0.345	0.089	0.086
Americas	13,396,869,174	8,078,417	0.279	0.459	0.489	0.530	0.496	0.006	0.007
Asia	20,803,266,721	12,961,224	0.263	0.708	0.724	0.245	0.240	0.005	0.007
Europe	7,634,744,312	1,815,258	0.271	0.569	0.585	0.183	0.192	0.222	0.199
Oceania	3,405,496,896	512,346	0.290	0.639	0.651	0.279	0.278	0.018	0.017
Others	128,740,375	2,583	0.350	0.604	0.617	0.283	0.273	0.111	0.106

Note: All figures are annually averaged for the 8,644 sample firms from 2014 to 2019. We chose six regions as Japanese firms' export destinations.

Source: Authors' calculation based on the Japan Customs export declaration data and the Basic Survey of Japanese Business Structure and Activities (BSJBSA) data compiled by the Ministry of Economy, Trade and Industry (METI).

Table 2. Averaged Intra-firm Export Share and Invoice Currency Share by Industry

Industry Classification:	Averaged Export Amount (in Yen)	Averaged Number of Export Transactions	Averaged Intra-firm Export Share	Averaged Invoice Currency Share						Number of Firms
				Japanese Yen		U.S. Dollar		Euro		
				Amount- basis	Transaction -basis	Amount- basis	Transaction -basis	Amount- basis	Transaction -basis	
Livestock Products	2,060,601,587	46,988	0.150	0.739	0.767	0.208	0.188	0.019	0.020	293
Textiles	3,201,224,806	930,172	0.258	0.595	0.612	0.339	0.320	0.041	0.047	149
Chemicals	26,582,896,786	4,565,605	0.217	0.599	0.621	0.327	0.308	0.033	0.045	615
Plastic Products	5,836,499,360	647,111	0.343	0.666	0.702	0.288	0.255	0.014	0.018	347
Glass and its Products	15,058,460,588	1,067,382	0.153	0.659	0.666	0.279	0.271	0.039	0.047	159
Iron and Steel	12,440,570,633	1,476,583	0.182	0.650	0.693	0.307	0.263	0.026	0.028	152
Non-Ferrous Metal Products	30,105,480,168	5,813,825	0.304	0.641	0.663	0.313	0.291	0.019	0.025	185
Fabricated Architectural Metal Products	3,438,609,359	676,384	0.268	0.695	0.714	0.246	0.233	0.018	0.022	427
Boilers, Engines and Turbines	18,317,304,394	7,021,622	0.265	0.736	0.776	0.204	0.160	0.028	0.036	339
Metal Working Machinery	29,602,835,439	6,628,036	0.242	0.774	0.791	0.171	0.147	0.027	0.037	735
Office, Service Industry and Household Machines	56,969,067,897	12,086,372	0.275	0.616	0.637	0.280	0.265	0.068	0.066	278
Electronic Parts and Devices	56,857,749,324	49,523,908	0.362	0.486	0.506	0.465	0.439	0.019	0.036	339
Industrial Electrical Equipment Manufacturing	47,097,872,568	66,673,906	0.314	0.630	0.661	0.290	0.273	0.025	0.033	399
Communication Equipment and Related Products	32,334,605,552	5,591,424	0.332	0.450	0.493	0.467	0.438	0.045	0.042	121
Motor Vehicles, Parts and Accessories	157,360,938,441	100,020,047	0.476	0.677	0.739	0.241	0.186	0.021	0.030	627
Miscellaneous Manufacturing Industries	23,086,446,140	3,984,969	0.250	0.674	0.685	0.261	0.254	0.028	0.032	187
Shosha (Trading Company)	33,842,910,929	19,078,570	0.226	0.648	0.653	0.289	0.281	0.030	0.041	2,349

Note: All figures are annually averaged for the 8,644 sample firms from 2014 to 2019. We chose six regions as Japanese firms' export destinations.

Source: Authors' calculation based on the Japan Customs export declaration data and the Basic Survey of Japanese Business Structure and Activities (BSJBSA) data compiled by the Ministry of Economy, Trade and Industry (METI).

Table 3. Averaged Intra-firm Export Share and Invoice Currency Share by Firm Size

Firm Size (Percentile Rank)	Averaged Export Amount (in Yen)	Averaged Number of Export Transactions	Averaged Intra-firm Export Share	Averaged Invoice Currency Share		
				JPY	USD	EUR
(1) Rank in Export Amounts				Share on amount-basis		
-25	8,851,726	735	0.146	0.747	0.206	0.024
25-50	104,906,848	6,203	0.235	0.707	0.236	0.020
50-75	588,524,827	44,233	0.293	0.649	0.287	0.025
75-	10,687,980,237	2,593,211	0.390	0.523	0.393	0.044
99-	476,374,012,441	349,454,753	0.478	0.296	0.558	0.077
(2) Rank in Number of Export Transactions				Share on transaction-basis		
-25	120,411,063	51	0.123	0.765	0.193	0.022
25-50	365,021,822	1,333	0.208	0.712	0.234	0.028
50-75	1,319,131,282	16,114	0.301	0.666	0.273	0.035
75-	12,492,417,248	1,595,835	0.433	0.572	0.335	0.061
99-	405,440,175,324	374,324,640	0.508	0.447	0.390	0.112

Note: All figures are annually averaged for the 8,644 sample firms from 2014 to 2019. The first column shows the percentile rank used to measure firm size. “-25” denotes the lowest quartile. “20-50” denotes the second lowest quartile. “50-75” denotes the second largest quartile. “75-” denotes the largest quartile. “99-” denotes the top one percent group of firms.

Source: Authors’ calculation based on the Japan Customs export declaration data and the Basic Survey of Japanese Business Structure and Activities (BSJBSA) data compiled by the Ministry of Economy, Trade and Industry (METI).

Table 4. Determinants of Invoice Currency Share: Baseline Results of Intra-firm Export Share

	Dependent Variable: <i>Invoice Currency Share</i>							
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
	JPY_amount	JPY_amount	JPY_transact	JPY_transact	USD_amount	USD_amount	USD_transact	USD_transact
<i>Intra-firm</i>	-0.004 ** (0.001)	-0.168 ** (0.033)	-0.003 ** (0.001)	-0.169 ** (0.034)	0.005 ** (0.001)	0.117 ** (0.025)	0.005 ** (0.001)	0.117 ** (0.025)
Firm FE	YES	NO	YES	NO	YES	NO	YES	NO
HS6 FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Destination FE	YES	YES	YES	YES	YES	YES	YES	YES
Standard Error	Robust	Cluster	Robust	Cluster	Robust	Cluster	Robust	Cluster
Model	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Obs.	4,101,210	4,101,607	4,101,210	4,101,607	4,101,210	4,101,607	4,101,210	4,101,607
Adj R2	0.410	0.147	0.416	0.149	0.419	0.194	0.424	0.197

Note: The dependent variable is an invoice currency share of the Japanese yen (JPY) or the U.S. dollar (USD). The invoice currency share is calculated by export amounts (JPY_amount or USD amount) or by the number of transactions (JPY_transact or USD_transact). Results of OLS estimation with robust standard errors and cluster standard errors at the industry level are presented. The industry classification is based on the BSJBSA classification. See Table 2 for the BSJBSA classification. Double (**) and a single (*) asterisk(s) denote(s) 1 percent and 5 percent significance levels, respectively.

Table 5-A. Determinants of Yen-Invoiced Share: Intra-firm Export Share and Firm Size

	Dependent Variable: <i>Invoice Currency Share</i>							
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
	JPY amount	JPY amount	JPY amount	JPY amount	JPY amount	JPY amount	JPY amount	JPY amount
<i>Intra-firm</i>	-0.003 *	-0.143 **	-0.004 **	-0.163 **	-0.002 #	-0.122 **	-0.004 *	-0.149 **
	(0.001)	(0.033)	(0.001)	(0.033)	(0.001)	(0.033)	(0.001)	(0.033)
<i>ln(Sales)</i>	-0.010 **	-0.026 **						
	(0.001)	(0.004)						
<i>ln(Export)</i>			-0.013 **	-0.020 **				
			(0.000)	(0.002)				
<i>ln(N_transact)</i>					-0.023 **	-0.027 **		
					(0.000)	(0.004)		
<i>ln(N_product)</i>							-0.017 **	-0.031 **
							(0.000)	(0.004)
Firm FE	YES	NO	YES	NO	YES	NO	YES	NO
HS6 FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Destination FE	YES	YES	YES	YES	YES	YES	YES	YES
Standard Error	Robust	Cluster	Robust	Cluster	Robust	Cluster	Robust	Cluster
Model	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Obs.	4,101,210	4,101,607	4,101,210	4,101,607	4,101,210	4,101,607	4,101,210	4,101,607
Adj R2	0.410	0.157	0.414	0.155	0.413	0.167	0.413	0.159

Note: The dependent variable is an invoice currency share of the Japanese yen (JPY) calculated by export amounts (JPY_amount). Results of OLS estimation with robust standard errors and cluster standard errors at the industry level are presented. The industry classification is based on the BSJBSA classification. See Table 2 for the BSJBSA classification. “Sales” denotes the firm’s total sales. “Export” denotes the firm’s export amounts. “N_transact” denotes the number of the firm’s export declarations. “N_product” denotes the number of the firm’s export products to each destination country. Double (**) and a single (*) asterisk(s) denote(s) 1 percent and 5 percent significance levels, respectively.

Table 5-B. Determinants of USD-Invoiced Share: Intra-firm Export Share and Firm Size

	Dependent Variable: <i>Invoice Currency Share</i>							
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
	USD_amount	USD_amount	USD_amount	USD_amount	USD_amount	USD_amount	USD_amount	USD_amount
<i>Intra-firm</i>	0.005 ** (0.001)	0.101 ** (0.023)	0.005 ** (0.001)	0.113 ** (0.024)	0.004 ** (0.001)	0.087 ** (0.022)	0.005 ** (0.001)	0.103 ** (0.024)
<i>ln(Sales)</i>	0.005 ** (0.001)	0.016 ** (0.003)						
<i>ln(Export)</i>			0.010 ** (0.000)	0.014 ** (0.001)				
<i>ln(N_transact)</i>					0.015 ** (0.000)	0.018 ** (0.002)		
<i>ln(N_product)</i>							0.014 ** (0.000)	0.023 ** (0.002)
Firm FE	YES	NO	YES	NO	YES	NO	YES	NO
HS6 FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Destination FE	YES	YES	YES	YES	YES	YES	YES	YES
Standard Error	Robust	Cluster	Robust	Cluster	Robust	Cluster	Robust	Cluster
Model	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Obs.	4,101,210	4,101,607	4,101,210	4,101,607	4,101,210	4,101,607	4,101,210	4,101,607
Adj R2	0.419	0.199	0.421	0.199	0.421	0.204	0.421	0.202

Note: The dependent variable is an invoice currency share of the U.S. dollar (USD) calculated by export amounts (USD_amount). Results of OLS estimation with robust standard errors and cluster standard errors at the industry level are presented. The industry classification is based on the BSJBSA classification. See Table 2 for the BSJBSA classification. “Sales” denotes the firm’s total sales. “Export” denotes the firm’s export amounts. “N_transact” denotes the number of the firm’s export declarations. “N_product” denotes the number of the firm’s export products to each destination country. Double (**) and a single (*) asterisk(s) denote(s) 1 percent and 5 percent significance levels, respectively.

Table 6-A. Determinants of Yen-Invoiced Share: Intra-firm Export Share, Firm Size, and R&D Expenditure

	Dependent Variable: <i>Invoice Currency Share</i>							
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
	JPY_amount	JPY_amount	JPY_amount	JPY_amount	JPY_amount	JPY_amount	JPY_amount	JPY_amount
<i>Intra-firm</i>	-0.006 ** (0.002)	-0.122 ** (0.043)	-0.006 ** (0.002)	-0.121 ** (0.043)	-0.005 ** (0.002)	-0.104 * (0.041)	-0.006 ** (0.002)	-0.116 ** (0.042)
<i>ln(Sales)</i>	-0.008 ** (0.002)	-0.014 * (0.007)						
<i>ln(Export)</i>			-0.014 ** (0.000)	-0.018 ** (0.002)				
<i>ln(N_transact)</i>					-0.027 ** (0.000)	-0.030 ** (0.006)		
<i>ln(N_product)</i>							-0.018 ** (0.000)	-0.027 ** (0.004)
<i>ln(R&D)</i>	0.004 ** (0.001)	-0.013 * (0.005)	0.003 ** (0.001)	-0.019 ** (0.003)	0.004 ** (0.001)	-0.003 (0.005)	0.003 ** (0.001)	-0.016 ** (0.003)
Firm FE	YES	NO	YES	NO	YES	NO	YES	NO
HS6 FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Destination FE	YES	YES	YES	YES	YES	YES	YES	YES
Standard Error	Robust	Cluster	Robust	Cluster	Robust	Cluster	Robust	Cluster
Model	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Obs.	2,842,371	2,842,590	2,842,371	2,842,590	2,842,371	2,842,590	2,842,371	2,842,590
Adj R2	0.413	0.155	0.417	0.160	0.418	0.168	0.417	0.162

Note: The dependent variable is an invoice currency share of the Japanese yen (JPY) calculated by export amounts (JPY_amount). Results of OLS estimation with robust standard errors and cluster standard errors at the industry level are presented. The industry classification is based on the BSJBSA classification. See Table 2 for the BSJBSA classification. “Sales” denotes the firm’s total sales. “Export” denotes the firm’s export amounts. “N_transact” denotes the number of the firm’s export declarations. “N_product” denotes the number of the firm’s export products to each destination country. “R&D” denotes the natural log of research and development (R&D) expenditures. Double (**) and a single (*) asterisk(s) denote(s) 1 percent and 5 percent significance levels, respectively.

Table 6-B. Determinants of USD-Invoiced Share: Intra-firm Export Share, Firm Size, and R&D Expenditure

	Dependent Variable: <i>Invoice Currency Share</i>							
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
	USD_amount	USD_amount	USD_amount	USD_amount	USD_amount	USD_amount	USD_amount	USD_amount
<i>Intra-firm</i>	0.008 ** (0.002)	0.094 ** (0.029)	0.009 ** (0.002)	0.093 ** (0.029)	0.008 ** (0.002)	0.082 ** (0.027)	0.009 ** (0.002)	0.090 ** (0.028)
<i>ln(Sales)</i>	0.004 * (0.002)	0.008 (0.005)						
<i>ln(Export)</i>			0.010 ** (0.000)	0.012 ** (0.001)				
<i>ln(N_transact)</i>					0.017 ** (0.000)	0.021 ** (0.004)		
<i>ln(N_product)</i>							0.015 ** (0.000)	0.020 ** (0.003)
<i>ln(R&D)</i>	-0.002 ** (0.000)	0.007 (0.006)	-0.002 ** (0.000)	0.011 ** (0.003)	-0.002 ** (0.000)	-0.001 (0.005)	-0.002 ** (0.000)	0.008 * (0.004)
Firm FE	YES	NO	YES	NO	YES	NO	YES	NO
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Destination FE	YES	YES	YES	YES	YES	YES	YES	YES
Standard Error	Robust	Cluster	Robust	Cluster	Robust	Cluster	Robust	Cluster
Model	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Obs.	2,842,371	2,842,590	2,842,371	2,842,590	2,842,371	2,842,590	2,842,371	2,842,590
Adj R2	0.428	0.202	0.430	0.205	0.430	0.209	0.431	0.207

Note: The dependent variable is an invoice currency share of the U.S. dollar (USD) calculated by export amounts (USD_amount). Results of OLS estimation with robust standard errors and cluster standard errors at the industry level are presented. The industry classification is based on the BSJBSA classification. See Table 2 for the BSJBSA classification. “Sales” denotes the firm’s total sales. “Export” denotes the firm’s export amounts. “N_transact” denotes the number of the firm’s export declarations. “N_product” denotes the number of the firm’s export products to each destination country. “R&D” denotes the natural log of research and development (R&D) expenditures. Double (**) and a single (*) asterisk(s) denote(s) 1 percent and 5 percent significance levels, respectively.

Appendix Table A1. Basic Statistics

Variables:	Observations	Mean	Std. Dev.	Max	Min
<i>JPY_value</i>	4,408,033	0.587	0.481	1	0
<i>JPY_trans.</i>	4,408,033	0.588	0.478	1	0
<i>USD_value</i>	4,408,033	0.311	0.453	1	0
<i>USD_trans.</i>	4,408,033	0.310	0.449	1	0
<i>Intra-firm</i>	4,408,033	0.423	0.385	1	0
<i>Sales</i>	4,408,033	521,061	1,503,599	6,327,767	335
<i>ln(Sales)</i>	4,408,033	11.006	2.074	15.573	5.731
<i>Export</i>	4,408,033	70,297,660	2.136e+9	4.748e+11	1
<i>ln(Export)</i>	4,408,033	14.142	2.564	26.728	0
<i>N_transact</i>	4,408,033	1,149,028	18,192,605	2.1746e+9	1
<i>ln(N_transact)</i>	4,408,033	9.249	2.800	21.236	0
<i>N_product</i>	4,408,033	106.448	579.002	25,337	1
<i>ln(N_product)</i>	4,408,033	2.375	2.004	9.989	0
<i>R&D</i>	4,408,033	20,443	73,748	317,192	0
<i>ln(R&D)</i>	4,408,033	5.031	4.121	12.589	0

Notes: The maximum and minimum values denote a simple average of the 10 largest and smallest firms, respectively.

“Sales” denotes the firm’s total sales (1 million yen). “Export” denotes the firm’s export amounts (1 million yen).

“N_transact” denotes the number of the firm’s export declarations. “N_product” denotes the number of the firm’s export products to each destination country. “R&D” denotes the research and development (R&D) expenditures (1 million yen).