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New evidence from a questionnaire survey of Japanese export firms

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Abstract

This paper is the first comprehensive research using a questionnaire survey on the choice of invoicing currency with all Japanese manufacturing firms listed in the Tokyo Stock Exchange. Questionnaires were sent out to 920 Japanese firms in September 2009, and 227 firms responded. We present new firm-level evidence on invoicing currency by the destination and type of trading partners, with a particular emphasis on the difference between arms-length and intra-firm trades. We also conduct cross-section analysis to investigate what determines the invoicing choice of Japanese firms. Our novel findings are as follows. (1) The invoicing choice depends on whether it is an intra-firm trade or an arms-length trade. While yen invoicing tends to be chosen in arms-length trades, there is a strong tendency that invoicing in the importer's currency is used in intra-firm trades, suggesting that the parent firm in Japan assumes and manages the currency risk. In exports to Asian subsidiaries, U.S. dollar invoicing is used. (2) Firm size does matter in the choice of invoice currency. The larger (smaller) the size of the firms, the more likely they are to conduct intra-firm (arms-length, resp.) trades. (3) In terms of the number of Japanese firms, using yen invoicing is more prevalent than U.S. dollar invoicing. However, adjusting for the export value of each firm, the share of U.S. dollar invoicing is on average larger than that of yen invoicing, mainly because Japanese firms with a large volume of exports tend to have a global sales and production network where U.S. dollar invoicing is dominant, especially in the case of "triangular trade."

***JEL Classification*:** F23, F31, F33

Keywords: Invoice currency; Japanese exports; Intra-firm trade; Production network

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1. Introduction

Choice of invoicing currency has gained a great deal of attention in the recent literature of international economics. As discussed in the new open economy macroeconomics, in which currency the export price is denominated, has significant implications for macroeconomic adjustment to the currency shocks among countries. The question on invoicing currency is also closely related to the exchange rate pass-through, as Engel (2006) theoretically demonstrates the equivalence result between them. While there have been a large number of empirical studies on the exchange rate pass-through, an empirical investigation of currency invoicing is surprisingly scarce, mainly because detailed data on the choice of invoicing currency is seldom disclosed or published from the official source. The novelty of this paper is first to present the evidence of the firm-level invoicing choice among Japanese exporters obtained by our large-scale questionnaire survey of all Japanese exporting firms that are listed on the stock exchanges in Japan, and second to empirically investigate the determinants of their invoicing decisions.

The limitation of data availability has impeded the development of empirical research on the exporter's currency invoicing behavior, but several attempts have been made at overcoming such limitation in recent years. Goldberg and Tille (2009) and Gopinath, Itskhoki and Rigobon (2010) examined the invoicing choice of Canadian and US imports, respectively, by using the unpublished customs-level data.[1] Although the information on the invoicing share by highly disaggregated commodity and by source country is used in these studies, the customs-level data does not distinguish between the invoicing share of arms-length trade and that of intra-firm trade. Such distinction is particularly important in considering the impact of increasing global operations of export firms in recent years. For intra-firm trades, it is the firm as a corporate group cannot escape the currency risk, and the choice of invoicing currency is the choice between the parent and the subsidiary of who is better suited to manage the risk. Japanese firms, for instance, have built a regional production network in Asia with trade between group companies growing substantially. A natural question is whether firms' invoicing behavior differs between arms-length trade and intra-firm trade, but only a few studies have empirically examined this issue.

There are only two studies, to our best knowledge, that empirically investigate the firm-level invoicing behavior. Friberg and Wilander (2008) obtained detailed data on the

[1] See also Donnenfeld and Haug (2003, 2008) for the similar empirical investigation using the unpublished customs level data on the share of invoice currency. Without the information on the choice of invoice currency, Fukuda and Ji (1994) and Sato (2003) empirically examine the Japanese exporter's currency invoicing behavior based on the pricing-to-market model with highly disaggregated export commodity data.

invoicing choice of Swedish exporting firms by conducting a questionnaire survey and empirically analyzed the determinants of invoicing choice. Although a number of interesting evidence is reported in the paper, neither destination breakdown data on invoicing choice nor the invoicing share of intra-firm trade was presented. Ito, Koibuchi, Sato and Shimizu (2012) conducted interview analysis of 23 major Japanese exporting firms that operate globally through active intra-firm trade with overseas subsidiaries. They empirically found that globally operating firms with overseas subsidiaries tend to choose local currency invoicing in their exports to advanced countries and also to choose US dollar invoicing in their exports to emerging economies, especially Asian countries. Although results were quite interesting, the number of sample firms of their interview analysis is small and the detailed information on the invoicing choice of intra-firm trade was not obtained from their interview.

This paper conducts a large-scale questionnaire survey covering all Japanese manufacturing firms listed on the stock exchanges in Japan. In marked contrast to the previous studies, we obtained the detailed information on the firm-level invoicing choice for each destination. More specifically, our survey results reveal which currency is used in intra-firm trade, i.e., in exports of Japanese headquarters to sales and production subsidiaries in various destinations. Moreover, we also collect the data on the production subsidiary's invoicing choice in exports to each destination or in local sales. It is often pointed out that Japanese overseas production subsidiaries in Asia tend to export finished goods to the United States, while intermediate input goods are procured from Japan and neighboring economies. We empirically investigate whether such a unique trade pattern, so-called "triangular trade", affects the invoicing pattern of Japanese headquarters as well as overseas production subsidiaries. The main finding of this paper is as follows.

First, our firm-level data shows that invoicing choice depends on whether it is intra-firm trade or arms-length trade. A strong tendency was found in cross-section analysis in that exporters choose the currency of importer's country in intra-firm trade, while yen-invoicing is chosen in arms-length trade. This finding has a marked contrast to recent empirical studies of exchange rate pass-through based on the micro-data. Neiman (2010) and Hellerstein and Villas-Boas (2010) found higher exchange rate pass-through in intra-firm trade than in arms-length trade. Since invoicing in the importer's currency results in short-run price stickiness in terms of the importer's currency, our findings imply less exchange rate pass-through and, hence, higher pricing-to-market (PTM) in intra-firm trade, thus our result differs markedly from the previous studies on the exchange rate pass-through in intra-firm trade.

Second, our firm-level data clearly shows that the larger (smaller) the size of firms, the more (less, resp.) likely they conduct intra-firm trade. Given the above difference in invoicing behavior between intra-firm trade and arm's length trade, the firm size is likely to affect the

choice of invoice currency. However, we show that, even after controlling this size effect, intra-firm trade significantly lowers the yen invoicing exports and increases the importer's currency/US dollar invoicing transactions.

Third, among the key determinants of invoicing choice, product differentiation and the world market share, which are related to the firm's export competitiveness, significantly increase the share of yen invoicing. The finding fits the conventional wisdom in that an internationally competitive firm with a high world production share can shift currency risk to customers, as customers do not have alternative source of imports.

Fourth, growing and deepening regional production network in Asia is likely to discourage yen-invoiced transactions by Japanese firms. Asian subsidiaries typically import semi-finished goods from Japanese parent and export finished products to the rest of the world. The cross-section regression analysis using the survey suggests that Japanese production subsidiaries with high export propensity tend to choose US dollar-invoiced transactions. As long as Japanese production subsidiaries in Asia export their finished goods to countries outside the region, such as the United States, US dollar invoicing tends to be chosen even in exports from Japanese headquarters to production subsidiaries in Asia.

The remainder of this paper is organized as follows. Section 2 describes our questionnaire survey and presents the new firm-level evidence of invoicing choice. Section 3 empirically examines the determinants of currency invoicing decision. Section 4 concludes the paper with a few observations with policy implications.

2. The Survey

2-1. Questionnaire

The primary purpose of the questionnaire survey is to collect detailed information on the firm-level invoicing choice of Japanese exporters. We first selected all Japanese manufacturing firms that were listed on the stock exchanges in Japan and reported foreign sales in their consolidated financial statements as of fiscal year 2008.[2] Then, questionnaires were sent out to 920 firms by postal mail in September 2009 in cooperation with Research Institute of Economy, Trade, and Industry (RIETI), Japan. We finally received responses from 227 firms by December 2009 and the response rate is 24.7 percent. Among the 227 sample firms, 208 firms (91.6%) are manufacturing firms with a capital of 1 billion yen or more and 174 firms (76.4%)

[2] All sample firms are listed on one of 6 stock exchanges (Tokyo, Osaka, Nagoya, Fukuoka and Sapporo) or 3 emerging markets (JASDAQ, Mothers, and Hercules).

have 300 employees or more. Therefore, most of respondents are considered as large companies.

Table 2-1 reports simple arithmetic averages of both consolidated sales and foreign sales to show an average size of the 920 listed firms and the 227 respondents for each industry. By dividing the amount of foreign sales by that of corresponding consolidated sales, we can check whether the ratio of foreign sales to consolidated sales (henceforth, "foreign sales ratio") is similar between all 920 listed firms and the 227 respondents. The foreign sales ratio for all manufacturing industries is almost the same between the 920 listed firms and the 227 respondents. Even at an industry level, the foreign sales ratio is not very different between two sets of firms except for the pharmaceutical industry. This observation shows that the size of our sample firms (i.e., 227 respondents) is, on average, similar to that of all 920 listed firms. It must be noted that the 227 respondents do not answer all questions. Hence, in the following analysis, the number of all sample firms can be different across questionnaire items.

Table 2-1. Size of Manufacturing Firms: All 920 Listed Firms and 227 Respondents

	920 Firms (All Manufacturing Firms)			227 Firms (Respondents to Questionnaires)		
Type of Industry	(A) Consolidated Sales (Average, Million Yen)	(B) Foreign Sales (Average, Million Yen)	(B)/(A)	(A) Consolidated Sales (Average, Million Yen)	(B) Foreign Sales (Average, Million Yen)	(B)/(A)
All Manufacturing	328,576	159,912	37.6	380,951	190,145	37.0
Foods	859,322	334,191	22.3	483,825	227,374	32.3
Textiles & Apparel	179,476	58,815	24.2	102,142	17,585	23.2
Pulp & Papers	54,182	13,335	21.2	---	---	---
Chemicals	207,557	74,702	30.2	273,090	105,240	34.7
Pharmaceuticals	313,333	123,127	29.7	230,864	22,951	10.5
Oil & Coal Products	2,731,327	369,007	17.6	3,428,211	399,070	11.6
Rubber Products	338,174	223,537	34.5	98,511	47,124	32.2
Glass & Ceramics	185,996	88,000	36.4	55,315	25,978	30.3
Steel Products	576,693	191,604	27.8	882,765	298,665	23.4
Nonferrous Metals	420,983	129,423	28.0	203,383	30,943	17.6
Metal Products	99,223	31,922	30.7	172,879	73,012	37.8
Machinery	128,780	64,683	40.9	158,355	89,751	35.7
Electrical Machinery	352,841	181,586	43.4	529,526	231,003	43.7
Transport Equipment	848,975	580,951	45.7	888,213	631,035	41.3
Precision Instruments	103,474	64,888	44.6	110,474	85,505	48.2
Other Products	200,189	84,130	36.2	57,600	33,241	37.0

Note: Questionnaires were sent to 920 Japanese firms listed on the stock exchanges in Japan. We selected the firms that reported foreign sales in their consolidated financial statements as of fiscal year 2008, and 920 firms were finally chosen.

Source: 2009 RIETI Survey

2-2. Choice of Invoice Currency

Invoice currency and settlement currency

Before moving on to the detailed information on the firm-level invoicing choice, let us present the result of our preliminary question about whether an invoice currency (a currency to be used at the stage of contracts) is the same as a settlement currency (a currency to be used at the stage of payments). It is found that 200 firms out of 226 respondents, which is equivalent to 88.4 percent of our sample firms, answered that the same currency was used for both invoicing and settlements. While the role of invoicing currency is often distinguished from that of settlement currency in the theoretical studies such as Friberg (1998), our findings show that the same currency is used for invoicing and settlements in most cases, which conforms to the finding of Friberg and Wilander (2008).

Result 1: For most of Japanese firms, the same currency is used for both invoicing and settlements.

Currency Invoicing in Japanese Exports to the World

Table 2-2 presents the invoicing share of Japanese exports to the world based on the results of the questionnaire survey. In the interview analysis, we obtained the share of invoice currency that each sample firm reported. Based on this information, we present two types of the share of invoice currency. The first one is a simple arithmetic average share and the second one is a weighted average share. While the simple arithmetic average is a useful measure to see which currency is the most frequently chosen for trade invoicing by Japanese firms, it does not necessarily show the actual invoicing pattern in Japanese total exports, because the arithmetic average share does not take into account a difference in the volume of exports across sample firms. Thus, we compute the weighted average share as well to allow for the size effect of each firm by using the amount of foreign sales as a proxy for firm's exports to the world, which is likely to show the real picture of Japanese total exports. It must be noted that the destination breakdown data on firm-level exports is not available and also that we collect the data on firm's foreign sales from the annual financial statement of each sample firm. Since even data on destination specific foreign sales is not available, we can present the weighted average share of currency invoicing only for exports to the world.

In Table 2-2, when looking at the arithmetic average share of all manufacturing industries, where 217 firms responded, the share of yen-invoicing is larger (48.2 percent) than that of US dollar invoicing (42.2 percent). The share of euro invoicing accounts for only 7.1

percent, and other currencies are seldom used for currency invoicing (2.7 percent). Next, turning to the weighted average share, which is calculated by using the amount of foreign sales of respective sample firms, the share of US dollar invoicing becomes the highest, amounting to 54.1 percent.[3] The share of yen invoicing declines to only 28.7 percent that is far lower than the corresponding arithmetic average share.

This striking difference reveals the novel characteristics of Japanese firms' invoicing choice. Specifically, the arithmetic average share suggests that about a half of Japanese firms conduct yen invoicing exports. Taking into consideration the firm size in terms of foreign sales, however, more than a half of Japanese exports are invoiced in US dollars. This observation suggests that foreign currency invoicing tends to be chosen by export firms with larger size in terms of foreign sales, which will be demonstrated below by presenting far more detailed data on the invoicing share.

Result 2: In terms of the number of firms, Japanese firms tend to use the yen more than the US dollar for export invoicing. In terms of the export amounts, however, the US dollar is much more used than the yen in Japanese total exports to the world.

Table 2-2. Share of Currency Invoicing in Japanese Exports to the World (Percent)

	All Firms		Total Consolidated Sales			Foreign Sales*		
	Arithmetic average[1)]	Weighted average[2)]	Large[1)] (upper 1/3)	Medium[1)] (middle 1/3)	Small[1)] (lower 1/3)	Large[1)] (upper 1/3)	Medium[1)] (middle 1/3)	Small[1)] (lower 1/3)
Currency: Number of sample firms[3)]	217	217	80	70	67	64	70	83
Japanese Yen	48.2	28.7	38.1	50.0	58.3	41.2	52.2	50.2
US Dollar	42.1	54.1	47.8	41.7	35.8	45.5	39.0	42.1
Euro	7.1	11.3	10.5	5.1	5.2	11.0	5.7	5.3
Other Currencies	2.7	5.9	3.7	3.3	0.7	2.5	3.0	2.5

Note: * Foreign sales ratio is calculated by dividing the total foreign sales by the total consolidated sales.
1) Arithmetic average. 2) Weighted average is calculated in terms of foreign sales in FY2008 of each firm.
3) Number of firms.
Source: 2009 RIETI Survey

Table 2-2 divides the 217 sample firms into three categories, i.e., large (upper 1/3), medium (middle 1/3) and small (lower 1/3), not only by the firm size that is measured by total consolidated sales[4] but also by the foreign sales ratio (i.e., the ratio of total foreign sales to total

[3] Since it is hard to obtain the amounts of exports of each sample firm, we use the data on the amount of foreign sales as a proxy for that of exports.
[4] Sales data are taken from the annual statement as of the reporting date that is immediately before the survey (mostly in the end of March 2009).

consolidated sales). It is shown that, in terms of the consolidated sales, the larger (smaller) the firm size, the lower (higher) the share of yen-invoicing is. On the other hand, the larger (smaller) the firm size, the larger (smaller) the share of US dollar invoicing is. This finding is also supported by the invoicing share in terms of the foreign sales ratio. Even though looking at the arithmetic average share, we can observe a clear pattern of currency invoicing choice in Japanese exporting firms.[5]

Result 3: The firm size does matter in the choice of export invoicing. The smaller (larger) the firm size, the higher the share of yen (US dollar) invoicing is.

The Share of Currency Invoicing by Destination

Let us turn to the invoicing choice by destination. Table 2-3 shows the invoicing choice in Japanese exports to advanced countries and emerging economies excluding Asian countries, where the simple arithmetic average is reported. Focusing on all manufacturing firms, we can observe a clear pattern of the invoice choice. First, the US dollar is mainly used in Japanese exports to North America. Obviously, the share of US dollar invoicing is the highest (77.9 percent) in exports to the United States. Even in exports to Canada and Mexico, the US dollar accounts for the largest share, 48.2 percent and 66.0 percent, respectively. Second, in exports to Euro area, the share of euro invoicing is 51.0 percent, while 35.3 percent of exports are invoiced in the yen. In exports to the UK, the share of the UK pound invoicing is 32.1 percent, somewhat lower than that of yen invoicing (35.0 percent). But, taking into account the share of euro invoicing (15.7 percent) as well, the share of invoicing in European currencies becomes much larger. Third, the yen is the most used currency in exports to emerging economies even including Australia and New Zealand. Fourth, it is generally observed that the larger the size of firms, the higher the share of US dollar invoicing or importer's currency invoicing is.

The invoicing pattern in exports to Asian countries is more interesting. First, while it is generally pointed out that US dollar is dominantly used in Asian trade, Table 2-4 clearly shows that yen-invoicing generally accounts for the highest share. When looking at all manufacturing firms, the share of yen-invoicing is more than 50 percent for all destinations except for Hong Kong. Second, the choice of invoicing currency depends on the size of firms. There is a clear tendency that the larger (smaller) the size of firms, the higher the share of US dollar (yen) invoicing is. In the case of larger firms, the share of yen-invoicing is somewhat higher than that of US dollar invoicing. For smaller size firms, 70 to 91 percent of exports are invoiced in the

[5] Ito, Koibuchi, Sato and Shimizu (2012) provided the evidence obtained by interview analysis that Japanese export firms with active global operations and large foreign sales tend to choose US dollar (or destination currency) invoicing.

yen except for exports to China and Hong Kong. Thus, while the simple arithmetic average data shows that yen-invoicing is largely chosen in exports to Asian countries, the share of US dollar invoicing is likely to become much higher if taking into account the firm size or the amounts of exports.

Result 4: In terms of the number of firms, importer's currency invoicing is typically conducted in exports to the United States, the Euro area and the UK. While US dollar is the most frequently used currency in exports to North and Latin American countries, yen invoicing is generally chosen in Japanese exports to Asia, other emerging/developing countries and Australia/New Zealand.

Result 5: There is a clear relationship between the size of firms and the choice of invoicing currency in Japanese exports to Asia and other emerging countries. The larger (smaller) the firm size, the higher the share of US dollar (yen) invoicing is.

Table 2-3. Share of Invoice Currency in Japanese Exports by Destination (Percent)

	Destination											
	USA	Canada	Mexico	Brazil	Central & Latin America	Euro Area	UK	Russia	Eastern Europe	Austra-lia	New Zealand	Africa
Number of answers	168	50	36	51	39	133	65	34	40	70	37	35
Japanese Yen												
All Manufacturing	21.8	29.2	34.0	50.3	50.3	35.3	35.0	63.0	58.9	52.5	56.5	63.3
Large	16.0	13.7	23.0	37.6	41.7	29.7	30.5	58.8	52.0	42.6	54.3	61.5
Medium	23.9	45.0	45.7	60.0	55.6	30.1	17.7	37.5	46.8	50.3	33.2	62.5
Small	26.5	61.4	57.1	80.0	71.6	49.2	65.0	90.0	88.9	84.6	80.0	75.0
US Dollar												
All Manufacturing	77.9	48.2	66.0	45.6	45.1	13.6	18.5	29.7	13.1	29.1	32.6	34.7
Large	83.5	59.6	77.0	61.7	54.7	11.4	12.7	30.1	12.5	30.6	32.4	35.4
Medium	76.1	30.0	54.3	30.0	44.4	16.4	30.0	50.0	15.9	41.4	66.8	37.5
Small	72.9	29.5	42.9	11.0	14.4	13.9	21.4	11.1	11.1	7.7	7.5	25.0
Euro												
All Manufacturing	0.3	1.7	0.0	4.1	4.6	51.0	15.7	8.4	28.0	1.3	0.0	2.0
Large	0.7	2.7	0.0	0.6	3.6	58.8	23.6	11.1	35.5	2.4	0.0	3.1
Medium	0.0	0.0	0.0	10.0	0.0	53.2	10.7	12.5	37.3	0.0	0.0	0.0
Small	0.0	0.0	0.0	9.0	14.0	36.9	0.7	0.0	0.0	0.0	0.0	0.0
Importer's Currency												
All Manufacturing	---	20.0	0.0	0.0	0.0	---	32.1	0.0	0.0	18.5	2.7	0.0
Large	---	22.6	0.0	0.0	0.0	---	35.7	0.0	0.1	25.9	0.0	0.0
Medium	---	25.0	0.0	0.0	0.0	---	41.7	0.0	0.0	11.1	0.0	0.0
Small	---	9.1	0.0	0.0	0.0	---	12.9	0.0	0.0	7.7	12.5	0.0
Other Currencies												
All Manufacturing	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	8.2	0.0
Large	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	13.3	0.0
Medium	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Small	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: The simple arithmetic average share is reported.

Source: 2009 RIETI Survey

Table 2-4. Share of Invoice Currency in Japanese Exports by Destination: Asian Countries (Percent)

	Destination											
	China	Korea	Taiwan	Hong Kong	Singapore	Thailand	Malay-sia	Indonesia	Philippines	Vietnam	India	Middle-East
Number of answers	174	142	150	106	103	122	94	84	71	61	72	63
Japanese Yen												
All Manufacturing	55.4	69.0	62.5	45.6	56.9	60.1	56.1	61.6	63.0	64.9	76.3	51.9
Large	45.3	62.5	53.3	33.3	52.0	54.7	51.1	53.3	52.6	67.9	68.6	41.5
Medium	60.5	68.9	63.0	44.5	54.0	57.3	45.7	66.7	64.7	41.9	81.3	50.3
Small	63.4	78.9	75.2	68.3	70.5	75.5	84.1	74.9	82.4	80.9	91.0	73.4
US Dollar												
All Manufacturing	43.7	25.5	35.3	49.4	37.8	30.4	42.4	33.8	35.8	35.1	21.2	42.7
Large	52.4	32.8	42.6	61.9	42.6	35.4	48.4	41.0	43.9	32.1	29.4	49.4
Medium	40.9	25.8	35.7	46.7	43.1	32.5	50.7	27.5	35.3	58.1	18.7	49.1
Small	34.2	13.8	24.0	30.7	21.2	16.7	15.4	25.1	18.8	19.1	1.9	23.4
Euro												
All Manufacturing	0.5	1.1	0.3	0.0	0.5	0.2	0.3	0.6	0.0	0.0	1.1	4.2
Large	0.4	0.5	0.0	0.0	1.0	0.4	0.5	1.2	0.0	0.0	2.1	6.7
Medium	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
Small	1.2	1.9	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1
Importer's Currency												
All Manufacturing	1.3	4.5	2.4	4.8	4.8	9.4	1.1	4.0	1.4	0.0	1.4	2.4
Large	3.2	4.2	4.1	4.7	4.2	9.5	0.0	4.5	2.9	0.0	0.0	4.9
Medium	0.0	4.2	2.1	8.9	2.9	10.1	3.6	5.8	0.0	0.0	0.0	0.0
Small	0.0	5.4	0.4	0.0	8.4	7.8	0.0	0.1	0.0	0.0	7.1	0.0
Other Currencies												
All Manufacturing	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.3	0.0	0.0	0.3
Large	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.7	0.0	0.0	0.6
Medium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Small	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: The simple arithmetic average share is reported.

Source: 2009 RIETI Survey

2-3. Type of Trading Partners and Invoice Currency Decision

Intra-Firm Trade or Arm's Length Trade

In the questionnaire survey, we investigate whether there is any clear relationship between the choice of invoice currency and the type of importers/trading partners. We consider five trading partners: (i) local production subsidiaries, (ii) local sales subsidiaries, (iii) local trading agencies, (iv) *Sogo Shosha* (Japanese trading companies), and (v) others. (i) and (ii) are regarded as an *intra*-firm trade, and (iii) through (v) as an *inter*-firm or arm's length trade.

Let us first check which trade, intra-firm trade or arm's length trade, is mainly conducted in each destination. Table 2-5 reports the share of exports to each destination by

trading partners. First, in exports to the United States, Euro area and the UK, Japanese firms export their products mainly to their local subsidiaries. Even in exports to Canada, Mexico and Brazil, the share of exports to the local subsidiaries is the largest, accounting for around 38 through 41 percent. Second, in exports to Asia, Japanese firms have a strong tendency to export to their local subsidiaries, except for Korea, the Philippines, India and Middle-East countries, where the local agency (local trading company) is the largest importer. Third, in exports to other developing countries including Australia and New Zealand, local agency (local trading company) is the main importer. Finally, although reported in Appendix Table A1, it is found that larger firms tend to have a large share of intra-firm trade. For example, the strong tendency to export to local subsidiaries becomes more evident in the large size firm's exports to Asian countries. In contrast, in the small size firm's exports, the local agency (local trading company) is the largest importer in all Asian countries except China. Interestingly, Japanese trading company (*Sogo Shosha*) plays a relatively minor role even in Japanese exports to Asian countries.

Table 2-5. Japanese Exports by Destination and by Trading Partner

	Destination											
	USA	Canada	Mexico	Brazil	Central & Latin America	Euro Area	UK	Russia	Eastern Europe	Austra-lia	New Zealand	Africa
All Sample Firms: Number of answers	150	44	32	45	35	117	61	31	34	63	34	33
All Subsidiaries (a)+(b)	70.8	38.7	38.1	40.5	22.3	52.1	55.6	16.1	30.9	31.5	26.5	12.2
(a) Subsidiaries (Plants)	20.8	10.0	11.0	28.6	6.0	12.2	15.5	1.0	20.6	6.7	8.8	3.1
(b) Subsidiaries (Sales)	50.0	28.7	27.1	11.8	16.3	39.8	40.1	15.1	10.3	24.7	17.6	9.1
Local Agencies	10.4	35.6	20.3	33.3	41.3	25.3	23.3	36.7	31.7	37.3	55.9	44.3
Japanese Trading Companies	7.6	11.6	18.7	16.4	24.9	7.7	1.3	30.7	22.7	16.4	5.6	29.6
Others	11.0	14.2	22.9	9.8	11.4	15.2	19.8	17.5	15.9	15.8	12.1	13.9

	Destination											
	China	Korea	Taiwan	Hong Kong	Singapore	Thailand	Malay-sia	Indonesia	Philippines	Vietnam	India	Middle-East
All Sample Firms: Number of answers	155	131	135	96	93	110	82	77	65	56	65	57
All Subsidiaries (a)+(b)	59.8	27.2	39.6	54.1	46.2	54.7	44.8	42.2	30.9	32.8	28.4	12.2
(a) Subsidiaries (Plants)	35.0	9.7	16.7	6.6	6.1	40.4	33.8	32.7	22.5	24.9	18.4	2.6
(b) Subsidiaries (Sales)	24.8	17.5	22.8	47.6	40.2	14.3	11.0	9.4	8.4	7.9	10.1	9.6
Local Agencies	14.2	38.3	34.6	25.6	30.5	23.2	29.9	25.1	37.9	30.9	29.7	40.6
Japanese Trading Companies	13.5	12.2	9.7	6.7	9.9	8.6	7.0	16.0	13.5	18.3	17.9	27.2
Others	13.5	22.2	16.1	13.5	13.4	13.6	19.2	16.7	17.7	20.2	24.0	20.0

Note: A simple arithmetic average share is reported for each trading partner.

Source: 2009 RIETI Survey.

Result 6: In exports to North America, Brazil, the Euro area, the UK, and most Asian countries, intra-firm trade (exports to the local subsidiaries) accounts for the largest share. In exports to other countries, arm's length trade (exports to non-grouped firms, especially to local trading companies) plays a major role. It is generally observed that the larger the

firm size, the higher the share of intra-firm trade is in Japanese exports.

The Choice of Invoice Currency in Intra-Firm and Arm's Length Trade

Let us turn to the currency invoicing pattern of Japanese exports by trading partners. In our questionnaire survey, we obtained the information not on the exact share of currency invoicing but on which currency is the most frequently used one in exports to various trading partners in each destination. Following Friberg and Wilander (2008), we name the most frequently used currency for invoicing the "main invoice currency".[6] Table 2-6 reports the share of invoice currency obtained by calculating the simple arithmetic share of the main invoice currency across sample firms.

Table 2-6 shows the currency invoicing pattern by trading partners in Japanese exports to advanced countries and non-Asian emerging/developing countries. First, we can observe a clear pattern of invoicing choice in intra-firm trade. In exports to the United States, other North American countries and Latin American countries, the US dollar is the most frequently used in intra-firm trade. The local (importer's) currency invoicing is dominant in exports to Euro area and UK, while euro is largely used in exports to East European countries. Interestingly, when Russia is the destination country, the yen appears to be the most frequently used currency in intra-firm trade. For other countries, it is hard to observe a clear-cut pattern of invoicing choice. Second, the yen is generally used in arm's length trade (i.e., exports to local trading companies and *Sogo Shosha*) in all destination countries except the United States, Mexico and the Euro area where the importer's currency invoicing is dominant.

Next, Table 2-7 presents the currency invoicing pattern in Japanese exports to Asian countries. First, the yen and the US dollar are dominantly used in both intra-firm and arm's length trades with Asian countries. Second, while the yen is used somewhat more than the US dollar for trade invoicing in exports to local production subsidiaries, the US dollar is used more for trade invoicing in exports to local sales subsidiaries. The use of the local currency for trade invoicing is very small in intra-firm trade with Asia. Third, in arm's length trade, the share of yen invoicing is far larger than that of US dollar invoicing.

Result 7: The importer's currency tends to be used in intra-firm trade from Japan to developed countries/area. The yen and the US dollar are mainly used in intra-firm trade from Japan to Asian countries.

[6] For example, we regard the US dollar as the main invoice currency in exports to Asia, if 50 percent of its exports to Asia are invoiced in US dollars, 30 percent in the local currency, and 20 percent in the yen. Friberg and Wilander (2008) also employ this main invoice currency approach for their questionnaire survey analysis and conduct empirical examination.

Result 8: The share of yen invoicing is the largest in arm's length trade, which is more evident in exports to Asia and other developing countries. The share of US dollar invoicing is the second largest, but it is much lower than the corresponding share of yen invoicing.

Table 2-6. The Choice of Invoice Currency by Trading Partner: Japanese Exports to Advanced and Emerging Countries

	Destination											
	US	Canada	Mexico	Brazil	Central & Latin Americas	Euro Area	UK	Russia	East European countries	Australia	New Zealand	African countries
Number of respondents	150	44	32	45	35	117	61	31	34	63	34	33
Subsidiaries(plants)												
# of answers	51	6	5	17	4	29	12	1	7	5	3	2
1. JPY	21.6	16.7	0.0	23.5	0.0	24.1	16.7	100.0	28.6	40.0	33.3	50.0
2. USD	78.4	66.7	100.0	64.7	100.0	6.9	16.7	0.0	0.0	20.0	66.7	50.0
3. Euro	0.0	0.0	0.0	11.8	0.0	69.0	25.0	0.0	71.4	0.0	0.0	0.0
4. Importer's currency	---	16.7	0.0	0.0	0.0	---	41.7	0.0	0.0	40.0	0.0	0.0
5. Others	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subsidiaries(sales)												
# of answers	109	17	11	7	8	62	27	6	6	20	7	4
1. JPY	7.3	0.0	18.2	14.3	25.0	24.2	22.2	50.0	50.0	25.0	42.9	50.0
2. USD	92.7	58.8	72.7	85.7	50.0	11.3	11.1	33.3	0.0	25.0	14.3	50.0
3. Euro	0.0	0.0	0.0	0.0	25.0	64.5	18.5	16.7	50.0	5.0	0.0	0.0
4. Importer's currency	---	41.2	9.1	0.0	0.0	---	48.1	0.0	0.0	45.0	0.0	0.0
5. Others	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42.9	0.0
Local agencies (no capital ties)												
# of answers	31	17	8	14	19	46	17	12	14	28	20	15
1. JPY	38.7	52.9	50.0	85.7	63.2	45.7	47.1	83.3	85.7	53.6	65.0	73.3
2. USD	61.3	29.4	50.0	14.3	36.8	6.5	23.5	16.7	7.1	35.7	25.0	26.7
3. Euro	0.0	0.0	0.0	0.0	0.0	47.8	0.0	0.0	7.1	0.0	0.0	0.0
4. Importer's currency	---	17.6	0.0	0.0	0.0	---	29.4	0.0	0.0	10.7	5.0	0.0
5. Others	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese trading companies												
# of answers	25	12	8	11	12	20	8	12	11	14	4	15
1. JPY	56.0	58.3	37.5	54.5	75.0	45.0	62.5	58.3	72.7	78.6	75.0	86.7
2. USD	44.0	16.7	62.5	45.5	25.0	0.0	0.0	41.7	9.1	21.4	25.0	13.3
3. Euro	0.0	8.3	0.0	0.0	0.0	55.0	25.0	0.0	18.2	0.0	0.0	0.0
4. Importer's currency	---	16.7	0.0	0.0	0.0	---	12.5	0.0	0.0	0.0	0.0	0.0
5. Others	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Others												
# of answers	30	11	14	10	8	29	15	10	9	14	6	9
1. JPY	43.3	27.3	50.0	80.0	62.5	48.3	40.0	60.0	55.6	71.4	50.0	66.7
2. USD	56.7	54.5	50.0	20.0	37.5	24.1	20.0	30.0	22.2	28.6	33.3	33.3
3. Euro	0.0	0.0	0.0	0.0	0.0	27.6	20.0	10.0	22.2	0.0	0.0	0.0
4. Importer's currency	---	18.2	0.0	0.0	0.0	---	20.0	0.0	0.0	0.0	0.0	0.0
5. Others	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: The share of invoice currency is obtained by calculating the simple arithmetic average of the main invoice currency by trading partner and by destination country.

Source: 2009 RIETI Survey

Table 2-7. The Choice of Invoice Currency by Trading Partner: Japanese Exports to Asian Countries

	Destination											
	China	Korea	Taiwan	Hong Kong	Singapore	Thailand	Malaysia	Indonesia	Philippines	Vietnam	India	Mid-East countries
Number of respondents		131	135	96	93	110	82	77	65	56	65	57
Subsidiaries(plants)												
# of answers	93	23	36	10	12	62	35	30	16	17	15	2
1. JPY	51.6	56.5	63.9	20.0	58.3	58.1	51.4	46.7	37.5	29.4	73.3	50.0
2. USD	45.2	30.4	30.6	70.0	41.7	30.6	45.7	43.3	56.3	64.7	20.0	50.0
3. Euro	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Importer's currency	3.2	13.0	5.6	10.0	0.0	11.3	2.9	10.0	6.3	0.0	6.7	0.0
5. Others	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subsidiaries(sales)												
# of answers	75	37	44	53	48	28	14	14	9	9	10	9
1. JPY	42.7	64.9	52.3	32.1	37.5	57.1	57.1	35.7	44.4	77.8	60.0	33.3
2. USD	57.3	29.7	40.9	60.4	54.2	32.1	42.9	57.1	55.6	22.2	30.0	66.7
3. Euro	0.0	0.0	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0
4. Importer's currency	0.0	5.4	6.8	5.7	8.3	10.7	0.0	7.1	0.0	0.0	0.0	0.0
5. Others	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Local agencies (no capital ties)												
# of answers	41	63	65	33	34	31	32	23	26	20	21	25
1. JPY	68.3	73.0	66.2	60.6	85.3	87.1	68.8	69.6	76.9	75.0	71.4	68.0
2. USD	29.3	23.8	32.3	39.4	11.8	12.9	31.3	30.4	23.1	25.0	28.6	32.0
3. Euro	0.0	1.6	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Importer's currency	2.4	1.6	0.0	0.0	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5. Others	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese trading companies												
# of answers	47	28	29	10	16	21	14	23	16	19	20	26
1. JPY	76.6	82.1	79.3	70.0	68.8	76.2	71.4	82.6	87.5	78.9	90.0	65.4
2. USD	21.3	17.9	20.7	20.0	25.0	23.8	28.6	8.7	12.5	21.1	10.0	30.8
3. Euro	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8
4. Importer's currency	2.1	0.0	0.0	10.0	6.3	0.0	0.0	8.7	0.0	0.0	0.0	0.0
5. Others	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Others												
# of answers	39	45	33	20	18	27	24	21	19	18	22	16
1. JPY	56.4	68.9	60.6	45.0	88.9	70.4	62.5	71.4	68.4	72.2	86.4	37.5
2. USD	43.6	28.9	39.4	50.0	11.1	29.6	37.5	28.6	31.6	27.8	13.6	37.5
3. Euro	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.5
4. Importer's currency	0.0	2.2	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.5
5. Others	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: The share of invoice currency is obtained by calculating the simple arithmetic average of the main invoice currency by trading partner and by destination country.

Source: 2009 RIETI Survey

2-4. Choice of Invoice Currency by Production Subsidiaries

By the questionnaire survey, we also obtained the information on where and in which currency Japanese production subsidiaries export their products. Since Japanese firms have built a regional production network in Asia, such information will reveal the firms invoicing behavior in production chain or in triangular trade that is a well-known trade pattern in Asia. As shown in Appendix Table A-2, Japanese production subsidiaries are located mainly in Asian countries. A

question is how these production subsidiaries in Asia choose invoice currency in both imports and exports.

Table 2-8 presents the main invoice currency in Japanese exports to two types of production subsidiaries in Asia. The first type is the production subsidiaries that mainly sell their products to the local market, and the second one is the subsidiaries that export their products to other countries. Interestingly, 67 percent (113 out of 168) are invoiced in the yen in Japanese firm's exports to the first type (the local sales oriented production subsidiaries), but the corresponding share declines to 51 percent (88 out of 172) in Japanese exports to the second type (the export oriented production subsidiaries). This observation suggests that the share of yen invoicing will be declining if Japanese exports are toward the export-oriented production subsidiaries.

Table 2-8: Main Invoice Currency in Japanese Exports to Production Subsidiaries in Asia

	Destination											
	Asia	China	Hong Kong	Taiwan	Korea	Singapo-re	Malaysia	Thailand	Indonesia	Philippi-nes	Vietnam	India
Number of respondents	340	93	8	36	23	14	36	62	30	12	14	12
1) Exports to Production Subsidiaries (Local Sales Oriented)												
Total number of answers	168	43	4	17	13	5	18	29	16	5	7	11
1. JPY	113	26	2	12	7	2	11	20	11	4	7	11
2. USD	45	15	2	4	5	3	5	6	4	1	0	0
3. Euro	0	0	0	0	0	0	0	0	0	0	0	0
4. Importer's currency	9	2	0	1	1	0	1	3	1	0	0	0
5. Others	0	0	0	0	0	0	0	0	0	0	0	0
2) Exports to Production Subsidiaries (Export Oriented)												
Total number of answers	172	50	4	19	10	9	18	33	14	7	7	1
1. JPY	88	22	4	11	6	7	7	16	3	5	6	1
2. USD	74	27	0	7	2	2	11	13	9	2	1	0
3. Euro	0	0	0	0	0	0	0	0	0	0	0	0
4. Importer's currency	10	1	0	1	2	0	0	4	2	0	0	0
5. Others	0	0	0	0	0	0	0	0	0	0	0	0

Note: The number of answers is reported.

Source: 2009 RIETI Survey.

Table 2-9 reports the invoicing pattern of production subsidiaries in China by destination. Notably, the US dollar is the most frequently used currency by Japanese production subsidiaries in China. Even in exports of the production subsidiaries to Japan, only one-third (14 out of 35) are invoiced in the yen and the rest of exports (20 out of 35) are mostly in US dollars. For other destination, the yen is used only in a few cases. In contrast, the US dollar is mainly used in the subsidiaries' exports to Asia (83 percent; 20 out of 24) and even to Euro area (57 percent; 8 out of 14). Such an invoicing pattern is also observed in Japanese production subsidiaries in Thailand (see Appendix Table A-3).

Thus, triangular trade by Japanese production subsidiaries is likely to facilitate not yen

invoicing but US dollar invoicing. Growing and deepening production network of Japanese firms ironically prevents yen invoicing trade and strengthens the dollar invoicing transactions.

Result 9: Japanese production subsidiaries in Asia have a strong tendency to choose US dollar invoicing in their exports to foreign countries.

Table 2-9. Choice of Invoice Currency in Exports of Japanese Production Subsidiaries in China

Invoice currency choice in exports from plants in China to each destination
[# of "main currency," most frequently used currency in exports from plants in China to each destination / total number of answers]

Destination	Japan	US	Canada	Mexico	Brazil	Central & Latin America	Euro Area	UK	Russia	East Europe	Austlaria	New Zealand	Africa
# of answers	35	17					14		1		1		
A. JPY	[14/35]						[1/14]						
B. USD	[20/35]	[17/17]					[8/14]		[1/1]		[1/1]		
C. Euro	[1/35]						[5/14]						
D. Chinese Yuan													
E. Importer's currency													

Destination	Asia	China	Korea	Taiwan	Hong Kong	Singapore	Thailand	Malaysia	Indonesia	Philipine	Vietnam	India	Mid-East Asia
# of answers	24	---	4	4	9	2	1	1	1				2
A. JPY	[2/24]	---	[1/4]		[1/9]								
B. USD	[20/24]	---	[3/4]	[3/4]	[7/9]	[2/2]	[1/1]	[1/1]	[1/1]				[2/2]
C. Euro		---											
D. Chinese Yuan	[2/24]	---		[1/4]	[1/9]								
E. Importer's currency		---											

Note: The number of answers is reported.

Source: 2009 RIETI Survey.

3. Empirical Results

3-1. Empirical Framework

We conduct Probit estimation of the following equation to test the firm-level determinants of invoice currency:

$$\Pr(Currency_{i,j,k}) = a_0 + a_1 Country_{i,j,k} + a_2 Commodity_{i,j,k} + a_3 Channel_{i,j,k} + a_4 Company_{i,j,k} + \varepsilon_{i,j,k}, \quad (1)$$

where the dependent variable takes the value of one if the firm *i* chooses a particular currency, e.g. yen, as the "main invoice currency", the most frequently used currency, in Japanese exports to trading partner *k* in destination country *j*, and zero if the currency is not chosen as the main invoice currency.

The explanatory variables in the right hand side are categorized into four groups of variables and an error term, $\varepsilon_{i,j,k}$.

Country is a vector of variables to capture the country specific characteristics in terms of foreign exchange transactions. First, we test the hypothesis that the higher (lower) the hedging cost between the yen and the importer's currency, the lower (higher) the share of importer's currency invoicing is. As an explanatory variable, we use a bid-ask spread of outright three month forward transactions between the yen and the importing country's currency as of April 2009 as a straightforward proxy for the cost of exchange rate hedging. The data is taken from *Datastream* of Thomson-Reuters. Second, to take into account the effect of accessibility to the multi-currency cash settlement system, we include a dummy variable that takes one if the country has a membership in the Continuous Linked Settlement (CLS) Bank, and otherwise zero[7]. By satisfying the qualifications such as the deregulation of capital account transactions and the sovereign rating of government bonds, the CLS Bank member countries can reduce the cost of foreign exchange settlements by accessing to the multi-currency cash settlement system. Thus, we consider the dummy for the CLS Bank membership to be a useful measure of the cost of settlements by the importer's currency. Finally, we put a dummy variable for *de facto* dollar peg countries as of 2009, which includes China, Taiwan, and Hong Kong.

Commodity is a vector of variables to control for commodity/product characteristics. First, to test whether Japanese firms tend to choose yen invoicing in their exports of highly differentiated and strongly competitive goods, we set up a dummy variable for differentiated export goods. We identify the sample firm's export products listed in their financial statement and check whether these products conform to the Rauch's (1990) index based on SITC (Standard International Trade Classification) Rev.2.[8] The dummy takes the value of one if these products are regarded as the differentiated ones according to the Rauch index, and zero otherwise. Second, we construct a dummy for top share goods which is a proxy for the firm's competitiveness in the global market. We check whether the sample firm's export products listed in their financial statement match the world top share goods listed in *Nihon Shoken Journal* (NSJ).[9] The variable takes one if firms export the product(s) that account(s) for the largest share in the global market, and zero otherwise. Finally, we use a dummy variable for exports of intermediate goods obtained from our questionnaire survey.

Channel is a vector of variables that allow for different trade channels by trading

[7] The CLS Bank had 17 currencies in its membership as of 2009 including currencies of Japan, US, Euro Area, UK, Switzerland, Canada, Australia, Singapore, Demark, Sweden, Norway, Hong Kong, New Zealand, South Korea, South Africa, Israel, and Mexico.

[8] Rauch (1990) divides traded goods into three types; differentiated goods, reference priced goods (for instance in trade journals), and goods with prices that are set on organized exchanges.

[9] The NSJ releases a list of Japanese listed companies that have the world's top share goods as of 2008.

partner. We put dummy variables for four different trading partners: production subsidiaries, sales subsidiaries, *Sogo Shosha* (Japanese trading companies), and others, assuming exports to local trading agencies to be a benchmark. The coefficients of dummies for production and sales subsidiaries will show possible difference in currency invoicing decision between intra-firm and arms-length exports. In addition, we set up a dummy for production subsidiaries that export their products to other countries. By taking the interaction term between this dummy variable and the dummy for production subsidiaries, we show whether the choice of invoice currency is affected by the Japanese exports to the production subsidiaries that have a high export propensity. Finally, while both dummies for production subsidiaries and sales subsidiaries are regarded as a proxy for intra-firm trade, we additionally set up a dummy for subsidiaries wholly owned by Japanese head office. By taking the interaction term between this dummy variable and the dummy for production or sales subsidiaries, we will test whether strength of capital tie between Japanese head office and local subsidiaries affects currency invoicing decision in Japanese exports.

Company is a vector of variables to control for selected characteristics of the firm. First, the natural log of consolidated sales is used to control for the firm size, the data of which is taken from the annual financial statement of sample firms as of fiscal year 2008. We also consider two measures of the firm's capacity of exchange rate risk management. In the questionnaire survey, we asked whether the firms use currency hedging instruments through the exchange rate market including forward, currency option, and other currency derivatives, and/or operational hedging instrument like "marry" and "netting". Measures are taken from these survey results. The dummy for market hedging takes one if firms use any tools of hedging in the market to manage their exchange rate risk. The dummy for operational hedging takes one if firms use operational hedging such as "marry and netting," by which firms can offset the same amounts of exports and imports denominated in the same currency and minimize the exchange rate risk exposure. By using these dummies, we test whether the sample firm's capacity to manage currency risk affects the choice of invoice currency. Lastly, we include industry dummies to allow for possible differences across 16 industries. The details of the 16 industries are reported in Table 2-1. We set up the dummies for 15 industries by assuming the transport equipment industry to be a benchmark.

3-2. Results of Estimation

Determinants of Invoice Currency in Japanese Exports to All Countries

In Table 3-1, we present the results of estimation where exports to all destinations are

included in the sample. The dependent variable is the choice of the yen as the main invoice currency in specifications (1) through (4), the US dollar in (5) through (8), and the importer's currency in (9) through (12), respectively. Estimated coefficients are reported as marginal effects. The pseudo R-squared takes values from 0.12 to 0.38.

Let us first look at values in the third line that show how many exports by trade partner are invoiced in each currency. The numbers of observations that are invoiced in the yen are 1222 (54% to total observations), 816 (36%) in the US dollar, and 394 (17%) in the importer's currency, respectively.[10] These numbers are consistent with those of the firm-level evidence shown in Table 2-2, which indicates that the yen invoicing in is more prevalent than US dollar in terms of the number.

Second, we evaluate the estimated coefficients of the explanatory variables included in the *Country* vector. The coefficient of the Bid-Ask spread is positive and strongly significant in specifications (1) through (3) in the yen invoicing regression, and negative and strongly significant in (5) through (12) in the dollar invoicing regression and the importer's currency invoicing regression. These results clearly show that an increase in hedging costs of the importer's currency tends to promote yen-invoicing and to lower the US dollar invoicing and importer's currency invoicing. The coefficient of the dummy for multicurrency cash settlement is also statistically significant in all specifications. Among the CLS Bank member countries, costs of settlements by foreign currencies can be reduced by fully utilizing the multi-currency cash settlement system, which likely promotes US dollar invoicing and importer's currency invoicing. Interestingly, the estimated coefficient calculated as marginal effects (0.18) in the importer's currency regression is larger than that in the US dollar invoicing regression (0.04), which suggests that the participation in the multi-currency cash settlement system is likely to increase importer's currency invoicing rather than US dollar invoicing. The dummy for US dollar peg country/region has negative and statistically significant coefficients in the importer's currency invoicing regression, while it has positive but insignificant coefficients in yen invoicing and US dollar invoicing regressions.

Third, among explanatory variables included in the *Commodity* vector, coefficients of both dummies for the differentiated goods (Rauch) and the world's top share goods are positive and strongly significant in the yen invoicing regression. This result is consistent with the existing literature that has found positive impact of product differentiation and the world market share on the home currency invoicing. The dummy for intermediate goods has negative impacts on yen invoicing and positive impacts on dollar invoicing with the strongly significant level, which suggests that exports of intermediate goods are different from those of final goods in

[10] The number of the importers currency invoicing includes that of US dollar invoicing in export to the US.

terms of currency invoicing decision.

Forth, regarding the trading partner dummies in the *Channel* vector, in the specification without any interaction terms, (1), (5) and (9), coefficients of both dummies for export to product subsidiaries and sales subsidiaries are negative and highly significant in the yen invoicing regression, while positive and strongly significant in the dollar invoicing and importer's currency invoicing regressions. Estimated coefficients calculated as marginal effects show that exports to production subsidiaries and exports to sales subsidiaries decrease probability of yen invoicing by 17 percent and 29 percent, respectively, as compared to exports to local trading agencies. In contrast, the intra-firm exports significantly promote dollar invoicing and importer's currency invoicing. Among the arms-length trade, coefficients of exports via *Sogo Shosha* (Japanese trading companies) are positive and statistically significant in the yen invoicing regression and significantly negative in the dollar invoicing regression, while having no significant impact on importer's currency invoicing. Thus, exports via *Sogo Shosha* increase the probability of yen invoicing by 29 percent and decrease that of dollar invoicing by 15 percent, respectively, as compared to the exports to local trading agencies. These results strongly suggest that invoicing choice depends on whether it is intra-firm trade or arms-length trade.

For the further check of significant difference in invoicing choice between intra-firm trade and arms-length trade, we focus on two kinds of interaction terms related to intra-firm trade. First, by using the interaction term between the dummy for subsidiaries exporting to other country and the share of exports to production subsidiaries, we can make a distinction in the invoicing choice between Japanese exports to the local sales oriented production subsidiaries and those to the export oriented production subsidiaries. The interaction term takes negative and highly significant coefficient in the yen invoicing regression and significantly positive coefficient in the dollar invoicing regression, while positive but insignificant coefficient in the importer's currency regression. This result shows that the yen is less used for trade invoicing if Japanese firms export their products to overseas production subsidiaries that have high export propensity. Second, by including the interaction term between the dummy for subsidiaries wholly owned by Japanese head office and the dummy for intra-firm exports, we can test whether close capital ties affect the choice of invoice currency. The estimated coefficients are negative and statistically significant only in the yen invoicing regression. These additional results provide strong evidence that the invoicing choice depends significantly on the trade channel and distinction between the intra-firm trade and the arms-length trade.

Finally, among firm characteristics variables included in the *Company* vector, the firm size measured by the natural log of total consolidated sales, is negative and statistically significant at the 1 percent level in the yen invoicing regression, and negative and significant at

5 percent or 10 percent level in the dollar invoicing regression after controlling for the industry dummies taking the transportation machinery as a benchmark. This result indicates that an increase in the firm size in terms of consolidated sales lowers yen invoicing exports and increases dollar invoicing exports. We also include two measures of firm's capacity to manage exchange rate risk in the specifications (4), (8) and (12). Both market hedging and operational hedging dummies have significantly negative coefficients in the yen invoicing regression and significantly positive coefficients in the dollar invoicing regression. Interestingly, coefficients of the natural log of consolidated sales are insignificant if two measures of exchange rate management are included, which suggests that large-size firms with the capacity to use various hedging instruments are more likely to choose the dollar invoicing rather than yen invoicing. Thus, in light of exchange rate risk management, the firm size does matter in the choice of invoice currency.

Table 3-1. Determinants of currency invoicing in exports to all countries/region

Dependent variable	Prob(Japanese Yen = 1)				Prob(US dollar = 1)				Prob(importer's currency = 1)			
Number of Observations	2261				2261				2263			
Number of samples that dependent variable =1	1222				816				394			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Country characteristics												
Bid-Ask Spread (vis-à-vis JPY, 3 months)	0.256*** (0.032)	0.259*** (0.032)	0.250*** (0.033)	0.264*** (0.033)	-0.122*** (0.030)	-0.124*** (0.030)	-0.120*** (0.031)	-0.126*** (0.031)	-0.191*** (0.022)	-0.191*** (0.022)	-0.191*** (0.022)	-0.191*** (0.022)
Dummy for multi-currency cash settlement	-0.199*** (0.024)	-0.201*** (0.024)	-0.191*** (0.024)	-0.201*** (0.024)	0.046** (0.037)	0.048** (0.023)	0.044* (0.023)	0.046** (0.023)	0.189*** (0.017)	0.189*** (0.017)	0.189*** (0.017)	0.189*** (0.017)
Dummy for US dollar peg countries/region	0.042 (0.028)	0.044 (0.028)	0.047 (0.028)	0.047 (0.029)	0.037 (0.027)	0.035 (0.027)	0.034 (0.027)	0.034 (0.027)	-0.108*** (0.011)	-0.108*** (0.011)	-0.109*** (0.011)	-0.108*** (0.011)
Commodity/Product characteristics												
Dummy for differentiated goods (Rauch)	0.329*** (0.038)	0.330*** (0.038)	0.329*** (0.038)	0.313*** (0.039)	-0.310*** (0.041)	-0.310*** (0.041)	-0.310*** (0.041)	-0.295*** (0.0422)	-0.016 (0.022)	-0.017 (0.022)	-0.017 (0.023)	-0.015 (0.022)
Dummy for World's Top share goods	0.093** (0.042)	0.098** (0.042)	0.114*** (0.042)	0.084* (0.043)	-0.051 (0.037)	-0.055 (0.037)	-0.061 (0.037)	-0.039 (0.038)	-0.032* (0.013)	-0.032* (0.013)	-0.032* (0.013)	-0.031* (0.013)
Dummy for intermediate goods	-0.112*** (0.029)	-0.108*** (0.029)	-0.104*** (0.029)	-0.101*** (0.029)	0.121*** (0.028)	0.117*** (0.028)	0.116*** (0.028)	0.112*** (0.028)	0.013 (0.014)	0.013 (0.014)	0.012 (0.014)	0.012 (0.014)
Trade channnel dummies												
Export to Product subsidiaries	-0.170*** (0.039)	-0.094** (0.046)	-0.053 (0.051)	-0.096** (0.046)	0.098*** (0.038)	0.037 (0.044)	0.020 (0.048)	0.041 (0.044)	0.148*** (0.035)	0.141*** (0.038)	0.131*** (0.042)	0.139*** (0.038)
*Export to other countries		-0.162*** (0.049)	-0.149*** (0.050)	-0.158*** (0.049)		0.126*** (0.049)	0.120** (0.049)	0.116** (0.049)		0.009 (0.023)	0.007 (0.023)	0.010 (0.024)
*Export to 100% subsidiaries			-0.101** (0.051)				0.040 (0.048)				0.012 (0.025)	
Export to Sales subsidiaries	-0.290*** (0.031)	-0.293*** (0.172)	-0.239*** (0.045)	-0.286*** (0.031)	0.219*** (0.032)	0.220*** (0.032)	0.194*** (0.045)	0.213*** (0.032)	0.152*** (0.027)	0.152*** (0.027)	0.161*** (0.038)	0.152*** (0.027)
*Export to 100% subsidiaries			-0.086* (0.050)				0.038 (0.045)				-0.006 (0.019)	
Export via Sogo Shosha	0.171*** (0.037)	0.172*** (0.037)	0.173*** (0.037)	0.166*** (0.038)	-0.151*** (0.033)	-0.151*** (0.033)	-0.151*** (0.033)	-0.145*** (0.033)	-0.008 (0.018)	-0.008 (0.018)	-0.008 (0.018)	-0.009 (0.018)
Export to Other customers	-0.000 (0.036)	-0.000 (0.036)	-0.001 (0.036)	-0.002 (0.037)	0.029 (0.035)	0.029 (0.035)	0.029 (0.035)	0.034 (0.035)	-0.019 (0.016)	-0.019 (0.016)	-0.019 (0.016)	-0.019 (0.016)
Company characteristics												
Log of Consolidated Sales	-0.026*** (0.007)	-0.024*** (0.007)	-0.026*** (0.007)	-0.000 (0.008)	0.013** (0.006)	0.012* (0.006)	0.012* (0.006)	-0.010 (0.007)	-0.003 (0.003)	-0.003 (0.003)	-0.003 (0.003)	-0.003 (0.003)
Dummy for company engaging market hedging activities				-0.067** (0.029)				0.061** (0.026)				0.006 (0.012)
Dummy for company engaging operational headging activities				-0.146*** (0.027)				0.151*** (0.025)				-0.002 (0.012)
Industry Dummy												
Foods	-0.345*** (0.096)	-0.339*** (0.099)	-0.331*** (0.110)	-0.349*** (0.095)	0.447*** (0.094)	0.439*** (0.096)	0.437*** (0.096)	0.454*** (0.092)	-0.034 (0.031)	-0.034 (0.031)	-0.035 (0.030)	-0.035 (0.030)
Textiles & Apparel	-0.121 (0.076)	-0.103 (0.077)	-0.095 (0.077)	-0.121 (0.078)	0.183** (0.076)	0.168** (0.076)	0.165** (0.076)	0.186** (0.078)	-0.045* (0.016)	-0.046* (0.015)	-0.046* (0.013)	-0.047* (0.015)
Chemicals	-0.087* (0.049)	-0.068 (0.049)	-0.060 (0.049)	-0.099** (0.049)	0.118** (0.048)	0.104** (0.048)	0.101** (0.049)	0.141*** (0.049)	-0.045*** (0.013)	-0.045*** (0.013)	-0.046*** (0.013)	-0.046*** (0.013)
Pharmaceuticals	-0.309*** (0.087)	-0.295*** (0.090)	-0.277*** (0.093)	-0.255** (0.097)	0.324*** (0.099)	0.311*** (0.101)	0.303*** (0.102)	0.279*** (0.105)	0.005 (0.054)	0.003 (0.053)	0.001 (0.052)	0.001 (0.052)
Oil & Coal									-0.022 (0.095)	-0.022 (0.094)	-0.023 (0.093)	-0.024 (0.092)
Rubber Products	-0.141 (0.097)	-0.117 (0.099)	-0.114 (0.099)	-0.170* (0.097)	0.210** (0.098)	0.189* (0.099)	0.188* (0.099)	0.258*** (0.098)	-0.023 (0.032)	-0.024 (0.032)	-0.023 (0.032)	-0.026 (0.031)
Glass & Ceramics	-0.132 (0.081)	-0.107 (0.083)	-0.099 (0.083)	-0.127 (0.083)	0.173** (0.085)	0.152* (0.085)	0.149* (0.086)	0.185** (0.087)	-0.038 (0.020)	-0.039 (0.019)	-0.039 (0.019)	-0.040 (0.019)
Steel Products	-0.041 (0.147)	-0.027 (0.146)	-0.022 (0.146)	-0.136 (0.145)	0.086 (0.145)	0.077 (0.145)	0.075 (0.145)	0.195 (0.149)	-0.025 (0.047)	-0.025 (0.047)	-0.025 (0.047)	-0.025 (0.047)
Nonferrous Metals	-0.085 (0.101)	-0.069 (0.101)	-0.065 (0.101)	-0.134 (0.100)	0.145 (0.102)	0.133 (0.102)	0.131 (0.102)	0.206** (0.103)	0.007 (0.051)	0.006 (0.050)	0.005 (0.050)	0.004 (0.050)
Metal Products	0.167** (0.060)	0.184*** (0.059)	0.182*** (0.060)	0.096 (0.068)	-0.025 (0.063)	-0.039 (0.062)	-0.038 (0.062)	0.063 (0.071)	-0.064*** (0.008)	-0.064*** (0.008)	-0.064*** (0.008)	-0.064*** (0.008)
Machinery	0.038 (0.045)	0.059 (0.045)	0.067 (0.045)	0.050 (0.046)	-0.034 (0.042)	-0.050 (0.042)	-0.053 (0.042)	-0.037 (0.044)	-0.027* (0.014)	-0.028* (0.014)	-0.029* (0.014)	-0.030* (0.015)
Electrical Machinery	-0.146*** (0.042)	-0.119*** (0.043)	-0.109** (0.044)	-0.086* (0.044)	0.213*** (0.042)	0.191*** (0.043)	0.187*** (0.043)	0.161*** (0.043)	-0.056*** (0.013)	-0.057*** (0.013)	-0.058*** (0.013)	-0.058*** (0.013)
Precision Instruments	0.017 (0.060)	0.044 (0.060)	0.045 (0.060)	0.028 (0.060)	0.104* (0.060)	0.082 (0.060)	0.082 (0.061)	0.109* (0.061)	-0.066*** (0.008)	-0.066*** (0.008)	-0.066*** (0.008)	-0.066*** (0.008)
Other Products	-0.233*** (0.072)	-0.219*** (0.073)	-0.210*** (0.074)	-0.192** (0.076)	0.259*** (0.076)	0.246*** (0.077)	0.241*** (0.077)	0.217*** (0.079)	-0.018 (0.026)	-0.019 (0.026)	-0.019 (0.026)	-0.020 (0.026)
Pseudo R-squared	0.176	0.179	0.181	0.190	0.125	0.127	0.127	0.141	0.384	0.384	0.385	0.384

Note:

1) Dependent variable: Probability of the choice of invoice currency in Japan's exports to each destination by trade channel.

2) Destination: US, Canada, Euro area, UK, Australia, China, Hong Kong, Taiwan, Korea, Philippines, Vietnam, Singapore, Thailand, Malaysia, Indonesia, and India.

3) Method: Probit estimation.

4) The marginal effect and the standard errors (in parentheses) are reported in each column.

5) Asterisk(s), ***, **, and * denote the 1 percent, 5 percent and 10 percent significance level, respectively.

Determinants of Invoice Currency in Japanese Exports to Advanced and Asian Countries

We also run the Probit estimation for two sub-samples: the first sub-sample covers Japanese exports to five advanced economies that have international currencies with full convertibility, and the second one exports to all Asian countries. The estimated results using sub-samples are reported in Table 3-2, and enable us to show marked differences in invoicing decision between the above two destinations.

First, values in the third line shows how many exports by trade partner are invoiced in each currency in the sample of each destination. Among exports to Advanced economies, the numbers of observations that are invoiced in the yen are 214 (33% to total observations in export to Advanced economies), 269 (41%) in the US dollar, and 345 (53%) in the importer's currency, respectively.[11] In contrast, among exports to Asian countries, the number of observations that are invoiced in the importers currency is only 49 (3% to total observations in export to Asian countries) while 1008 (62%) in the yen and 547 (34%) in the US dollar, respectively. In this sense, we confirm that the importer's currency invoicing is much more significant in the export to advanced economies than the export to Asian countries, and the US dollar invoicing is more important for export to Asian countries.

Second, the coefficient of the world top share dummy is highly significant in exports to advanced economies but insignificant in exports to Asian countries. The export competitiveness with a large market share is clearly an important determinant of invoicing choice in exports to advanced countries, but such strong competitiveness does not necessarily affect the choice of currency invoicing in exports to Asian countries. In contrast, the coefficient of the differentiated good dummy is highly significant in export to Asian countries but insignificant in exports to advanced economies. These results suggest that among the characteristics related to the product competitiveness, the product differentiability is a more sensitive factor to the choice of yen invoicing in exports to Asian countries while significantly dominant share in the World trade market is more important in promoting yen invoicing in export to advanced economies.

[11] The number of the importers currency invoicing includes that of US dollar invoicing in export to the US.

Third, the interaction term between the dummy for export to other countries and the dummy for export to production subsidiaries does not show any significant coefficients in exports to advanced economies, but negative and significant coefficients in exports to Asian countries. Moreover, when including the above interaction term in exports to Asian countries, the dummy for exports to production subsidiaries becomes insignificant in both the yen invoicing regression and the dollar invoicing regression, which indicates that Japanese exporters tend to lower (increase) yen (dollar) invoicing transactions only in exports to the export oriented production subsidiaries, which is consistent with our findings from Tables 2-8 and 2-9. Thus, Japanese production network built in Asia, characterized by the unique triangular trade by Japanese production subsidiaries, tends to lower the yen invoicing transactions, given exports of production subsidiaries in Asia are typically invoiced in US dollars as shown in Table 2-9.

Finally, coefficients of both market hedging and operational hedging dummies are insignificant in most exports to advanced economies, but coefficients of two dummies are statistically significant in exports to Asian countries in both yen and dollar invoicing regressions. This evidence suggests that hedging activities play more important role in the invoicing choice of Japanese exports to Asian countries mainly due to the relatively large currency risk in trade with Asian countries.

Table 3-2. Determinants of currency invoicing in exports to advanced economies and Asian countries

Export destination	Advanced economies						Asian countries					
Dependent variable	Prob(Japanese Yen = 1)		Prob(US dollar = 1)		Prob(importer's currency = 1)		Prob(Japanese Yen = 1)		Prob(US dollar = 1)		Prob(importer's currency = 1)	
Number of Observations	648		653		650		1608		1608		1445	
Number of samples that dependent variable =1	214		269		345		1008		547		49	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Country characteristics												
Bid-Ask Spread (vis-à-vis JPY, 3 months)	1.287***	1.324***	-3.305***	-3.343***	-5.579***	-5.611***	0.084**	0.087**	-0.092**	-0.094**	0.001	0.001
	(0.447)	(0.449)	(0.494)	(0.497)	(0.584)	(0.587)	(0.040)	(0.041)	(0.040)	(0.040)	(0.008)	(0.007)
Dummy for multi-currency cash settlement							-0.061*	-0.056*	0.033	0.028	0.021**	0.021**
							(0.033)	(0.034)	(0.032)	(0.032)	(0.010)	(0.010)
Dummy for US dollar peg countries/region							-0,050	-0.049	0.052*	0.051*	-0.003	-0.003
							(0.031)	(0.031)	(0.030)	(0.030)	(0.006)	(0.006)
Commodity/Product characteristics												
Dummy for differentiated goods (Rauch)	0.106	0.102	-0.160**	-0.161**	-0.015	-0.005	0.402***	0.384***	-0.393***	-0.368***	0.008	0.005
	(0.064)	(0.065)	(0.079)	(-.079)	(0.086)	(0.086)	(0.047)	(0.048)	(0.049)	(0.051)	(0.010)	(0.011)
Dummy for World's Top share goods	0.266***	0.267***	-0.133*	-0.132*	-0.211**	-0.192**	0.037	0.026	-0.030	-0.014	-0.003	-0.005
	(0.086)	(0.088)	(0.069)	(0.070)	(0.079)	(0.083)	(0.046)	(0.047)	(0.043)	(0.045)	(0.009)	(0.008)
Dummy for intermediate goods	-0.099*	-0.100*	0.128**	0.130**	0.016	0.012	-0.101***	-0.083**	0.107***	0.091***	-0.001	-0.007
	(0.048)	(0.048)	(0.056)	(0.056)	(0.061)	(0.062)	(0.033)	(0.033)	(0.032)	(0.033)	(0.006)	(0.006)
Trade channnel dummies												
Export to Product subsidiaries	-0.142**	-0.109	0.039	0.006	0.192**	0.184**	-0.148***	-0.071	0.091**	0.026	0.083***	0.062***
	(0.058)	(0.071)	(0.079)	(0.088)	(0.077)	(0.088)	(0.045)	(0.053)	(0.044)	(0.051)	(0.037)	(0.034)
*Export to other countries		-0.094		0.088		-0.011		-0.166***		0.136**		0.017
		(0.092)		(0.111)		(0.121)		(0.057)		(0.057)		(0.016)
Export to Sales subsidiaries	-0.311***	-0.308***	0.194***	0.189***	0.328***	0.319***	-0.239***	-0.237***	0.189***	0.187***	0.064***	0.067***
	(0.043)	(0.043)	(0.058)	(0.059)	(0.056)	(0.057)	(0.040)	(0.041)	(0.040)	(0.041)	(0.021)	(0.030)
Export via Sogo Shosha	0.213***	0.209***	-0.167**	-0.160**	-0.163**	-0.168**	0.159***	0.155***	-0.161***	-0.157***	0.020	0.020
	(0.075)	(0.075)	(0.069)	(0.070)	(0.079)	(0.079)	(0.039)	(0.040)	(0.036)	(0.036)	(0.021)	(0.021)
Export to Other customers	0.040	0.043	0.021	0.019	-0.142*	-0.149**	-0.025	-0.020	0.026	0.037	-0.003	-0.002
	(0.062)	(0.063)	(0.070)	(0.070)	(0.074)	(0.074)	(0.008)	(0.042)	(0.041)	(0.041)	(0.012)	(0.012)
Company characteristics												
Log of Consolidated Sales	-0.036***	-0.028**	0.002	-0.006	0.023	0.015	-0.025***	0.005	0.027***	-0.004	-0.001	-0.000
	(0.012)	(0.014)	(0.013)	(0.015)	(0.014)	(0.016)	(0.008)	(0.009)	(0.007)	(0.009)	(0.001)	(0.002)
Dummy for company engaging market hedging activities		-0.012		-0.003		0.073		-0.081**		0.100***		-0.008
		(0.049)		(0.053)		(0.058)		(0.032)		(0.030)		(0.008)
Dummy for company engaging operational headging activities		-0.047		0.080*		0.012		-0.178***		0.184***		-0.004
		(0.046)		(0.048)		(0.053)		(0.030)		(0.030)		(0.006)
Industry Dummy												
Foods	-0.078	-0.088	0.141	0.164	-0.043	-0.059	-0.410***	-0.405***	0.538***	0.538***		
	(0.189)	(0.186)	(0.223)	(0.220)	(0.223)	(0.223)	(0.123)	(0.124)	(0.096)	(0.097)		
Textiles & Apparel	-0.066	-0.058	0.028	0.027	0.022	0.001	-0.172	-0.185**	0.300***	0.317***	-0.014	-0.014
	(0.110)	(0.113)	(0.137)	(0.138)	(0.152)	(0.154)	(0.093)	(0.095)	(0.092)	(0.094)	(0.005)	(0.005)
Chemicals	-0.164**	-0.160**	0.014	0.017	0.148	0.141	-0.073	-0.102*	0.207***	0.250***	-0.024***	-0.025***
	(0.064)	(0.065)	(0.089)	(0.089)	(0.092)	(0.093)	(0.057)	(0.059)	(0.061)	(0.062)	(0.006)	(0.006)
Pharmaceuticals	0.063	0.090	-0.214	-0.209	0.029	0.003	-0.401***	-0.336***	0.484***	0.423***	-0.008	-0.006
	(0.229)	(0.232)	(0.176)	(0.178)	(0.242)	(0.245)	(0.101)	(0.115)	(0.092)	(0.108)	(0.011)	(0.012)
Oil & Coal					0.055	0.069						
					(0.596)	(0.594)						
Rubber Products			0.290	0.304			-0.130	-0.184*	0.256**	0.320***	-0.014	-0.014
			(0.242)	(0.243)			(0.109)	(0.111)	(0.110)	(0.108)	(0.004)	(0.004)
Glass & Ceramics	-0.074	-0.067	-0.101	-0.089	0.157	0.140	-0.179	-0.183*	0.334***	0.344***		
	(0.112)	(0.116)	(0.144)	(0.148)	(0.140)	(0.145)	(0.109)	(0.104)	(0.098)	(0.100)		
Steel Products	0.164	0.149	--0.028	-0.008	-0.181	-0.144	-0.041	-0.177	0.109	0.277*	0.003	-0.002
	(0.389)	(0.391)	(0.373)	(0.383)	(0.367)	(0.384)	(0.158)	(0.166)	(0.162)	(0.164)	(0.032)	(0.022)
Nonferrous Metals	-0.255**	-0.256**	-0.139	0.158	0.375*	0.373*	0.024	-0.040	0.090	0.170	-0.007	-0.018***
	(0.060)	(0.055)	(0.220)	(0.221)	(0.120)	(0.122)	(0.105)	(0.114)	(0.116)	(0.122)	(0.014)	(0.005)
Metal Products	0.179	0.156	-0.085	-0.052	-0.252**	-0.235*	0.0133*	0.045	0.013	0.139		
	(0.127)	(0.131)	(0.115)	(0.123)	(0.113)	(0.120)	(0.063)	(0.077)	(0.077)	(0.090)		
Machinery	-0.131**	-0.125*	-0.034	-0.031	0.169**	0.151*	0.115**	0.125**	-0.023	-0.032	-0.018***	-0.019***
	(0.060)	(0.067)	(0.077)	(0.080)	(0.079)	(0.083)	(0.048)	(0.049)	(0.054)	(0.055)	(0.006)	(0.005)
Electrical Machinery	-0.095	-0.076	0.092	0.073	-0.007	-0.027	-0.177***	-0.107**	0.300***	0.231***	-0.027***	-0.026***
	(0.064)	(0.271)	(0.076)	(0.077)	(0.081)	(-.083)	(0.051)	(0.052)	(0.053)	(0.055)	(0.007)	(0.007)
Precision Instruments	0.137	0.139	0.023	0.036	-0.251**	-0.263**	-0.034	-0.026	0.183**	0.182**	-0.019***	-0.018***
	(0.113)	(0.115)	(0.113)	(0.115)	(0.107)	(0.107)	(0.069)	(0.069)	(0.074)	(0.076)	(0.004)	(0.004)
Other Products	-0.259***	-0.254**	0.181	0.160	0.287**	0.269*	-0.180*	-0.131	0.346***	0.303***		
	(0.046)	(0.049)	(0.136)	(0.140)	(0.109)	(0.115)	(0.096)	(0.097)	(0.092)	(0.097)		
Pseudo R-squared	0.180	0.183	0.132	0.136	0.261	0.263	0.161	0.184	0.167	0.195	0.166	0.175

Note:

1) Dependent variable: Probability of the choice of invoice currency in Japan's exports to each destination by trade

channel.

2) Destination: Advanced economies (US, Canada, Euro area, UK, and Australia) and Asian countries (China, HongKong, Taiwan, Korea, Philippines, Vietnam, Singapore, Thailand, Malaysia, Indonesia, and India).

3) Method: Probit Estimation.

4) The marginal effect and the standard errors (in parentheses) are reported in each column.

5) Asterisk(s), ***, **, and * denote the 1 percent, 5 percent and 10 percent significance level, respectively.

4. Conclusion

By conducting a large-scale questionnaire survey covering all Japanese manufacturing firms listed in the stock exchanges in Japan, the detailed information is presented on the firm-level invoicing choice by destination and by type of trading partners, with a particular emphasis on the difference between arm's length and intra-firm trades. We have also shown the results of the cross-section regression analysis that investigates what determines the choice of invoice currency by Japanese export firms. We have found that the invoicing choice is strongly influenced by whether it is intra-firm trade or arms-length trade. While yen-invoicing tends to be chosen in arms-length trade, there is a strong tendency that importer's currency is used in invoicing intra-firm trade. In exports to Asian subsidiaries, US dollar as an invoicing currency is widely used. We have also revealed that the firm size does affect the choice of invoice currency, because the larger (smaller) the size of firms, the more likely Japanese firms are to conduct intra-firm (arms-length) trade. Moreover, growing and deepening regional production network in Asia is likely to discourage yen-invoiced transactions even by Japanese firms. Japanese production subsidiaries that export finished goods to the rest of the world tend to choose US dollar-invoiced transactions for their imports of semi-finished goods from Japanese parent.

A few policy implications emerge from results obtained in the paper. First, if Japanese exporters would like to increase the share of yen invoiced-trades in order to avoid currency risk, to develop and concentrate in globally competitive goods with high market shares is important. Second, it may be rational to expect that a large parent firm in Japan with diversified export destination to manage global currency risk, rather than production or sale subsidiaries abroad manage their own currency risk individually. Hence, dollar-invoiced trade between the parent and subsidiaries seems rational. Given the fact of globalized trades with cross-border supply chain, it may not be rational to expect increasing a share of yen-invoiced trades for this type of trades. Third, whether American or European global exporters behave like Japanese exporters is an interesting question. They may have power to impose the US dollar or the euro to the rest of the world, as the two currencies are global key currencies, unlike the yen; or they may behave

like Japanese globally active firms, as they have capacity to allow importers to choose invoicing currency denomination and to manage multicurrency risk at the level of parent firm. Fourth, it is also our future task to analyze Japanese importers' behavior whether they are in the position to insist the yen-invoiced trades on their trade counterpart.

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Appendix Table A1: Japanese Exports by Destination, by Trading Partner and by Firm Size

(1) Japanese Exports by Trading Partner: Advanced and Developing Countries Sample arithmetic average (%)

	Destination											
	USA	Canada	Mexico	Brazil	Central & Latin America	Euro Area	UK	Russia	Eastern Europe	Austra-lia	New Zealand	Africa
1. Large-Size Firms: Number of answers	57	28	22	28	24	52	37	16	18	35	23	21
All overseas subsidiaries (a)+(b)	77.1	45.4	46.4	58.4	28.6	69.5	66.0	25.7	46.9	42.5	39.3	19.3
(a) Subsidiaries(plants)	26.5	12.2	16.1	39.3	8.9	18.9	20.3	2.0	27.9	9.3	13.1	4.9
(b) Subsidiaries(sales)	50.5	33.1	30.4	19.1	19.7	50.6	45.7	23.7	19.1	33.2	26.2	14.4
Local agencies (no capital ties)	4.2	27.2	20.6	17.9	32.4	12.0	16.3	26.8	15.5	30.1	47.9	45.9
Japanese trading companies	7.4	11.8	13.0	11.8	22.7	4.9	1.6	28.5	26.4	15.8	4.4	25.2
Others	8.9	12.4	16.0	8.6	12.6	12.0	13.7	14.8	7.9	10.8	4.4	5.3
2. Medium-Size Firms: Number of answers	49	6	5	8	7	33	12	6	9	17	5	8
All overseas subsidiaries (a)+(b)	75.2	39.2	20.0	12.5	0.0	55.3	72.9	16.7	22.2	17.6	0.0	0.0
(a) Subsidiaries(plants)	26.8	0.0	0.0	12.5	0.0	8.5	16.7	0.0	22.2	0.0	0.0	0.0
(b) Subsidiaries(sales)	48.4	39.2	20.0	0.0	0.0	46.8	56.3	16.7	0.0	17.6	0.0	0.0
Local agencies (no capital ties)	8.7	34.2	0.0	50.0	52.9	21.7	8.3	16.7	33.3	47.1	80.0	25.0
Japanese trading companies	9.6	10.0	40.0	37.5	32.9	6.6	2.1	50.0	22.2	10.6	0.0	43.8
Others	6.5	16.7	40.0	0.0	14.3	16.4	16.7	16.7	22.2	24.7	20.0	31.3
3. Small-Size Firms: Number of answers	45	11	6	10	5	33	13	10	8	12	7	5
All overseas subsidiaries (a)+(b)	56.6	18.2	16.7	9.0	20.0	20.0	6.2	0.0	0.0	16.7	0.0	0.0
(a) Subsidiaries(plants)	6.7	9.1	0.0	9.0	0.0	5.2	0.0	0.0	0.0	8.3	0.0	0.0
(b) Subsidiaries(sales)	49.9	9.1	16.7	0.0	20.0	14.8	6.2	0.0	0.0	8.3	0.0	0.0
Local agencies (no capital ties)	19.9	54.5	33.3	60.0	60.0	48.8	55.4	60.0	62.5	41.7	57.1	60.0
Japanese trading companies	5.4	10.9	19.2	11.0	20.0	12.9	0.0	19.5	12.5	25.0	12.9	20.0
Others	18.1	16.4	30.8	20.0	0.0	18.3	38.5	20.5	25.0	16.7	30.0	20.0

(2) Japanese Exports by Trading Partner: Asian Countries

	Destination											
	China	Korea	Taiwan	Hong Kong	Singapore	Thailand	Malay-sia	Indonesia	Philippines	Vietnam	India	Middle-East
1. Large-Size Firms: Number of answers	64	56	55	45	43	49	44	40	34	28	36	31
All overseas subsidiaries (a)+(b)	63.5	34.8	52.2	63.6	60.3	62.7	54.3	52.1	45.3	41.7	44.5	16.2
(a) Subsidiaries(plants)	32.2	10.7	21.4	4.7	8.3	48.6	44.0	36.8	30.9	29.8	27.7	1.7
(b) Subsidiaries(sales)	31.2	24.2	30.8	58.9	52.1	14.2	10.4	15.2	14.3	11.9	16.8	14.5
Local agencies (no capital ties)	7.8	24.1	23.9	16.4	19.3	14.4	22.8	17.4	20.5	21.9	24.3	32.4
Japanese trading companies	12.6	14.4	8.6	9.7	8.4	8.5	5.4	13.1	13.8	23.4	15.9	32.3
Others	14.8	25.2	13.6	8.3	9.9	12.5	15.4	15.2	17.7	13.9	12.8	16.2
2. Medium-Size Firms: Number of answers	51	40	43	27	27	39	23	22	16	13	17	12
All overseas subsidiaries (a)+(b)	67.0	32.7	36.7	54.3	41.1	60.2	47.4	44.1	10.9	27.9	11.8	8.3
(a) Subsidiaries(plants)	44.1	17.0	20.1	11.9	4.1	50.3	27.7	43.2	7.2	27.9	11.8	8.3
(b) Subsidiaries(sales)	22.9	15.7	16.6	42.4	37.0	9.9	19.7	0.9	3.8	0.0	0.0	0.0
Local agencies (no capital ties)	8.1	43.7	35.7	23.9	23.3	16.4	20.9	20.0	47.8	19.2	23.8	34.2
Japanese trading companies	16.5	6.0	11.6	0.0	17.0	10.8	10.4	26.4	16.3	19.2	23.2	24.2
Others	8.9	17.7	16.0	21.8	18.5	12.5	21.3	9.5	25.0	33.6	41.2	33.3
3. Small-Size Firms: Number of answers	41	36	38	25	24	23	16	16	16	16	13	15
All overseas subsidiaries (a)+(b)	43.3	8.7	23.6	35.5	25.0	25.9	12.5	12.5	18.8	18.8	3.8	6.7
(a) Subsidiaries(plants)	27.0	0.1	5.7	4.0	4.2	4.3	12.5	6.3	18.8	12.5	0.0	0.0
(b) Subsidiaries(sales)	16.3	8.6	17.9	31.5	20.8	21.5	0.0	6.3	0.0	6.3	3.8	6.7
Local agencies (no capital ties)	32.1	53.6	48.0	43.2	57.5	52.2	58.8	50.0	62.5	55.0	50.0	60.0
Japanese trading companies	10.9	15.6	9.0	8.4	4.2	4.6	5.9	8.1	9.4	7.2	15.3	17.3
Others	16.7	22.2	19.5	13.6	13.3	17.4	25.3	29.4	9.4	19.1	30.8	16.0

Note: Simple arithmetic average share is reported.

Source: 2009 RIETI Survey.

Appendix Table A2: Export Destination of Japanese Overseas Production Subsidiaries

Country/region where sample firms have subsidiaries (plants)	Number of firms having subsidiaries (plants)	Number of firms that answer destination	Export destination							
			Japan	Americas	US	Europe	Euro Area	Asia	China	Pacific & Africa
Americas (total)	76	28	6	36	9	9	7	5	2	0
US	49	15	4	19	---	7	5	4	2	0
Canada	6	3	0	3	3	0	0	1	0	0
Mexico	4	3	0	3	2	0	0	0	0	0
Brazil	13	7	2	11	4	2	2	0	0	0
Central & Latin Americas	4	0	0	0	0	0	0	0	0	0
Europe (total)	45	21	4	5	4	19	9	5	1	1
Euro Area	25	10	3	3	3	7	---	4	1	1
UK	12	7	1	2	1	5	5	1	0	0
Russia	1	0	0	0	0	0	0	0	0	0
East European countries	7	4	0	0	0	7	4	0	0	0
Pacific & Africa (total)	9	5	0	2	1	0	0	4	0	3
Australia	4	3	0	1	0	0	0	4	0	2
New Zealand	3	2	0	1	1	0	0	0	0	1
African countries	2	0	0	0	0	0	0	0	0	0
Asia (total)	330	184	103	41	40	33	31	169	19	5
China	85	55	35	17	17	15	14	25	---	0
Korea	19	11	8	2	1	2	1	11	3	0
Taiwan	33	19	7	1	1	1	1	27	8	1
Hong Kong	9	6	4	1	1	2	2	5	3	0
Singapore	14	9	3	3	3	3	3	9	0	1
Thailand	58	33	20	9	9	5	5	29	1	2
Malaysia	33	17	9	1	1	1	1	20	1	0
Indonesia	30	14	7	2	2	2	2	23	1	0
Philippines	16	10	5	3	3	1	1	10	2	0
Vietnam	16	8	5	2	2	1	1	7	0	0
India	14	1	0	0	0	0	0	1	0	0
Mid-East countries	3	1	0	0	0	0	0	2	0	1

Note: The number of firms is reported.

Source: 2009 RIETI Survey.

Appendix Table A3: Choice of Invoice Currency in Exports of Japanese Production Subsidiaries in Thailand

Invoice currency choice in exports from plants in Thailand to each destination
[# of "main currency," most frequently used currency in exports from plants in Thailand to each destination / total number of answers]

Destination	Japan	US	Canada	Mexico	Brazil	Central & Latin America	Euro Area	UK	Russia	East Europe	Austlaria	New Zealand	Africa
# of answers	19	9					5				1		
A. JPY	[5/19]						[1/5]						
B. USD	[11/19]	[9/9]					[2/2]						
C. Euro							[2/2]						
D. Thai Baht	[3/19]										[1/1]		
E. Importer's currency													

Destination	Asia	China	Korea	Taiwan	Hong Kong	Singapore	Thailand	Malaysia	Indonesia	Philipine	Vietnam	India	Mid-East Asia
# of answers	22	1	2	2	4	5	---	1	3	1	2	1	
A. JPY	[1/22]		[1/2]				---						
B. USD	[17/22]	[1/1]	[1/2]	[2/2]	[4/4]	[4/5]	---	[1/1]	[1/3]		[2/2]	[1/1]	
C. Euro							---						
D. Thai Baht	[4/22]					[1/5]	---		[2/3]	[1/1]			
E. Importer's currency							---						

Note: The number of answers is reported.

Source: 2009 RIETI Survey