Volume Title: Financial Deregulation and Integration in East Asia, NBER-EASE Volume 5

Volume Author/Editor: Takatoshi Ito and Anne O. Krueger, Editors

Volume Publisher: University of Chicago Press

Volume ISBN: 0-226-38671-6

Volume URL: http://www.nber.org/books/ito_96-1

Conference Date: June 15, 1994

Publication Date: January 1996

Chapter Title: The Structural Determinants of Invoice Currencies in Japan: The Case of Foreign Trade with East Asian Countries

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Chapter URL: http://www.nber.org/chapters/c8561

Chapter pages in book: (p. 147 - 165)

5 The Structural Determinants of Invoice Currencies in Japan: The Case of Foreign Trade with East Asian Countries

Shin-ichi Fukuda

5.1 Introduction

During the past decade, Japan's share as a trading partner of East Asian countries increased substantially. In addition, in the late 1980s, direct investment from Japan to most East Asian countries rose significantly. However, despite these growing roles for Japan, the internationalization of the Japanese yen has not increased as rapidly as Japan's economic power in East Asia. For example, Frankel (1991) and Frankel and Wei (1994) showed that East Asian governments were less tempted to link their currencies to the yen than to the dollar. To the extent that reducing exchange rate volatility can reduce trade risk, it is natural to suppose that East Asian governments will try to link their currencies to the Japanese yen unless a costless hedge through a perfect forward/futures market is possible. However, Frankel and Wei's results imply that this is not the case in East Asian countries and that the U.S. dollar still has the dominant weight in East Asian currency baskets. In addition, they pointed out that the U.S. dollar continues to be the dominant invoicing currency among East Asian countries.

Table 5.1 reports time-series data of invoice currency ratios in Japan's exports and imports. Yen-invoiced ratios, which were negligible in 1970, jumped to 40 percent of exports and 20 percent of imports in 1993. However, the shares of the U.S. dollar are still significant not only in Japan's total exports and imports but also in Japan's trade with East Asian countries. In addition, compared to other developed countries, Japan still lagged in the use of its own currency. Table 5.2 reports domestic invoice currency ratios in 1976, 1980, and 1988

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The author thanks J. Eaton, A. Kohsaka, T. Ito, and other seminar participants for their helpful comments on an earlier draft of this paper.

Table 5.1 **Invoice Currency Ratios in Japanese Exports and Imports (%)**

	Exports				Imports			
	In Yen		In U.S. Dollar		In Yen		In U.S. Dollar	
Year	World	East Asia	World	East Asia	World	East Asia	World	East Asia
1969	0.6	–	90.1	–	–	–	–	–
1970	0.9	–	90.5	–	0.3	–	80.0	–
1971	2.0	–	90.4	–	–	–	–	–
1972	8.6	–	82.8	–	–	–	–	–
1973	11.3	–	81.0	–	–	–	–	–
1974	15.0	–	77.7	–	–	–	–	–
1975	17.0	–	78.5	–	0.9	–	89.9	–
1976	19.4	–	76.3	–	–	–	–	–
1977	18.8	–	76.9	–	–	–	–	–
1978	19.8	–	75.4	–	1.6	–	–	–
1979	–	–	–	–	–	–	–	–
1980	28.9	–	66.3	–	2.4	–	93.1	–
1981	31.8	29.8	62.8	68.9	–	–	–	–
1982	33.8	–	60.9	–	–	–	–	–
1983	40.5	48.0	50.2	–	3.0	2.0	–	–
1984	39.5	–	53.1	–	–	–	–	–
1985	39.3	47.3	52.2	51.3	7.3[a]	–	–	–
1986	35.5	37.5	53.5	–	9.7	9.2	82.1[b]	88.6[b]
1987	33.4	41.1	55.2	56.5	10.6	11.5	81.7	87.6
1988	34.3	41.2	53.2	56.0	13.3	17.5	78.5	86.9
1989	34.7	43.5	52.4	53.6	14.1	19.5	77.3	79.0
1990	37.5	48.9	48.8	48.1	14.5	19.4	75.5	78.8
1991	39.4	50.8	46.7	45.9	15.6	21.6	75.4	76.5
1992	40.1[c]	–	46.6[c]	–	17.0[c]	–	74.5[c]	–
1993	40.7[c]	–	48.6[c]	–	21.6[c]	–	72.1[c]	–

Sources: Exports: Until 1982, *Yushutsu Shinyojyo Toukei* by Bank of Japan; between 1983 and 1991, *Export Confirmation Statistics* by Ministry of International Trade and Industry (MITI); for 1992, *Kessai Tuka Douko* by MITI.

Imports: Until 1980, *Yushutsu Syonin Todokede Houkokusho* by MITI; between 1981 and 1985, *Houkokusyorei Ni Motoduku Houkoku* by Ministry of Finance; between 1986 and 1991, *Import Reporting Statistics* by MITI; for 1992, *Kessai Tuka Douko* by MITI; for 1993, *Yusyutu (Yunyu) Houkokusyo Douko* by MITI.

Note: Unless specified, data are averaged annually.

[a]Figures for fiscal year.

[b]Figures for December 1986.

[c]Figures for September.

among major OECD countries. In the United States and Germany, almost all exports were invoiced by their own currencies. However, domestic invoice currency ratios in Japan were very small, the lowest among these countries in both exports and imports.

The purpose of this paper is to investigate why yen-invoiced ratios are so

Table 5.2 **Domestic Invoice Currency Ratios among Major OECD Countries (%)**

	Export			Import		
Country	1976	1980	1988	1976	1980	1988
Japan (world trade)	19.4	28.9	34.3	0.9[a]	2.4	13.3
Japan (East Asian trade)	–	29.8[b]	41.2	–	–	17.5
France	68.3	62.5	58.5	31.5	33.1	48.9
Germany	86.9	82.3	81.5[c]	43.0	43.0	52.6
Italy	–	36.0	38.0	–	18.0	27.0[c]
Sweden	66.1	–	–	25.8	–	–
Denmark	54.0	–	–	23.0	–	–
Austria	54.7[a]	–	–	24.7	–	–
Netherlands	50.2	–	–	31.4	–	–
Belgium	47.7[d]	–	–	25.4[d]	–	–
United Kingdom	73.0[e]	76.0	57.0	–	38.0	40.0
United States	–	97.0	96.0	–	85.0	85.0

Sources: Data for 1976, *Annual Report* (Tokyo: MITI, 1979); data for 1980 and 1988, Tavlas and Ozeki (1991).

[a]Figure for 1975.

[b]Figure for 1981.

[c]Figure for 1987.

[d]Figure for January to September 1976.

[e]Figure for October to November 1976.

low in Japan's foreign trade with East Asian countries and the United States. Related issues have already been investigated by several authors (see, among others, Hamada and Horiuchi 1987; Tavlas and Ozeki 1992; Kawai 1992, 1994; Takeda and Turner 1992; Ito 1993; Taguchi 1994). Most of these studies, however, have focused on general aspects of the internationalization of the Japanese yen. Extending some results in the existing literature, this paper focuses on more specific aspects of invoice currencies and investigates how Japan's trade structures affected the choice of the invoice currencies.

The first part of the paper investigates the determinants of invoice currencies in Japan's exports. Focusing on the heavy reliance of Japan's exports on the United States, we show that the "pricing-to-market" (PTM) behavior of Japanese exporters may well explain the choice of invoice currency.[1] One noteworthy result in the paper is that although most Japanese exports to East Asia are still invoiced in the U.S. dollar, the Japanese yen is becoming the dominant invoice currency when exporting TVs, VCRs, and automobiles to East Asia.

1. PTM models were originally presented by Krugman (1987) and others. Several authors have investigated the PTM behavior of Japanese exporters (e.g., Giovannini 1988; Ohno 1989; Marston 1990; Saxonhouse 1993). All of these studies were based on the data set of domestic and export price indexes for disaggregated commodities. However, except for Saxonhouse (1993), these studies did not focus on export price discrimination among different foreign countries. The following analysis is in marked contrast with these studies in that we use a data set that classifies export prices by both commodity and country bases.

The reason is that for these commodities, product differentiation may make price arbitrage among different markets very difficult. Hence, the PTM theory implies that Japan's exporting firms, which have relatively strong market power in East Asian markets, tend to choose the Japanese yen as an invoice currency in the exports of these product-differentiated commodities.

The second part of the paper considers other structural determinants of invoice currencies. In the analysis, we focus on invoice currency ratios in Japan's imports and on the relation between invoice ratios and trade dependency. We show that low yen-invoiced ratios are caused mainly by the large shares of oil and raw materials in Japan's imports. We also show that recent changes in Japanese invoice currency ratios are due to East Asia's changing trade dependency on the United States.

The paper is organized as follows: Based on the PTM theory, section 5.2 considers the determinants of invoice currency and presents our hypothesis. Section 5.3 explains the characteristics of invoice currency ratios in Japan's exports. Section 5.4 empirically examines how the PTM theory can explain the choice of invoice currency by Japanese exporters. Section 5.5 discusses invoice ratios in Japan's imports, and section 5.6 investigates the relation between invoice ratios and trade dependency. Section 5.7 summarizes our main results and discusses their implications.

5.2 Determinants of Invoice Currencies in Japan's Exports

In explaining the determinants of invoice currencies in Japan's exports, several previous studies have pointed out four factors. The first is the heavy reliance of Japan's exports on the United States. Since only a small fraction (16 percent in 1991) of Japanese exports to the United States are invoiced in the yen and since a large fraction of Japanese exports go to the United States, the structure of Japan's exports leads to relatively low yen-denominated invoice currency ratios in Japan's total exports. The second factor is inertia due to the previous economic power of the United States. It is well known that once a country's currency is established as an invoice currency, a large change in economic environment is necessary to replace it, even if the relative economic power of that country has declined in world trade (see Krugman 1980; Matsuyama, Kiyotaki, and Matsui 1993). Thus, although Japan's economic power in world trade has risen, it will take a long time for the yen to become the key currency in world trade. The third factor is the relatively small size of the short-term capital market in Japan. Although its volume has been increasing recently, the size of the treasury bill market in Japan is still much smaller than in the United States. Since the short-term capital market would be where foreign investors would park their yen-denominated funds, its limited size reduces the invoice currency ratio of the yen in trade. The fourth factor is the role of Japan's large trading companies, which handle the bulk of Japanese exports and imports. Since these companies have a relative advantage in avoiding foreign ex-

change risks, their existence may lead to relatively low yen-denominated invoice currency ratios in Japan's total exports.

The first factor indicates that low invoice ratios are caused by some structural problem in Japanese exports. However, it does not necessarily show why only a small fraction of Japan's exports to the United States are invoiced in the Japanese yen. In addition, it cannot explain why most exports to East Asian countries are invoiced in the U.S. dollar. The following analysis looks into this and shows that PTM models may explain why yen invoice ratios are low in Japanese exports.

Authors such as Ito (1993) have conjectured that the issue of invoice currency may be related to the PTM behavior of Japanese exporters. In addition, Giovannini (1988) has shown theoretically that firms set their export prices in foreign currency if profits are a concave function of the exchange rate while they set their export prices in home currency if profits are a convex function of the exchange rate. Fukuda and Ji (1995) have applied Ito's and Giovannini's results and presented a rigorous empirical study of the relationship between PTM behavior and the choice of invoice currency in Japanese exports.

The basic idea of these studies is that invoice prices in contracts cannot be changed easily when the exchange rate fluctuates. To the extent that the foreign market is highly competitive and exporters cannot control market prices for their own products, a rise in selling price will mean a loss of market share in the foreign market. Thus, Japanese manufacturers, who maximize their long-run profits, will choose to invoice their exports in terms of the importer's currency. The following analysis examines the validity of this idea empirically. We consider the following hypothesis:

HYPOTHESIS: When invoicing in the foreign currency, the export price in terms of the domestic currency is positively correlated with the exchange rate in terms of the domestic currency. When invoicing in the domestic currency, the correlation between the export price and the exchange rate is ambiguous in terms of the domestic currency.

This hypothesis implies that the choice of invoice currency may be revealed by the correlation between the export price and the exchange rate.[2] The basic reason is that invoicing exports in the foreign currency can eliminate unexpected selling price fluctuations caused by unexpected exchange rate fluctuations. Thus, exports are invoiced in the foreign currency if the exporters prefer stabilizing the selling price in the foreign market. Since the export price is positively correlated with the exchange rate in terms of the domestic currency when the selling price is stabilized in the foreign market, the hypothesis follows. In sections 5.3 and 5.4, we examine this hypothesis empirically.

2. For a formal proof of this hypothesis, see Giovannini (1988) and Fukuda and Ji (1995). A similar hypothesis was originally proposed by McKinnon (1979, chap. 4) in a less formal framework.

5.3 Invoice Currency Ratios of Japanese Exports

In order to examine the validity of our hypothesis, this section first investigates invoice currency ratios in Japan's exports to the United States and East Asian countries.[3] Table 5.3 lists average invoice currency ratios by U.S. dollar and Japanese yen for each commodity in 1991, and table 5.4 lists yen-invoiced ratios for each commodity in 1983. The tables show two noteworthy features.

First, for commodities such as textiles, chemicals, and metal products, the U.S. dollar is the dominant export invoice currency both for the United States and for East Asia. In 1983, yen-invoiced ratios were negligible among all of these commodities. Even in 1991, almost all exports of steel were invoiced in the U.S. dollar, and only one-fourth of chemical exports were invoiced in the yen both for the United States and East Asian countries.

Second, for electric machines and automobiles, invoice currency ratios showed marked differences between the United States and East Asian countries. When we look at exports to the United States, more than 90 percent were invoiced in the U.S. dollar. However, when we look at exports to East Asian countries, yen-invoiced ratios were relatively high. This implies that for these specific commodities, the yen is becoming the dominant export-invoicing currency in East Asian countries (see also table 5.5).

One possible explanation for this implication is the increase in intrafirm trade in recent years. Because the intrafirm trade of Japanese companies tends to be invoiced in the yen, recent increases of yen-invoiced ratios may be attributable to increases in intrafirm trade in these commodities. However, Tables 5.4 and 5.5 show that, except for TV exports, yen-invoiced ratios in these exports were already high in 1983 and 1987, when the size of Japan's direct investment in East Asia was limited. In addition, since intrafirm trade has similarly increased in other industries and to other areas, it cannot explain why the yen is becoming the dominant currency only in exports of electric machines and automobiles to East Asian countries.

For commodities such as TVs, VCRs, and automobiles, product differentiation may make price arbitrage among different markets very difficult. Thus, for these commodities, Japan's exporting firms tend to choose different invoice currencies in different foreign markets depending on their preference for price stabilization. On the other hand, for commodities such as textiles, chemicals, and metal products, the degree of product differentiation will be limited. Thus, for these relatively homogeneous commodities, the PTM theory is less relevant, and their selling prices tend to be quoted in the international currency, that is, the U.S. dollar.

To the extent that our hypothesis holds true, the above results imply that

3. East Asia includes the following 17 countries: Korea, Taiwan, Hong Kong, Thailand, Singapore, Malaysia, the Philippines, Indonesia, India, Brunei, Cambodia, Laos, Myanmar, Pakistan, Sri Lanka, Nepal, and Bhutan.

Table 5.3 **Invoice Currency Ratios in Japanese Exports, 1991 (%)**

	To United States			To East Asia			To World		
Commodity	U.S. Dollar	Yen	Misc.[a]	U.S. Dollar	Yen	Misc.[a]	U.S. Dollar	Yen	Misc.[a]
All commodities	83.4	16.5	0.1	45.9	50.8	3.3	46.8	39.4	13.8
Foodstuffs	76.3	23.6	0.0	55.7	42.5	1.8	55.6	41.2	3.2
Textiles	80.1	19.5	0.4	71.0	28.5	0.5	63.0	32.5	4.5
Chemicals	74.8	25.0	0.2	78.6	20.1	1.2	63.0	26.2	10.8
Nonmetal mineral	78.8	21.1	0.1	61.3	36.7	1.9	53.5	40.5	6.0
Metal products	89.3	10.6	0.0	78.8	19.9	1.3	76.8	19.5	3.7
Steel	99.1	0.9	0.0	88.6	10.9	0.5	87.7	9.4	2.9
Machines	83.3	16.6	0.1	33.2	62.6	4.2	42.2	42.8	15.0
Generators	83.2	16.6	0.1	25.9	67.5	6.6	40.7	48.8	10.5
TVs	91.4	8.3	0.3	19.9	74.8	5.3	35.0	56.6	8.4
VCRs	91.4	8.6	0.1	27.7	62.3	10.0	42.1	39.7	18.2
Automobiles	86.1	13.9	0.0	19.1	69.8	11.1	44.2	35.3	20.5
Ships	97.6	2.4	0.0	22.8	77.2	0.1	13.7	86.2	0.1
Heavy electric	73.3	26.6	0.1	45.4	51.7	2.9	41.0	51.5	7.5
Other	86.5	13.3	0.1	58.7	39.4	1.9	52.7	30.4	16.9

Source: Export Confirmation Statistics (Tokyo: MITI, 1991).

[a]Invoice ratios for other miscellaneous currencies.

Table 5.4 **Yen-Invoiced Ratios in Japanese Exports, 1983 (%)**

Commodity	To United States	To East Asia	To World
All commodities	13	48	40
Textiles	0	9	31
Chemicals	–	20	12
Metal products	1	6	14
General machinery	27	70	53
Electric machines	6	75	41
Tape recorders	2	85	32
Automobiles	18	83	46
Motorcycles	–	89	26
Ships	–	100	90
Optical instruments	14	8	47

Source: Annual Report of the International Finance Bureau (Tokyo: Ministry of Finance, 1984).

selling prices of TVs, VCRs, and automobiles are stable in U.S. markets but unstable in East Asian markets. In other words, for TVs, VCRs, and automobiles, we can expect that the exchange rate in terms of the yen is positively correlated with the yen-denominated export prices to U.S. markets and is less correlated with those to East Asian markets. The following section investigates the validity of this implication empirically.

Table 5.5 **Invoice Currency Ratios in Japanese Exports to East Asian Countries (%)**

	1987		1988		1989		1990		1991	
Commodity	June	December	June	December	June	December	June	December	June	December
Invoiced in the Japanese yen										
All commodities	45.1	41.1	42.0	42.8	42.6	47.9	49.2	52.0	51.5	52.2
Machines	58.0	53.1	53.7	55.0	53.8	58.6	60.6	63.7	63.1	63.8
Generators	72.0	56.1	59.7	60.4	73.9	65.3	70.3	68.8	70.0	64.7
TVs	37.9	41.8	43.4	41.5	58.4	67.1	74.7	77.1	70.5	78.0
VCRs	53.8	63.0	39.6	49.0	44.0	48.8	64.8	64.9	60.7	63.6
Automobiles	73.6	71.7	68.4	69.5	66.7	68.4	65.3	65.3	69.4	72.4
Ships	39.2	4.4	59.2	86.8	42.9	95.9	88.0	97.0	99.2	97.7
Heavy electric	30.4	34.4	41.2	43.9	34.9	51.5	43.9	50.2	48.2	58.4
Invoiced in the U.S. dollar										
All commodities	52.6	56.3	55.2	54.2	54.4	49.3	48.1	44.3	45.6	44.2
Machines	39.4	43.7	42.6	41.2	42.2	37.8	35.9	31.5	33.3	31.7
Generators	27.1	33.0	39.9	37.6	25.8	34.3	28.9	22.9	28.8	20.7
TVs	55.7	49.5	47.8	51.1	39.0	27.0	22.3	14.4	21.9	14.5
VCRs	36.4	30.9	46.6	40.0	46.1	41.6	25.2	27.9	31.6	26.1
Automobiles	22.6	27.4	24.7	24.2	25.1	24.4	28.7	28.1	21.9	17.8
Ships	60.8	95.6	40.8	13.2	57.1	4.1	12.0	3.0	0.8	2.3
Heavy electric	58.8	61.0	57.9	54.6	61.9	46.3	54.2	45.7	50.3	39.7

Source: Export Confirmation Statistics (Tokyo: MITI, various issues).

5.4 Empirical Results

Using highly disaggregated data sets of Japanese export prices, this section investigates how the PTM behavior of Japanese exporters can explain the choice of invoice currency.[4] Specifically, we examine how the prices of TVs, VCRs, and automobiles are correlated with the yen-dollar exchange rate in exports to the United States and East Asian countries.

Before this investigation, however, we must first mention that East Asian currencies have traditionally been tied more to the U.S. dollar than to the Japanese yen.[5] If stabilizing the selling price in East Asian markets is desirable, the strong link between East Asian currencies and the U.S. dollar will imply that Japanese exporters will achieve more effective selling price stabilization by invoicing in the dollar than by invoicing in the yen. On the other hand, if invoice ratios of the U.S. dollar are low, we can conjecture that Japanese exporters may have less incentive to stabilize their selling prices in East Asian markets. We apply this conjecture to exports of TVs, VCRs, and automobiles, and examine the validity of our hypotheses.

In the following empirical analysis, data on export prices are based on Japan Tariff Association (various issues). These trade statistics report the quantity and value of Japanese exports by both commodity and country. Each export value is based on f.o.b. value in terms of the yen.[6] Since commodity classifications are highly disaggregated, dividing each export value by its export quantity leads to the approximate export price of each commodity to each country.

All data are monthly. The sample period of estimations is January 1988 to December 1992. We chose this sample period because the commodity classifications in *Japan Export and Imports (Commodity by Country)* changed at the beginning of 1988. The sample period almost corresponds to the period for which the invoice ratios of Japanese exports are available on a commodity and country basis. In addition, the yen-dollar exchange rate showed relatively mild fluctuations during this sample period.

We ran the following regression:

$$(1) \qquad \mathrm{dEP}(i,j)_t = \text{constant} + \sum_{k=0}^{2} a_k^* \, \mathrm{dS}_{t-k} ,$$

where $\mathrm{dEP}(i,j)_t$ is the first difference of the logarithm of the relative price of commodity i's export to country j at time t, and dS_t is the first difference of the logarithm of the U.S. dollar exchange rate in terms of the yen at time t. The

4. Empirical results in this section are based on Fukuda and Ji (1995).

5. Among East Asian countries, Hong Kong pegs its currency to the U.S. dollar. On the other hand, most other East Asian currencies have adopted the basket system to peg their currencies. Although the composition of the basket is not officially announced, it is well known that the weight of the yen has not been significant.

6. When exports are invoiced in the foreign currency, export prices are transformed to yen-denominated prices by using some announced exchange rate. Although the announced exchange rate is not equal to the actual exchange rate, it is highly correlated with the actual exchange rate.

relative price of commodity i's export was calculated by dividing the export price of commodity i by the corresponding domestic price indexes.

We estimated equation (1) by the ordinary least squares method. Since East Asian currencies are highly correlated with the U.S. dollar, we used only the (monthly averaged) yen-dollar exchange rate as an exchange rate variable. We also allowed lagged exchange rate effects by the Almon lag method.

We estimated the above equation for TVs, VCRs, and automobiles.[7] Although various kinds of data are available for these commodities, we used data on commodities that have a significant amount of exports both to the United States and to East Asian countries (see the appendix for details). To be consistent with tables 5.3 and 5.4, we included the 17 countries listed in footnote 3 as the East Asian countries.

As we examined in the last section, our hypothesis implies that the exchange rate in terms of yen will be positively correlated with the yen-denominated prices of exports to U.S. markets but will be less correlated with those of exports to East Asian markets. Thus, we expect the sum of estimated coefficients, $\sum a_k$, in equation (1) to be significantly positive in exports to U.S. markets but to be less statistically significant in those to East Asian markets.

Table 5.6 reports the regression results. The table shows two noteworthy results. First, in the case of exports to the United States, all estimates of $\sum a_k$ are significantly positive. In particular, except for TVs, the estimated values of $\sum a_k$ lie between zero and one and are close to one.[8] This result implies that when exporting to the United States, Japanese exporters largely adjust their yen-denominated export prices to exchange rate fluctuations in order to keep their selling prices constant in terms of the U.S. dollar.

Second, in the case of exports to East Asian countries, the estimated values of $\sum a_k$ are small and not significantly different from zero. This implies that when exporting to East Asian countries, Japanese exporters do not adjust their yen-denominated export prices to exchange rate fluctuations.

Noting that most exports to the United States are invoiced in the U.S. dollar and that most exports to East Asian countries are invoiced in the yen, the above two results are consistent with our hypothesis. In particular, we conjecture that Japan's export price behavior differs markedly between U.S. and East Asian markets.

5.5 Determinants of Invoice Currencies in Japan's Imports

As we explained in the introduction, the yen-invoiced ratios in Japan's imports are still very low. This is true not only in comparison to other OECD

7. Although Japan's exports of automobiles were voluntarily restricted, the restriction was not binding during our sample period.

8. Even the estimated result for exports of TVs may be consistent with our hypothesis because their dollar-invoiced ratios were unstable over time (94.4 percent in 1987, 77.6 percent in 1989, and 91.4 percent in 1991).

Table 5.6 Regressions of Export Prices on Exchange Rates

Commodity and Destination	Estimates of Σa_k	R^2	D-W
TV			
United States	2.56 (1.28)**	0.07	2.87
East Asia	0.15 (0.70)	0.03	1.51
VCR			
United States	0.86 (0.45)**	0.27	2.90
East Asia	−0.08 (0.47)	0.09	2.57
Automobiles (type 1)			
United States	0.95 (0.34)**	0.17	2.42
East Asia	0.32 (0.57)	0.09	2.77
Automobiles (type 2)			
United States	0.98 (0.28)**	0.22	2.45
East Asia	0.30 (0.51)	0.01	2.72

Sources: See appendix.

Note: Numbers in parentheses are standard errors.

**Significant at 2.5 percent level.

countries but also in comparison to ratios in Japan's exports. As in exports, inertia due to the previous economic power of the United States as well as the relatively small size of the short-term capital market in Japan may be somewhat responsible for the low ratios. However, in the case of Japan's imports, it has been stressed that almost negligible yen-invoiced ratios in oil and raw material imports are more important.[9]

Table 5.7 reports invoice currency ratios for each commodity in Japan's imports by commodity and country bases. A salient feature in this table is that yen-invoiced ratios are almost negligible in mineral and other raw material imports. In particular, crude oil imports are almost always invoiced in the U.S. dollar. The reason is that products of crude oil and other raw materials are traded in well-established international markets. Because trades denominated in the U.S. dollar dominate these international markets, dollar invoice ratios are dominant in mineral and other raw material imports.

Noting that Japan's import structure is heavily weighted toward minerals and other raw materials,[10] it is easy to see that these high dollar-invoiced ratios lead to low yen-invoiced ratios in Japan's total imports. In fact, if we confine our attention to the imports of manufactured goods, yen-invoiced ratios are significantly higher. In particular, in imports from East Asian countries, more than 30 percent of manufactured goods are yen-invoiced on average (see table 5.7). In addition, more than 30 percent of imports from Korea and Taiwan were yen-

9. Ito (1993) showed that the rise in Japan's yen-invoiced imports over the decade was due to the recent decline in the share of oil and raw materials in Japan's imports.

10. E.g., the proportion of food, fuel, and raw materials in Japan's total imports was 53 percent in 1988, while that in German total imports was 25 percent.

Table 5.7 **Invoice Currency Ratios in Japanese Imports by Commodity, 1991 (%)**

	Origin of Imports								
	Total		United States		East Asia		European Community		
Commodity	U.S. Dollar	Yen	U.S. Dollar	Yen	U.S. Dollar	Yen	U.S. Dollar	Yen	Deutsche Mark
All commodities	75.4	15.6	88.7	11.2	76.5	21.6	15.9	31.4	29.5
Foodstuffs	72.4	22.2	85.1	14.8	73.1	26.3	22.2	40.3	7.1
Raw material and fuel	97.2	1.9	98.5	1.5	97.4	2.4	50.0	22.1	5.8
Textiles	77.4	12.5	99.9	0.1	79.9	19.7	53.9	19.6	6.2
Ore and scrap metal	98.1	1.2	99.0	1.0	97.1	2.4	88.2	2.7	1.5
Other raw material	91.8	5.9	97.8	2.2	90.5	8.9	32.2	29.0	7.1
Mineral and fuel	99.5	0.3	99.9	0.1	99.7	0.3	73.9	16.9	4.8
Crude oil	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	0.0
Manufactured	60.0	23.7	87.2	12.6	63.8	32.8	13.5	30.4	33.8
Chemicals	51.7	32.5	84.6	15.1	69.8	28.0	12.3	58.5	21.4
Machines	52.5	22.5	87.4	12.4	49.5	43.9	7.3	17.9	59.3
Other	66.9	21.9	88.1	11.6	68.5	29.0	21.5	26.9	12.6

Source: Import Reporting Statistics (Tokyo: MITI. various issues).

invoiced in recent years, although most imports from ASEAN countries were invoiced in the U.S. dollar (see table 5.8).

This feature is true even if we confine our attention to imports of intermediate goods. Table 5.9 reports the results of the survey conducted by the Economic Planning Agency of the Japanese government in 1993. The survey asked Japan's major manufacturers about invoice ratios in their intermediate goods imports. The results show that in pulp and paper products, petroleum and coal products, and metal products, almost all imports of intermediate goods are invoiced in the U.S. dollar. In addition, in these industries, the shares of imports are very high among their inputs of intermediate goods. On the other hand, in general machinery, electrical machinery, and transportation equipment and precision instruments, less than half of intermediate goods imports are invoiced in the U.S. dollar. However, in these industries, most intermediate goods are purchased inside Japan.

The above results imply that low yen-invoiced ratios are mainly due to Japan's import structure. That is, yen-invoiced ratios are high in the imports of manufactured goods and some intermediate goods. However, the weight of these imports is very small in Japan's total imports. On the other hand, dollar-invoiced ratios are very high in the imports of raw materials. Since raw materi-

Table 5.8 **Invoice Currency Ratios in Japanese Imports by Country, 1991 (%)**

	1987		1988		1989		1990		1991	
Country	U.S. Dollar	Yen	U.S. Dollar	Yen	U.S. Dollar	Yen	U.S. Dollar	Yen	U.S. Dollar	Yen
World	81.7	10.6	78.5	13.3	77.3	14.1	75.9	14.4	75.4	15.6
United States	90.6	9.2	85.9	8.8	89.5	10.2	80.9	11.6	88.7	11.2
East Asia (average)	87.6	11.5	81.2	17.5	79.0	19.5	78.8	19.4	76.5	21.6
Korea	72.8	27.2	62.9	37.0	60.5	39.3	61.8	38.1	59.7	39.8
Taiwan	85.2	14.8	77.4	22.5	71.9	27.7	67.8	31.6	66.3	33.1
ASEAN	94.7	4.2	91.7	6.6	90.3	7.9	89.0	9.1	85.7	12.1
West Asia	98.7	1.1	98.2	1.8	98.4	1.5	98.8	1.1	98.5	1.4
European Community	19.5	27.3	21.0	26.9	19.5	27.7	16.3	26.9	15.9	31.4

Source: Import Reporting Statistics (Tokyo: MITI, various issues).

Table 5.9 **Invoice Currency Ratios in the Imports of Japanese Manufacturers, 1993 (%)**

Industry	Invoice Ratios of U.S. Dollar	Share of Imports in Material Costs	Share of Material Costs in Sale Prices
Foodstuffs	53.4	30.5	45.6
Textile products	76.5	27.1	45.3
Lumber and wood	71.3	45.0	66.3
Pulp and paper	97.5	27.2	55.3
Chemicals	66.7	21.4	45.2
Petroleum and coal	99.8	55.6	79.1
Iron and steel	82.5	37.9	61.9
Nonferrous metals	90.7	30.9	66.5
General machinery	10.0	3.5	46.2
Electrical machinery	36.3	8.2	52.6
Trans & precision[a]	16.5	3.0	45.0
Other	65.7	45.4	53.5
Average	63.3	23.1	52.0

Source: Unpublished report by Economic Planning Agency.

[a]Trans & precision = transportation equipment and precision instrument.

als account for a relatively large share of Japan's imports, average yen-invoiced ratios become very low in Japan's total imports.

5.6 What Structural Changes Can Increase Yen-Invoiced Ratios?

In previous sections, we discussed the proposition that relatively low invoice ratios of the Japanese yen are due to the structure of Japan's foreign trade. The purpose of this section is to investigate whether recent structural changes in

Japan's foreign trade have affected yen-invoiced ratios in East Asian countries. In the analysis, we focus on the degree of trade dependency of East Asian countries on Japan and the United States. One simple-minded conjecture is that an East Asian country will increase yen-invoiced ratios when its degree of trade dependency on Japan increases and that on the United States decreases because a country that has a large share in foreign trade will have relatively strong bargaining power in deciding its invoice currency.

In order to investigate the validity of this conjecture, we regressed the invoice ratios in Japan's foreign trade on East Asian trade dependency ratios and estimated the following equations:

$$\text{(2a)} \qquad \text{MY} = a_1 + c_2{*}MY_{-1} + c_1{*}XJ + c_2{*}XUS,$$

$$\text{(2b)} \qquad \text{MD} = a_3 + c_4{*}MD_{-1} - c_1{*}XJ - c_2{*}XUS,$$

$$\text{(3a)} \qquad \text{XY} = b_1 + b_2{*}XY_{-1} + d_1{*}MJ + d_2{*}MUS,$$

$$\text{(3b)} \qquad \text{XD} = b_3 + b_4{*}XD_{-1} - d_1{*}MJ - c_2{*}MUS,$$

where MY = yen-invoiced ratios in Japan's imports from East Asia, MD = dollar-invoiced ratios in Japan's imports from East Asia, XY = yen-invoiced ratios in Japan's exports to East Asia, and XD = dollar-invoiced ratios in Japan's exports to East Asia. In addition, XJ = the East Asian export dependency ratio on Japan, XUS = the East Asian export dependency ratio on the United States, MJ = the East Asian import dependency ratio on Japan, and MUS = the East Asian import dependency ratio on the United States.

All data are quarterly. The sample periods are from the first quarter of 1986 to the fourth quarter of 1991 in the case of Japanese imports and from the first quarter of 1987 to the fourth quarter of 1991 in the case of Japanese exports. The estimation is based on the maximum likelihood method, with the constraints that the effects of trade dependency ratios on the yen- and dollar-invoiced ratios are opposite but of the same magnitude. To the extent that our conjecture is correct, we expect that c_1 and d_1 are significantly positive and that c_2 and d_2 are significantly negative.

Table 5.10 reports the estimation results. The estimates of c_2 and d_2 are significantly negative, as expected. However, no estimates of c_1 and d_1 are significant. These results imply that although yen-invoiced ratios tend to increase when the degree of trade dependency on the United States decreases, they change little even when the degree of trade dependency on Japan increases. In other words, at least in our sample period, Japan's invoice currency ratios are affected by changing trade dependency on the United States and not by changing trade dependency on Japan.

In previous sections, we showed that Japan's exporters tend to choose the U.S. dollar as an invoice currency in order to keep market share in foreign markets. We also pointed out that Japan's importers tend to invoice in the U.S. dollar because most of their imports are traded in terms of the U.S. dollar in

Table 5.10 Effects of Trade Dependency Ratios on Invoice Currency Ratios

	Imports[a]	Exports[b]
Dependency on Japan	0.08	0.02
(estimates of c_1 and d_1)	(0.26)	(0.47)
Dependency on United States	−0.41**	−0.57**
(estimates of c_2 and d_2)	(−3.39)	(−2.22)
R^2 in eq. (2a) or (3a)	0.86	0.96
R^2 in eq. (2b) or (3b)	0.86	0.97

Source: Except for Taiwan, the data of each region's trade dependency ratios are from *Direction of Trade Statistics* (Washington, D.C.: International Monetary Fund, various issues).

Note: Numbers in parentheses are *t*-values.

[a]Estimated equations (2a) and (2b).

[b]Estimated equations (3a) and (3b).

**Signifiant at 2.5 percent level.

well-established international markets. The results in this section are consistent with these views because they can be interpreted to mean that Japan's exporters and importers are passive (or reluctant) to change their choice of invoice currencies.

5.7 Concluding Remarks

We have investigated the determinants of invoice currencies in Japan's foreign trade with East Asian countries. We showed that the Japanese yen is becoming the dominant invoice currency in exports of TVs, VCRs, and automobiles to East Asia. We also pointed out that in imports of manufactured products from East Asian countries, Japan tends to invoice in the yen. However, since the weights of these commodities have been relatively small in Japan's total foreign trade, neither of these two factors was enough to increase average yen-invoiced ratios in Japan's exports and imports. In addition, Japan's exporters and importers are relatively passive in changing their invoice currency from the U.S. dollar to the yen.

Aside from the choice of invoice currencies, there is recent evidence that the use of the yen is prevailing among East Asian countries. For example, table 5.11 reports the currency composition of external debt among selected East Asian countries. It shows that in these countries yen-denominated external debt increased greatly in the latter half of the 1980s. Probably these increases occurred partly because the yen's appreciation raised nominal debt after 1985 and partly because official development assistance from Japan increased yen-denominated loans in these countries.

However, when we look at invoice currency ratios in the late 1980s, the yen's ratios in Japan's exports decreased. In addition, the yen's ratios in Japan's imports were still low, although they had gradually increased throughout the

Table 5.11 **Currency Composition of East Asian External Debt (%)**

Country	1980		1983		1986		1989	
	U.S. Dollar	Yen	U.S. Dollar	Yen	U.S. Dollar	Yen	U.S. Dollar	Yen
Indonesia	43.5	20.0	42.3	23.3	26.0	33.9	19.5	35.2
Korea	53.5	16.5	64.4	12.5	49.4	22.0	35.1	26.6
Malaysia	38.0	19.0	65.8	14.2	30.4	45.0	34.2	36.6
Philippines	51.6	22.0	51.2	20.0	48.1	25.5	36.9	32.6
Thailand	39.7	25.5	32.5	27.3	20.6	39.9	23.6	40.9
Aggregate of above	47.3	19.5	53.2	18.5	38.5	29.3	28.1	35.7

Source: Tavlas and Ozeki (1992).

1980s. An implication of this paper is that without substantial changes in Japan's trade structure, the low invoice ratios of the Japanese yen may not change in the near future.

Appendix

The data on export prices are based on Japan Tariff Association (various issues). In the estimation, we used the following four kinds of commodities: (1) TV = color television receivers incorporating cathode-ray television picture tubes, for broadcasting, other than chassis and kits; (2) VCR = video-recording or reproducing apparatus of magnetic tape type; (3) automobiles (type 1) = motor cars and other motor vehicles principally designed for the transport of persons with spark-ignition internal combustion reciprocating piston engines, with cylinder capacity exceeding 1,000 cc but not exceeding 1,500 cc, excluding those unassembled or disassembled; and (4) automobiles (type 2) = motor cars and other motor vehicles principally designed for the transport of persons with spark-ignition internal combustion reciprocating piston engines, with cylinder capacity exceeding 1,500 cc but not exceeding 2,000 cc, excluding those unassembled or disassembled.

References

Frankel, Jeffrey A. 1991. Is a yen bloc forming in Pacific Asia? In *Finance and the international economy,* ed. R. Obrien and S. Hewin. New York: Oxford University Press.

Frankel, Jeffrey A., and Shang-Jin Wei. 1994. Yen bloc or dollar bloc: Exchange rate

policies of the East Asian economies. In *Macroeconomic linkage: Savings, exchange rates, and capital flows*, ed. T. Ito and A. O. Krueger, 295–329. Chicago: University of Chicago Press.

Fukuda, Shin-ichi, and Ji Cong. 1995. On the choice of invoice currency by Japanese exporters: The PTM approach. *Journal of the Japanese and International Economies* 8:511–29.

Giovannini, Alberto. 1988. Exchange rates and traded goods prices. *Journal of International Economics* 24:45–68.

Hamada, Koichi, and Akiyoshi Horiuchi. 1987. Monetary, financial, and real effects of yen internationalization. In *Real-financial linkages among open economies*, ed. S. W. Arndt and J. D. Richardson, 167–91. Cambridge: MIT Press.

Ito, Takatoshi. 1993. The yen and the international monetary system. In *Pacific dynamism and the international economic system*, ed. C. F. Bergsten and N. Noland, 299–322. Washington, D.C.: Institute of International Economics.

Japan Tariff Association. Various issues. *Japan exports and imports (commodity by country)*. Tokyo: Japan Tariff Association.

Kawai, Masahiro. 1992. Internationalization of the yen (in Japanese). In *Current status of international finance*, ed. T. Ito, 275–326. Tokyo: Yuhikaku.

———. 1994. The international use of the Japanese yen: Currency invoicing of Japanese trade. Paper presented at annual meeting of the Japan Association of Economics and Econometrics, Nanzan University, Nagoya, September 23–24.

Krugman, Paul R. 1980. Vehicle currencies and the structure of international exchange. *Journal of Money, Credit, and Banking* 12:513–26.

———. 1987. Pricing to market when the exchange rate changes. In *Real-financial linkages among open economies*, ed. S. W. Arndt and J. D. Richardson, 49–70. Cambridge: MIT Press.

Marston, Richard C. 1990. Pricing to market in Japanese manufacturing. *Journal of International Economics* 29:217–36.

Matsuyama, Kiminori, Nobuhiro Kiyotaki, and Akihiko Matsui. 1993. Toward a theory of international currency. *Review of Economic Studies* 60:283–307.

McKinnon, Ronald I. 1979. *Money in international exchange: The convertible currency system*. Oxford: Oxford University Press.

Ohno, Kenichi. 1989. Export pricing behavior of manufacturing: A U.S.-Japan comparison. *IMF Staff Papers* 36:550–79.

Saxonhouse, Gary R. 1993. Pricing strategies and trading blocs in East Asia. In *Regionalism and rivalry*, ed. J. A. Frankel and M. Kahler, 89–119. Chicago: University of Chicago Press.

Taguchi, Hiroo. 1994. On the yen bloc. In *Macroeconomic linkage: Savings, exchange rates, and capital flows*, ed. T. Ito and A. O. Krueger, 335–55. Chicago: University of Chicago Press.

Takeda, Masahiko, and Philip Turner. 1992. *The liberalisation of Japan's financial markets: Some major themes*, BIS Economic Paper no. 34. Basel: Monetary and Economic Department, Bank of International Settlements.

Tavlas, George S., and Yuzuru Ozeki. 1992. *The Japanese yen as an international currency*. IMF Occasional Paper no. 90. Washington, D.C.: International Monetary Fund.

Comment Akira Kohsaka

Fukuda intends to identify determinants of currency invoicing ratios and their changes in Japanese external trade. More specifically, he tries to explain the apparently modest role of the Japanese yen as an invoice currency. He concludes by emphasizing the role of strategic pricing policies on the export side and commodity composition on the import side. The first half of the paper on the export side is relatively well argued, but the latter half does not seem very convincing and, in fact, seems tautological in explaining the small share of yen invoicing.

Turning to the export side, the paper links currency invoicing to exporter pricing strategies. By looking at the impact of yen-dollar exchange rate changes on export prices by commodity and by region, it is shown that for selected machinery products there is a significant positive correlation between yen-dollar exchange rates and relative export prices for Japanese exports to the United States but that there is no such correlation for exports to East Asia. This is claimed to suggest that Japanese exporters use pricing strategies to stabilize dollar prices in the United States and do not use such strategies in East Asia. Thus, as far as Japanese manufacturing exports to the United States are concerned, the paper confirms at least partially Saxonhouse's (1993) observation that the large share of dollar invoicing can be attributed to Japanese exporter pricing behavior.

I have several comments and questions at this point. First, I wonder whether we can truly identify currency invoicing with strategic price stabilization denominated in that currency. Noting that invoice currency ratios vary greatly both by commodity and by trading partner, as shown in tables 5.3, 5.4, 5.7, and 5.8, export prices are determined in diverse ways depending not only on market structures such as openness, competitiveness, and so on, but also on product characteristics such as degree of product differentiation. Thus it might be more appropriate to claim that the strategic price-setting behavior of exporters constitutes only a part of the story in explaining levels and changes in invoice currency ratios.

Second, although it is true that local currencies in East Asia have been more or less linked to the U.S. dollar, the author seems to put too much emphasis on their close linkage. In fact, in East Asia, a few Asian newly industrialized economies have had sharp appreciation of their currencies against the U.S. dollar since the latter half of the 1980s, and others have been through a series of devaluations during the same period. Despite this, the paper does not seem to pay due attention to the differences between yen-dollar and yen–local-currency exchange rates. If this were properly taken into account, its impact on export prices in terms of *local currencies in East Asia* could give some

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results different from those obtained in the paper. Until then, we cannot tell for sure whether Japanese exporter pricing policy is consistent with the pricing-to-market theory in East Asia.

In addition, a few minor points about equation (1) need clarification. The Japanese export price is partly converted from dollar denomination using a certain "official conversion rate," which is known to be fairly different from actual rates. Does this affect the result obtained, and to what extent? The author supposes price adjustment to be symmetric between upward and downward movements. Is it likely that yen depreciation will make Japanese exporters increase their yen export prices? In the case of differentiated manufacturing goods such as TVs and VCRs, the content of Japanese exports could differ between those to the United States and those to East Asia. If this is the case, can we distinguish between pricing-to-market and "pricing-to-product"?

On the import side, the author ascribes the low yen-invoicing ratio to import concentration or "bias" toward low yen-invoiced items or regional concentration on low yen-invoiced imports from the United States. This seems to be a tautology, however, and would never constitute reasoning or explanation for why the yen-invoicing ratio is low. Rather we would like to know the reasons for differences in invoice currency ratios for the same items and/or the same trading partners between Japan and other developed economies, (if such differences exist).

Finally, although the author concludes that "without substantial changes in Japan's trade structure, the low invoice ratios of the Japanese yen may not change in the near future," it is too hasty to draw this kind of conclusion from this paper.

First, even *without* changes in the Japanese trade structure, exchange rate changes against the U.S. dollar and the yen in the currencies of non-U.S. trade partners (especially East Asia) and changes in their market structures could increase yen-invoicing ratios.

Second, and more important, since we have observed rapid changes in Japan's trade structure since the 1970s across both regions and commodities along with increasing yen-invoicing ratios, there is no reason we will no longer see this kind of development for the near future. Accordingly, yen-invoicing ratios are likely to increase in time, unless the recent trend is unexpectedly reversed.

Reference

Saxonhouse, Gary R. 1993. Pricing strategies and trading blocs in East Asia. In *Regionalism and rivalry: Japan and the United States in Pacific Asia,* ed. Jeffrey A. Frankel and Miles Kahler, 89–119. Chicago: University of Chicago Press.